THE IMPACT OF COMMUNICATION OF WATER QUALITY INFORMATION
ON AWARENESS CREATION WITHIN PRIMARY SCHOOLS
IN NAKURU MUNICIPALITY, NAKURU COUNTY

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(Environmental Education) in the School of Environmental Studies of Kenyatta
University

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DECLARATION

This thesis is my original work and has not been submitted for the award of any degree/diploma in any other college.

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This work is dedicated to all the environmental activists endeavoring to achieve a safe and sustainable environment
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<td>Intelligence Quotient</td>
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<td>MCN</td>
<td>Municipal Council of Nakuru</td>
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<td>NAWASSC</td>
<td>Nakuru Water and Sewerage Services Company</td>
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<td>Nakuru Business Association</td>
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ABSTRACT

Nakuru municipality has serious water resource problem brought about by contamination and pollution of the drinking water. The Water source within most of the schools in Nakuru municipality is from piped water mains, rain / boreholes, roof catchment, dams and pans and shallow wells. This study was on impact of communication of water quality information on awareness creation within primary schools in Nakuru Municipality. The purpose of the study was to find out whether information on water quality communicated to the schools by Sustainable Community Environmental Programme (SCEP) a Non-Governmental Organization (NGO) had improved awareness on water quality, and thereby reduce diseases that affect humans emanating from poor quality water. The objective of the study was to determine the impact of communication of water quality information on awareness creation levels of pupils in Nakuru Municipality, to find out the level of awareness on water quality to pupils and to ascertain whether the awareness creation had improved the suitability of water for consumption in the schools. The target study groups were primary schools within Nakuru Municipality that were identified by SCEP to have poor quality water and had functional environmental clubs. Data was collected by use of interview schedules, focused group discussions and by use of questionnaires which were administered to environmental club members in upper primary schools, environmental club patrons and school management committee representatives. Data collected was analyzed by qualitative and quantitative methodologies using percentages, means and frequency distributions. The reliability of the main source of water (piped water) from Nakuru Municipality to the schools was found to be moderate at 61.9% while not reliable at 29.9%. The main sources of pollution to water in the schools was sewage overflows at 40%, industrial discharge at 20%, and the least was poor storage of water and oil spillage from garages each at 3.3%. The water quality awareness had been moderately undertaken (63%). The study concluded that the i) The information on water quality communicated to pupils in primary schools in Nakuru Municipality improved their level of awareness ii) The level of awareness on water quality to the pupils in the identified schools however is still low. iii) The awareness creation has improved the suitability of water for consumption in the schools. The study recommended that i) The stakeholders in the schools and communities should raise awareness on importance of treatment of drinking water through empowering of environmental club members and offering administrative support. ii) The schools should source for suitable clean water storage facilities, invest in rain water harvesting facilities so as to acquire water during the dry season. iii) The schools should also acquire more hand washing points to improve hygiene of pupils and enhance good water practices like closing of taps. iv) The policy makers should come up with better policies of water quality usage in schools.
CHAPTER ONE: INTRODUCTION

1.1 Background information

Water is essential to man, animals and plants, without water, life on earth would not exist. Drinking water should be free from pathogenic organisms and should not contain compounds that have adverse effects, immediate or long term on human health. (Bartram et al., 2003). The water should be clear, that is low turbidity, little color and should not be saline. It should also not contain compounds that cause offensive taste or odour.

The water supply in Nakuru has been characterized by chronic shortages affecting mainly schools, residential and industrial sectors. The town gets its water from both surface and underground water sources. Whilst most of the water distributed to consumers is treated by chlorination, some from the boreholes is not. Available information from the Municipal Council of Nakuru indicates that the water distribution system is inadequate, with only about 35 square kilometers (about 34 percent which is 170,000 people) of the municipality being covered. It is estimated that the water sources in Nakuru have a capacity of 36,260 cubic meters’ per day and the actual water supply is 28,280 cubic meters’ per day obliging the population to resort to poor quality water. (Municipal council of Nakuru)

The sewage network covers a very limited area is undersized and is in a poor operating condition with frequent blockages and overflows. This situation leads to frequent water related diseases outbreaks such as typhoid, cholera and dysentery. In 1999 a cholera outbreak reported 175 cases at the Municipal dispensaries only.
Typhoid can be described as endemic with statistics increasing from 67 cases in 1995 in Municipal Dispensaries, to 204 in 2000. Gastroenteritis cases in Municipal dispensaries were high at 588 in 1999. Other supplementary sources include, the National Water Conservation and Pipeline Corporation, the Kenya Army-Lanet Barracks, eight private boreholes and self-help water projects (e.g. Barut and Mogooin). The supplementary sources provide a total of 11,990 cubic metres per day against a design capacity of 15,290 cubic metres per day. The source of the statistics is from Municipal Council of Nakuru/ NAWASSCO. But supply is well below the present demand (population of Nakuru municipality is approximately 500,000 people).

The Water source within most of the schools in Nakuru municipality is from piped water mains, rain / boreholes, roof catchment, dams & pans and shallow wells. The quality of these sources is wanting in that many of the schools acquire water borne, water related and water based diseases. There, is therefore, a critical need to carry out a study to determine the factors and/or underlying causes that affect the said quality of the water within the schools.

![Figure 1.1: Sources of water in schools of Nakuru Municipality (Source: Kraft 2009)](image)

The water sources, to a large extent, are reliable in schools. However, at certain
periods the supply is not consistent and is routinely interrupted by rationing by the Nakuru Water, Sewerage and Sanitation Company (NAWASSCO) especially when the rains are inadequate (Kraft, 2009).

Piped water supplied by the Nakuru Water, Sewerage and Sanitation Company (NAWASSCO) to schools is usually treated at source but by the time it reaches the end users possibility of contamination is high due to pipe breakages and handling which then tends to reduce the quality of water. The main sources of water contamination within schools and their environs maybe from human excreta/sewage, poor disposal of garbage, waste water discharge from factories, dirty containers, farm chemicals, deforestation and soil erosion. The above could be the main causes of water pollutants within the municipality and hence causing health problems for the inhabitants of Nakuru Municipality. There is need to create awareness and raise the knowledge on waste water and its management (Nakuru, 2010).

Awareness creation had been undertaken within the schools in the past, hence the need to find out the levels of awareness on water quality among the school community. Some of the challenges that might have contributed to poor water quality could be; inadequate water harvesting facilities, inadequate training on environmental issues and negative attitude by pupils and the community in general. The criteria for selecting the target ten schools were based on awareness creation that was carried out by SCEP in Nakuru schools in 2007. These schools were found to have poor access to quality water
1.2 Problem statement and justification

Nakuru municipality has serious water resource problem brought about by high fluoride levels in the drinking water. Studies done by Catholic diocese of Nakuru (CDN) found that high levels of fluoride in water made it unsafe for cooking or drinking. The CDN has been taking the challenge of finding ways of bringing the level of fluoride down to an acceptable level by using a filter system containing bone char. Awareness in schools on the high fluoride levels has been made by SCEP. However there is need to undertake an evaluation to determine whether this information is being used to improve quality of water in the said schools.

1.3 Research questions.

1. How has the communicated information on water quality impacted on the awareness creation of Pupils in Nakuru Municipality?

2. What is the level of awareness on water quality to the pupils in the identified schools?

3. How has the awareness creation improved the quality usage of water in the schools?

1.4 The Study Objectives

Overall objective

To determine the impact of communication of water quality information on awareness creation level of pupils in Nakuru Municipality schools

Specific objectives

i. To find out the level of awareness on water quality to the pupils in the identified schools.

ii. To ascertain whether the awareness creation has improved the suitability of water for
consumption in the schools.

1.6 Significance of the study

This study will provided information on the levels of awareness on water quality. The study will make recommendations on how to increase awareness on water quality in the school community. This awareness can reduce occurrence of water related illnesses. Information acquired from this study will be used to advise policy makers on availability, access and utilization of quality water. Data from this study will inform organizations in the municipality on the area that need urgent attention on awareness. The study will also provide literature for other scholars who may wish to explore the area.

