

# WATER MANAGEMENT CASE STUDY

Case Study in Water Management in an expansive metropolitan area, composed of millions of households in Africa - Nairobi, Kenya.

## NAIROBI

Nairobi is an expansive metropolitan area, composed of numerous households. Within these households, everyday activities such as cleaning, cooking, showering, waste disposal among many other domestic water applications occur. Furthermore, Nairobi houses numerous industries, which are prone to release waste.



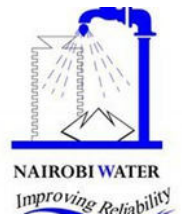
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### N.C.W.S.C.

Nairobi City Water and Sewerage Company Head Offices



# Water & Wastewater Treatment in Kenya



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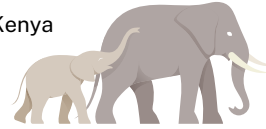


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## DANDORA, KENYA WASTEWATER TREATMENT PLANT

Dandora Estate Sewerage Company treats about 120,000 cubic meters of waste water daily, but has a capacity of 160,000 cubic meters. Physical treatment is the initial process, which involves passing the waste water through a series of screens to filter out cloth, plastics, and paper, which would cause clogging and machine damage. Next, the water undergoes biological treatment within anaerobic ponds, for a period of 5 days, which reduces anaerobic bacteria by 60%. Over a period of 35 days, both anaerobic and aerobic bacteria are used to further reduce the organic load in the facultative ponds. Finally, maturation ponds, allow for sunlight to penetrate the water and eliminate pathogens such as E-Coli. Monitoring is done daily to check waste water quality at different stages from the intake to the outflow.



Image credits: Sustainable Sanitation Alliance

**Water Inlet Distribution  
Channels, Dandora treatment  
plant**

# Water Management Case Study



## Ngethu Kenya Water Treatment Plant



### WATER CLARIFIER

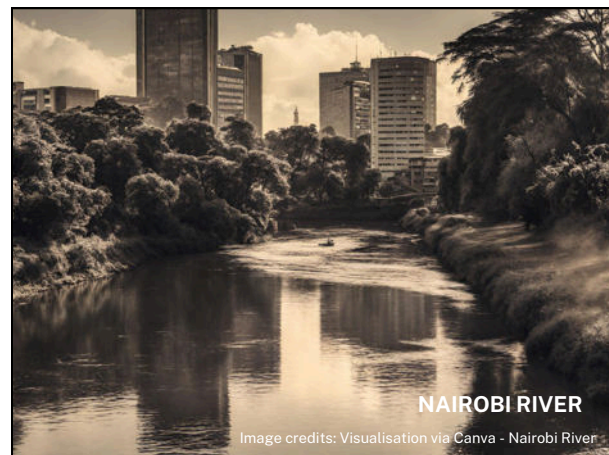
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NCWSC is equipped with infrastructure dedicated to its core purpose of ensuring Nairobi residents receive water and sewerage services at affordable rates and within government regulations. The company's infrastructure is scattered across various locations within the central region, Kenya. For waste water treatment and disposal, dedicated plants namely; Dandora Estate Sewerage Treatment Plant and Kariobangi Sewerage Treatment works are stationed at Ruai and Outering road respectively, while for water treatment, the company has stationed water treatment plants at Ngethu, Sasumuwa, Kabete, and Kikuyu Springs. Within these treatment plants, there exist frameworks for auditing the processes applied in both the treatment of water and waste water. The process adhered in either scenario differs in that one is aimed at removing waste and pollutants and releasing water back into the ecosystem through the Nairobi River, whilst the other, is aimed at ensuring Nairobi residents receive clean and safe water that adheres to the quality standards proposed by the world Health Organization guidelines.



### AERIAL VIEW OF NGETHU TREATMENT PLANT

Image Credits: Google Earth Pro



### NAIROBI RIVER

Image credits: Visualisation via Canva - Nairobi River



## Waste Water Treatment Process

Waste water treatment at both plants is done through both physical and biological processes to extract solids, remove pollutants, and break down organic waste matter. Dandora Estate Sewerage Company treats about 120,000 cubic meters of waste water daily, but has a capacity of 160,000 cubic meters. Physical treatment is the initial process, which involves passing the waste water through a series of screens to filter out cloth, plastics, and paper, which would cause clogging and machine damage. Next, the water undergoes biological treatment within anaerobic ponds, for a period of 5 days, which reduces anaerobic bacteria by 60%. Over a period of 35 days, both anaerobic and aerobic bacteria are used to further reduce the organic load in the facultative ponds. Finally, maturation ponds, allow for sunlight to penetrate the water and eliminate pathogens such as E-Coli. Monitoring is done daily to check waste water quality at different stages from the intake to the outflow.



