

# GIZ WAVEplus TRAINING KENYA



## Wastewater Management and Sanitation

Theme: Collection, Treatment and disposal of Domestic Wastewater and Sanitation For Enhanced Public Health and Environmental Protection in Kenya

Held at Milele Nairobi PCEA Guest House and Conference Centre  
8<sup>th</sup> to 12<sup>th</sup> July, 2013

## TRAINING COURSE DOCUMENTATION REPORT

July 2013

IMPLEMENTED BY:



**giz**

WAVEplus

in collaboration with



Kenya Water Institute

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## 1.0 Day One Activities

### 1.1 Registration, Welcome & Introductions

#### 1.1.1 Registration

Registration of participants was done between 8.00 and 8.30 am, and facilitated by Ms Caroline Wambui.



#### 1.1.2 Introductions of Participants and Trainers

This session was called to order by Mr. Joseph Kihara who welcomed members to the workshop and asked them to introduce themselves. The participants were drawn from 11 Water Companies as follows:

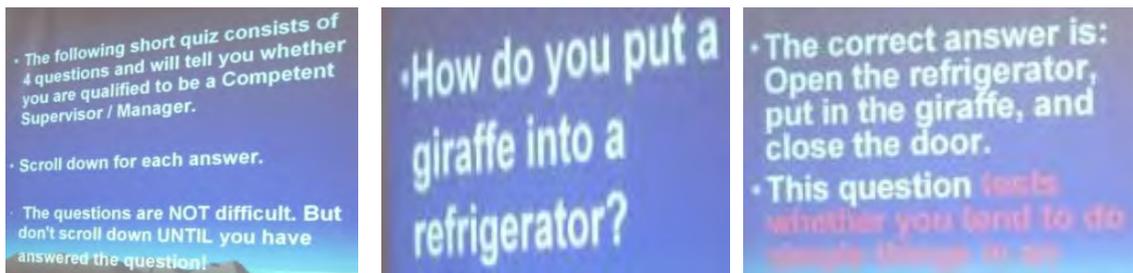
	Organization	Number of participants
1.	Garissa Water & Sewerage Co.	2
2.	Kericho Water & Sanitation Co.	3
3.	Nyeri Water & Sewerage Co.	2
4.	Eldoret Water & Sanitation Co.	3
5.	Nanyuki Water & Sewerage Co.	2
6.	Limuru Water & Sewerage Co.	2
7.	Meru Water & Sewerage Co.	3
8.	Mombasa Water & Sanitation Co.	3
9.	Embu Water & Sanitation Co.	3
10.	Thika Water & Sewerage Co.	2
11.	Nairobi Water & Sewerage Co.	3
	Total	28



### 1.1.3 Climate Setting

Mr. Kihara then introduced an ice breaking exercise called management quiz (shown below). Participants attempted to answer the questions posed by Mr. Kihara. The questions and their correct answers are shown below.

Question	Answer
1. How do you put a giraffe in a refrigerator?	Open the fridge door, put in the giraffe and close the door.
2. How do you put an elephant in a refrigerator?	Open the fridge, remove the giraffe and put in the elephant.
3. The Lion King is hosting an animal conference. All the animals attend except one. Which animal did not attend?	The elephant did not attend because it is in the fridge.
4. There is a river you must cross but it is used by crocodiles, and you do not have a boat. How do you manage it?	You jump into the river and swim across. All the crocodiles are attending the meeting.



Mr. Alfred Kirubi, the Focal Point of GIZ WAVEplus, once again welcomed members to the workshop and outlined a few logistical issues.

### 1.1.4 Setting of Participants' Norms

Mr. Kihara led the session on setting the ground rules. He requested a participant to volunteer to list the rules as they came from the other participants. The rules agreed upon were as follows:

1. Keeping time and observing punctuality at all times.
2. Strictly adhere to the timetable
3. Respect for one another's ideas and opinions.
4. Cell phones to be switched off or put in silent mode.
5. All to participate in discussions.



Participants selected a time keeper, Mary Wanjiru Theuri from Nyewasco.

### 1.1.5 Participants' Expectations

Mr. Kihara took participants through this session on expectations. This was achieved through each participant writing one expectation on a piece of paper. The lead trainer, Eng. Njaggah guided the participants into grouping the expectations into three main groups as follows:

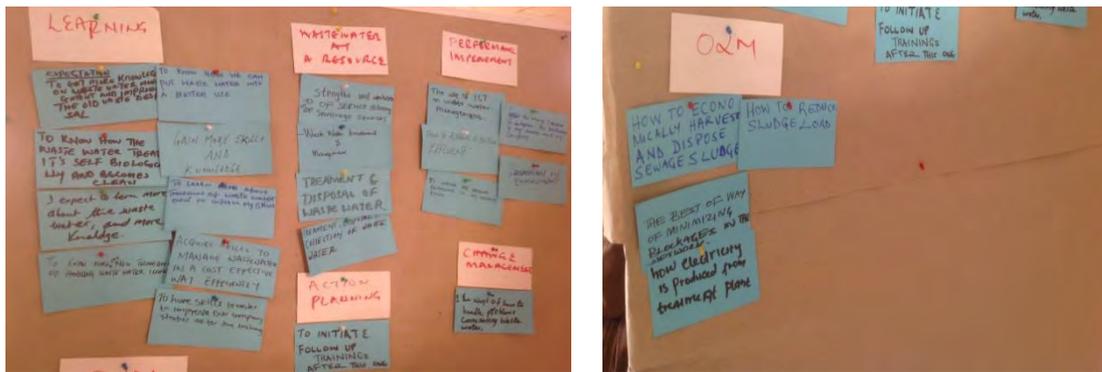
1. More knowledge on Collection and disposal of wastewater.
2. O&M and Wastewater reuse/wastewater as a resource
3. Wastewater and environment/performance improvement

Below is the full version of the expectations:



General Interest	Area of	Expectation
Learning		<ul style="list-style-type: none"> <li>• To get more knowledge on waste water management and improving the old waste disposal.</li> <li>• To know how the waste water treats its self biologically and becomes clean.</li> <li>• To learn more about the waste water and more knowledge</li> <li>• To know more on new techniques of handling waste water issues</li> <li>• To know how we can put waste water into a better use.</li> <li>• Gain more skills and knowledge</li> </ul>

	<ul style="list-style-type: none"> <li>• To learn more about treatment of waste water and to improve my skills.</li> <li>• Acquire skills to manage waste water in a cost effective way effectively.</li> <li>• To have skills in order to improve our company status after the training</li> </ul>
O&M	<ul style="list-style-type: none"> <li>• How to economically harvest and dispose sewage sludge.</li> <li>• How electricity is produced from treatment plant.</li> <li>• The best way of minimizing blockages in the network.</li> <li>• How to reduce sludge load.</li> </ul>
Wastewater as a Resource	<ul style="list-style-type: none"> <li>• Strengths and weaknesses of service delivery in sewerage services.</li> <li>• Waste water treatment and management.</li> <li>• Treatment and disposal of waste water.</li> <li>• Treatment, disposal, collection of waste water.</li> </ul>
Action Planning	<ul style="list-style-type: none"> <li>• To initiate and follow up trainings after this one</li> </ul>
Performance Improvement	<ul style="list-style-type: none"> <li>• How to achieve a better effluent.</li> <li>• The use of ICT on waste water management</li> <li>• To improve my general performance in my working place.</li> <li>• I expect to improve the production of my section and my company.</li> <li>• Sanitation on environment.</li> </ul>
Change Management	<ul style="list-style-type: none"> <li>• The ways of how to handle problems concerning waste water</li> </ul>



Eng. Njaggah then remarked that these expectations will guide the training. The expectations will be used to assess training at the end of the week – whether we shall have achieved.

## 1.2 Briefing About WAVEplus Kenya

Mr Kirubi made the following remarks concerning the GIZ WAVEplus program in Kenya and training.

- GIZ Wave Plus is a capacity building programme and is in 5 countries namely Kenya, Uganda, Tanzania and Zambia and recently, in South Sudan.
- MDs were also brought together – 4 MDs workshops so far and which has become an annual event.
- There was a lot of emphasis on water, leaving out wastewater and sanitation. Later in the programme, GIZ Waveplus picked up the issue and started by conducting a TOT for the trainers who later developed the wastewater management and sanitation course. This course is the first wastewater and sanitation management course conducted under WAVEplus. Similar training courses are being implemented in other WAVE countries.
- It was emphasized that the certificates will be issued after participants have implemented parts of their action plans.
- WAVE methodology approach is participatory approach giving everybody a chance to participate.

## 1.3 Official Workshop Opening

Mr. Kirubi invited Mr. David Ngetich, the Deputy Director KEWI to make a few remarks then invite the Director KEWI to open the workshop. Mr. Ngetich welcomed participants to Nairobi and Milele PCEA guest house in particular. He then made the following remarks:

- Thanked wave plus for enabling this programme to take place
- Thanked WASREB and KEWI
- Just one of a series of courses to be conducted this year.
- Only a few participants invited due to shortage of funds.
- After this, KEWI will take up the training course and conduct it as a short course.

- Trainers are well trained and experienced. I assure you that the trainers' experiences will be of good help to the participants.
- All the participants' expectations are in the time table and therefore will all be met.

Mr. Ngetich then invited the Guest of honour, Dr. L. Sumba, the acting Director, Kewi to open the workshop.



Dr. Sumba made the following remarks:

- Welcome all to Milele PCEA Guest House, South C
- She KEWI is honored to mount the first Wastewater Management and Sanitation course in collaboration with GIZ WAVEplus.
- GIZ WAVEplus programme is a part of the German Development Co-operation and funded by the Federal Ministry for Economic Co-operation and Development (BMZ).
- Collaboration between KEWI and WAVE started way back in 2005 (1<sup>st</sup> phase).
- Now, we are in the 2<sup>nd</sup> phase which will be ending in 2014.
- Many WSPs have benefitted from GIZ WAVEplus Sponsored training courses in Commercial and Customer Orientation (CCO), Non Revenue Water (NRW), Water Integrity and E-learning courses.
- Some of you are beneficiaries of some of these courses.
- Wastewater treatment systems in Kenya have been neglected with very little being done to maintain and improve the systems.
- Treatment efficiency at the plants operated by the WSPs - only around 20%.
- Coverage rate of sanitation is declining.
- Currently, only 3-4% of wastewater produced in the urban areas is treated with the rest is being discharged into the environment without treatment.
- National Water Services strategy (2007-2015) goal no 3 - 75% sanitation coverage by 2015.
- Kenya's Economic blue print, Vision 2030's sub-sector's goal on sanitation - sustainable access to basic sanitation to all Kenyans by 2030.
- CoK (2010) - Every person has the right to access of reasonable standards of sanitation.
- Kenya Water Institute (KEWI) in collaboration with GIZ WAVEplus has developed a training course on O&M of wastewater treatment plants and Sanitation.

- Today's course - addresses challenges of O&M of wastewater treatment plants in Kenya, for both conventional and waste stabilization ponds and onsite sanitation for the urban poor.
- Course intended to enable you the participants to appreciate the need for O&M of wastewater treatment plants and what you can do to improve the performance of your respective WSPs in the wastewater management and sanitation
- Course participants have been drawn from 11 WSPs in Kenya namely: Nairobi, Nyeri, Eldoret, Embu, Mombasa, Thika, Nanyuki, Garissa, Kericho, Limuru and Meru Water Companies.
- Varied backgrounds of participants will allow exchange of experiences and benefits will be derived from these experiences.
- Experienced resource persons will add a wealth of experience to the course.
- Field visit to Nairobi Water Company to see practically how they are applying what you are going to learn.
- It is my hope that you will be able to learn from the course and from one another.
- When you go back to your companies, translate the knowledge into practical terms and ensure that you improve the O&M of your sewerage system and sanitation. This will minimize pollution of our environment
- Last but not least I wish to thank
  - GIZ Senior Program Manager Mr. Heiko in Germany for his continued support to ensure WSPs receive capacity building.
  - All those who have contributed to the organization of this course and in particular GIZ WAVEplus Focal Point Mr. Alfred Kirubi, Eng. Njaggah the Lead Trainer and other Wave trainers together with those offering logistical support to the training course.

With those remarks Ms Sumba declared the course officially open.

#### **1.4 Group Photo**

The group photo session was facilitated by Mr. Kirubi.





## 1.5 Wastewater Management and Treatment Systems

### 1.5.1 Introduction to Wastewater Management (Network and Treatment)

Margaret Maina introduced and invited Eng. Njaggah to facilitate this session. Eng Njaggah made the following remarks:

- Constitution: every Kenyan has a right to sewerage and sanitation facilities.
- Provision is by the government but the government has delegated this to you.
- You have a constitutional obligation to provide people with the service.
- Perception about wastewater - You work in this section, it is a punishment.
- Blueprint - Water and sanitation to all by 2030- with this attitude, are we going to achieve this vision?

He then introduced wastewater management as follows:

#### 1. Background

- WW mgt – a shared responsibility between sectors – education
- Inadequate focus compared to water
- Poor are affected

#### 2. Wastewater management in Kenya

- **Historical development** – bush, pit latrines (beginning of ww mgt), independence brought hope (deregulation of waste disposal and promise of service provision in urban areas), population increase & limited resources (failure to provide & regulate sanitation), breakdown of authority of traditional rulers
- **Facts to Consider:**
  - 21 Million Kenyan use shared or unsanitary latrines
  - 5.6 million defacate in the open
  - Open defacation cost Kenya US \$88 million per year
  - Eliminating practice requires building 1.2 million toilets
- **Economic Impact of Poor Sanitation in Kenya**
  - Poor sanitation costs US\$324 million (kshs 27 b) in lost access time, premature death, productivity losses, health care cost).

- **Sanitation implementation plan (SIP)**
  - Formulated in 2009 by MWI
  - Intended to give sanitation priority
- **Wastewater Management in Kenya – Status today**
  - Access to urban sanitation – 69%
  - Access to rural sanitation – 82%
  - 95% of sewer effluent and excreta discharged into the environment poorly treated or untreated.
  - Sanitation coverage in urban areas – 19% - majority using onsite sanitation.
- **Key challenges**
  - Low access and inadequate facilities
  - High density population – high public health risk
  - Increasing contamination of water
  - Lack of data base
- **What needs to be done**
  - Allocate resources to sanitation
  - Target investment to the poorest
  - Address bottlenecks in service delivery pathways
  - Prioritize elimination of open defecation
- **Creating awareness for wastewater management**

### 3. Way forward for wastewater management

- Need to introduce a levy to be paid by those connected and those not connected. If there is a sewer line passing, you pay whether you are connected or not. At the end of the day all are polluting the environment, even those with pit latrines and septic tanks.
- Ring fence all sanitation charges.
- Service providers to develop and implement Sanitation Development Plans.



#### Questions & Answers

Do we have a tariff for sewage?

Yes we do though it is not reflective of the service itself. It is 75% of the water tariff.

#### 1.5.2 The need for efficient O&M of Waste Water Treatment Plants

This session was facilitated by Mr. Kirubi and he gave an overview of the following:

- How are we utilizing what we have?
- How can we make the systems we have more efficient?

- Definition of wastewater
- Classification of wastewater based on origin (sanitary, commercial, industrial, agricultural, surface runoff)
- Wastewater/sewage. Sewage is a subset of wastewater that is contaminated with feces or urine.
- Wastewater treatment – process of removing contaminants from wastewater.
- Why O&M of WTP?
  - About 95% of effluent is discharged into the environment untreated.
  - Exhausted sludge from onsite sanitation facilities is dumped in surface water bodies causing public health hazards and water resource pollution.
  - Majority of Waste Water Treatment Plants are operating at 20% efficiency due to inadequate operation and maintenance.
  - Most onsite sanitation facilities lack post toilet sludge treatment facilities (sanitation chain not complete).
  - Diseases attributable to poor sanitation currently kill more children globally than AIDS, malaria and measles put together, and diarrhoea is the single biggest killer of children in Africa.
  - Discharge of wastewater into the aquatic environment indiscriminately endangers the lives of the downstream residents.
  - 90% of the Kenyan population drinks water directly from water sources including rivers, lakes, wells, boreholes, streams etc.
- Impacts of discriminate wastewater disposal.
  - Performance of WTP is compromised
  - Quality of domestic water sources deteriorated
  - Ground water sources polluted



The facilitator posed the question: Do you think there is serious need to maintain our wastewater systems? The participants responded: YES

#### **Group Discussion**

Participants were then asked to discuss the following issue relating to the Kenyan situation. “What is the current situation of the operation and maintenance of your wastewater treatment

facilities?”



The following are participants’ responses to the above question:



GARISSA WATER & SEWERAGE COMPANY

- Poor town planning
- Illegal connections
- Sewer blockages due to dumping of solid wastes like paper bags etc.
- Inadequate facilities to handle wastewater leading to discharge of raw sewage to the river.

LIMURU SEWERAGE WORKS

- ① CAPACITY - 560 M<sup>3</sup>/D  
CURRENT MAINTAINING MORE THAN DOUBLE.
- ② ALL MACHINERY WHICH HAVE CHANGES OF SPARE PARTS WHEN THE BREAKDOWNS WHICH ARE FREQUENT.
- ③ DISCHARGE TO OUR WETLAND NOT TO THE STANDARDS REQUIRED.
- ④ SILT COMING TO SEWER WORK THROUGH SEWER LINES DUE TO CHALLENGES OF VANDALISM OF MATERIALS.
- ⑤ LACK OF ENOUGH EQUIPMENTS FOR HANDLING BLOCKAGES.