1.7 Definition of terms

**Water quality**-is a technical term that is based upon the characteristics of water in relation to guideline values of what is suitable for human consumption and for all usual domestic purposes, including personal hygiene. Components of water quality include microbial, biological, chemical, and physical aspects.

**Water quality awareness**- Having knowledge of the suitability of water for consumption.

**Municipality**-an urban district having corporate status and powers of self-government
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Water quality awareness creation is a powerful advocacy tool aimed at sensitizing the school pupils, environmental club patrons and the head teachers in schools on the quality of their water. It is also very crucial that advocacy on water quality is undertaken at every level as the water chain process can change before consumption and after use thus affecting human beings. Nonetheless, the Nakuru community has endured the environmental consequences unabated, which calls for serious intervention in water quality awareness creation in all the schools and it justifies why the same should be replicated in the communities within the lake Nakuru basin.

2.2 Current status of water used in Nakuru Municipality schools

According to Swinburne (2000) accessibility of safe drinking water, particularly among the low-income communities is still a problem in developing countries. In Nakuru, which is located in the African Rift Valley, in Kenya (156km from Nairobi), water supply falls short of demand, resulting in many residents using less than what is considered sanitary. Poor waste disposal mechanisms in both urban and rural areas are below satisfactory requirements, and this contributes in the pollution of water sources in the district” (Mamo and Chabalala, 2001).

Some of the major emerging and re-emerging water-borne agents are: *Vibrio cholera* biotype El Tor Serotype 0139. This microorganism is responsible for cholera, which is a painless form of diarrhea, characterized by rice-watery stool. *Escherichia coli* 0157:H7 is an
emerging *E. coli* strain responsible for most dysentery cases even in developed countries. *Salmonella typhi* is responsible for typhoid fever, and recently, resistant strains of this microorganism have been reported in most developing countries. *Giardia* and *Cryptosporodias* species are causative agents of most of the Gastroenteritis diseases reported around the world. Viral agents like hepatitis species are also among the worst causative agents of water-borne diseases in Africa, Asia and South America.

It should be understood that there are numerous types of microorganisms responsible for water-borne diseases, besides the ones mentioned above (Mamo and Chabalala, 2001). Water-borne diseases are “dirty-water” diseases; mainly attributed to water that has been contaminated by human, animals or chemical wastes. Worldwide, it has been shown that water-borne diseases are responsible for over 12 million deaths a year. This is mainly due to poor sanitation facilities; and unsafe drinking, washing, and cooking water (Hinrichsen, 1998). Millions of people throughout the world have little access to sanitary waste disposal infrastructure or clean water. As a result, millions of people are at risk because of lack of access to safe drinking water and adequate sanitation facilities. Diarrhea diseases, which are major water-borne diseases, are prevalent in many countries, mainly due to inadequate sewage treatment. An estimation of 4 billion cases of diarrhea disease occurs every year, causing 3-4 million deaths among children” (Gugnani, 1999).

### 2.3 Consequences of contaminated water use globally

South Africa, Malawi, Zimbabwe, Swaziland, Zambia and Mozambique had cholera outbreaks. These outbreaks were attributed to lack of safe drinking water and adequate
sanitation. By the end of June 2001, South Africa had 103,425 cases, 212 deaths and the case fatality rate of 0.02%. This was reported as a breakthrough in the history of cholera outbreaks, because other countries have the case fatality rates of more than 20% to 50%” (National Department of Health, 2001).

Thousands of citizens in Hyderabad were affected by the unhygienic drinking water. Health Department declared emergency in all government hospitals of the city and cancelled leaves of doctors and paramedics. This step was taken in view of the rising number of gastroenteritis and other abdominal diseases cases due to use of the unhygienic drinking water. Emergency counters were established in all government and other hospitals in the city and required medicines were supplied to them. The number of patients suffering from gastroenteritis, diarrhea, vomiting and fever was alarmingly increased due to use of the hazardous drinking water. (Manzoor 2004)

2.4 Fluoride concentration for water in Kenya

Kenya has extremely high levels of fluoride ion in its ground water. The ranking of provinces in order of maximum values of fluoride concentration (ppm) recorded for water samples taken in each province showed that Nakuru District of Rift Valley Province under concentration of 57.0(ppm) being the highest in the country. The studies above clearly show that high fluoride levels are a serious health threat, particularly in developing countries (Ongweny 1973; Nair and Manji, 1984). Gikunju et al (1995) carried out a study on water fluoride levels in Molo division. Borehole water was found to have more fluoride (0.66 ppm) than any other water source, while rain water had the least amount of fluoride (0.07 ppm). The highest fluoride encountered in this study was 2.0 ppm while the lowest was 0.06 ppm.
2.5 Water quality and sources of information in Nakuru Municipality

In the recent past Nakuru town has been characterized with chronic water shortages. The town gets its water from water reservoirs and boreholes. Most of the water from the reservoirs is treated whereas that from the boreholes is not treated. The sewerage system is inadequate as well as waste disposal. Occasional sewerage blockage and spilling may lead to contamination of water. Most of the environmental problems in the town are attributed to low environmental awareness among the residents (Mwangi, 2000). It can therefore be understood that poor water quality is a great burden to the health of the population; however, the extent of the problem has not been determined.

2.6. Drinking water supply and sanitation

According to local Agenda 21, safe water supplies and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty, safe water is also crucial to many traditional and cultural activities. An estimated 80% of diseases and over one third of deaths in developing countries are caused by the consumption of contaminated water, and on average as much as one tenth of each persons productive time is sacrificed to water related diseases.

Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the worlds poorest people. The most outstanding of these efforts was the launching in 1981 of the international drinking water supply and sanitation decade which resulted from the Mar del plata Action plan adopted by the United Nations Water Conference in 1977. The commonly agreed premise was that, all peoples, whatever their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs.
2.7 Environmental Education awareness at school

In a study carried out in primary schools in India, Environmental consciousness should inform teaching in schools and colleges and should be integrated in the entire education process. Although there was no separate environmental education policy and plan of action either at union or the state levels, environmental education had been influenced by politics and plans of other sectors and strategies of environmental education have been outlined stage wise and subject wise in the national curriculum framework, 1987 (Bandhu).

The most recent developments are the introduction of environmental science (EVS) as compulsory course for all undergraduates after the invention of supreme court and the introduction of environmental studies as a curricular are at primary stage (1-5 class). Environmental studies combines science with social studies and environment and stresses the link between teaching and the immediate environment of the child. The teachers for EVS reported that emphasis of their efforts was rather to create awareness issues and to give the children concrete suggestions how to behave in a more environmentally friendly way than explaining the scientific background of environmental problems.

A new approach to address environmental issues at school is the Eco-club scheme that aims to bring NGOS more closely to the school system. The most important difference to normal classes on environment is the project manner Eco-club scheme uses to address environmental issues. The schools can choose on their own which campaigns they want to launch. The projects range from campaigns like “say no to plastic bags “ against the
use of crackers at Deewali or campaigns promoting the use of natural colours at Holi to efforts in creating a green and clean surrounding of the school by collecting waste and planting trees and flowers.

Most of the projects urge children to deal with environmental issues they are confronted with in their everyday life and give concrete suggestions how to behave in an environmental friendly way. The idea of ministry of Environment and forests in India supplements the campaign by organizing special competition like poster painting, essay writing or debates. The winners receive money prices additionally to the small annual amount of financial aid (400 rupees) every Eco-club is granted by the Ministry of environment and Forests. Eco-clubs usually meet once or twice per week under the guidance of a teacher. Recent developments in the Education at Indian schools like the introduction of EVSn or Eco-club definitively prove that as far as educational policy is concerned there is an understanding for the importance of promoting environmental issues.