**KARIOBANGI TREATMENT PLANT, PERSPECTIVE VIEW**

Image credits: NCWSC



Image Credits: Google Earth Pro



**PRESCREENING**  
sorting out the trash

Image credits: Sustainable Sanitation Alliance

# WATER

Similarly, at Kariobangi waste water treatment plant, both physical and biological treatment process are utilized. However, it has a lower capacity of approximately 32,000 cubic meters during a dry weather flow and a hydraulic storm capacity of 96,000 cubic meters. Furthermore, it includes a waste water laboratory to analyze the adherence of waste water quality to legal requirements. The treatment process starts at the screening, where screens are installed to extract solids from the waste water. In the biological process, treatment begins within sedimentation tanks where primary clarification is done. This process allows for the clarification of the waste water and separation of sludge. The water is directed to trickling filters, while the sludge gets fed into anaerobic digesters. Secondary sedimentation occurs in humus tanks where the tanks aid in removing the trace slime. Organic matter is broken down within anaerobic tanks releasing carbon dioxide, hydrogen sulphide, and methane. The solids are then removed and exposed to the sun for drying on sludge drying beds to be sold to farmers at low prices for tree planting, while the supernatant is fed back in the inlet for recycling. Notably, although the sludge is good for tree planting and flower cultivation, it is unsuitable for crop production due to its high concentration of heavy metals.

At both sewerage treatment plants, effluent is released into Nairobi river for reuse, while the sludge is sold to farmers at very low prices.

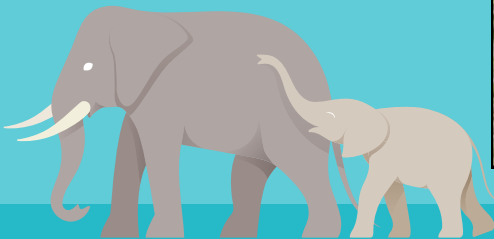
## Water Treatment Process

The process begins with the reception of raw water from the source, in the case of Kabete Treatment plant, water comes from Ruiru Dam. Screening is the initial stage after the inlet works to prevent solids from entering the system through the intake pipes. Then, the water flows into a sump and is pumped to the next stage. In the clarification stage, suspended impurities are targeted and removed through a combination of chemical processes; flocculation and coagulation. The latter and former involve the use of chemicals such as Aluminium Sulphate, which form the flocs. Afterwards, the water undergoes filtration to remove any remnant suspended materials. Filtration is followed by disinfection, which is aimed at killing harmful microorganisms and improve the water quality through chlorine dosing. Finally, before the water is pumped to the Reservoir for distribution, it is allowed to settle in clear well tanks, which are dosed with soda ash.

## Final Effluent at Dandora Treatment Plant, Green due to algae



Image Credits: Sustainable Sanitation Alliance



## WATER TREATMENT, NAIROBI

In conclusion, different processes are applied at NCWSC depending on the source of the water. For raw waste water (sewage) both physical and biological processes are used to improve its quality before effluent discharge into Nairobi river, reducing pollutants in the environment. On the other hand, water treatment for raw water involves a combination of physical and chemical processes, before it is clean and safe for consumption. Nevertheless, a bit needs to be done, as according to the Athi Water Works Development Agency, the asset holding body of NCWSC, due to overloading, the effluent released into the Nairobi river is short of meeting the quality standards.



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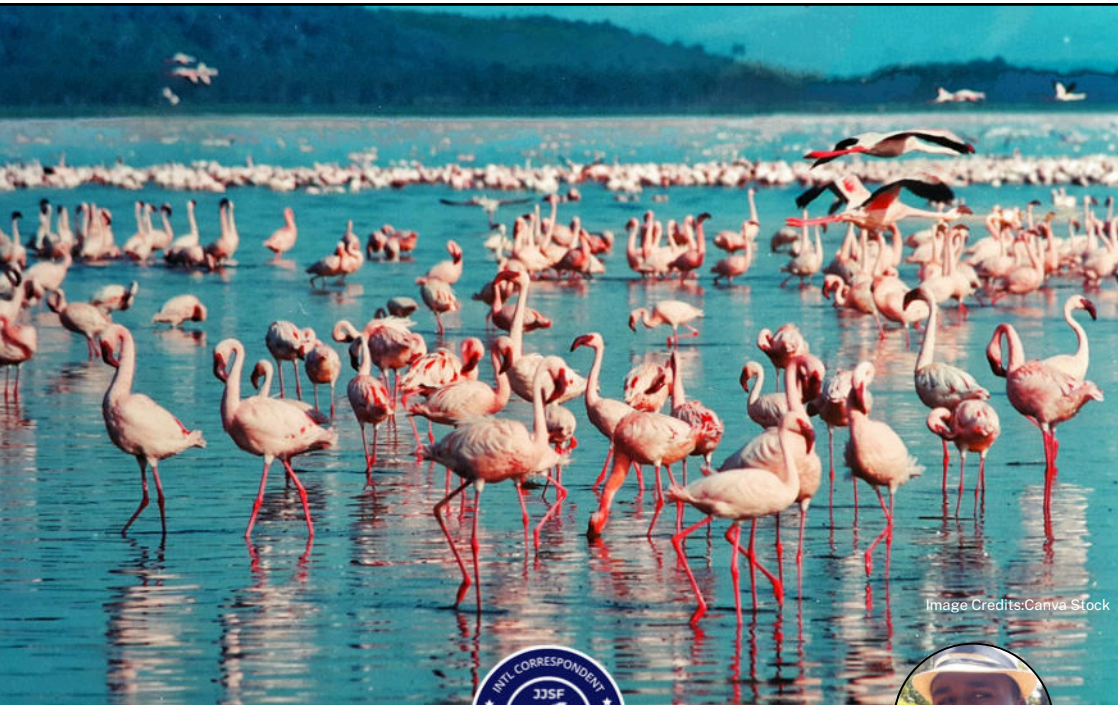


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