### NAWASCO

- (1) population growth  
overloading of Wastewater Treatment facility.
- (2) Run off water (Storm water) is a problem
- (3) Operation and Maintenance <sup>Records</sup> not in place
- (4) Dredging of Wastewater ponds takes too long.
- (5) Assigned Capacity 100000?

### EWASCO

- FROM THE JET CONNECTION TO THE PRE ABOUT 50
- STILES/ MAN HOLES COVERS
- Blockages in culvert pipes & plastic pipes (1973)
- Accumulated silt in culvert pipes
- Accumulated sludge in stabilization ponds
- Frequently sample analysis must required red.
- Capacity 14000m<sup>3</sup> per day (21000m<sup>3</sup> 4 ponds)
- Coverage area about 1/4 of Town.

### WSP - NWSC

Currently We are trying but a lot of Challenges

- a. Encroachment of way/leaves
- b. dumping on sewer lines
- c. Vandalism.
- d. Allocation of plots downwards after the sewer line
- e. organised gangs (Mungiki)
- f. migration towards

This leads to sewer overflows and not enough reaches the treatment works

Currently Kariobangi treatment plant & Dandora Sewerage Treatment plant Ruai  
 Kawa kawa oxidation pond  
 Karen oxidation pond  
 Kariobangi treatment plant has been encroached and partly vandalised

### MEWASS

- Operating beyond capacity.
- Lack of trained personnel.
- Vandalism e.g. Manhole covers, grills,
- Open defecation within the facility.
- Lack of sludge storage disposal method

6000m<sup>3</sup>/day. → KIPPUSI

### MOMBASA WATER SUPPLY & SANITATION CO.

- 1) 15% Central Sewerage cover.
- 2) Partly discharge to raw Sewage to Ocean.  
- One plant (Kizingo - Dead)
- 3) - 2<sup>nd</sup> - good.
- 4) Separate system.  
- But there are illegal connections to storm water drains.
- 5) Vandalism of metallic MH covers.
- 6) High Electricity bills from pump stns & WWTP.
- 7) Old infrastructure (Island) 1998

### NSP - ELDOWAS

Desig

- Collection (sewer)
- 1) Town Agricultural - Run off to the river  
- Sulphates, Nitrate, phosphate
- 2) Eldowas System is Combined  
- During Storm water collection the trunklines cannot carry the Sewage + Storm.
- 3) - Most overflows/blockages have increased  
- Due to Design of the Sewer (Storm water) x Vandalism of manhole covers
- 4) Plants - Design Capacity 190000m<sup>3</sup>  
- 1950-1980  
- M. has (rate) has reduced the efficiency the operations of the plant due to aging facilities requirement of spare pumps, screen  
- The water quality however is still ok at 75%  
- Sediment rate in primary ponds is high due to the position.

**NYEWASCO**  
 Both the convention system  
 & Stabilization ponds are operational with capacity of 6000m<sup>3</sup>/day  
 & treating 2000 2500m<sup>3</sup>/day  
 -The major challenge was Vandalism of manhole covers but currently installing plastic covers

**KEWASCO WATER AND SANITATION AND SANITATION**  
 ① Open Manholes due vandalism of manhole covers especially on slums.  
 ② Increase in water blockages due open manholes  
 ③ Land grabbing hence erecting buildings on top to top sewerlines  
 ④ Lack of modern unblocking equipment  
 ⑤ TO Procurement processes taking too long time, procure for broken tools and repair treatment facilities.  
 6 Challenges of silt deposit  
 7 Combine conventional and stabilisation ponds

NO.	COMPANY	PROBLEMS
1.	KEWASCO	<ul style="list-style-type: none"> <li>• Open manholes due to vandalism of manhole covers especially on slums.</li> <li>• Increase blockages due open manholes.</li> <li>• Land grabbing hence erecting building on top of sewer lines.</li> <li>• Lack of modern unblocking equipment</li> <li>• Procurement processes taking too long time, procure for broken tools and repair treatment facilities.</li> <li>• Challenges of silt deposit</li> <li>• Combine conventional and stabilization ponds.</li> </ul>
2.	MOWASSCO	<ul style="list-style-type: none"> <li>• 15% central sewerage cover.</li> <li>• Partly discharge of raw sewage to the ocean.                             <ul style="list-style-type: none"> <li>○ One plant (kizito – dead),</li> <li>○ 2<sup>nd</sup> – good</li> </ul> </li> <li>• Separate system. But there are illegal connections to storm water drains.</li> <li>• Vandalism of metallic MH covers.</li> <li>• High electricity bills from pump stations and WWTP.</li> </ul>

		<ul style="list-style-type: none"> <li>• Old infrastructure (island) 1950s</li> </ul>
3.	NWSC	<ul style="list-style-type: none"> <li>• Encroachment of way waves</li> <li>• Dumping on sewer lines</li> <li>• Vandalism</li> <li>• Allocation of plots downwards after the sewer lines</li> <li>• Organized gangs (mungiki)</li> <li>• Irrigation</li> <li>• Overload</li> <li>• This leads to sewer overflows and not enough reaches the treatment work.</li> <li>• Kariobangi treatment plant has been encroached and partly vandalized.</li> </ul>
4.	EWASCO	<ul style="list-style-type: none"> <li>• From the first connection to the area about 5km</li> <li>• Stolen manholes covers</li> <li>• Blockages in culvert pipes and plastic pipes (1973)</li> <li>• Accumulated sludge in stabilization ponds</li> <li>• Frequently samples analysis meet required standards</li> <li>• Capacity 1400cm<sup>3</sup> per day (21000cm<sup>3</sup> for ponds)</li> <li>• Coverage area about ¼ of town</li> </ul>
5.	MEWASS	<ul style="list-style-type: none"> <li>• Operating beyond capacity</li> <li>• Lack of trained personnel</li> <li>• Vandalism e.g. manhole covers, grills</li> <li>• Open defecation within the facility</li> <li>• Lack if sludge disposal method</li> </ul>
6.	GAWASCO	<ul style="list-style-type: none"> <li>• Poor town planning</li> <li>• Illegal connections</li> <li>• Sewer blockages due to dumping of solid wastes like</li> </ul>

		<p>paper bags etc.</p> <ul style="list-style-type: none"> <li>• Inadequate facilities to handle waste water leading to discharge of raw sewerage to the river.</li> </ul>
7.	ELDOWAS	<ul style="list-style-type: none"> <li>• Collection (sewer), town agricultural, runoff to the river - Sulphate, nitrates phosphates</li> <li>• ELDOWAS system is combined, therefore, during storm water collection, the trunk lines cannot carry the sewage storm.</li> <li>• Most overflows/blockages have increased due to design of the sewer (storm water) and vandalism of manhole covers.</li> <li>• O&amp;M has reduced the efficiency of the operations of the plant due to ageing.</li> <li>• The water quality however is still okay at 78%.</li> <li>• Siltation rate in primary ponds is high due to the design.</li> </ul>
8.	LWSC	<ul style="list-style-type: none"> <li>• Capacity – 560m<sup>3</sup>/d, currently carrying more than double.</li> <li>• All machinery working.</li> <li>• Old machines which have challenges of spare parts, when the breakdowns which are frequent.</li> <li>• Discharge to our wet land not to the standards needed</li> <li>• Silt coming to sewer works through sewer lines due to challenges of vandalism of manuals.</li> <li>• Lack of enough equipment for handling blockages.</li> </ul>
9.	NYEWASCO	<ul style="list-style-type: none"> <li>• Both the convention system and stabilization ponds are operational with capacity of 6000m<sup>3</sup>/day and treating 2500m<sup>3</sup>/day.</li> <li>• The major challenge was vandalism of manhole covers but currently installing copolymer plastic covers.</li> </ul>
10.	NAWASCO	<ul style="list-style-type: none"> <li>• Population growth – overloading of waste water treatment facility.</li> </ul>

		<ul style="list-style-type: none"> <li>• Runoff water (storm water) is a problem.</li> <li>• Operation and maintenance records not in place.</li> <li>• Dislodging of waste water ponds takes too long.</li> <li>• Designed capacity 1000m<sup>3</sup>/day.</li> </ul>
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Observations:

- Problems common but we have to take the first step.
- Old infrastructures.
- Treatment works must have been run down.
- People who used to work there were disciplinary cases - Sanitation should be taken as a dignitary job.
- People not trained in those lines.
- Illegal connections.
- Low sewerage coverage.
- Vandalism of manhole covers.

## 1.6 Role of Training Institutions - Wastewater and Sanitation Management

Eng. Njaggah ushered in Dr. Sumba to facilitate this session. The following are some highlights from Dr. Sumba:

1. Water needed in everyday life.
2. Need for water, increased population , all putting pressure on water resources
3. Socio economic growth – scarce water leading to conflicts as well as risk of diseases
4. Scarcity of water even affecting learning
5. Why address sanitation – water is life, sanitation is dignity? What can we do?
6. Role of water training institutions in wastewater management
  - KEWI is well positioned to train in wastewater management.
  - We design curriculum incorporating sanitation component
  - Designing specialized short courses

Question: Is KEWI offering any courses in sanitation?

Answer: No, the component is built in the other courses.

## 1.7 Kenya Situational Analysis - Wastewater Treatment and Management

The session was facilitated by Eng. Njaggah. He gave a case study – findings of a research carried out on wastewater. He discussed the following:

### Introduction

- Study carried by MWI and GIZ
- 43 WWTPs assessed, 37 public and 6 private

### Objectives

- Establish the status.

- Identify challenges in O&M of WWTPs.
- Identify opportunities for economical operation of WWTPs.
- Recommend way forward for management of WWTPs.

#### Findings

- Plans well designed and in good technical conditions.
- Wide range of technologies applied.
- Gravity flow therefore energy efficient.
- 80% of the WWTPs produce biogas but do not use/capture – a potential representing about 10% of electrical energy consumption in Kenya.
- Water sector reform has created a positive thinking for sanitation/sewer.
- Capacity in WWTPs is large and not utilized.

#### Short Comings

- Lack of basic data for influent and effluent BOD5, COD etc.
- 80% of wastewater discharged raw into the environment with disastrous pollution effects.
- Outfalls from some WWTPs are located next to raw water intakes (Kisumu, Homabay).
- Insufficient HR and lack of incentives for staff and profile of sanitation still low.
- Economic potential of by-products of wastewater treatment not exploited and where exploited, appropriate guidelines not followed.
- Land grabbing – land set aside for the WWTPs grabbed – people of city planning messing up by issuing land. These people are not sensitive to the need of sewerage services.

We should see wastewater as a resource so that we protect it. It can be reused in: fish farming (Nyeri), growing bananas and sugarcane – for consumption by staff and visitors (Meru).

#### Question and Answers

Question	Answer
1. Is it hygienic to eat crop grown using this sludge and wastewater to grow crops.	<ul style="list-style-type: none"> <li>• Yes, so long as proper cleaning is done.</li> </ul>
2. How can we change the mindset of the people to see wastewater as a resource instead of as waste?	<ul style="list-style-type: none"> <li>• By ensuring that we keep on talking about it to the people.</li> <li>• MEWASS now belongs to the community after MEWASS spent a lot in sensitizing the people so that they see the need to protect their sanitation infrastructure.</li> <li>• There is a global effort towards change of mind of people and GIZ is investing a lot in this. Bill</li> </ul>

	Gates has put in money in innovation in this direction. But where are the change agents in Kenya. We are the change agents therefore after this course; we are expected to be ambassadors of wastewater.
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### Recommendations

- 1) Improve routine maintenance of sewer network and WWTPs.
- 2) Capacity Building in Measurement and Process Operation
  - i. Most important is the BOD (Biochemical Oxygen Demand) test – the amount of oxygen required by bacteria to stabilize the wastewater. Domestic waste – a figure of about 500 mg/l.
  - ii. Ensure you observing occupational health and safety – fencing, handrails, boats e.t.c.
- 3) Improve sludge treatment and management - Desludging of treatment plant
- 4) Explore use of treated effluent in irrigation and aquaculture.
- 5) Reengineer
- 6) Diversify

### Way forward

- 1) Rapidly improve the operation to improve treatment from 20% to 80% efficiency.
- 2) Design and implement training programs.
- 3) Develop and use manual for minimum operation procedures.
- 4) Increase coverage.
- 5) Market services.
- 6) Develop an appropriate communication strategy.
- 7) Elaborate tariff and tariff structure for operation cost.
- 8) Improve network maintenance.
- 9) Enforce bylaws on sewer connections.
- 10) External sewer lines/conveyance.

### A Small Step Towards Saving the Planet

- If each one of us can do the best we can, we can achieve saving the planet.
- Mind set – some people have a problem with wastewater reuse, especially in agriculture and aquaculture (fish reared with wastewater) for example in Wajir. The solution is that we need to talk and talk to change the mindsets of the people.
- Change has to start with us. We start by appreciating ourselves, then preach to other people to help them understand and appreciate our jobs. They should understand how we dress and the need to dress that way.

## 1.8 Wrap Up and Evaluation of Day One

Wrap up of the day was steered by Mr. Kihara who requested members to ensure that they sign in every day and that there are two forms being signed – one for Milele and the other for KEWI. He then formed 4 groups. Group one is to prepare a recap – a

comprehensive summary of what happened today and report the following morning. He then requested participants to evaluate the day by indicating whether the day was good or bad – secret ballot.

The other groups would do recaps for Tuesday, Wednesday and Thursday.

## **2.0 Day Two Activities**

### **2.1 Treatment Process and Quality Control**

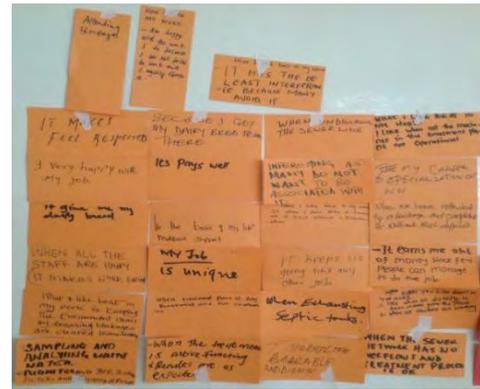
Eng. Njaggah started off this session by showing a video clip on wastewater treatment, a plant that was constructed in 1922.

#### **2.1.1 Types of Wastewater Treatment Systems – Conventional Treatment Plants**

This session was facilitated by Margaret Maina. She covered the following.

- Water is life – save every drop
- Water is life – sanitation is dignity
- In a water treatment plant, you know things are bad when you get turbid water. Even in a wastewater treatment plant, you can know when things are bad by just observing.
- Wastewater characteristics can tell you when things are bad and when seasons are good – by observing at what comes with the wastewater - coins, food, spoons, pegs, etc.
- The video clip has summarized the conventional treatment. Participants were given some two cards, one red and one orange and then given the following assignment.
  - On the red card, put down how you would note if there is a problem with the treatment works by looking at the treatment works - at a glance.
  - On the orange card, put down what you like best about your job. Results from assignment are shown below





- Sewage is the waste while sewerage includes the networks such as pipes, manhole – network, the whole system, the conduit that carries sewage.
- Components of a treatment works
  - Inlet
  - Measuring gadgets – flow meters, flumes and weirs
  - Screens
  - Grit Chamber – flow is constant and slow allowing the grit to settle down. In Thiwasco, grit chamber is not working; the grit has to be removed manually. The grit can cause blockage and also hinder the rest of treatment. Grit can also affect the biological treatment. It can also take up space in the sedimentation tank.
  - Sedimentary tanks. Sludge which should not go to the biological treatment settles here. The sludge is then taken away to a digester then to sludge drying beds, then to disposal.
  - Aeration tank
  - Final sedimentation tank
  - Disinfection tank – how is disinfection done? Disinfection is done to make sure that the discharge into the river is of good quality. Unfortunately in Kenya, we just discharge into the rivers and depend on the self purification of the river.

We need to understand the workings of our systems.