2.8 Analysis of alternatives to improve the quality of water

For Nakuru town, considering the baseline analysis conducted, alternatives have been considered which concluded that under the present momentum of human settlement, growth rates, laissez-faire development control policies, the present trends of infilling and densification in the west of the town north of the Njoro River at Baruti and Kwa Rhoda will be difficult to stop. The economic considerations of completely curtailing population growth and moving it to other areas of Kenya are diverse and large because the hinterland has a high agricultural potential. The principal contributor to Nakuru’s growth is the economic potential of agriculture on its fertile hinterland. Limitation of population
growth will mean that some of the most productive land in the nation will not be brought into full use causing a significant impact on national food output and contributing to an increased foreign debt burden. (Muchukuria and Grenier 2009)

The economic implications of limiting growth of Nakuru Municipality by encouraging development in smaller urban centres in its immediate surroundings is less severe, but as indicated above, if population growth is to continue in the area albeit at an alternate urban focal point, the scheme to supply water will be almost identical to that proposed for Nakuru Municipality and there would be no discernible difference in economic terms. Other alternatives considered were the sinking of more boreholes in existing well fields but these sites are presently exploited at maximum capacity.

The geology in the Nakuru watershed does not have any large-scale aquifer formations which mean that groundwater resources are marginal and expensive to exploit. Favorable groundwater conditions have been found in the Olobanita area sufficient to increase water production capacity for Nakuru Municipality by 15,000m3/day. However, the fluoride content of the ground water ranges from 1.2 to 4 mg/l and will be diluted to the acceptable WHO range by mixing with water from other sources. As the population continues to increase, it will be necessary to have more projects that store run-off for use during periods of low riverflow or drought. Different dams and rivers were considered but these have been earmarked for other communities in the National Water Master plan, or are too expensive to develop except Itare Dam which is the next feasible option after the Olobanita well field development (Shigeo, 2001).

Different options have also been considered for disposal of waste water, i.e. discharging all waste water into Lake Nakuru, but the option retained is to discharge treated water
into the Lake Nakuru up to a limit of 33,000 m$^3$/day and direct the rest away from the lake. Also on-site sanitation for low density urban areas in the short term, while connecting high density areas to the sewerage system is the preferred option (Shigeo, 2001).

2.9 Beneficial Impacts

It has been estimated that the lake can take discharges of up to 33,000 m$^3$/day without any adverse effects on its conductivity. According to the feasibility study the maximum discharge of 33,000 m$^3$/day is expected to be reached at year 2020. Then alternative discharge of treated water will be required at that time. The number of industries and houses discharging untreated sewage into the Lake Nakuru catchments will be reduced by connecting them to the system; therefore reducing direct pollution of the catchment (Rift Valley Water Supply and Sanitation Project, 2004).

Current balance of water use within the Lake Nakuru basin indicates that there is a net deficit in Lake Nakuru. Should this continue there is a real risk that lake levels will be persistently low, or risk drying up, thus adversely impacting the Nakuru ecosystems. Executing the project can reverse and stabilize the trend as effective monitoring is instituted, and control placed on the balance of water use from the various sources. Also, the Water Resources Management Strategy under development by the Government will address this problem. The continuation of the Lake as a well managed wet land will contribute to its viability as a tourist attraction and source of revenue to both the management of the Lake and the Town (Rift Valley Water Supply and Sanitation Project, 2004). The high water level in the lake would maintain Spirulin sp. growth and the large number of flamingos as well as enhance the lake’s biodiversity provided that
appropriate chemical balance is maintained. This will certainly increase the value of the Lake Nakuru National Park as a tourist attraction.

2.10 Mitigation of sewage and solid waste

According to (African development fund 2004) Sewage will be treated at 2 treatment plants in Nakuru to ensure that waste water reaching the lake is of acceptable quality. Awareness building towards professionals and beneficiaries of the water and sewage system is part of the capacity building to avoid discharge of sludge into the drainage canals or sewers. Awareness building and monitoring of potentially harmful use of waste water, such as its use for vegetable irrigation because of health hazards will be done by the Municipal Council, as part of the project, to avoid diseases outbreaks and protect population’s health.

The existing legislation on pollution and waste disposal as well as Municipal by-laws will be enforced by the Municipal Council, which will put an emphasis on requiring the industries to build and operate efficient sewage pre-treatment facilities. The Municipal Council will address the pollution problems emanating from car repair garages, railway repair and other small workshops by ensuring their connection to the sewerage system with proper grease traps. The storm drains and the lake outfalls will be fitted with filter screens to stop the solid waste from blocking the network and getting into the lake. The sludge from drain cleaning will be properly disposed and not dumped at the drain sides. The Municipal Council is committed to be proactive and instrumental for providing solutions to the problems related to solid waste. AFD is working with the municipality to develop a project to improve the solid waste management system (African development bank, 2004). In the developing world, for decades, universal access to water and sanitation
has been seen as the essential step in reducing the preventable burden, but it is now clear that this is best achieved by programmes that integrate hygiene promotion with improvements in water quality, availability and sanitation.

About 2 million people die every year due to diarrhea diseases; most of them are children less than 5 years of age. The most affected are the populations in developing countries, living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants. Providing access to sufficient quantities of safe water, the provision of facilities for a sanitary disposal of excreta, and introducing sound hygiene behaviors are of capital importance to reduce the burden of disease caused by these risk factors.( African development fund 2004)

2.11 Awareness to the people

Research shows that, if widely practiced, hand washing with soap could reduce diarrhea almost fifty percent and respiratory infections by nearly twenty-five percent. Hand washing with soap also reduces the incidence of skin diseases, eye infections like trachoma and intestinal worms, especially ascariasis and trichuriasis. Other hygiene practices, such as safe disposal of waste, surface hygiene, and care of domestic animals, are also important in low income communities to break the chain of infection transmission. The term sanitizer has been used to define substances that both clean and disinfect. More recently this term has been applied to alcohol-based products that disinfect the hands (alcohol hand sanitizers). Alcohol handsanitizers however are not considered to be effective on soiled hands. The term biocide is a broad term for a substance that kills, inactivates or otherwise controls living organisms. It includes
antiseptics and disinfectants, which combat micro-organisms, and also includes pesticides (Muchukuri and Grenier, 2009).

Body hygiene pertains to hygiene practices performed by an individual to care for one's bodily health and well being, through cleanliness. Motivations for personal hygiene practice include reduction of personal illness, healing from personal illness, optimal health and sense of well being, social acceptance and prevention of spread of illness to others. Personal hygiene practices include: seeing a doctor, seeing a dentist, regular washing/bathing, and healthy eating. Personal grooming extends personal hygiene as it pertains to the maintenance of a good personal and public appearance, which need not necessarily be hygienic (Margaret, 2008)

Body hygiene is achieved by using personal body hygiene products including: soap, hair shampoo, toothbrushes, tooth paste, cotton swabs, antiperspirant, facial tissue, mouthwash, nail files, skin cleansers, toilet paper, and other such products. The benefits of body hygiene can be diminished by the risks of excessive body hygiene, which is hypothesized to cause allergic disease and bodily irritation. The hygiene hypothesis was first formulated in 1989 by Strachan who observed that there was an inverse relationship between family size and development of atopic allergic disorders - the more children in a family; the less likely they were to develop these allergies. From this, he hypothesized that lack of exposure to “infections” in early childhood transmitted by contact with older siblings could be a cause of the rapid rise in atopic disorders over the last thirty to forty years. Strachan further proposed that the reason why this exposure no longer occurs is, not only because of the trend towards smaller families, but also “improved household amenities and higher standards of personal cleanliness”(Margaret, 2008).
Although there is substantial evidence that some microbial exposures in early childhood can in some way protect against allergies, there is no evidence that we need exposure to harmful microbes (infection) or that we need to suffer a clinical infection. Nor is there evidence that hygiene measures such as hand washing, food hygiene etc. are linked to increased susceptibility to atopic disease. If this is the case, there is no conflict between the goals of preventing infection and minimizing allergies. A consensus is now developing among experts that the answer lies in more fundamental changes in lifestyle etc. that have led to decreased exposure to certain microbial or other species, such as helminthes, that are important for development of immuno-regulatory mechanisms. There is still much uncertainty as to which lifestyle factors are involved. In response to the need for effective hygiene in home and everyday life settings, the International Scientific Forum on Home Hygiene has developed a “risk-based” or targeted approach to home hygiene that seeks to ensure that hygiene measures are focused on the places, and at the times most critical for infection transmission. Whilst targeted hygiene was originally developed as an effective approach to hygiene practice, it also seeks, as far as possible, to sustain “normal” levels of exposure to the microbial flora of our environment to the extent that is important to build a balanced immune system (African development fund 2004).

Literature review has revealed that the current water quality status in Nakuru is in a bad state. Most of the drinking water status is bound to have high concentration of fluoride which is a health problem. The town has been hit by chronic water shortages in the past as well an inadequate sewerage system. Most of these water problems are associated with
the various environmental problems bedeviling the municipality. However the literature has cited lack of environmental knowledge and awareness being the major factor contributor. Margaret et al. (2003) has documented that awareness of the individual can help address the hygiene levels with regard to water. The level of awareness according to the SCEP report is still little explored especially in schools. Hence there is need to carry out studies to ascertain the awareness levels in order to come up with appropriate policies to address the problem.
CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Study Design

The study design employed in this study was descriptive and observational in nature. Investigations therefore were based on cross sectional type study. Cross sectional study involve observation of all of a population, or a representative subset, at a defined time. It can be used to describe absolute risks and not only relative risks.

3.2 Study Area (Location)

Nakuru Town is located 160 kilometers north-west of Nairobi. It is the fourth largest urban centre in Kenya after Nairobi, Mombasa and Kisumu, and began as a railway station on the Kenya-Uganda railway at the beginning of the twentieth century. It is situated at an altitude of 1,840 metres above sea level and has a warm climate with maximum monthly temperatures of 28.1°C. The long rains fall between March and May while the short rains occur between October and December. The mean annual rainfall is only 95.1 millimeters; Nakuru is in a semi-arid region and its name comes from a Masai word meaning a dusty place. Nakuru town is located in an environmentally sensitive area, sandwiched between Lake Nakuru National Park to the south and the Menengai crater and its associated volcanic landscapes. To the north-east of the town is the Bahati escarpment which forms the western fringe of the Aberdares escarpment. The town is characterized by unstable geological zones and experiences frequent local geological faulting, making it, as well as the Nakuru area and the Rift Valley region as a whole, highly vulnerable to subsidence, landslides, earthquakes and related disasters. Lake Nakuru is the lowest point in the region, at only 1,758 meters above sea level, and all
rivers in the region drain into it. Official statistics suggest that in 1948, the population of Nakuru was 17,625 and this had increased to 38,181 by 1962, 92,980 by 1979 and 163,982 by 1989, 308,801 by 2009 census, projections suggesting a population of 760,000 by 2015. The municipality expanded from 78 square kilometers in 1994 to 292 square kilometers.
Figure 3.1: Nakuru Municipality (the study area)

Source (Kraft 2009)
3.3 Sampling design and Sample schools

Cluster sampling was used to select schools that were included in the study. This study was carried out within the five zones viz. Eastern, Northern, southern, western and central zones of Nakuru municipality as indicated in the table below. Random sampling was used to select students in the schools whose ages ranged between 12-16 years.

Table 3.1: Names of the five zones and the respective schools where the study was carried out in Nakuru municipality, Kenya.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Eastern</th>
<th>Central</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names of primary Schools</td>
<td>Naka</td>
<td>Kaloleni</td>
<td>Moi</td>
<td>Kaptembwa</td>
<td>Kelelwet</td>
</tr>
<tr>
<td></td>
<td>Lionhill</td>
<td>St.Marys</td>
<td>Lenana</td>
<td>Mama</td>
<td>Kiptenden</td>
</tr>
</tbody>
</table>

The sample size for student was determined using the Krejcie and Morgan (1970) formula:

\[
S = XNP(1-P) \\
\]

\[
d(N-1)+XP(1-P) \]

where

\[
S = \text{required sample size} \\
N = \text{given population size} \\
P = \text{population proportion (assumed to be 50)} \\
d = \text{the degree of accuracy (0.05)} \\
X = \text{table value of chi squared for one degree of freedom relative to the cleared level of confidence which is 3.841 for .95 confidence level (from table)}
\]
The total population of the students in the study area was 49,087 (n), and this according to the Krejcie and Morgan (1970) table for determining sample size from a given population will be 381 pupils, where n = population size and s = sample size.

The sampling fraction therefore was as shown below:

$$\frac{381}{9197} = 0.0414$$

The numbers of pupils in each school were determined as shown in the table below. The sample also included the patrons of the environmental clubs in each of the schools. Hence 10 patrons were included in the study. Three members of the school management committees (SMC) were also included in the study. Hence a total of 30 SMC representatives were be included in the study. The total sample size of the respondents in the study was therefore 421.
Table 3.2: Sample size of pupils in each of the schools

<table>
<thead>
<tr>
<th>School</th>
<th>Total enrolment</th>
<th>Sample size of pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaptembwo</td>
<td>1603</td>
<td>66</td>
</tr>
<tr>
<td>St. Mary’s girls</td>
<td>1036</td>
<td>43</td>
</tr>
<tr>
<td>Mama ngina</td>
<td>1720</td>
<td>71</td>
</tr>
<tr>
<td>Kelelwet</td>
<td>331</td>
<td>14</td>
</tr>
<tr>
<td>Kiptenden</td>
<td>490</td>
<td>20</td>
</tr>
<tr>
<td>Naka</td>
<td>500</td>
<td>21</td>
</tr>
<tr>
<td>Kaloleni</td>
<td>273</td>
<td>11</td>
</tr>
<tr>
<td>Moi</td>
<td>1830</td>
<td>76</td>
</tr>
<tr>
<td>Lenana</td>
<td>432</td>
<td>18</td>
</tr>
<tr>
<td>Lion Hill</td>
<td>982</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>9197</td>
<td>381</td>
</tr>
</tbody>
</table>

3.4 Data Collection Methods.

3.4.1 Data collection and instruments

The following were the appropriate qualitative methods of data collection in respect to water quality during the study: Questionnaire A for environmental club patrons and members, Questionnaire B for school management committee representatives and Questionnaire C for pupils.

The researcher, analyzed the questions on the questionnaires and the interview
schedules, item by item, with a view of structuring them in such a way that they have clear wording and avoid any ambiguity in soliciting the necessary and appropriate responses for the respondents

3.4.2 Data Collection procedure

Researcher administered questionnaires were distributed targeting the environmental club members in upper primary school, SMC members and club patrons in the study area. The researcher was assisted by two research assistants who were trained on the contents of the questionnaire and the information sought. In addition, the research assistants helped the researcher in interpreting questions to the study group.

Respondents were allowed to participate in the study purely on voluntary basis. Both the questionnaires and interview schedules were then administered. Permission to carry out the research was sought from the relevant ministry. A degree of confidentiality was guaranteed to each respondent to avoid suspicions that the information would be used to victimize them based on their responses.

3.4.3 Data analysis and presentation

Data collected was analyzed using descriptive statistics methods, especially the measures of central tendency (mean, mode and median). Data collected through the questionnaires was analyzed according to emerging patterns or opinions derived through statistics using Statistical programme for social science (SPSS) and Ms excel. Data was organized in frequency distribution tables as well as measures of dispersion. Graphical presentation of data included histograms, pie charts and bar graph.
CHAPTER FOUR: RESULTS

4.1 Characteristics of the study population

Several demographic factors were considered which were important in interpretation of the responses given. The factors included; sex and the name of the school where the students were from. The students were mainly from upper primary school (Std 6 to std 8) aged 12 to 14 years. Among the students who were recruited 150(39.4%) were males while 231(60.6%) were females as shown in table 4.1 below

Table 4.1: Characteristics of students

<table>
<thead>
<tr>
<th>Demographic factor</th>
<th>Categories</th>
<th>Counts</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>Kaptembwo</td>
<td>66</td>
<td>17.3</td>
</tr>
<tr>
<td></td>
<td>St.Mary’sgirls</td>
<td>43</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>Mamangina</td>
<td>71</td>
<td>18.6</td>
</tr>
<tr>
<td></td>
<td>Kelelwet</td>
<td>14</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Kiptenden</td>
<td>20</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Naka</td>
<td>21</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Kaloleni</td>
<td>11</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Moi</td>
<td>76</td>
<td>19.9</td>
</tr>
<tr>
<td></td>
<td>Lenana</td>
<td>18</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>LionHill</td>
<td>41</td>
<td>10.8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>381</td>
<td>100</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>150</td>
<td>39.4</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>231</td>
<td>60.6</td>
</tr>
</tbody>
</table>

The demographic characteristics of the study were considered to provide a basis of explaining certain patterns of the results. The number of students that were recruited per
school was related to the total population of the school.