How would you know that your treatment plant is experiencing problems	What you like best about your job
<ul style="list-style-type: none"> <li>- When the water is greenish in color.</li> <li>- When the sewer overflow in the town.</li> <li>- When the smell is bad.</li> <li>- Volume of waste water.</li> <li>- The effluent (final).</li> <li>- Malfunctioning of machines.</li> <li>- Too much sludge accumulation.</li> <li>- Lack of green algae.</li> <li>- High foul smell.</li> </ul>	<ul style="list-style-type: none"> <li>- It makes me feel respected.</li> <li>- Am very happy with my job.</li> <li>- It gives me my daily bread.</li> <li>- When all the staff is happy it makes work easier.</li> <li>- Keeping the environment clean by ensuring blockages are cleared immediately.</li> <li>- My job is unique.</li> </ul>

<ul style="list-style-type: none"> <li>- When the screen bars are broken.</li> <li>- When not enough waste water is reaching the inlet.</li> <li>- End product not treated well.</li> <li>- No flow to treatment works.</li> <li>- When the sludge is too thick.</li> <li>- Odor at the trickling filters and the secondary ponds.</li> <li>- When the water (waste) does not move or it moves slowly around the grid chamber.</li> <li>- Foul smell.</li> <li>- Infrequent flow.</li> <li>- Rising flocks in sedimentation table.</li> <li>- When is full of sludge.</li> <li>- No difference (distinct) in color between the 1<sup>st</sup> and the last ponds.</li> <li>- When there is no form/green matter on the surface of the waste stabilization ponds.</li> <li>- Too much blockages on the lines</li> <li>- Bad smell.</li> <li>- If I find the color of the waste water very dark or very green</li> <li>- The final effluent quality is not good i.e color.</li> <li>- When there is low volume of waste water flowing in.</li> <li>- The place is very smelly.</li> <li>- All the pumps are not in operation.</li> <li>- When the fish die there is a problem.</li> <li>- At the outfall from the treatment plant.</li> <li>- When effluent is turbid.</li> <li>- Treatment plant is not working well and the end product is not colorless.</li> <li>- Broken mechanical system.</li> <li>- The sewer system is not working well.</li> <li>- Is when you see an overflow in a manhole and notice the strong smell and high turbidity.</li> <li>- When the sewer network has no overflows and treatment process is okay.</li> </ul>	<ul style="list-style-type: none"> <li>- Am happy with the work I do because am not forced to work and I choose it.</li> <li>- It pays well.</li> <li>- It is the basis of my life's material support.</li> <li>- Because I get my daily bread from there.</li> <li>- When unblocking the sewer line.</li> <li>- Interesting as many do not want to be associated with it.</li> <li>- It keeps us going like any other job.</li> <li>- When treatment plant is fully functioning and full cooperation.</li> <li>- It is when I open a sewer and it flows without a problem.</li> <li>- It makes life bearable and dignity.</li> <li>- Attending blockages.</li> <li>- It has the least interference because many avoid it.</li> <li>- When exhausting septic tanks.</li> <li>- When the treatment is functioning and results are as expected.</li> <li>- Sampling and analyzing waste water.</li> <li>- Monitoring the trickling filters and efficiency of pumps.</li> <li>- My career and specialization on waste water.</li> <li>- When we have attended to a blockage and completed it without much difficult.</li> <li>- It earns me a lot of money since few people can manage to do the job.</li> <li>- I like when all the machines in the treatment plants are operational.</li> <li>- I like when all dislodge is been remove from the plant.</li> <li>- When all machines are working.</li> </ul>
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When people do not pay for wastewater, we should disconnect their sewerage system. Our work is very important. When we disconnect, we alert the public health

officer to deal with the owner of the plot. Give the disconnection notice and give copies to the relevant bodies – NEMA, public health, etc.

Kamau wa Maji and Kamau wa Mavi, who is more important? Of course, Kamau wa Mavi! We should call him Kamau wa Sani.

## 2.1.2 Types of Wastewater Treatment System – Waste Stabilization Ponds

This session was facilitated by Eng. Njaggah. He covered the following.

### Types of Lagoons – Aerobic, Anaerobic and Facultative.

- Aerobic Lagoons – requires dissolved oxygen
- Anaerobic – work without any dissolved oxygen
- Facultative – most common type in use.

### Design of lagoons

- Continuous discharge, controlled discharge, no discharge
- Waste Stabilization Ponds

**Anaerobic Pond:** 3-5 m deep. Main objective is to reduce the BOD strength – up to 70%. No oxygen. Scum forms at the top and this scum should not be removed. It assists in keeping the oxygen out. Can produce odours. Good for treating industrial wastes.



**Facultative Pond** - Removal of pathogens. These are about 2 m deep. They create a mechanism for growth of algae that produce oxygen needed by bacteria for digestion during photosynthesis. In the facultative pond, no scum should form because this will inhibit oxygen which is very much needed by bacteria. A facultative pond must look green from algae growth. Upper portion of these lagoons is aerobic, while the bottom layer is anaerobic. Some times, mechanical aerators supply the oxygen to the upper layer.

**Maturation Ponds** – could be one, two or three. Purpose is to kill the pathogens. These should be shallow to allow for penetration of UV light. They are less than 1 m deep. These must not have scum. They have protozoas which will eat the bacteria/pathogens and clean up the sewage. The protozoas are heavy and therefore will stay at the bottom of the pond and will not flow to the river.

Stabilization ponds take up a lot of space and requires no skilled staff to run the system.

Discharge from the ponds to: river, wetland or land application.

### Biochemistry of a Lagoon

- The life cycle of a lagoon depends on a number of factors.
- Organisms, including algae, bacteria and protozoa depend on levels of:
  - Dissolved oxygen.
  - Nutrients.
  - Each other for viability.

**Odor Control** – odor results from over loading, long periods of cloudy weather, poor lagoon circulation and/or industrial wastes. To control odour:

- Increase aeration
- Recirculate lagoon effluent
- Eliminate high strength industrial wastes
- Run system in parallel to reduce loading
- Apply chemicals

#### Control of Vegetation

- High weeds promote animal nesting places for animals
- Can cause weakening of the dike
- Unsightly appearance
- Reduces wind action

#### Groupwork

The participants were divided into 3 groups: Group A, Group B and Group C.

The following exercise was given:

It has been reported that there has been an outbreak of cholera in the informal settlement within the jurisdiction of your water utility. NEMA authority has taken your WSP to court for pollution to the river and the built up environment. Identify operational challenges and mitigation measures in the following systems:

1. Conventional treatment systems – Team A
2. Waste stabilization pond – Team B
3. Sewer network – Team C



#### Responses from participants

### Team A - Conventional Treatment Systems

#### **Operational Challenges and Mitigation Measures**

1. Operational consideration – grit chamber
  - There was a fault in pumping machine causing the grit to overflow to the aeration chamber which interfered with the biological process, so we decided to remove it manually
2. Screen chamber
  - There is no continuous monitoring of screen chamber removal. Planning for efficient shift system
3. Aeration tanks
  - Interruption of power supply.
  - Aerobic bacteria don't get sufficient oxygen to break down organic matter.
  - Install backup generator.
4. Sedimentation tank
  - Failing to remove the sludge vandalized
  - Put enough security / put in store the required gate valves

### Team B- Waste Stabilization Ponds

#### **Operational Challenges and Mitigation Measures**

Operational considerations of a waste water treatment plant - Check inlet, screening, aerobic, facultative, maturation.

##### **Challenges**

- Determine the quality of the influent
- Determine the quantity of the inflow
- Determine the sludge levels in the aerobic ponds

##### **Mitigations (corrective measures)**

- Removal of screening to ensure a smooth flow of sewage
- Desludge the ponds
- Ensure frequent analysis / monitoring of both influent and effluent of BOD, COD, PH, SS, fiscal coliform.
- Ensure algae growth in the facultative and maturation ponds

### Team C – Sewer Network

- Open manholes
- Blockages and over flows
- Leakages along sewer lines
- Private exhausters discharging into the network
- Non operational pump stations – flow through by passes
- Underground contamination

- Old sewer network
- Poor planning of the settlement

#### **Causes**

1. Open manholes
  - Vandalism
  - Poor maintenance
  - Private plumbers
2. Blockage and over flows
  - Illegal connections
  - Negligence by workers
  - Illegal dumping of waste
  - Surface run off
3. Leakage along sewer line
  - Poor quality of sewer pipes
  - Poor workmanship

#### **Solutions**

- Replace manhole covers on time
- Attend to blockages immediately
- Patrol sewer lines
- Have a work (maintenance) schedule in place i.e. daily, weekly, monthly.
- Sensitize the community on good sanitation and hygiene methods
- Attend to leakages as soon as they are identified
- Pumping stations should be monitored continually
- Ensure sewer lines are not criss-crossing the clean water pipes
- Have marker posts for the sewer lines
- In case of an outbreak advise the community to boil water and disinfect the pipeline.

### **2.1.3 Treatment Processes– Challenges and Solutions**

This session was facilitated by Eng. Njaggah. He covered the following:

### **2.1.4 Wastewater and Sludge Reuse in Kenya**

This session was facilitated by Margaret Maina who covered the following:

- Wastewater reuse
  - Water reuse – beneficial use of treated wastewater
  - Water reclamation – treating wastewater so that it can be beneficially used
  - Water recycling – reuse of wastewater back in the same cycle where it is generated.
- Categories of water reuse
  - Direct – use of treated wastewater

- Indirect – reuse of wastewater within the context of natural systems such as rivers, lakes, groundwater, etc, the ultimate being the hydrological cycle.
- Driving factors for wastewater reuse
  - Water scarcity – wastewater is available and has met standards for different uses.
- Effluent disposal and utilization
  - Fish farming: e.g. Nyeri, Kisumu (unplanned).
  - Forestry: e.g. at the EPZ wastewater treatment works in Mavoko County Council.
  - Irrigated agriculture: e.g. at Isiolo and Nanyuki.
- Wastewater reuse application
  - Agriculture.
  - Industry .
  - Groundwater recharge .
  - Urban usage, including landscape irrigation and fire protection.
- Benefits of wastewater reuse
  - Conservation and more rational allocation of freshwater resources
  - Avoidance of surface water pollution.
  - Reduced requirements for artificial fertilizers and associated reduction in industrial discharge and energy expenditure.
  - Soil conservation through humus build-up and prevention of land erosion.
  - Contribution to better nutrition and food security for many households (WHO, 1989).
- Reuse concerns
  - While wastewater reuse for agriculture has many benefits, it should be carried out using good management practices to reduce negative human health impacts.
  - For industries scaling, corrosion, biological growth, and fouling, may impact industrial process integrity and efficacy, as well as product quality.
  - Groundwater pollution if effluent quality is poor.
  - Negative human health impacts.
- Environmental concerns
  - Groundwater pollution if effluent quality is poor.
  - Negative human health impacts.

Reuse is taking place in many WSPs – Embu, Mombasa, Nyeri, Meru, Limuru (Pear farm).



Limuru Pear Farm

### 2.1.5 O&M Procedures: Treatment Plant & Sewer Network

This session was facilitated by Margaret Maina who covered the following:

**Routine Maintenance** – assist in timely servicing and repair of equipments and minimizes breakdowns and down time.

**Reporting procedures** – daily log book, weekly and monthly reports, lab records (levels of our treatment works performance), flow rate reports (can enable us to know changes such as overloads and underloads, floods, unusual increase in velocity), unusual occurrence.

**Primary Treatment Process - Screening**

**Grit Chambers** – grit removal

**Pumping** – used for both effluent and sludge. Pumps should be serviced regularly

**Aerating** – mechanical aerators should be in good condition

**Removing sludge** – sludge standard requirements to be adhered to including disposal

**Maintenance**

- **Preventive Maintenance** – Usipoziba ufa, utanjenga ukuta. Involves simple things as oiling, cleaning, greasing, removing soils from manhole, just walking around ensuring all is well.
- **Corrective Maintenance** – trying to replace something that may not have been done well or has gone wrong. Integrity is running down our systems – saying repairs have been done when they have not. Let us be people of integrity.
- **Reactive Maintenance** –when things have gone wrong, such as motor that has blown

### 2.1.6 Impact of Wastewater on the Environment

Eng. Njaggah invited Mr. Bakari Mangale, a Senior Compliance Officer at NEMA to facilitate this session and he discussed the following:

**Introduction**

Wastewater is any water that has been adversely affected sewage, stormwater.

Composition: organic, inorganic particals, animals such as protozoa, macro solids, pharmaceuticals and hormones, gases, emulsions etc

**Sources/streams**

- Sanitary sewage – homes, businesses, institutions and industries
- Stormwater from rain that drains off rooftops etc

Whichever the source, the wastewater ends into our environment.

**Major Impacts**

Releases to surface water

- Has negative effects on fish and wildlife – decaying organic matter depletes oxygen, excessive nutrients such as phosphates and nitrates – can cause eutrophication or over fertilization of receiving waters – can be toxic to aquatic life, chlorine compounds, heavy metals – acute chronic toxic effects

#### Release into the air

- Methane and other green house gases

#### Release to land

- Large quantities of solid waste – grit, debris, other non biodegradables
- Organic solids can be used to generate energy. These solid wastes can also be used as fertilizers

#### **Challenges in Wastewater Management**

- Wastewater generation is increasing at an exponential rate
- There is a large population without sanitation
- Only small fraction is treated at secondary level
- Huge volumes of untreated water are dumped into our water resources
- Wastewater treatment plants are heavy capital investment

#### **What needs to be done?**

- New and different ways of looking at wastewater – reduce wastewater at source, need to see wastewater as a resource
- Innovative ways of tackling wastewater
- Education and capacity building – sensitize decision makers and the public on importance of tackling sanitation and wastewater problems
- Integration of sanitation and wastewater

#### **Examples of decentralized systems**

- Seed production farm – Arusha, Tanzania
- Kiembeni Estate – Bamburi, Mombasa Rehabilitation
- Design and supervision of construction of stabilization ponds
- Private house – Nyali, Mombasa – lack of water and desire to irrigate garden – design and construction of reed bed system.
- Tambuzi flower farm in Nanyuki wetland for recycling
- Van den Berg in Naivasha – wetland



Seed farm production in Arusha, Tanzania	
	
Wastewater stabilization pond, Mombasa	Rehabilitation of oxidation ponds and construction of wetland system – Kiembeni - Bamburi, Mombasa

### NEMA

- A regulatory authority - wastewater quality regulation
- Requires a declaration of what an organization releases and the constituents
- Meru, Lake Victoria North – doing well with license renewal

### Questions & Answers

<p><b>Exhauster Charges – who is paid?</b></p> <p>Anybody giving this service requires a license so that NEMA can know where they will transport the solid and liquid waste.</p>
<p><b>Most people using shallow wells, the water does not meet the requirement</b></p> <p>WRMA and NEMA are involved. For them to dig the well, WRMA must license. Then NEMA follows in monitoring.</p>
<p><b>Laboratory accreditation – who does that, what do we need to do to have our laboratory accredited?</b></p> <p>The laboratories are not accredited but need to be recognized as some of the laboratories that people should take their samples to, a lab enlisted by NEMA to serve the people. Make a formal request for the laboratory to be recognized.</p>
<p><b>Structure on top of sewer – what should be done?</b></p> <p>If an EIA is done, such issues come up. Otherwise, if the structure was approved by other bodies, NEMA goes to them and intervenes. NEMA intervenes on many issues by investigating and recommending. The recommendations are then shared with other authorities who have a role in the issue being raised.</p>
<p><b>Sampling issues – what type of samples does NEMA take</b></p> <p>If NEMA has to take samples, it takes from the same source as the company for quality control. NEMA needs a detailed map of your treatment works so as to map out sampling points.</p>
<p><b>Overlap Between WRMA and NEMA functions – what needs to be done?</b></p> <p>This is a coordination and consultation issue. The matter should be brought to the attention of all stakeholders – bring them together and discuss the issue. Hold a joint meeting to resolve issues. Can also request WASREB intervention.</p>
<p><b>Standards &amp; parameters with environment in consideration – are these uniform for all</b></p>

**regions?**

These standards are the same for all regions. NEMA has harmonized the discharge fee. There is need to harmonize regulations with legal frameworks. There is need for review.

**Shared wetland with Bata Shoe industry – challenges**

If it is a constructed wetland (MWI), then the ministry needs to license and give standards for discharge but NEMA will visit and do a follow up on the issue.

Eng. Njaggah requested that a participant volunteer to give a vote of thanks.

**2.1.7 Quality Control and Monitoring Procedures**

Ms Ann Mwangi invited Ms. Margaret Maina to facilitate this session. Margaret started by stating that the Water Industry is the best employer and made the following remarks:

**Introduction**

- Thika is ISO certified
- Embu Water is generating its own power.
- To be ISO certified, one has to do things by following laid down procedures and processes.
- As wastewater operators, we cannot avoid working as a team where everybody matters.



Team at work



**Importance of quality control**

- Ensures that treatment processes are efficient and effective
- Monitors the efficiency of the treatment processes
- Guarantees the adherence to the set standards
- Provides the mitigation measures

**Wastewater Treatment Objectives**

- To ensure human and industrial liquid wastes are safe to return to the aquatic or terrestrial environment, clean enough for reuse for particular purposes.
- To use the same processes that would occur in a natural aquatic system only they do it faster and in a controlled situation.

**Biological Pollutants**

- Pathogens

- Oxygen demanding substances
- BOD
- Nitrogen & phosphorous – in sewage
- Viruses – resistant to sewage disinfection

**Why Quality Control**

- Gives an indication of performance
- Assessment of loading
- Assess the performance of each stage

**Tests for basic monitoring of the treatment processes**

- Visual observation – colour change and smell, overflows (blockages), underflows (caused by blocked sewers).
- Microbiological testing – efficiency of operations, quality of effluent, pointer to malfunctioning in the treatment processes.
- Chemical tests - Oxygen demand (COD), BOD, phosphates and nitrates.
- Dissolved oxygen - lack of dissolved oxygen leads to foul smell.
- pH of raw sewage – affects the biological processes by interfering with the microorganisms that treatment relies on (6.8-7.8).

**Importance of wastewater monitoring**

- The process makes sure there is optimisation of the treatment facility
- The facility achieves the set treatment targets
- The quality of effluent meets the required standards.

**Questions & Answers**

1. What are the guidelines for drinking water	Depends on the temperature of the area
2. What are the daily basic tests that need to be done?	<ul style="list-style-type: none"> <li>• pH</li> <li>• Colour</li> <li>• Suspended solids</li> <li>• Dissolved Oxygen</li> <li>• Temperature</li> <li>• COD, BOD and Bacteriological tests need to be done by qualified personnel.</li> </ul>

**2.2 Wrap Up and Evaluation**

**2.2.1 Recap up of Day One**

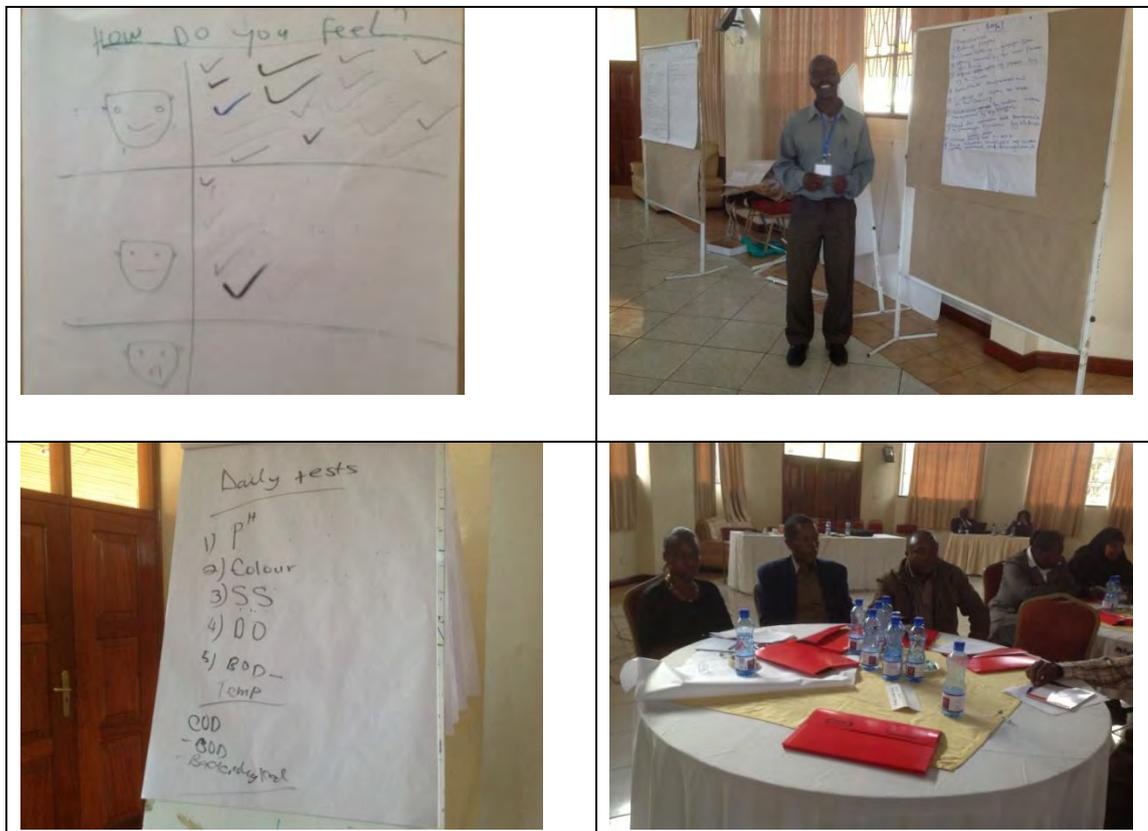
A participant presented the recap of day one as follows:

1. Registration

2. Opening prayer
  3. Climate setting – giraffe story
  4. Opening remarks by the Focal Person, Mr. Kirubi
  5. Official opening speech by Dr. Sumba
  6. Participants expectations
  7. Setting up norms or rules for the training
  8. Introduction to waste water management by Eng. Njaggah
  9. Need for operation and maintenance of sewerage systems by Mr. Kirubi
- Lunch break**
10. Challenges facing our team work
  11. Kenya situation analysis of waste water treatment and management.

### 2.2.2 Evaluation of Day One

The results of evaluation indicated that the feeling yesterday was good as follows:



### **3.0 Day Three Activities**

#### **3.1 Recap of and Evaluation of Day Two**

##### **3.1.1 Recap**

This session was steered by Mr. Kihara who invited the Group Two to present the Recap. The following was presented in form of news where the different members of the group were involved.

##### **Morning News**

- News in brief
- Five minutes video by eng. Njaggah
- Margaret urges all to love their work with passion
- Conventional treatment plants
- Eng. Njaggah – waste water stabilization ponds
- Group task over a court case between nema and wsp

##### **Main News**

- The five minutes video of waste water treatment plant in Ohio
  - Built between 1922 – 1928 – physical, biological and chemical process.
  - 310 million gallons per day
- The team of experts agreed unanimously that all sewerage staff be referred to as sanitation engineers
- Conventional treatment plant
  - Mechanically operated
  - General layout details – reporter from Milele
- Waste stabilization lagoons
  - Anaerobic – facultative – maturation 1-3
  - Advantages, disadvantages (reporter 2)
- Court case battle between NEMA and WSP over alleged dumping of waste water in the river thus causing cholera in a nearby slum. (reporter 3)
- Waste water and sludge re-use – Limuru
- O&M procedures – maintaining the system instead of setting up a new one – preventive, corrective and avoid reactive response.
- Mr. Bakari from NEMA – impacts on waste water to the environment – six questions and promised to follow up wetland where Bata and Limuru Water Company waste water disposal

Finally – quality control and monitoring procedures

Major parameter indicating efficiency of the treatment plant.

##### **Sports news**

- There was hide and seek game by team in the main hall were detected
- Stiff competition between all team members in “kata mashamba na kichwa game”.

**Interlude**

An interlude was presented where participants were requested to assign marks to letters of the alphabet where A=1, B=2, C=3 ..... Z=26. They were then to assign marks to ‘KNOWLEDGE’, ‘SKILLS’, and ‘ATTITUDE’.

KNOWLEDGE	11+14+15+23+12+5+4+7+5	96
SKILLS	19+11+9+12+12	63
ATTITUDE	1+20+20+9+20+21+4+5	100

Even if we got knowledge and skills, without the right attitude, we shall not attain 100% in any of them but the right attitudes in whatever we do will earn us 100% straight away. In what we do, we need to have the right attitudes.

**Pick of the day**

Gunshots were heard and some disappeared in thin air but reports indicate that world vision team under the table and that on their stomachs.

**3.1.2 Evaluation**

The results of evaluation indicated that the feeling for day two was good as indicated below:



**3.2 The Process of Continuous Improvement – Starting the Kaizen Journey**

Eng. Njaggah invited Mr. Kihara to present the topic Continuous improvement. He started by posing the following question: ‘What do you understand by the term improve? The response was:

- To get better
- To add quality
- To move from one point to another
- To change for better

The facilitator then gave and explained the meaning of ‘improve’ as:

- Get better
- Pick up
- Look up

- Recover
- Advance
- Progress
- Develop

### Participants' Activity

1. Identify two items/products and two services in which we can say we have experienced major improvement in our country in the last 10 years.
2. Narrate at least three areas in these products or services which are indicative of these improvements.

### Participants' Responses

- **Group 1:** Communication industry, water service delivery
- **Group 2:** Revenue collection, attitude, service delivery, stakeholders in WSP in WSP management, donor perception to water sector.
- **Group 3:** Service - Communication (Mpesa), infrastructure (Thika Superhighway); Products - water, oil in Turkana (discovery).
- **Group 4:** Product - agriculture, infrastructure; Services – freedom of expression, access to clean water.



### Equity Bank Improvements

- Many branches – increased market share nationally and regionally
- Agency banking

### The Gemba Kaizen Model

- The process of continuous improvement in the workplace – improvement (Kaizen) in the actual place (Gemba).

### GEMBA is where:

- The work is done
- The value is created
- The problem solving is delegated

### Kaizen – What is it all about?

- Process improvement
- Observation (scanning)
- Use new paradigms (shift the thinking)
- Short time
- Zero investment

- Human development & empowerment
- Profits and savings - plenty

Participants watched a short video clip on **Gemba Kaizen**.

[http://www.youtube.com/watch?v=E6rRHqb5MV0&feature=player\\_detailpage#t=181s](http://www.youtube.com/watch?v=E6rRHqb5MV0&feature=player_detailpage#t=181s)

#### **Lessons learnt from the video clip**

1. We can save time by applying Keizen to our place of work
2. We can lessen the energy we spend
3. Improve our means of storage
4. Listing of equipment required

#### **Core Values**

Organization core values

- Integrity – meru
- Teamwork – meru
- Continuous learning – nyeri
- Customer satisfaction

Personal core values

- Honesty
- Trust
- discipline

#### **Fundamental Kaizen Values**

- Today is better than yesterday.
- Tomorrow will be better than today.
- What you are doing, you can always do better.
- There is, and there will always be room for improvement.
- Dissatisfaction – regard the way we do things today as the worst way of doing it.

#### **Kaizen Targets**

- Improve Quality
- Reduce Costs
- Improve Delivery
- Improve Safety
- Improve Environment
- Improve Morale

### **3.3 Health & Safety, Reporting, Documentation**

This session was facilitated by Ann Mwangi who was ushered in by Margaret

#### **3.3.1 Health and Safety at Workplace**

##### **Introduction**

- How many companies have Occupational Health and Safety Committee?  
Mewass, Ewasco, Nairobi, Kericho, Eldoret, Thika.

- There is a requirement that any company employing more than 20 workers have a committee on Occupation Health and Safety.
- What is the composition of the committee? Mix of management and workers.
- Why is safety at the treatment plant so important? To reduce accidents. It can mean the difference between life and death.

#### **Types of Hazards at Treatment Works**

- Blood borne pathogens – blood in the wastewater which has disease causing organisms
- Falls – ponds (Nyewasco, Mewass)
- Lifting – heavy equipments
- Drowning
- Suffocating – when you open a manhole, you should wait for air to circulate before going in.
- Electrocutation
- Poisonous gases
- Explosions
- Confined places like a manhole
- Wildlife – hippos, crocodiles, snakes (Nairobi, Garissa)

#### **Hazards Prevention**

- Blood borne pathogens – maintain personal hygiene.
  - It is important to have showers at the treatment works so that workers take shower after work. How many have showers at workplace? Thika, Garissa, Eldoret, Mewass – showers at the treatment works. Talk to management (Embu, Mombasa) to repair the broken showers.
  - Wash hands often using soap and disinfectant
  - Use waterless soap
  - Wear gloves
  - vaccinations
- Falls – good housekeeping.
- Lifting
  - Don't carry a load that's too large for you
- Drowning
  - Wear life jackets (Garissa, Meru, Embu)
  - Floater tubes
  - Give warnings
- Electrocutation
  - Ensure all electrical installations are in proper working conditions
- Suffocation – covered
- Poisons
  - Special masks for prevention – Nyeri
- Explosions – related to gases – keep away all combustible materials
- Confined spaces and other underground work – aeration basins, digesters, machines, primary tanks, manholes, sampling pits – take a lot of care.
  - No smoking

- You should not have all people inside the manhole or wherever
- Don't use tools which can create a spark
- Wildlife – keeping the grass cut and the area clear so that one can see far, stay alert
- Poor lighting
- Plant security – fencing off, limited access, visitor supervision

**Personal Protective Equipment - PPE**

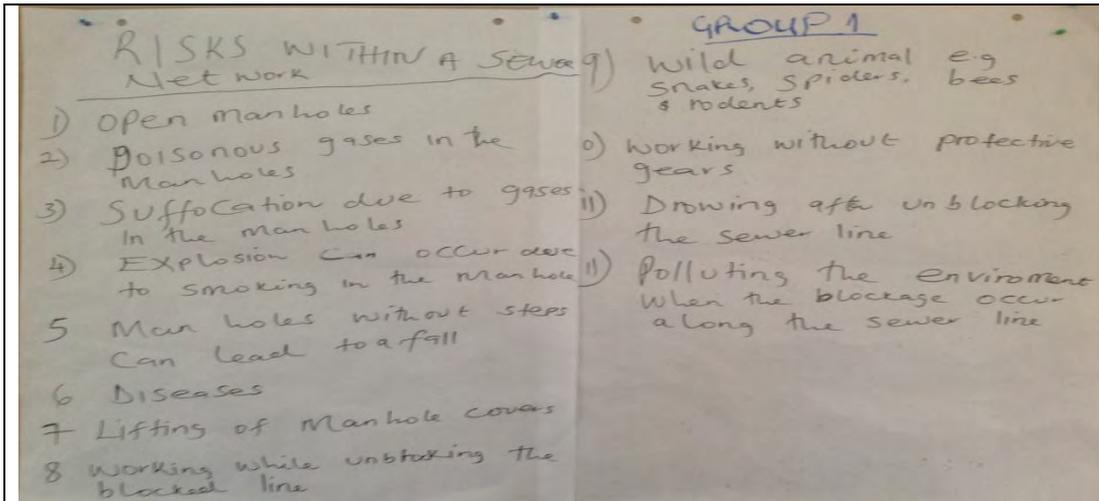
- Employer's Responsibility – to provide the equipment
- Employees responsibility – to utilize equipment well, to take care. In Nyeri, there is a method of disciplining staff who do not wear and those who misuse the protective equipment. In Nairobi, the issue is turned political.

**Group Exercise**

1. Identify the potential risk areas within a sewer network.
2. Identify the potential risk areas within sewerage treatment plants.
3. What can you do to mitigate the risk within the network and wastewater treatment plant?

**Participant's Responses**

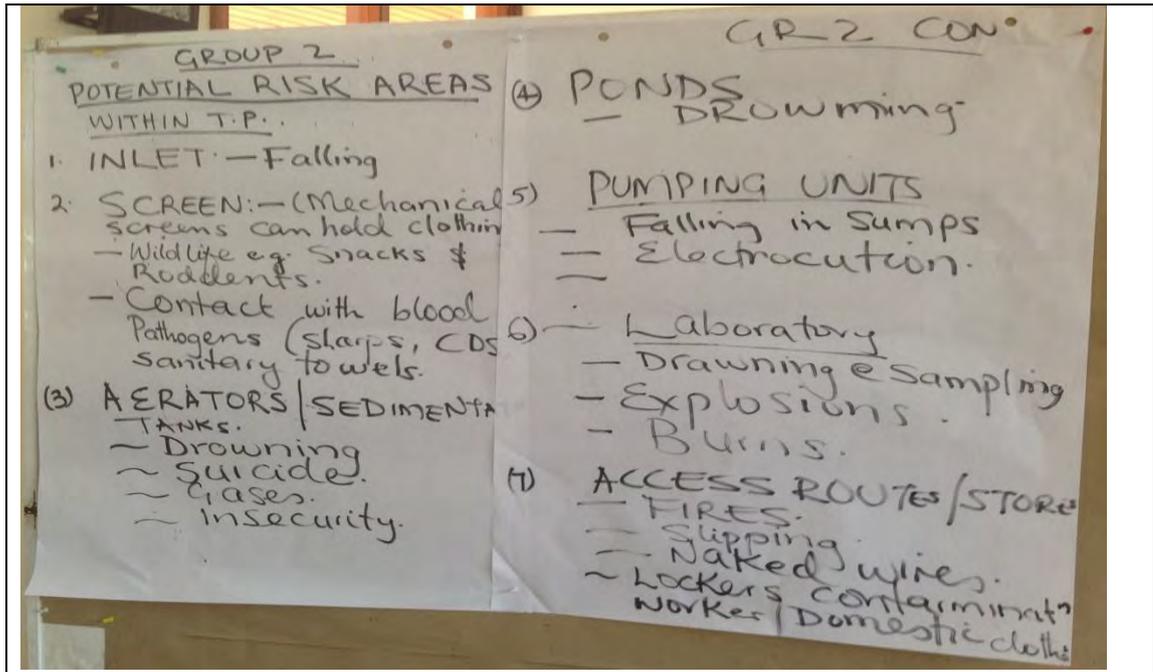
Group 1: Potential Risk Areas Within A Sewer Network	
	<ul style="list-style-type: none"> <li>● Open manholes</li> <li>● Poisonous gases in the manholes</li> <li>● Suffocation due to gases in the manholes</li> <li>● Explosion can occur due to smocking in the manhole</li> <li>● Manholes without steps can lead to a fall</li> <li>● Diseases</li> <li>● Lifting of manhole covers</li> <li>● Working while unblocking the blocked line</li> <li>● Wild animals e.g snakes, spiders, bees and rodents</li> <li>● Working without protective gears</li> <li>● Drowning after unblocking the sewer line</li> <li>● Polluting the environment when the blockage occur along the sewer line</li> </ul>
	



**Group 2: Potential Risk Areas Within the Sewage Treatment Plant**



- Inlet – falling
- Screen
  - Mechanical screens can hold clothing, wildlife e.g snacks and rodents
  - Contact with blood pathogens (sharps, CDs, sanitary towels)
- Aerators / sedimentation tanks. Drowning, suicide, gases and insecurity
- Ponds – drowning
- Pumping units – falling in sumps, electrocution
- Laboratory – drawing and sampling, explosions, burns
- Access routes / stores – fires, slipping, naked wires, lockers contamination worker / domestic clothes



### Group 3: Mitigation Within Sewer Network and Wastewater Treatment Plant



#### Sewer Network

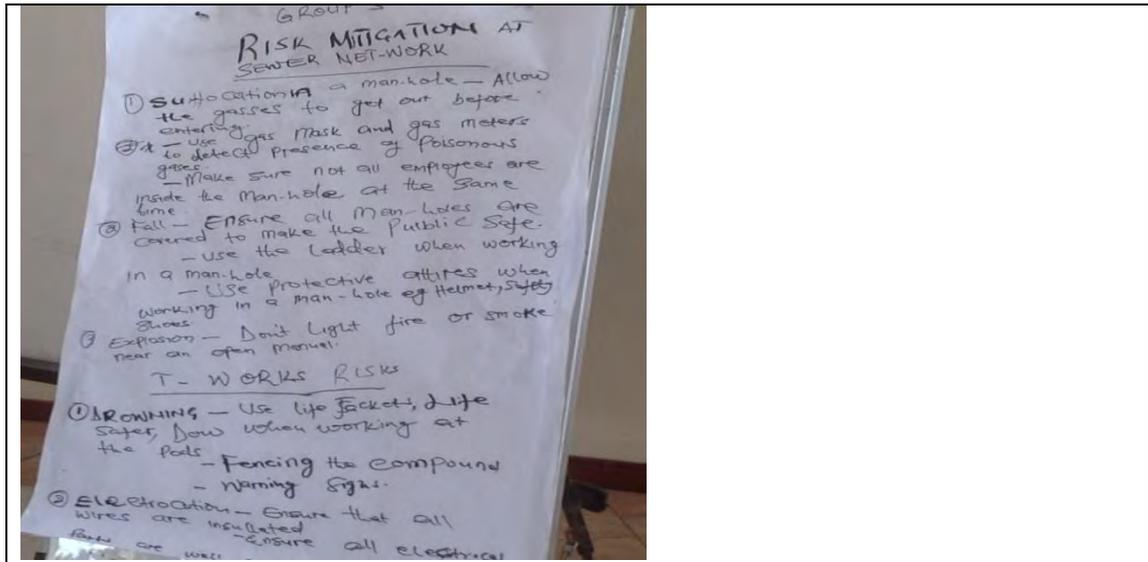
- Use gas mask and gas meters to detect presence of poisonous gases. Make sure not all employees are inside the manhole at the same time
- Fall – ensure all manholes are covered to make the public safe. Use the ladder when working in a manhole. Use protective attires when working in a manhole e.g helmet, safety shoes
- Explosion – do not light fire or smoke near an open manual.