4.2 Reliability of the main source of water

The respondents were asked to comment on the reliability of the main water source (piped water from then Municipal council). Table 4.2 below represents the results on the reliability of the water sources.

Table 4.2: Reliability of main water source within Nakuru Municipality

<table>
<thead>
<tr>
<th>Days in a week water flows(tap)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Every day) very reliable</td>
<td>31</td>
<td>8.1</td>
</tr>
<tr>
<td>(3-4days) Reliable moderately</td>
<td>236</td>
<td>61.9</td>
</tr>
<tr>
<td>(at least once a week) Not reliable</td>
<td>114</td>
<td>29.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>381</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Figure 4.1 Frequency of water from municipal council of Nakuru (piped)

According to the data collected most of the water resources in the municipality are moderately reliable. Among the respondents 31 (8.1%) considered their main source of water very reliable while 236 (61.9%) moderate and 114 (29.9%) not reliable (Table 4.2). The reliable water was considered as a case where the respondents were able to receive water from the source frequently without fail. Moderately reliable was considered as a case where the water source provided water most of the time but with some occasional shortages. The unreliable source was that in which the water source could not provide water oftenly. Lack of water storage facilities and lack of piped water are some of the issues raised by the schools. The reliability of water sources in Nakuru has been noted with a lot of concern. It since has seen the initiation of several water projects (Africa development Bank, 2004).

4.3: Sources of water pollution

The study sought to know the main sources of water pollution in the school. The main sources of pollution within schools as indicated by the SMC representative are as
stipulated in table 4.3 below. All the respondents were also required to state whether there has been any quality awareness in the school and the results are tabulated in the table 4.3 below.

**Table 4.3: Source of water pollution in the school and any awareness created**

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>Categories</th>
<th>Freq</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of water pollution in the school</td>
<td>Sewage overflows</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Industrial discharge</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Acid rain silage</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Stagnant water</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td>Oil spillage from Garages</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>Poor storage of Water</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>Excess fluoride and chlorine levels in water</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Has there been a water quality awareness creation in your school?</td>
<td>Yes</td>
<td>265</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>156</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>421</td>
<td>100</td>
</tr>
<tr>
<td>School</td>
<td></td>
<td>60</td>
<td>14.2</td>
</tr>
<tr>
<td>Environmental Clubs</td>
<td></td>
<td>205</td>
<td>48.8</td>
</tr>
<tr>
<td>Municipal Council of Nakuru</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Governmental Departments</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGO’s, FBO’s and CBO’s</td>
<td></td>
<td>156</td>
<td>0</td>
</tr>
<tr>
<td>NR</td>
<td></td>
<td>421</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
All the respondents indicated that main sources of water pollution are water pollutants that is 3 (10%) sewage overflows, 6 (20%) industrial discharge, 3 (10%) acid rain silage, 4 (13.3%) stagnant water, 1(3.3%) oil spillage from garages, 1 (3.3%) poor storage of water and 12 (40%) said excess fluoride and chlorine levels in water. Most of the respondents 265(63%) stated that there has been a water quality awareness in their schools but 156(37%) had not heard of any. Those authorities responsible for the water quality awareness were 60 (14.2%) from the schools, 205 (48.8%) was the awareness from the environmental clubs but 156(37%) of the respondents did not respond.

The results are in line with Tsjimira(2001), who outlined the various sources of contamination within the Nakuru municipality. He however includes other unique contaminants in Nakuru as agricultural waste water, factory waste water, urban garbage, industrial waste and other pollutants generated in and around Nakuru Municipality. They not only are liable to contaminating the water but are deemed to be the chief pollutants of the Lake Nakuru.

4.4 Effects of water pollution to the environment and human beings

The study sought to know the effects of water pollution to the environment and human beings. The results gathered are shown in the table 4.4 below.
Table 4.4: Effects of water pollution on the environment and the human beings

<table>
<thead>
<tr>
<th>Effects of water</th>
<th>Effects</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution to the environment</td>
<td>Deaths</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Diseases such as</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Dental fluorosis, cancer,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cholera and skin disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad taste, smell and color</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Stains clothes</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Effects of water</td>
<td>Wilting of crops due</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Pollution to the garden</td>
<td>Stunted growth</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Contamination of fruits</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Decline In crop yield</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Crop diseases</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Among the SMC groups interviewed said the effects of water pollution to the environment at home and in the garden were as follows at home 5 (17%) causes deaths, 12(40%) causes diseases such as dental fluorosis, cancer, cholera, skin diseases, 8(26%) bad effects on taste, smell & color of water, 5(17%) stains clothes and then in the garden acid rain 6(20%) causes wilting of crops, 9(30%) crops develop stunted growth, 10(33%) Wilting of vegetables and crops, contamination of fruits, 3(10%) decline in crop yield, 2(7%) crop related diseases.
4.5: Benefits, challenges and achievements of water quality awareness carried out

The study sought to know the benefits, challenges and achievements of water quality awareness. The table 4.7 below represents the results.

**Table 4.5: Benefits, challenges and achievements of water quality awareness**

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievements</td>
<td>Good health of users</td>
<td>86</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td>Healthy community</td>
<td>59</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>No absenteeism due to school</td>
<td>90</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>Prevents tooth decay</td>
<td>61</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>Safes time, resource and health</td>
<td>86</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td>Less contamination</td>
<td>39</td>
<td>9.3</td>
</tr>
<tr>
<td>Challenges</td>
<td>Water treatment and</td>
<td>56</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Not enough supply</td>
<td>42</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>High population</td>
<td>45</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Poor and lack of storage</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>High fuel prices</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Frequent in eruptions</td>
<td>45</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Disconnections due to no</td>
<td>84</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Lack of awareness of water</td>
<td>56</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Ignorance</td>
<td>34</td>
<td>8</td>
</tr>
<tr>
<td>Achievements and club activities.</td>
<td>Creation of water points and better storage</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Closing taps after use</td>
<td>63</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Use of leaky tins</td>
<td>55</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Sensitization of personal</td>
<td>92</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Cleaning of the school</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Water education</td>
<td>96</td>
<td>23</td>
</tr>
</tbody>
</table>

In respect to the SMC, club patrons and the pupils, they considered that the water quality awareness 86 (20.4%) led to the improvements of good health of users, 59 (14%) led to a healthy community, 90(21.4%) pupils not being absent from school due to illnesses, 61(14.5%) prevents tooth decay, 86(20.4%) safes time, resources and its cheaper and 39(9.3%) less in contamination. The challenges faced by the club patrons, school
management committees and environmental club members in achieving quality of water at school were 56 (13%) water Treatment and maintaining quality standards, 42(10%) supply was not enough, 45(11%) high population meant more quality water, 36(8%) poor & lack of storage facilities, 23(6%) high fuel prices, 45(11%) frequent interruptions, 84(20%) lack of payment of water bills leading to disconnections, 56(13%) lack of awareness on water quality and 34(8%) due to ignorance.