#### Treatment Works

- Drowning – use life jackets and life safer when working at the pods. Fencing the compound and put warning signs
- Electrocutation – ensure that all wires are installed, ensure all electrical parts are well maintained
- Diseases – vaccination for all employees working there, should wear PPE
  - Take a shower after work
  - Use water - less hand cleaners

#### Guidelines

- – rails, fencing, cutting grass, disclaimers and insurance policy for workers.



For the action plans, we need to come up with quick wins.

### 3.3.2 Reporting and Documentation

Why report and document?

Why keep records?

- For the purposes of operations
  - Effluent quality
  - What is coming in
  - What is going out
- For planning purposes – for the future
  - How are the sewage flows
  - How are the strengths?
- For the purposes of maintenance
- For the purposes of costing and budgeting
- For research – Nairobi water has a department for research and development

#### Group Exercise

1. Identify the types of records that we keep in wastewater treatment plant.
2. What is the situation of record keeping in your companies?
3. Discuss the importance of record keeping in wastewater treatment plants
4. How can we improve record keeping in our wastewater treatment?

#### Responses from the 4 groups

Group 1 – Types of Records	Group 2 – Situation of Record Keeping in Your Companies
<ul style="list-style-type: none"> <li>• Daily register</li> <li>• Flow record – hourly, daily</li> <li>• Monthly record</li> <li>• Electricity consumption</li> </ul>	<ul style="list-style-type: none"> <li>• Records for analysis                             <ul style="list-style-type: none"> <li>○ BOD, COD, PH, temperature, colour etc</li> </ul> </li> </ul>

<ul style="list-style-type: none"> <li>• Sampling and testing record</li> <li>• Maintenance record</li> <li>• Visitors / scholars / students records</li> <li>• Weather records</li> <li>• Leave roaster</li> <li>• Shift chart</li> <li>• Exhauster dumping record</li> <li>• Pump hour run record</li> <li>• Inventory record</li> <li>• Fuel consumption record</li> <li>• Casual workers record</li> <li>• Vaccination / medical record</li> <li>• Personal protective equipment record</li> </ul>	<ul style="list-style-type: none"> <li>• Records of influent and effluent discharges</li> <li>• Records of blockages</li> <li>• Exhauster records</li> <li>• Records for dislodging of manuals</li> <li>• Records for winching</li> <li>• Records dislodging of pods</li> <li>• Records for new sewer connections and disconnections</li> <li>• Records for accidents</li> <li>• Records for maintenance</li> <li>• Visitors records</li> <li>• Electricity bill records</li> <li>• Daily registers</li> </ul>
<p><b>Group 3 – Importance of Record Keeping in Wastewater Treatment Plant</b></p>	<p><b>Group 4 – How to Improve Record Keeping in Our Wastewater Treatment Plant</b></p>
<ul style="list-style-type: none"> <li>• Flow measurements depict current levels and help planning for future.</li> <li>• Maintenance records e.g greasing for timely sourcing and repairs</li> <li>• Costing (purchase records) controlling and budgeting expenses</li> <li>• Research/ documentation</li> <li>• Easy availability of operation and expansion</li> <li>• To know the number of visitors</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce the ICT system</li> <li>• Store in back-up system</li> <li>• Train staff on the importance of record keeping</li> <li>• Strict auditing of records</li> <li>• Proper labeling if using filing method</li> <li>• Arranging them in order e.g according to alphabet</li> <li>• Monitoring files using the register methods</li> <li>• Use of AUTOCAD or ARCHICAD for storing maps and designs</li> <li>• Introduce an archive for hard copies</li> <li>• All records should be checked and approved by required authority</li> <li>• Records should be kept safe and in a visible place.</li> <li>• Frequent updates of records</li> </ul>

The facilitator summarised the presentations by stating that records that are properly kept can save someone or even the company. Most importantly, **NEVER COOK THE BOOKS!**

### **3.4 Sanitation – Introduction to Sanitation Technologies and Systems**

This session was facilitated by Eng Njaggah who was ushered in by Margaret Maina. Eng. Njaggah started by informing members that, just as there is World Water Day, there is World Toilet Day which is 19<sup>th</sup> November of every year. Participants were also informed that Bill gates has set aside billions of dollars for development of sanitation.

Eng. then highlighted some points from the speech delivered by the Minister in a workshop on urban sanitation that took place from 2<sup>nd</sup> to 4<sup>th</sup> July 2013.

He underscored the need to improve and up scale the sanitation sector. He also stated that there are opportunities for jobs in the sanitation sector.

Participants then watched a video clip on sanitation

#### **Definition of Sanitation**

- Provision of sanitation facilities and services for safe disposal of human faeces and urine to maintain hygienic conditions

#### **Global Picture of Sanitation**

- 2.6 billion people (out of about 6.6 billion population world) are looking for a toilet. Sanitation issue is the concern of all.

#### **Kenyan Sanitation Situation**

- 5.6 million Kenyans are looking for a toilet.
- Sanitation situation in our urban centres is pathetic.
- 2/3 reside in informal settlements
- At one point, effluent from Dandora Treatment Plants was diluting the Nairobi River. Is NEMA justified in charging Nairobi Water for discharging into the river? NEMA should actually pay Nairobi Water for assisting them.
- Slum situation
- Commercial toilets
- Eco- toilet
- Biodigester sanitation

#### **Group Exercise**

Discuss in teams of 3 and write:

1. One reason as to why Sanitation coverage is not increasing
2. What needs to be done to reverse the trend?

## Participants' Response

### Group One

1. Culture
  - Some religious issues related to toilet management
2. Poverty
  - Materials are expensive in some cases.
  - High capital involved.
3. Ignorance
  - Lack of prioritization
4. Land shortage / not available for consumption of sewage t/plants
  - Resistance by the local people
5. Land ownership – squatter ownership e.g at the coast.
6. Poor planning
  - Sanitation aspect is usually ignored. There is need to review our building by-laws.
7. Sensitization – the community need to be sensitized on the need to have good sanitation facilities
8. Leaders – grabbing of public utility plots
9. Lack of defined reporting structure in issues dealing with sanitation
10. Poverty – source for donor funding to help in programs dealing with sanitation
11. Legislation – the chief's act was being used = need one to deal with sanitation issues
12. Ecosan options and cheaper technology
13. Additional sources of funding required
14. Extension services to be introduced
15. No clear placement of sanitation department
16. Need to embrace technologies

### Group Two

#### **Why Sanitation Is Not Increasing**

#### **What Needs To Be Done**

- |                                  |                        |
|----------------------------------|------------------------|
| 1. Culture                       | 1. Sensitization       |
| 2. Poverty                       | 2. Poverty eradication |
| 3. Cultural beliefs              | 3. Legislation         |
| 4. Traditional norms             | 4. Creating awareness  |
| 5. Poor planning                 | 5. Econ san options    |
| 6. Ignorance                     | 6. Capacity building   |
| 7. Lack of space – land shortage | 7. Cheaper technology  |

- |                                        |                          |
|----------------------------------------|--------------------------|
| 8. Lack of funds (institutions)        | 8. Prioritize sanitation |
| 9. Awareness of dangers of having none | 9. Address land issues   |
| 10. Land ownership                     |                          |
| 11. High capital                       |                          |

The facilitator then summarised the reasons why sanitation is not increasing are as follows:

- **Culture** – Muslims culture prohibits, father inlaw cannot use same toilet as daughter in law.
- **Poverty** – for many Kenyans, it is an expensive venture to even put up a pit latrine. In some places, a foot costs about kshs. 1600 to dig which is very expensive for an ordinary Kenyan.
- **Ignorance** – priorities wrong. One prefers to put up rental houses even in very small pieces of land.
- **Shortage of land** – land is not available for expansion of sewerage facility. People do not want sewerage facilities next to them.
- **Land ownership** – difficult to acquire land for a WWTP. You can't invest so heavily when land is not yours.
- **High capital** – cost of construction of a WWTP is capital intensive.
- **Poor planning** – no provision for sanitation. First priority should be for sanitation.

Solutions

- **Senzitization** – toilet is good for health. Leaders too need to be sensitized.
- **Poverty eradication** –
- **Ecosan options** – cheaper technologies
- **Extension services** – should be introduced. Remove overlap of sanitation responsibilities.

Eng. Njaggah then summarised that why sanitation is not increasing is because:

- **Awareness and priority**
- Lack of political will
- Low prestige and recognition
- Defective promotion and low public awareness
- **Institutional issues**
- No coordination among stakeholders
- Poor institutional framework
- **Legislation and policy issues**

**Conclusion – options for Kenya**

Mix of technologies

- Ecosan
- Biodigesters
- Dewats

- Eco toilets

Video clip – if we need change, we have to involve the community.

### **3.5 Introduction to Action Planning**

This session was facilitated by Mr. Kihara who was ushered in by Margaret Maina. Mr. Njaggah started by sharing some information on sanitation, that had come from the alumni of the participating 5 countries.

He then introduced action planning

#### **Action Plan Steps**

1. Identify areas of intervention within your mandate and functions.
2. Develop an action plan which will lead to efficient operation of waste water treatment plant.
3. Decide what you would like to improve in your wastewater treatment plant as far as O&M is concerned aiming on areas which need improvement.
4. Work as a team in your WSP.
5. Deal with interventions within available resources and priority to your WSP
6. Base your action plan on SMARTC criterion of action planning i.e. **S**pecific, **M**easurable, **A**chievable, **R**ealistic, **T**ime Bound and **C**hallenging.
7. Quantify your action plan for monitoring of impacts
8. Share a copy with the team

### **3.6 Wrap – Up of the day**

At this point, Mr. Kihara reminded the group tasked with preparing recap of the day to get ready to present the following day. He then requested participants to ensure punctuality the following day as it was a field trip day where we shall visit Kibera, then Ruai wastewater treatment plant (Waste Stabilization Ponds) and Kariobangi wastewater treatment plant (Conventional).

#### 4.0 Day Four Activities

The day started with Mr. Kihara welcoming and introducing Mr. Steven Mukiibi, the WAVEplus Regional Coach. He then requested Mr. Mukiibi to say a few remarks.

#### 4.1 Remarks from Coach

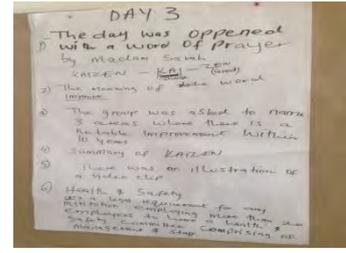
Mr. Mukiibi remarked the following:

- I greet you all and I am glad to be part of this training if only for a few days. I have already been introduced nevertheless still let me clarify that my role here as coach is to support the training team on methodological and some technical issues to ensure that this seminar is run to the highest standards.
- I am joining late and from what I have seen and heard of what had been going on, I think I have missed a lot in the days that I have not been around. Still my joining you late is a really a sign that you have a competent team of facilitators and our faith in the team has been increasing since the beginning of the WAVE programme so that now we feel that they need less support than in the beginning.
- Uganda where I am coming from is also concluding a Sanitation Marketing Workshop this week. My involvement in the course in Uganda and my review of the time table and content details of this course have convinced me that this is a course that is timely and I urge you to make the best use of this opportunity to learn and transform operations of your respective companies.
- At WAVE we believe in impact as opposed to just outputs and I am glad that some good time has been allocated to action planning. These action plans are going to be the mechanisms for transforming the knowledge that you will take from here into impact in your institutions. Do not miss the chance to pick the brains and experience of your facilitators on this while you are still in the workshop setting. As you can see the chance to meet and interact with some of the facilitators here may be rare.
- With these few words, may I encourage you to also enjoy the workshop and to stay focused until the end of the workshop.
- I thank you very much.



#### 4.2 Recap of Day Three

The recap was done by Group 3 as follows:



1. The day was opened with a word of prayer by Madam Carol.
2. KAIZEN – KAI(change) – ZEN(good)
3. The meaning of the word IMPROVE
4. The group was asked to name three areas where there is a notable improvement within ten years
5. Summary of KAIZEN
6. There was an illustration of a video clip
7. Health and safety  
It is a legal requirement for any institution employing more than twenty employees to have a health and safety committee comprising of management and staff
8. Types of hazards and prevention
9. Reporting and documentation
10. Sanitation  
Presented by Eng. Njaggah.  
The world toilet day is normally celebrated on 19<sup>th</sup> November
11. Why sanitation is not improving.
12. What needs to be done
13. Action plan to continue

#### 4.3 Preparation for Field Trip

After the recap, Mr. Kihara guided the participants through what is expected of them during the field trip as follows:

##### Expected Field Trip Outcomes

Participants are expected to:

- a) Identify areas / practices that can be improved in relation your work station / sections or department.
- b) Learn as an individual or as a group procedures / activities / services provided by a respective section / department within their company.

##### Methodology

- a) Make individual observations and record what you see by yourself
- b) Take notes of what you are shown and told
- c) Participate in discussions seek clarifications and take notes
- d) Look out for possible inputs for your Action Plan

The bus would leave at 9 am. We are expected back at 1 pm. After the trip, participants will analyze and report what they will have heard and seen.

#### 4.4 The Field Trip

All were in the bus at 9 am, ready to leave. Three visits were planned.

1. Umande Trust Biogas production – Kibera – an example of beneficial reuse of wastewater
2. Ruai Wastewater Treatment Plant – Waste Stabilization Ponds
3. Kariobangi Wastewater Treatment Plant – Conventional Treatment

The visit was to be in that order. However, when we started the journey, we were faced with the challenge of jam and time keeping became a major challenge.





Due to traffic jam along the way, we only managed to visit Kibera and Ruai treatment works. In Kibera, the visit was to two biogas production sites (Katwekera Tosha Bio Centre and Muvi Bio Centre) and a water kiosk. In Ruai, the visit was to the inlet of the treatment plant, the ponds (anaerobic, facultative and maturation ponds) and the effluent outlet.

The visits ended at 4 pm.

#### 4.5 Lessons Learnt from Field Trip

This session was facilitated by Margaret and Ann. The facilitators requested the participants to break into groups and in those groups, come up with:

1. Lessons Learnt
2. Areas you noted during the field trip that in your opinion, need improvement
3. What you can borrow from what you saw



Participants will present the lessons learnt from field trip the following morning.

#### **4.6 Wrap Up of Day 4**

The wrap up was done by Eng. Njaggah who was ushered in by Margaret. He made a few remarks about what we saw during field trip. He then recapped the week's lessons, then informed participants that:

- There is Nairobi by night. We leave at 7 pm. We have just enough time to go freshen up. Dress appropriately for the day. Prepare to dance.
- They remember to evaluate the day.