Achievement and club activities recorded within the schools showed that there are indications of increased environmental awareness involvement by club members than the SMCs, 50(12%) Lion Hill and Naka schools have increased water points and introduced portable water storage tanks of 5000 liters each. In Kaloleni and St. Mary’s schools 63(15%) the respondents practiced the habit of closing taps after use. Some respondents 55(13%) practiced the use of leaky tins in watering flowers. Sensitization of pupils on personal hygiene was also done by most 92(22%) of the responding schools. This included peer education, writing posters on water quality (case of Mama Ngina girls).

Other activities include; cleaning of general school environment 65(15%) (Collection of papers, containers, draining of stagnant water cutting of tall grass etc), use of clean water storage containers and 96(23%) water education to other pupils and the surrounding school communities and this contributed greatly in controlling water pollution.

4.8 Awareness of effects of mineral contamination

The study sought to know whether the respondents knew what caused teeth staining, to know the percentage of students who had stained teeth and also know the likely effects of stained
teeth. The figures 4.2, 4.3 and 4.4 below shows the results obtained from the pupils.

**Figure 4.2: Are you aware of what causes staining of the teeth**

The respondents indicated that 63(34.8%) were aware of the causes of the teeth staining, 72(39.8%) were not aware while 46(25.4%) of the respondents did not respond. The respondents 53(29.3%) further indicated that (75-100) % of their class members had stained teeth, 66(36.5%) stated that (50-74) % of their class members had stained teeth, 46(25.4%) indicated that the students who had stained teeth were below 50% but 16(8.8%) did not respond as indicated in figure 4.5 below. Respondents also indicated as shown in the figure 4.6 that the effects of stained teeth were among others 83(45.9%) feeling shy and not able to smile thus lowering oneself esteem, others 59(32.6%) indicated that the stained teeth could cause tooth decay and 39(21.5%) did not respond.
4.7 Environmental clubs

The study sought to know whether the schools had environmental clubs, how active they were, how frequent the club members met, how many members constituted the clubs, know the number of times the members had done an activity related to water pollution control in that year, know the level of involvement the club members were and finally
know the level of assistance given by the administration and the SMC. The table 4.8 below shows the results.

Table 4.6: Environmental clubs

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there an Environmental club in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>125</td>
<td>69</td>
</tr>
<tr>
<td>No</td>
<td>56</td>
<td>31</td>
</tr>
<tr>
<td>How active is your club?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very</td>
<td>101</td>
<td>81</td>
</tr>
<tr>
<td>Fairy</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Not</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>How often do the club Members meet?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Monthly</td>
<td>45</td>
<td>36</td>
</tr>
<tr>
<td>Once per term</td>
<td>70</td>
<td>56</td>
</tr>
<tr>
<td>Once per year</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Never meet</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>How many members Constitutes the club</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-20</td>
<td>4</td>
<td>3.2</td>
</tr>
<tr>
<td>21-40</td>
<td>73</td>
<td>58.4</td>
</tr>
<tr>
<td>41-60</td>
<td>48</td>
<td>38.4</td>
</tr>
<tr>
<td>61-80</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of times the Member had done an activity related to water pollution control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>109</td>
<td>87.2</td>
</tr>
<tr>
<td>3-4</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>5-6</td>
<td>6</td>
<td>4.8</td>
</tr>
<tr>
<td>7-8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The level of Involvement of the Level of assistance given by the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very active</td>
<td>85</td>
<td>68</td>
</tr>
<tr>
<td>Fairy active</td>
<td>38</td>
<td>30.4</td>
</tr>
<tr>
<td>Inactive</td>
<td>2</td>
<td>1.6</td>
</tr>
<tr>
<td>Very good</td>
<td>92</td>
<td>73.6</td>
</tr>
<tr>
<td>Fair</td>
<td>26</td>
<td>20.8</td>
</tr>
<tr>
<td>Very little</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

The study showed that the respondents 125(69%) indicated that there are active clubs in their schools, however 56(31%) of them said there were no Environmental clubs in their school. According to the results 101(81%) of the club members are very active, 14(11%) are fairly active and 10(8%) are not active at all.
The club members met at different times, 5(4%) met weekly, 45(36%) met monthly, majority 70(56%) met once per term and 5(4%) met once per year. The research further deemed to know the number of members who constituted a club and the respondents indicated that 4(3.2%) were 0-20 members, majority 73(58.4%) were between 21-40 members while 48(38.4%) were between 41-60 members. The study showed that the number of times that the clubs had involved themselves in an activity related to water pollution control that year were 109(87.2%) in 1-2 activities, 10(8%) had involved themselves 3-4 times in such activities and 6(4.8%) had been involved in 5-6 times but none had been in to such activities for more than 6 times. The club member’s level involvement was also varying according to the results of the table above. Majority 85(68%) were actively involved, 38(30.4%) were fairly active and 2(1.6%) were inactive. The study further showed that the level of assistance given by the administration and the SMC to the clubs was 92(73.6%) very good, 26(20.8%) fair, 5(4%) said it was very little and 2(1.6%) said there was no support at all.

It was found out that there is a strong relationship between school management committee and school administration on club member’s involvement and support to club’s activities. From the interpretation of the table above; administrative support is of critical essence as the club members have a lot of confidence in them. Any slight decrease in support will have an effect with drastic changes in levels of environmental pollution.

### 4.8 Strategies of improving water pollution control

The study sought to know the activities that the head teachers, club patrons, SMCs and environmental club members should involve themselves in to improve water pollution
control within the school and outside the school. In an interview the study participants presented the following suggestions. The head teachers in collaboration with club patrons and Environmental club members were to empower club members, encourage pupils to carry clean water from home, encourage the planting of more trees, educate parents and pupils to boil water before drinking, use the pupils to pass the information on water quality to the people and have many workshops to enlighten people on water quality. The SMCs on the other hand according to the results were to continuously supply quality piped water to all schools, improve water harvesting facilities that is tanks to be introduced to the schools inform NAWASCO to ensure repair and maintenance of leaking pipes in all the schools, facilitate recycle of waste materials, diversify usage of water, start school feeding programs, bring about action for better health and facilitate sinking of boreholes to increase water quantity.

At home they were encourage the knowledge on Water supplies, harvesting and treatment technologies, proper disposal of waste water, mobilize community on how to access quality water, cleaning the environment, planting crops, practice zero-grazing, do canal irrigation and could also start small restaurant.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study was carried out in the Nakuru municipality schools. This chapter deals with summary conclusion and recommendations of the study.

It sought to establish the impact of communication of information on quality of water to the pupils’ level of awareness in the schools of the Nakuru municipality. The study recruited students from 10 schools. The study participants were evenly distributed among the schools, however larger percentage of the students were from Kaptembwo School. The larger percentages of the participating students were females compared to males.

5.2 Summary of research findings and conclusions:

5.2.1 Summary findings

The study had the following findings;

- The school received water from the main source of water (piped water from municipal council) 3-4 times a week which was moderate. This was according to a large percentage of the respondent.
- The main sources of water pollution in the school were identified as sewage overflow, industrial discharge, stagnant water, acid rain silage, excess fluoride and poor storage of water according to the respondent.
- The effect of pollution to the environment and human according to majority of
respondents included, deaths, disease, staining clothes and bad taste, withering crops, stunted growth and contamination of fruits, decline in crop yield and crop diseases.

- Majority of the respondents indicated that water quality awareness was carried out in their schools by environmental clubs.

- The study revealed that benefits of water quality awareness created that benefits of water quality illness, good health of users, a healthy community prevents tooth decay and less contamination to the drinking water.

- The study also revealed the following challenges to maintenance of water quality, disconnections due to no pay, ignorance, not enough water supply, high population, lack of water treatment and maintaining quality standards, high fuel prices, lack of suitable storage facilities and lack of water quality.

- On achievements achieved, there was creation of water points, closing of taps after use, use of leaky tins, and sensitization of personal hygiene, cleaning of the school environment and increased water education.

- A small percentage of respondents were aware of causes of teeth staining while majority were not aware, some of the effects of stained teeth included feeling shy and not able to smile thus lowering one's self-esteem.

- The study revealed that there were active environmental clubs in the schools under study with active club members, met at least once per term.