#### **4.7 Nairobi By Night**



## 5.0 Day Five Activities

### 5.1 Recap of Day Four

The session was steered by Margaret who requested those tasked with the responsibility of presenting the recap to do the presentation. This was as follows:

#### Day's Recap

- Mr. Kihara was introduced by Margaret
- Women mirror issue
- A Ugandan brother was introduced to the team
- Kihara – news to include party
- Program – visit Kibera, Dandora, Kariobangi and dinner
- Boarded a bus outside of Milele Nairobi - KEWI bus
- To Kibera Olympics near voting prime ministers status
- There were estates South C, Langata Road, Mbagathi Road, Golf Course and Olympics estate
- Visited tent invited by Peter & Editor
- Civil society organization – Umande Trust
- Undertaking were plenty among them water and sanitation program

#### Kibera

- Umande Trust introduced by Idah, offers water and sanitation, access to justice and small financing
- Visited Katwekera Bio centre
- Issue cards like ATM
- Cash
- Showers 10/=, toilets 5/=
- Filtration – water re-used for fishing and cleaning
- Human waste – generation of revenue
- Biogas – for lighting and cooking. Cooking charged at 10/=.
- Gas sold at 10/= per bag
- Sludge for agriculture
- Water kiosk (innovation), M-pesa, chemist all under one roof

#### Dandora / Ruai Sewerage Treatment Work - Inlet

- The area covered by the system is big
- The system is mechanized (modernized)
- The inlet – the water flowing is black in colour
- Screening – in the first screener there was a dead goat
- Cup screening – it traps particles
- Grinder – it cuts the particles into small pieces
- Grinder chamber – the particles are dumped out

#### Dandora / Ruai Sewerage Treatment Work - Biological Treatment Ponds

- Anaerobic pond

- There are 6 in number
- They are 4.7m deep
- It takes 3-4 days to move to facultative
- Facultative ponds
  - The facultative is the biggest is the biggest pond which measures 700 by 500m. The water stay there for 35 days before it goes to the maturation ponds. They take 5 days to maturation ponds. In facultative some hipos were seen.
- Maturation pond – in this pond aquatic animals like fish are found
  - The effluence is being used for irrigation, the sweet bananas that we eat come from that area
  - They have well equipped laboratory, they carry out some test before they discharge the effluent to the river
  - They discharge their effluent to Nairobi river
  - The ponds were not fenced

#### **Business News (By Edwin)**

- When we visited Kibera several business activities WERE TAKING PLACE
  - Sale of biogas products from human wastes at 10/= a bag
  - Sale of clean drinking water at 5/= per 20 litre bucket
  - 5/= and 10/= for the use of a toilet and bathroom respectively
  - 10/= for use of kitchen
- Comparing prices

<u>Milele hotel laundry</u>	<u>Kibera supermarket</u>
1 shirt = 340/=	New shirt = 120/=
1 under vest = 205/=	New vest = 80/=
1 dress = 450/=	New dress = 250/=
- Elsewhere Madam Mrgaret could not withstand pain generated on her feet on our way to Dandora /Ruai and she decided to purchase a new pair of shoes taking advantage of the bus delays

#### **Brief on evening**

Entertainment and sports

By John Mwamburi

- WAVEplus team decided to have change in the way we have been spending our evenings.
- We were conducted through a tour of Nairobi by bus belonging to KEWI. The trip took about an hour to an exclusive place called Shade Hotel which looked like a members club.
- The food was good but the music and dance is what the team had missed since Monday.
- A member from Mombasa who became popularly known as Ndugu ya mama took to the floor was soon carried away by the music. Joined by a lady from the equator, he almost became a star. The regulator noticed this and mobilized all to join the pair. Soon everybody was on the floor dancing.

- Around 12.00pm the very able driver from KEWI brought the team back to Milele.

A short video clip showing Nairobi by night dance was aired by the documentalist.

## 5.2 Presentations on Lessons Learnt

### Group One

#### Lessons Learnt

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Automated screening systems</li> <li>- Well equipped laboratory</li> <li>- It's a large waste water treatment plant to serve a large population</li> <li>- Expanding the treatment works</li> <li>- Encouraging young personnel to work in the waste water treatment works</li> <li>- They are gender sensitive</li> </ul>	<ul style="list-style-type: none"> <li>- Use of human waste to produce bio-gas (methane gas)</li> <li>- Use of human waste to make organic manure</li> <li>- Maximum utilization of space economically</li> <li>- Creation of employment</li> <li>- Providing sanitation to informal settlements</li> <li>- It is an investment for the community</li> </ul>

#### Areas Needing Improvement

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Workers were not using PPEs</li> <li>- Lack of proper equipments / machinery and maintenance</li> <li>- Ground maintenance to be improved</li> <li>- The facility needs to be fenced</li> </ul>	<ul style="list-style-type: none"> <li>- The workers need to use the PPEs e.g gloves, overall gumboots, gas masks etc.</li> <li>- Separation (clear) of toilets and the kitchen</li> <li>- There is need for the beneficiaries to be educated on good sanitation and hygiene methods</li> <li>- To find a method of packaging the gas into gas cylinder</li> </ul>

#### What you Have Borrowed

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
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	<ul style="list-style-type: none"> <li>- Maximum utilization of space</li> <li>- Apply the same technology in our informal settlement in our area</li> <li>- Creation of employment</li> <li>- Use of human waste to make organic manure.</li> </ul>
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**Group Two**

**Lessons Learnt**

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Grit Removal Is automated and continuous</li> <li>- Automated screening system</li> <li>- Schematic drawings displayed in every strategic stage</li> <li>- Major parameters were analyzed in the lab plant</li> <li>- Effluent reuse for agriculture</li> </ul>	<ul style="list-style-type: none"> <li>- Communities were mobilized in Kibera for a sanitation solution</li> <li>- Sanitation solutions translates to income generating activities</li> <li>- Using human waste as resource (Bio-gas and manure)</li> <li>- Despite land problems the community came up with a simple story to provide one stop show (biogas toiler and community hall and bathroom)</li> <li>- Use of water storage support structure in housing other businesses (chemist, mpesa, refreshments).</li> <li>- Diagnostic services, advocacy of HIV &amp; AIDS</li> </ul>
	

**Areas Needing Improvement**

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Anaerobic ponds not maintained i.e</li> </ul>	<ul style="list-style-type: none"> <li>- Get a compressor to improve on</li> </ul>

<p>weeds and sludge</p> <ul style="list-style-type: none"> <li>- Floaters burnt on embankments</li> <li>- Securing the area with guardrails and fencing the plants to put</li> <li>- KWS involvement</li> </ul>	<p>biogas packaging</p> <ul style="list-style-type: none"> <li>- Provide security to provide 24 hour services</li> <li>- Develop flash systems inside the toiler and provide running water in bathrooms</li> <li>- To come up with reuse of bathroom water to toilet flushing system</li> <li>- Analyze sludge to identify its quality characteristics</li> </ul>
	

### What you Have Borrowed

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Schematic drawings and units labeling</li> <li>- Automated grit removal which is continuous</li> <li>- Fish in maturation ponds for checking good quality characteristics i.e oxygen, heavy metals</li> <li>- Need for continuous improvements 9WASSIP – 2012/2014)</li> </ul>	<ul style="list-style-type: none"> <li>- Partnering with NGOs for sanitation solution in informal settlements</li> <li>- Sense of ownership arising from community involvement from project concept to completion</li> <li>- Kiosk business entrepreneur (water kiosks)</li> <li>- Providing of cheap fuel (biogas)</li> <li>- Community job creation</li> </ul>

### Group Three

#### Lessons Learnt

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Waste stabilization ponds for serving large towns needs big space</li> <li>- Ponds are constructed in series</li> <li>- There is risk of being attacked by wild animals hence safety measures should be adhered to</li> <li>- Effluent can be used for irrigation</li> </ul>	<ul style="list-style-type: none"> <li>- Waste utilization for commercial purpose</li> <li>- Waste utilization for agricultural use</li> <li>- Biogas production form waste</li> <li>- Employment creation</li> <li>- Low cost energy for domestic use</li> <li>- Maximum utilization of a small plot</li> <li>- Water recycling for flushing</li> </ul>

<ul style="list-style-type: none"> <li>- In the maturation ponds there is aquatic life e.g fish, frogs etc</li> <li>- Highly mechanized inlet to the treatment works</li> <li>- Flumes are used to measure the inflow</li> <li>- Cost of the grid removal mechanical system is high both in purchase and maintenance</li> <li>- Well equipped laboratory to cater for all parameter needed in a treatment works</li> <li>- The treatment work needs highly skilled personnel to operate.</li> </ul>	
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### Areas Needing Improvement

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Dislodging all the ponds is needed</li> <li>- The compound is not secure as it is open to public</li> <li>- Bushes and grass needs to be cut to make the place look nice</li> <li>- Flow dividing chamber should be maintained</li> <li>- Safety precautions should be adhered to as the attendants were working without protective clothes</li> <li>- Serious maintenance of the mechanical devices due to large volumes of sewer from the city</li> </ul>	<ul style="list-style-type: none"> <li>- Gas packaging in plastic bags a risk</li> <li>- Poor accessibility to the bio-digesters projects as a result of the informal settlement</li> <li>- Increase water availability in the slums</li> <li>- Public awareness on the impact of the projects use of the project</li> <li>- Expand the project i.e toilets and water kiosks due to the high population</li> </ul>

### What you Have Borrowed

Ruai/Dandora Sewerage Plant	Kibera Sanitation Projects
<ul style="list-style-type: none"> <li>- Modern technology in the treatment work – laboratory equipments and technical equipment</li> <li>- Skilled personnel in the treatment works</li> <li>- Reduction of manpower due to</li> </ul>	<ul style="list-style-type: none"> <li>- Production of biogas from human waste for domestic use</li> <li>- Waste can be use to gain – money, to improve environment and to create</li> </ul>

<p>modern technology</p> 	<p>employment</p> <ul style="list-style-type: none"> <li>- To view waste water as a resource and not waste</li> <li>- Many activities taking place under one roof which make the community living there to deviate from their cultural barriers</li> </ul>
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### 5.3 Action Plans

#### Preamble

Challenges not on pipes, meters, treatment etc. Greater challenge is on us. How do we transform ourself to the changing environment? All sectors are going on strike except for the water sector since the reforms. With the reforms, you work well, you collect more revenue, and you pay yourself more. We have very little option but to change with the environment.

#### Action planning

- Decide to work as an individual or a team.
- Decide on what you would like to improve in your organization targeting Wastewater Management and Sanitation.
- Deal with interventions within available resource priority and priority to your WSP. Use strategic plan or business plan as reference materials.
- The action plan should be smartc.

#### Remember:

- The sum total of small actions brings about big impacts. From here, we are going to do the best we can.
- All of us are aware that safety is important, but the finance department does not see the need for the protective clothing and equipment. Many a times, we have to push from below we need champions at all levels. Uniform and protective equipment provision is a must for all working in the sewerage department in all companies, it is not a favor.
- Borrow the case of Meru Water where it is a must to use protective wear when working. This idea started with one of you who work in the sewerage department of MEWASS talking to the manager. The manager bought the idea and nowadays, management writes to staff on a regular basis, reminding them of the need to make use of the protective equipment. Other WSPs can follow suit.

- Nyeri where when staff are found not wearing personal protective clothing, they are penalized. This started with the MD who sensitized staff that use of the protective equipment is good for ones safety and health.
- This must start from us. All of us sitting in this room must be change champions.

**Action plan guide format**

Eng. Njaggah guided participants on how to prepare the action plan, starting from an introduction which would give a brief overview of your WSP and your mandate in the company.

He then suggested the format shown below:

**Suggested Format**

Area of Intervention	Current Status	Causes	Desired Change	Activity to be carried out	Resources	By whom	Time frame
							Confine yourself to 6 months

Participants were given the assignment to come up with action plans either individually or in groups. Below are the action plans produced.



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### 5.3.1 Action Plan for Sanitation for Limuru Water and Sewerage Company

Area of intervention	CURRENT status	Causes	Desired Change	Activities	Resources	By whom	Time Frame
Manhole	Open	Vandalism	Cover all	-Identify all open manholes -cast concrete slabs to cover them	Materials	Kyule Bore	6 months
Blockages	Frequent	Silted sewer line	Winching All the silt	-Identify the sections and Start the exercise	Labourer	Kyule Bore	6 months
<b>T-works</b>							
Compound	Not bad but need improvement	-	Trimming the k-apples fence and Cutting the grass Beautify the compound	-Check the sections where the fence has – overgrown -Repair the fence where necessary -Plant flowers	Labour	Kyule Bore	3 months
T-works face lifting	Paints faded	No painted for long	Repainting the t-works	Quantify the amount of paint needed and place a requisition	Labour	Kyule Bore	6 months
Maintenance-e schedule	Not in place	Lack of seriousness	Come up With one	Identify areas that Need maintenance and request relevant items	Lubricants	Kyule Bore	3 months
Records	Not organised	Not kept in One cabinet	Have all sewer records separately	Collect all The sewerage records and keep them together.	-	Kyule Bore	1 month
Work health and safety	Not adhered	Lack of concern	Safety measure be put in place.	Document all areas that need healthy and safety precautions and sensitise the staff.	-	Kyule Bore	6 months
Sanitation	Not adequate	resources	Advocate use of available sanitation services	-make the customers next to New sewer extensions get connected	Sensitization	Kyule Bore	6 months

### 5.3.2 Action Plan for EWASCO Wastewater Treatment Plant

S/No	Area of Intervention	Current Status	Causes	Desired Change (Objective)	Activity To Be Done	Resources	By Whom	Time Frame
1.	Sewerage treatment works	Compound not well maintained	Compound not well maintained	To improve to a recreational facility	Beautification of WWTP	200,000	Sewerage operators and management	1 Year
2.	Sewerage treatment works	Vandalized tools and equipment	Lack of security	Improve security at the WWTP	Hire a security officer	200,000	Sewerage operators and management	1 Year
3.	SPA Area	Lack of know how	Lack of awareness	Sensitization	Create awareness on world toilet day 19 <sup>th</sup> Nov	100,000	Sewerage operators and management	6 Months
4.	Records and reports	Poor records and reports	Lack of computer, printer and office desk	Improve record and report keeping	Purchase computer, printer and desk	100,000	Sewerage operators and management	6 Months
5.	Sewerage network and treatment plant	PPE not used	Ignorance	Sensitization	Strict supervision		Operators	1 Month
6.	Sewerage network and treatment plant	Fair	Presence of tools and equipments	Improve working standards	Motivation and team work	50,000	Sewerage operators and management	1 Month

### 5.3.3 Action Plan for GAWASCO Wastewater Treatment Plant

S/No	Area of Intervention	Current Status	Causes	Desired Change (Objective)	Activity To Be Done	Resources	By Whom	Time Frame
1.	Extension of sewer network	15% of Garissa town connected	Development of the town	Increase sewer coverage	New sewer connections	Materials and labour =200,000	Edwin & Zainab	6 Months
2.	Operation and maintenance	Blockages which occasionally occur	Open manholes to be covered	All the manhole to be covered	Replacing broken manhole covers	Construction materials and labor =50,000	Edwin & Zainab	1 Month
		Pump breakdown	Over working of pumps	Regular servicing of pumps	Greasing	Grease	Pump attendant	Weekly
		More sludge in the sump	More silty influent received at the sump	Regular disludging	Disludging	Equipments & casuels = 50,000	Sewer operator	Monthly
3.	Improvement of the environment	Lack of vegetation	Climate	Beautification of the compound	Plant flowers	Flower seedlings and labour =10,000	Edwin	6 Months
4.	Health and safety	No occupational and health committee and staff not vaccinated	Ignorance	1.Creating awareness committee 2.Staff Vaccinated	1. Formation of committee 2. Vaccination	Transport	Edwin & Zainab	3 Months
5.	Bush clearing around the ponds	Ponds are surrounded by bushes	Flooding & Neglect	Accessibility to ponds	Bush clearing	Casuals =150,000	Edwin	4 Months

### 5.3.4 Action Plan for Kericho Water & Sanitation Company

S/No	Areas of Intervention	Current Status	Causes	Desired Change	Activity To Be Carried	Resources	By Whom	Time Frame
1.	Screen	No pit for disposing the screening	The existing one is full	Cleanliness	Excavating a new pit	KSHS.15000	Supervisor through budgeting	3 Months
2.	Record reports	Not all records are there	Lack of skills	All records should be kept	Instruction to all staff involved	Stationery	Store officers & supervisor	1 months
3.	Sludge	Un collected sludge	Lack of market	Clean drying beds	Sell sludge at a lower cost		Sewerage staff	1 months
4.	Health and safety	Some not compliant	Negligence	Total compliance	Disciplinary actions		Supervisor	2 weeks
5.	Training	Not all are fully trained		Well trained staff	Internal training		Supervisor	2 weeks
6.	Blockages	Many blockages not attended	-lack of sewer rods -open manholes	Clean environment	Replace manhole covers Purchase sewer rods	budget	T1	6 months
7.	New sanitation technology	Some areas have no sanitation facilities	Poverty and ignorance	Water and sanitation should be accessible to all	Creating awareness and apply new technologies like	Mobilization of resources through self help groups	Combined effort of community and KEWASCO	6 months

					ECOSAN			
8.	Time	Time wasting in collecting small items	Lack of proper arrangement or negligence	No waste of time	Application of KAIZEN		Everybody	1 months

**5.3.5 Action Plan for MEWASS Wastewater Treatment Plant**

**MERU WATER AND SEWERAGE SERVICE (MEWASS)  
REGISTERED TRUSTEES**



**WASTE WATER ACTION  
PLAN 2013**

**MEWASS WWTP ACTION PLAN**

S/No	Area of Intervention	Current Status	Causes	Desired Change	Activity To Be Done	Resources	By Whom	Time Frame
1.	Appreciation of personnel in WWTP	Abhorrent of WWTP personnel	Nature of work	Culture change	Sensitization:- 1. Meet with top management. 2. Organize meeting of all staff	G.M., T.M., HR & S.F.	S.F.	3 Months
2.	Health & Safety 1) PPE 2) Diseases	Not regularly utilized	Ignorance	Attitude towards safety & health	1.Training on OSH act 2. Education on hazards associated with non usage of PPE & good practices	C.M., P.M.	S.F. & A.E.	3 Months
3.	Open defecation	Defecation within the WWTP	1.Ignorance 2.Vandalism of fence	1.Change of sanitation practices	1.Sensitization of communities on sanitation and waste water 2.Fencing	T.M., HR & Public Health Officer	S.F., A.E. & W.P.S	6 Months
4.	Records & Documentation	Inadequate documentation	Trend from previous system	Proper recording	Use of ICT	I.T. for backup and training	S.F. & A.E.	2 Months
5.	Compound Beautification	Not well kept	Neglect	Attractive environment	Landscape, plant flowers & trees, weeding, keep grass short	Labor intensive	T.M.& S.F.	3 Months
6.	Maps	Not updated	Mapping of extensions not done	Updated GIS Maps	GIS mapping	GPS handset	GIS specialist, A.E. & S.F.	4 Months

### 5.3.6 Action Plan for Nairobi Water & Sewerage Company

S/No.	Area of Intervention	Current Status	Causes	Desired Change	Activities To Be Carried Out	Resources	By Whom	Time Frame
1.	Sewer expansion	To reduce the No. of sewer blockages by 30%	Vandalism & encroachment of way leave.	Sensitize the public and political good will	Introduce lockable manholes	- Technical manpower - Materials & equipment	- Technical staff - N.C.C	Within 6 months
2.	Increase sewer network informal sector	No sewer line	Was not planned for	Should be budgeted for	Acquire drawings and plans & approvals	Finance	Nairobi water	3 months
3.	Discharge of fats & potato peels	Not very good	Ignorance	Sensitize the customer and put a notice in the media	To ask them to construct grease traps	Transport and airtime	-Technical staff -Public health -NEMA	6 months
4.	Ppe	Not very good	Ignorance weather condition	Sensitize the staff about the dangers	- Meeting monthly - Routine checkup	Liaising with the procurement office	Technical officer	3 months
5.	Waste water re-use	Not used discharging into Nairobi river	Public perception	Change attitude	- Use the water for irrigation - Use for green house	Water pump sprinklers	Staff	6 months
6.	Best practices	Average	- Workload - Technical knowhow	To use KAIZEN in our work	Lead by example	NIL	Me	1 month

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			Communication breakdown					
7.	Training	Average	Workload	Training to be more often to all staff	- Company to partner with KEWI - More practical training in field work	Finance transport	Experienced staff	3 months
8.	Sanitation	Poor in informal settlement	Insecurity, ignorance & poverty	Construct more toilets	- Sensitize the public	Land finance	Partnership with area residents	6 months

**5.3.7 Action Plan for NYEWASCO Wastewater Treatment Plant**

S/No.	Areas of Intervention	Current Status	Causes	Desired Change	Activity To Be Carried	Resources	By Whom	Time Frame
1.	Regular meetings	No meetings are held in sewerage department		Capacity building		Budget	Thuita/Wanjiru	Monthly
2.	Instant heaters	Not working	Short circuit	Hygiene	Install new ones	Budget	Thuita	2 months
3.	Soap dispenser	None available		Hygiene	Soap dispensers installed in the treatment works and instant hand sanitizers provided for the field workers	Budget	Thuita/Wanjiru	3 months
4.	Brush cutter	None available			Cutting of grass and weeds in sloppy areas	Budget	TM/Thuita	3 months

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5.	Sewer rods	Worn out	Frequent use		unblocking	Budget	Wanjiru	2 months
6.	Manhole covers	Some without covers	Vandalism		Replace cast iron covers with copolymer covers	NYEWASCO/NM C/world bank	Wanjiru	6 months
7.	Bag washing		Abrasion	Facelift of sedimentation tanks	Use of lime and cement	Budget	Thuita	3 months
8.	Incinerator	Waste burnt in the field		To reduce pollution	Construction	Budget	TM/Thuita	6 months

Report by: **Mary Theuri**

From: **NYERI WATER & SEWERAGE COMPANY LTD.**

### 5.3.8 Action Plan for MOWASSCO Wastewater Treatment Plant

S/No.	Area of Intervention	Current Status	Causes	Desired Change	Activity to be carried out	Resources	Budget	By Whom	Time Frame
1.	Frequent sewage overflows	Twelve blockages per day	Entry of solids through Manholes without covers	Reduce daily blockages to six (by 50%)	Continuous dislodging of manholes	Engaging casuals	200,000/=	OM WW/ T.O	By 31/12/13
2.	Replacement of manhole covers	150 without covers	Vandalism/ breakages	Replace all to have less blockages and reduce risk of falling into open manholes	Cast 50 R.C Covers and procure 100 polymer cement	Polymer cement covers/ Reinforced concrete manholes	1.2 million	OM WW/ T.O	By 31/12/13
3.	Collapse sewer section	Permanent blocked by	Old age	To have a new bypass	Replacement of clogged sections	Construction materials and	200,000/=	OM WW/ T.O	By 30/10/13

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		pass to the Ocean				Labour			
4.	Replacement of Kipevu WWTP gate	Knocked down	Brought down by a truck	Restore gate	Tender out the works	Construction materials and Labour	300,000/=	OM WW/ T.O	By 31/12/13
5.	Health and Safety at Kipevu WWTP	Lack of warning signs	Never installed	Display disclaimers	Introduce warning signs	Sign posts	30,000/=	OM WW/ T.O	By 31/8/13
		Lack of schematic drawings	Not installed	To have them at inlet works, laboratory, main treatment works	Prepare and place at strategic position	Frames and materials	30,000/=	OM WW/ T.O	By 30/11/13
		Lack of guard rails at sedimentation tanks	Never installed	To have g/rails installed	Construct guard rails	Construction materials	400,000/=	OM WW	By 31/12/13
6.	Beautification of Kipevu WWTP	Very few flowers	Big Compound	To create welcoming environment by planting flowers and trees	Purchase seedlings and cuttings (200 no.)	Labour and seedlings	10,000/=	OM WW/ T.O	By 30/9/13
7.	Reuse of treated final effluent	Only used for watering lawns	Prioritization.	To water flowers and plants	To purchase hose pipes		5,000/=	OM WW/ T.O	By 30/9/13

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8.	Use of Personal protective Equipment (e.g. Clothing, gloves, masks)	Available but staff don't use them	ignorance	Staff to use them	Advocacy and monthly meetings	The available supervisors	-	OM WW/ T.O	By 30/9/13
9.	Occupational Health and safety	Dormant Health, Safety and Environment (HSE) committee	Prioritization	To re activate HSE	To convince management to revive committee	MOWASSCO WAVEplus team	-	OM WW	BY 31/7/13
10.	Economic disposal of Sludge	Building up in sludge drying beds	Lack of market						
11.	Borrow/ acquire best practices for reuse of best practices	In adequate knowledge in reuse of sludge and effluent	Limited practical exposure	To raise agro forestry and increase company revenue	Benchmarking on WSPs, Meru & Nanyuki water and sanitation who are making economic use of sludge and effluent in banana farms.	Transport and Allowance	120,000/=	OM WW & 3 T.Os	By 30/9/13
12.	Improve sanitation in ten schools and informal settlements	Not a core business	Not within mandate	Mainstreaming sanitation as a core business	Draft a board paper to initiate advocacy	-	-	OM WW & 2 T.Os	By 31/8/13
13.	Increase sewer connection	Some within coverage	-	Connect all	Barazas, radio talks	Transport	-	T.O	30/11/13

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		not connected							
14.	Record keeping	Exhauster records kept by transport section	Lack of coordination	To realize accessibility of records	Collaboration at horizontal level		-	OM WW/ T.O	By 30/9/13
15.	Capacity Building for 75 WW Staff	Untrained WW staff	Inherited from the Council	To have staff with the right knowledge skills and Attitudes	Identify Hall and resource persons within Mowassco	Refreshments, transport and facilitation fees	200,000/=	OM WW/ 2 T.Os	31/12/13

**Ghant Chart for Action Plan**

S/No.	Area of Intervention	July	Aug	Sept	Oct	Nov	Dec
1.	Frequent sewage overflows						
2.	Replacement of manhole covers						
3.	Collapse sewer section						
4.	Replacement of Kipevu WWTP gate						
5.	Health and Safety at Kipevu WWTP						
6.	Beautification of Kipevu WWTP						
7.	Reuse of treated final effluent						
8.	Use of Personal protective Equipment						

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	(e.g. Clothing, gloves, masks)						
9.	Occupational Health and safety						
10.	Economic disposal of Sludge						
11.	Borrow/ acquire best practices for reuse of best practices						
12.	Improve sanitation in ten schools and informal settlements						
13.	Increase sewer connection						
14.	Record keeping						
15.	Capacity Building for 75 WW Staff						

#### **5.4 Course Evaluation and Closing**

Participants were given evaluation forms to fill by Eng. Njaggah and Margaret. Eng. Njaggah explained how the form should be filled.

Mr Kirubi appreciated the participants and thanked all – participants and the resource persons. He also issued the participants an evaluation form for the action plans.

Eng. Njaggah invited the facilitators to say a word or two to participants.

He then invited our guest of honour, Mr. David Ngetich, the Deputy Director, Kenya Water Institute. Mr. Ngetich had the following to say:

- Pleasure to thank all for patience and contribution. Training adult learners has never been easy.
- Aware that participants from 11 WSPs among them: Garissa, Limuru and Nanyuki.
- The course has been participatory and that you have learnt a lot from each other.
- The course has prepared you to face challenges in your work place – your treatment plants.
- Wastewater management is still a big challenge, however, a long journey begins with the first step. May this training be the first step in solving wastewater problems in our country.
- We are releasing you as change agents.
- If the area you are working fails, you fail.
- You have your action plans done, please ensure you translate them into action in your endeavor to face challenges in wastewater management.
- Thanked all those who made the course a success
  - Mkiibi – coach
  - Kirubi – wave plus
  - GIZ for sponsor
  - Wave facilitators
- Invited all to the 25<sup>th</sup> grad ceremony for KEWI which will take place on 19<sup>th</sup> July 2013.
- Officially declare the workshop closed

#### **Vote of thanks**

One of the participants gave a vote of thanks as follows:

- Thanked God for keeping us safe
- Appreciated GIZ, WAVE Plus team, trainers, KEWI and Milele Guest House
- Appreciated all participants
- Remember: Water is life and Sanitation is Dignity

From Eng. Njaggah to all of us: “When we go out there, let us do our best”.

Participants returned the dully filled evaluation forms and the workshop was declared officially closed.

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## 6.0 Appendices

### 6.1 List of Participants

**WASTEWATER MANAGEMENT AND SANITATION TRAINING HELD AT MILELE PCEA GUEST HOUSE AND CONFERENCE  
FROM 8<sup>TH</sup> TO 12<sup>TH</sup> JULY, 2013**

No.	Name	Gender	Qualifications	Position	Organization	Address	Tel. No.	Email address
1.	Zeinab Abdikadir Ibrahim	F	Certificate – Community Health & Development	Water Quality Control Officer	Garissa Water & Sewerage Co.	Box 1088 – 70100 Garissa	0462103330 / 724270044	<a href="mailto:garissawater@yahoo.com">garissawater@yahoo.com</a>
2.	Edwin Okoth Apuko	M	Diploma Water Engineering	Officer In-charge of sewerage system	Garissa Water & Sewerage Co.	Box 1088 – 70100 Garissa	0462103330 / 726803557	<a href="mailto:garissawater@yahoo.com">garissawater@yahoo.com</a> <a href="mailto:opraedwins@hotmail.com">opraedwins@hotmail.com</a>
3.	Edinah Sang	F	Sewerage stores	Sewerage stores	Kericho Water & Sanitation Co.	Box 1379 – 20200 Kericho	0720178751	
4.	Wilson Cheruiyot	M	Diploma Waste Water	Foreman	Kericho Water & Sanitation Co.	Box 1379 – 20200 Kericho	0711545720	
5.	Kenneth Mutai Kipngetch	M	Waste Water	Sewerage Foreman	Kericho Water & Sanitation Co.	Box 1379 – 20200 Kericho	0700398850	
6.	Alice Karoki Riungu	F	Higher Diploma Analytical Chemistry	Water Production Superintendent	Meru Water & Sewerage Services	Box 859-60200 Meru	064-32591 / 0721487152	<a href="mailto:alicriungu@yahoo.com">alicriungu@yahoo.com</a>
7.	Mercy Muthoni	F	Diploma waste water	Sewerage forewoman	Meru Water & Sewerage Services	Box 859-60200 Meru	064-32591 / 0720307431	<a href="mailto:karanim2013@gmail.com">karanim2013@gmail.com</a> <a href="mailto:/info@mewass.or.ke">/info@mewass.or.ke</a>

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	Karani							
8.	Christopher M. Kaume	M	Bachelor degree – Civil Engineering	Assistant Technical Manager	Meru Water & Sewerage Services	Box 859-60200 Meru	064-32591 / 0716409468	<a href="mailto:dr.chrismk@mail.com">dr.chrismk@mail.com</a> / <a href="mailto:info@mewass.or.ke">/info@mewass.or.ke</a>
9.	John Mfuko Mwamburi	M	Higher diploma – Building Civil – Waste Water	Operations Manager – waste water	Mombasa Water Supply & Sanitation Co.	Box 1100-80100 Mombasa	0722583546	<a href="mailto:mfukojohn@yahoo.com">mfukojohn@yahoo.com</a>
10.	Cristom K. Mwalimu	M	Waste Water	Technical Officer	Mombasa Water Supply & Sanitation Co.	Box 1100-80100 Mombasa	0724862583	<a href="mailto:ckmwalimu@gmail.com">ckmwalimu@gmail.com</a>
11.	Jared Mjomba	M	Diploma Waste Water	Technical Officer	Mombasa Water Supply & Sanitation Co.	Box 1100-80100 Mombasa	0722353479	<a href="mailto:mjombajared@yahoo.com">mjombajared@yahoo.com</a>
12.	Festus Murithi Nyaga	M	Waste water	Sewerage attendant	Embu Water & Sanitation Co. Ltd.	Box 2142-60100 Embu	06831156 / 0727085761	
13.	Joseck Fundi Njeru	M	Diploma Waste Water, one year operator course	Sewage Operator II	Embu Water & Sanitation Co. Ltd.	Box 2142-60100 Embu	06831156 / 0728790705	
14.	Silas Njagi M'Njeru	M	Sewage operators course	Sewage operator 1	Embu Water & Sanitation Co. Ltd.	Box 2142-60100 Embu	06831156 / 0724613644	
15.	Janet Wachera Kiguru	F	Waste Water Management & Sanitation	Sewerage Supervisor	Nanyuki Water & Sewerage Co.	Box 995-0400 Nanyuki	0721557397	<a href="mailto:wacheraj@yahoo.com">wacheraj@yahoo.com</a> / <a href="mailto:nawasco@yahoo.com">nawasco@yahoo.com</a>
16.	John Mukhaye Sikote	M	Diploma Waste Water Mgt & Sanitation	Sewerage Supervisor	Nanyuki Water & Sewerage Co.	Box 995-0400 Nanyuki	0716136559/074161365	<a href="mailto:nawasco@yahoo.com">nawasco@yahoo.com</a>
17.	Mary Wanjiru Theuri	F	Diploma Water Technology (Sanitation option)	Technician	Nyeri Water & Sewerage Co. Ltd.	Box 1520-0100 Nyeri	0724432491	<a href="mailto:mtheuri80@yahoo.com">mtheuri80@yahoo.com</a>