- The study also revealed that administrative support was of critical essence as the club members had a lot of confidence in them.

- On strategies of improving status of drinking water, the respondents suggested the following, empowerment of club members, encourage pupils to carry clean water
from home, planting of more trees, educate parents and pupils to boil water before drinking, use of pupils to pass information to the people through workshops.

5.2. Conclusions

Based on the study findings the following were the conclusions of the study:

- The information on water quality passed to pupils in primary schools in Nakuru municipality improved their level of awareness.
- The level of awareness on water quality to the pupils in the identified schools however is still low.
- The awareness creation had improved the suitability of water for consumption in the schools.
5.3 Recommendations

The following are the recommendations of the study:

i). The stakeholders in the schools should raise awareness in all
the schools and communities within the Nakuru municipality on the importance
of the treatment of drinking water through empowering of environmental club members and
offering administrative support.

ii). The schools should source for suitable clean storage facilities; invest in rain water
harvesting facilities so as to acquire water during the dry season.

iii). The schools should acquire more hand washing points to improve hygiene of the
pupils and enhance good water practices like closing of taps after use.

iv). The policy makers should come up with better policies of water quality usage in
schools.

v). Further research needs on information dissemination on water quality should be
conducted.
REFERENCES


Swinburne N. (2000). Local agenda 21 incentive project: Nakuru municipality, Nakuru, Kenya


United Nations (2002). The Johannesburg Declaration on sustainable Development

**APPENDICES**

APPENDIX I: Water quality tables

Microbiological limits for drinking water and containerized drinking water (Source: Adopted from KS 05-459: Part 1:1996)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>Type of micro-organism</th>
<th>Drinking Water</th>
<th>Containerized Drinking Water</th>
<th>Methods of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Total viable counts at 37°C, per ml, max</td>
<td>100</td>
<td>20</td>
<td>KS 05 – 200+</td>
</tr>
<tr>
<td>(ii)</td>
<td>Coliforms in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(iii)</td>
<td>E. Coli in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(iv)</td>
<td>Staphylococcus aureus in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(v)</td>
<td>Sulphite reducing anaerobes in 50ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(vi)</td>
<td>Pseudomonas aeruginosa fluorescence in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(vii)</td>
<td>Streptococcus faecalis</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(viii)</td>
<td>Shigella in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
<tr>
<td>(ix)</td>
<td>Salmonella in 250ml</td>
<td>Shall be absent</td>
<td>Shall be absent</td>
<td>KS 05 – 200</td>
</tr>
</tbody>
</table>
### Schedule 1: Aesthetic quality requirements for drinking water and bottled drinking water
(Source: Adopted from KS 05-459: Part 1:1996)

<table>
<thead>
<tr>
<th>SL NO</th>
<th>Substance or Characteristic</th>
<th>Unit</th>
<th>Drinking Water</th>
<th>Bottled Drinking Water</th>
<th>Methods of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Colour</td>
<td>True color units</td>
<td>15</td>
<td>15</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(ii)</td>
<td>Taste and odour</td>
<td>Shall not be offensive to consumers</td>
<td>Shall not be offensive to consumers</td>
<td>KS 05 - 459</td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>Suspended matter</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iv)</td>
<td>Turbidity</td>
<td>NTU, max</td>
<td>5</td>
<td>1</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(v)</td>
<td>Total dissolved solids</td>
<td>mg/l, max</td>
<td>1,500</td>
<td>1,500</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(vi)</td>
<td>Hardness as CaCO₃</td>
<td>mg/l, max</td>
<td>500</td>
<td>500</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(vii)</td>
<td>Aluminium as Al</td>
<td>mg/l, max</td>
<td>0.1</td>
<td>0.1</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(viii)</td>
<td>Chloride as Cl</td>
<td>mg/l, max</td>
<td>250</td>
<td>250</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(ix)</td>
<td>Copper as Cu</td>
<td>mg/l, max</td>
<td>0.1</td>
<td>0.1</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(x)</td>
<td>Iron as Fe</td>
<td>mg/l, max</td>
<td>0.3</td>
<td>0.3</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xi)</td>
<td>Manganese as Mn</td>
<td>mg/l, max</td>
<td>0.1</td>
<td>0.1</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xii)</td>
<td>Sodium as Na</td>
<td>mg/l, max</td>
<td>200</td>
<td>200</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xiii)</td>
<td>Sulphate as SO₄</td>
<td>mg/l, max</td>
<td>400</td>
<td>400</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xiv)</td>
<td>Zinc as Zn</td>
<td>mg/l, max</td>
<td>5</td>
<td>5</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xv)</td>
<td>PH</td>
<td></td>
<td>6.5 to 8.5</td>
<td>6.5 to 8.5</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xvi)</td>
<td>Magnesium as Mg</td>
<td>mg/l, max</td>
<td>100</td>
<td>100</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xvii)</td>
<td>Chlorine concentration</td>
<td>mg/l</td>
<td>0.2+0.5</td>
<td>Nil</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xviii)</td>
<td>Calcium as Ca</td>
<td>mg/l, max</td>
<td>250</td>
<td>250</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xix)</td>
<td>Ammonia (N)</td>
<td>mg/l, max</td>
<td>0.5</td>
<td>0.5</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xx)</td>
<td>Fluoride as F⁺</td>
<td>mg/l, max</td>
<td>1.5</td>
<td>1.5</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxi)</td>
<td>Arsenic as As</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxii)</td>
<td>Cadmium as Cd</td>
<td>mg/l, max</td>
<td>0.005</td>
<td>0.005</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxiii)</td>
<td>Lead as Pb</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxiv)</td>
<td>Mercury (total Hg)</td>
<td>mg/l, max</td>
<td>0.001</td>
<td>0.001</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxv)</td>
<td>Selenium as Se</td>
<td>mg/l, max</td>
<td>0.01</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxvi)</td>
<td>Chromium as Cr</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxvii)</td>
<td>Cyanide as CN</td>
<td>mg/l, max</td>
<td>0.01</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxviii)</td>
<td>Phenolic substances</td>
<td>mg/l, max</td>
<td>0.002</td>
<td>0.002</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxix)</td>
<td>Barium as Ba</td>
<td>mg/l, max</td>
<td>1.0</td>
<td>1.0</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xxx)</td>
<td>Nitrate as NO₃</td>
<td>mg/l, max</td>
<td>10</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
</tbody>
</table>

- The local and climatic conditions necessitate adaptation of Fluoride concentration in excess of 1.5 mg/l
- In exceptional cases, a Fluoride content of 3mg/l can be acceptable in Kenya.
**Schedule 2:** Limits for inorganic contaminants in drinking water and bottled drinking water  
(Source: Adopted from KS 05-459: Part 1:1996)

<table>
<thead>
<tr>
<th>SL_NO</th>
<th>Substance or Characteristic</th>
<th>Unit</th>
<th>Limit of Concentration</th>
<th>Method of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Arsenic as As</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(ii)</td>
<td>Cadmium as Cd</td>
<td>mg/l, max</td>
<td>0.005</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(iii)</td>
<td>Lead as Pb</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(iv)</td>
<td>Mercury (total as Hg)</td>
<td>mg/l, max</td>
<td>0.001</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(v)</td>
<td>Selenium as Se</td>
<td>mg/l, max</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(vi)</td>
<td>Chromium as Cr</td>
<td>mg/l, max</td>
<td>0.05</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(vii)</td>
<td>Cyanide as CN</td>
<td>mg/l, max</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(viii)</td>
<td>Phenol and phenolic substan</td>
<td>mg/l, max</td>
<td>0.002</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(ix)</td>
<td>Barium as Ba</td>
<td>mg/l, max</td>
<td>1.0</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(x)</td>
<td>Nitrate as NO₃</td>
<td>mg/l, max</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(xi)</td>
<td>Fluoride as F</td>
<td>mg/l, max</td>
<td>1.5</td>
<td>KS 05 - 459</td>
</tr>
</tbody>
</table>

**Schedule 3:** Limits for organic constituents of health significance in drinking water and bottled drinking water  
(Source: Adopted from KS 05-459: Part 1:1996)

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>Substance or Characteristic</th>
<th>Unit</th>
<th>Limit of Concentration</th>
<th>Method of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Benzoic</td>
<td>µg/l, max</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(iii)</td>
<td>Chlorophenics</td>
<td>µg/l, max</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td></td>
<td>Pentachlorophenol</td>
<td>µg/l, max</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td></td>
<td>2, 4, 6-Trichlorophenol</td>
<td>µg/l, max</td>
<td>10</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(iv)</td>
<td>Polynuclear aromatic</td>
<td>µg/l, max</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td></td>
<td>hydrocarbons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benzo(a)pyrene</td>
<td>µg/l, max</td>
<td>0.01</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td>(v)</td>
<td>Trihalomethanes</td>
<td>µg/l, max</td>
<td>30</td>
<td>KS 05 - 459</td>
</tr>
<tr>
<td></td>
<td>Chloroform</td>
<td>µg/l, max</td>
<td>30</td>
<td>KS 05 - 459</td>
</tr>
</tbody>
</table>
APPENDIX II

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

<table>
<thead>
<tr>
<th>N</th>
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<th>N</th>
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Note: “N” is population size

“S” is sample size.
Appendix II: Questionnaire

QUESTIONNAIRE FOR ENVIRONMENTAL CLUB PATRONS

SECTION A:

Name of the School:

................................................................................................................................................

Name of Respondent:

................................................................................................................................................

Sex:

(i) Male [   ]
(ii) Female [   ]

SECTION B:

1. WATER SOURCES

A) How many days in a week does the school get piped water from the Municipal Council?

i) Every day in the week [   ]

ii) 3 to 4 days [   ]

iii) Once a week [   ]

Explain briefly why
2. ENVIRONMENTAL AWARENESS

a) Has there been any environmental awareness creation on carried out in your school in the last six months?

Part I

Yes [ ]

No [ ]

Part II

If yes, who organized?
i) School environmental club [ ]
ii) Municipal Council of Nakuru [ ]
iii) Other government departments [ ]
iv) NGO’s, FBOs and CBO’s [ ]
v) Others (state)

…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

If your answer in part I is a yes answer question (c)

c) List the benefits, challenges and achievements of the awareness creation on water quality

Benefits
i) 
ii) 
iii) 

Challenges
i) 
ii) 
iii) 

Achievements
4. GENERAL

What activities would you suggest to be undertaken by the head teacher, club patron, School management committee and school environmental club members for improved water quality?

A) Within the school

a. By head teachers
   i)
   ii)
   iii)

b. By Club Patron
   i)
   ii)
   iii)

c. By School management committee
   i)
ii)

iii)

d. By Environmental club members

i)

ii)

iii)

B) Outside the school

i)

ii)

iii)

Thank you for your contribution in this study.

QUESTIONNAIRE FOR SMC REPRESENTATIVES SECTION A:

Name of the School:

........................................................................................................

Name of

Respondent:.........................................................................................

Sex:
(i) Male [ ]
(ii) Female [ ]

SECTION B:

1. WATER SOURCES

a) How many days in a week does the school get piped water from the Municipal Council?

i) Everyday in the week [ ]

ii) 3 to 4 days [ ]

iii) at least once a week [ ]

Explain briefly why

………………………………………………………………………………………………

………………………………………………………………………………………………

………………..

2. WATER POLLUTION

a) What are the five main sources of water pollution in your school?

i) …………………………………………………………………………….

ii) ……………………………………………………………………………

iii) ……………………………………………………………………………

iv) ……………………………………………………………………………

v) ……………………………………………………………………………

b) What is the level of water pollution in your school?
c) What are the effects of water pollution to:

i) Environment

.................................................................
.................................................................
.................................................................

............... 

i) Human beings

.................................................................
.................................................................
.................................................................
.................................................................
.................................................................

......................... 

d) What are the methods of controlling pollution of:

i) Drinking water

☐ .................................................................

☐ .................................................................
ii) Surface water

- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………

iii) Underground water

- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………
- ………………………………………………………………………

e) What are the main sources of waste water in your school?

i. ………………………………………………………………………

ii. ………………………………………………………………………

iii. ………………………………………………………………………

iv. ………………………………………………………………………

v. ………………………………………………………………………

3) Has there been any environmental awareness creation on water pollution carried out in
your school in the past six months?

Part I

Yes [ ]

No [ ]

Part II

If yes who organized

i) School environmental club [ ]

ii) Municipal Council of Nakuru [ ]

iii) Other government department [ ]

iv) NGO’s and CBO’s [ ]

v) Others(state)

……………………………………………………………………………………………………

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……………………………………………………………………………………………………

……………………………………………………………………………………………………

If you’re answer in part I is a yes answer question (g)

g) List the benefits, challenges and achievements of the awareness creation on environmental pollution
Benefits

i) 

ii) 

iii) 

Challenges

i) 

ii) 

iii) 

Achievements

i) 

ii) 

iii) 

4. ENVIRONMENTAL CLUBS

a) Does the school have an environmental club?

Part I

Yes [ ]

No [ ]

If yes how active is it? (Tick where appropriate)

Part II
If your answer to part I is yes answer question b,c,d,e,f,g, 

b) How frequent do the club members meet? 
   i) Weekly [ ]
   ii) Monthly [ ]
   iii) Once per term [ ]
   iv) Once per year [ ]
   v) Never meet [ ]

   How many members constitute the club? Boys [ ] Girls [ ]

e) List the water pollution control activities undertaken by the club in the last one year

   i) 
   ii) 
   iii) 
   iv) 

f) What is the level of pupil involvement in club activities?
   i) Very active [ ]
ii) Fairly active

iii) Inactive

5. GENERAL

What activities would you suggest to be undertaken by the head teacher, club patron, School management committee and school environmental club members for improved water pollution control?

A) Within the school

a. By head teachers

   i) 

   ii) 

   iii)
b. By Club Patron
   i)
   ii)
   iii)

c. By School management committee
   i)
   ii)
   iii)

d. By Environmental club members
   i)
   ii)
   iii)

B) Outside the school

a. By head teachers
   i)
   ii)
   iii)

b. By Club Patron
Thank you for your contribution in this study.

QUESTIONNAIRE FOR PUPILS SECTION A

Name of the school............................................................................................................

Name of the respondent.....................................................................................................

Sex:

i) Male [ ]

ii) Female [ ]
SECTION B

1. WATER SOURCES

a) How many days in a week does the school get piped water from the Municipal Council?

i) Every day in the week [    ]

ii) 3 to 4 days in a week [    ]

iii) at least once a week [    ]

Explain briefly

why……………………………………………………………………………………………
………………………………………………………………………………………………
………………….

3. AWARENESS OF THE EFFECTS OF MINERAL CONTAMINATION

a) Do you know what causes the staining of teeth?

Yes [    ]

No [    ]

Don’t know [    ]

b) What is the percentage of pupils in your class with stained teeth?
i) 75%-100% [   ]
ii) 50%-74% [   ]
ii) Below 50% [   ]

c) What are the effects of the stained teeth to the pupils

i)  
ii)  
iii)  
iv)  
v)  

d) Has there been any environmental awareness creation carried out in your school in the past six months?

Part I
Yes [   ]
No [   ]

Part II
If yes, who organized
vi) School environmental club [   ]
vii) Municipal Council of Nakuru [   ]
viii) Other government departments [   ]
ix) NGO’s ,FBOs and CBO’s [   ]
x) Others(state)

………………………………………………………………………………………
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………………………………………………………………………………………

If your answer in part I is a yes answer question (c)

e) List the benefits, challenges and achievements of the awareness creation on water quality

Benefits
i)
i
ii)
i
iii)

Challenges
i)
i
ii)
i
iii)

Achievements
i)
i
ii)
i
iii)
4. General

What activities would you suggest to be undertaken by the school environmental club members for improved water quality?

a) Within the school

By environmental club members

i)

ii)

iii)

Thank you for your contribution