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18.	George Thuita Kamunya	M	Certificate Water Engineering	In-charge Sewerage Treatment Works	Nyeri Water & Sewerage Co. Ltd.	Box 1520-0100 Nyeri	0726766294	<a href="mailto:georgethui@gmail.com">georgethui@gmail.com</a>
19.	Josphat M. Ndombi	M	Diploma Waste Water	Technician	Eldoret Water & Sanitation Co. Ltd.	Box 8418 ELDORET	053206191/0726036782	
20.	Joseph Kipkoeh Kipsang	M	Diploma Waste Water	Sewerage Technician	Eldoret Water & Sanitation Co. Ltd.	Box 8418 ELDORET	053206191/0724255538	<a href="mailto:Jk.kipsang@yahoo.com">Jk.kipsang@yahoo.com</a>
21.	Pierson Luvai Massiemo	M	Advance Sewage Operator	Senior Operator	Eldoret Water & Sanitation Co. Ltd.	Box 8418 ELDORET	053206191/0724255538	<a href="mailto:pearsonluvai@yahoo.com">pearsonluvai@yahoo.com</a>
22.	David K. Nderitu	M	Diploma Water Engineering	Technician	Thika Water & Sewerage Co.	Box 6103 THIKA	0724691221	
23.	Hellen Njunge Njeri	F	Waste Water	Sewerage Attendant	Thika Water & Sewerage Co.	Box 4084 THIKA	0724292961	
24.	Walter Nyongesa	M	O-level	Waste water operator	Nairobi City Water & Sewerage Co.	Box 30656-00100 NBI	0720359976	
25.	John Kabiru Githinji	M	KCSE	Waste Water Operator	Nairobi City Water & Sewerage Co.	Box 30656-00100 NBI	0723936636	
26.	Aggrey Achesa	M	Craft III Water & Sewerage Reticulation	Technician Waste Water	Nairobi City Water & Sewerage Co.	Box 30656-00100 NBI	0721571246	<a href="mailto:aggreyachesa@yahoo.com">aggreyachesa@yahoo.com</a>
27.	Dan Kiprotich Bore	M	Certificate Sewerage/Sanitation	Sewerage Operator	Limuru Water & Sewerage Co.	Box 1286-00217 LIMURU	0202374345 / 0752603937	
28.	Joseph Muli Kule	M	Diploma Water Technology	Commercial Manager	Limuru Water & Sewerage Co.	Box 1286-00217 LIMURU	0202374345 / 0726791051	<a href="mailto:joseph.kyule48@gmail.com">joseph.kyule48@gmail.com</a>

## 6.2 Facilitators/Logistic Persons

### WASTEWATER MANAGEMENT AND SANITATION TRAINING HELD AT MILELE PCEA GUEST HOUSE AND CONFERENCE FROM 8<sup>TH</sup> TO 12<sup>TH</sup> JULY, 2013

S/No.	Names	Gender	Location	Organisation	Position In The Organisation	E- Mail Address	Telephone
1.	Eng. Peter Njaggah	M	Nairobi	WASREB	Head Regulator / Lead Trainer	<a href="mailto:njaggah@yahoo.co.uk">njaggah@yahoo.co.uk</a>	0722 594 248
2.	Joseph K. Kibuchi	M	Nairobi	KEWI	Senior Lecturer / Trainer	<a href="mailto:kiharakibuchi@yahoo.com">kiharakibuchi@yahoo.com</a>	0722 282149
3.	Alfred J. Kirubi	M	Nairobi	KEWI	Senior Lecturer/ Giz Wave+ Focal Point	<a href="mailto:ajkirubi@hotmail.com">ajkirubi@hotmail.com</a>	0721 384846
4.	Catherine R. Githuku	F	Nairobi	KU	Lecturer/ Documentalist	<a href="mailto:rwamba_kiura@yahoo.com">rwamba_kiura@yahoo.com</a>	0721 843717
5.	Caroline Wambui	F	Nairobi	KEWI	Secretary / Seminar Assistant	<a href="mailto:carlywamb@yahoo.com">carlywamb@yahoo.com</a>	0720 234702
6.	Margaret Maina	F	Limuru	LWSC	Managing Director / Wave Trainer	<a href="mailto:magmaina@yahoo.com">magmaina@yahoo.com</a>	0721276727
7.	Anne Mwangi	F	Ongata Rongai	Ololaiser Water & Sewerage Company	Managing Director/ Wave Trainer	<a href="mailto:anndemi@hotmail.com">anndemi@hotmail.com</a>	0722 247839
8.	Steven Mukiibi	M	Kampala	GIZ/WAVE	Regional Coach	<a href="mailto:stevenmuk@gmail.com">stevenmuk@gmail.com</a>	+256772433634
9.	David Ngetich	M	Nairobi	KEWI	Deputy Director Academic Affairs/WAVE+ Trainer	<a href="mailto:kimtaid@yahoo.com">kimtaid@yahoo.com</a>	0720619332



### 6.3 Programme Timetable

#### Wastewater Management and Sanitation Course 8<sup>th</sup> To 12<sup>th</sup> July 2013

##### Programme

**Theme:** Collection, Treatment and Disposal of Domestic Waste Water and Sanitation for Enhanced Public Health and Environmental Protection in Kenya

**Venue:** Milele Nairobi PCEA Guest House and Conference Centre

**Lead Facilitator:** Eng. Njaggah

##### DAY ZERO: Sunday 7<sup>th</sup> July, 2013

Time	Activity	Responsible
4.00 p.m.	Arrival at workshop venue	Secretariat

##### DAY ONE: Monday 8<sup>th</sup> July, 2013

Time	Theme	Topic	Facilitator
8.00 – 8.30 a.m.		Registration	Secretariat
8.30 – 9.00 a.m.		Introduction of participants and trainers and climate setting	Joseph Kihara
9.00 – 9.15 a.m.		Participants Norms	Joseph Kihara
9.15 – 9.45 a.m.		Participants Expectations	Joseph Kihara
9.45 – 10.00 a.m.		Remarks by GIZ/KEWI WAVEplus Focal Point	Alfred Kirubi
10.00 – 10.15 a.m.		Opening Remarks	Dr. L. A. Sumba
<b>10.15 – 10.45 a.m.</b>	<b>GROUP PHOTO/TEA BREAK</b>		
10.45 – 11.30 a.m.	<b>Wastewater management and treatment system</b>	Introduction to Wastewater management (Network and Treatment)	Eng. Njaggah
11.30 – 1.00 p.m.		The need for efficient O&M (Network and Treatment)	Alfred Kirubi
<b>1.00 – 2.00 p.m.</b>	<b>LUNCH BREAK</b>		
2.00 – 2.30 p.m.	<b>Role of Training Institutions</b>	Wastewater and Sanitation management – Role of training institutions	Dr. L.A. Sumba
2.30 – 3.30 p.m.	<b>Kenya Situational Analysis</b>	Situational Analysis of	Eng. Njaggah

		Wastewater treatment and Management in Kenya	
<b>3.30 – 4.00 p.m.</b>	<b>TEA BREAK</b>		
4.00 – 5.00 p.m.		Situational Analysis of sanitation in informal settlement in WSPs	Eng. Njaggah
5.00 – 5.15 p.m.		Wrap up of day one	

**DAY TWO Tuesday 9<sup>th</sup> July, 2013**

Time	Theme	Topic	Facilitator
8.00 – 8.30 a.m.		Morning News	
8.30 – 9.30 a.m.	<b>Treatment process and quality Control</b>	Types of Wastewater treatment system-Conventional treatment plants.	Margaret Maina
9.30 – 10.30 a.m.		Types of Wastewater treatment system-Waste Stabilization ponds	Eng. Njaggah
10.30 – 11.00 a.m.		<b>TEA BREAK</b>	
11.00 – 11.30 a.m.	<b>Treatment process and quality Control</b>	Treatment process: Challenges and Solutions	Eng. Njaggah
11.30 – 1.00 p.m.		Wastewater and sludge reuse in Kenya	Margaret Maina
1.00 – 2.00 p.m.		<b>LUNCH BREAK</b>	
2.00 – 2.45 p.m.	<b>Treatment process and quality Control</b>	O&M procedures: Treatment plant/sewer network.	Margaret Maina
2.45 – 3.30 p.m.		Wastewater Disposal and Sludge Management – Role of NEMA and WSPs	Bakari Mangale Senior Compliance Officer - NEMA
<b>3.30 – 4.00 p.m.</b>	<b>TEA BREAK</b>		
4.00 – 5.00 p.m.	<b>Treatment process and quality Control</b>	Quality Control and Monitoring Procedures	Margaret
5.00 – 5.15 p.m.		Wrap up of the day two	

**DAY THREE: Wednesday 10<sup>th</sup> July 2013**

Time	Theme	Topic	Facilitator
8.00 – 8.30 a.m.		Morning News	
8.30 – 10.00 a.m.	<b>Kaizen</b>	The process of Continuous Improvement- starting the Kaizen Journey.	Joseph Kihara
<b>10.00 – 10.30 a.m.</b>	<b>TEA BREAK</b>		
10.30 – 12.00 Noon	<b>Health &amp; Safety, Reporting, documentation</b>	Health and Safety at Workplace	Anne Mwangi
12.00 – 1.00 p.m.		Reporting and Documentation	Anne Mwangi
<b>1.00 – 2.00 p.m.</b>	<b>LUNCH BREAK</b>		
2.00 – 3.00 p.m.	<b>Sanitation</b>	Introduction to Sanitation	Margaret/Njaggah
3.00 – 4.00 p.m.		Sanitation technologies and systems.	Margaret/Njaggah
<b>4.00 – 4.30 p.m.</b>	<b>TEA BREAK</b>		
4.30 – 4.50 p.m.		Introduction to action planning	Joseph Kihara
4.50 – 5.00 p.m.		Wrap up of the day three	Alfred Kirubi

**DAY FOUR: Thursday 11<sup>th</sup> July, 2013**

Time	Theme	Topic	Facilitator
8.00 – 8.30 a.m.		Morning News	
8.30 – 9:00 a.m.		Field Trip Instructions/Guidelines	Kihara
9.00 – 1.00 p.m.		Field Trip Visit to a treatment plant.	Njaggah, Margaret
<b>1.00 – 2.00 p.m.</b>	<b>LUNCH BREAK</b>		
2.00 – 3.30 p.m.		Group work exercise: lessons learnt on field trip.	Njaggah, Margaret
<b>3.30 – 4.00 p.m.</b>	<b>TEA BREAK</b>		
4.00 – 4.50 p.m.		Group work presentation on lessons learnt.	Njaggah, Margaret
4.50 – 5.00 p.m.		Wrap up day 4	

**DAY FIVE: Friday 12<sup>th</sup> July, 2013**

Time	Theme	Topic	Facilitator
8.00 – 8.30 a.m.		Morning News	
8.30 – 9:00 a.m.	<b>Action Planning</b>	Recap to action planning	Ngetich/Njaggah
9.00-10.30 a.m.		Preparation of Action planning	Ngetich/Njaggah
<b>10.30 – 11.00 a.m.</b>	<b>TEA BREAK</b>		
11.00 – 1.00 a.m.	<b>Action Planning</b>	Preparation of Action planning	Ngetich/Njaggah
1.00 – 2.00 p.m.	<b>LUNCH BREAK</b>		
2.00 – 3.00 p.m.	<b>Action Planning</b>	Review and Presentation of Action Plans	Ngetich/Njaggah /Kihara
3.00 – 3.30 p.m.	<b>Course Evaluation</b>	Course evaluation	Alfred Kirubi
3.30 – 4.00 p.m.		Official Closing	
<b>4.00 – 4.30 p.m.</b>	<b>TEA BREAK</b>		
<b>DEPARTURE</b>			



#### 6.4 Follow Up Action Plan Form



Kenya Water Institute

in collaboration with

WAVEplus



#### EVALUATION OF PARTICIPANT ACTION PLAN FORM

Improvement Area	Status Before WAVEplus Training	Changes Made	Current Status	Indicators

**In case the space is not enough, you can attach an additional sheet.**

State the challenges faced during implementation.

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I certify the above information to be correct:

Name \_\_\_\_\_ Signature \_\_\_\_\_

**Supervisor**

I agree/do not agree with the above progress report and hereby make the following comments:

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Name \_\_\_\_\_ Signed \_\_\_\_\_ Date \_\_\_\_\_

Company stamp  
(Head of WSP/Immediate supervisor)

Tel no: \_\_\_\_\_ : e-mail: \_\_\_\_\_



**WAVEPLUS**

## 6.5 Evaluation Results

The evaluations forms were analysed and the results of the analysis are as shown below.

### 6.5.1 Part 1: Participants

Survey:

Training / Further training

Dear participant,

You have taken part in a GIZ WAVEplus training event. To help us further enhance the alignment of such training with your needs, we would ask you to participate in this survey and share your experience and any suggestions you might have for improvements. Naturally, we evaluate all questionnaires anonymously and will not be passing on your data to any third party. The data is statistically grouped and evaluated to allow us to provide information on the quality of our training within the GIZ WAVEplus network. For this reason, we would ask you to answer all the questions in the survey.

Thank you for your help and support!

Your GIZ WAVEplus team

Please read the following statements and indicate your level of agreement by marking the appropriate box. You have six possible answers ranging from "totally disagree" to "totally agree". If you cannot answer or do not wish to, please tick the "no answer" box.

#### 1. General information

<b>Training Course Title:</b>	<b>Wastewater Management and Sanitation</b>
<b>Venue:</b>	<b>Milele PCEA Guest House and Conference Centre</b>
<b>Duration:</b>	<b>From: 8<sup>th</sup> July, 2013      To: 12<sup>th</sup> July, 2013</b>

## 2. Content relevance and transfer possibilities

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The topics and content of the training course are important for my work.	<input type="checkbox"/>	27	1				

**Please list the topics that the training course did not deal with but would have been important for your work:**

- First aid which is also important in treatment works
- Fire fighting
- How to deal with facilities that operate beyond capacity
- Sewer reticulation system
- Sewer pumping
- Types of unblocking equipment
- How to deal with rampant blockages
- Promotion in WWTPs
- Fats and greases discharged into our systems
- Wastewater analysis (was very shallow) – such as practical BOD, COD, Suspended Solids, BOD5, TDS vs conductivity, ammonia – ammonium chloride
- Eradication of dye stuff for WWTP – the phenyl group
- Just to elaborate a little bit more on all topics
- Management
- Counseling course in order to support other staffs and also the communities
- Feasibility study of waste as a resource besides the one in Kibera
- Basic knowledge for wastewater personnel
- HIV & Aids
- Design
- Operation and maintenance of pumping station
- Dealing with challenges at pumping stations
- Performance indicator or scorecard for a WWTP
- The use of ICT in detecting blockages in sewers

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The content of the training course successfully met my expectations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3	5	21	<input type="checkbox"/>
I know how I can apply the course content in my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	27	<input type="checkbox"/>
I know how I can pass on what I learnt to my colleagues.	<input type="checkbox"/>	28	<input type="checkbox"/>				
I can also make good use of what I have learnt in other contexts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	24	<input type="checkbox"/>

The course has enabled me to continue working independently with the materials.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>4</b>	<b>24</b>	<input type="checkbox"/>
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**Have you already got concrete ideas of how to apply what you have learnt?**

Yes: 20      No:

**Please describe the initial steps you will take to implement your ideas:**

- Appreciate my work first
- Teach my colleagues on the important of sanitation
- Work as a team
- I can use the smartc process
- Staff meeting (sewerage staff) informing on the same
- By sharing what I have learnt with my fellow colleagues in workplace
- Coming up with appropriate working plan
- Having a teamwork in workplace
- By applying the action plan
- Check on where we are doing things wrong and do them right
- Do audit for the plan of action I have prepared for our company
- Training staff under me
- Bringing positive change
- By holding a meeting with treatment works staff
- By implementing the tasks directed to me
- Personally applying the ideas I got during this course in my working station as a good picture to the staff under me.
- I will use the skills that I have and also the one that I have learnt during this workshop.
- Disseminate the ideas, budget and proposal
- Using the action plan developed
- Make a report to the management detailing lessons learnt, what I plan to do, action plan
- I will start with health and hygiene
- By holding some meetings
- Working practice
- By use of action plan and then put it into action immediately
- By designing an action plan which will guide be to the relevant areas using less resources/power
- Knowledge, skills and attitude
- To present a report to the management and start those activities that don't require finance resources
- To apply the knowledge that I have learnt
- Have training on PPE and OSH act
- Improve record and report keeping i.e. engage the S.F. in MEWASS to learn how to use excel and word
- Have regular visit to the treatment plant
- Reducing the no. of blockages per day by dislodging manholes to clear silt/sand and other solids entering the system through open manholes
- Implement the action plan as agreed at closure of the course

**What support do you require in this process?**

- Attending as many trainings as possible on treatment plants
- Assistance from my colleagues and the management
- Financial assistance
- Cooperation and teamwork
- Support from the managerial position in the company
- Finance to make it work
- Teamwork in all departments that I will be involved in
- Recognition – the company to appreciate what we have learnt and achieved
- The support of the management
- To have regular course to update the incomplete courses
- Technical skills and funding
- Company procedures are in place
- Management should be approached to provide funds
- I require the support of the procurement officer to supply with the required materials
- Working as a team
- The management support and team work from my colleagues
- The management support and teamwork of all workmates in workplace
- More training
- Follow up with WAVEplus
- Soft copies of the presentations
- Facilitation to acquire labour
- Take CEOs through a similar course so that they can own our action plans

**3. Working and learning methods**

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The content and outcomes of the individual learning units were clear.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	4	23	<input type="checkbox"/>
Participants were able to bring their own experience and examples into the training course.	<input type="checkbox"/>	<input type="checkbox"/>	1	1	2	24	<input type="checkbox"/>
The material (e.g. presentations, checklists, etc) helped me to understand the content better.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	24	<input type="checkbox"/>
The working and learning methods (mix of presentations, working groups, and field trip) were appropriate to the tasks and suitably varied.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	3	24	<input type="checkbox"/>
I could relate the case studies to the context of my own work and life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	26	2

The course was ...      too long       too short **11**      just right **17**

#### 4. Trainers/Resource persons

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The trainer obviously had considerable expertise in her/his own field and was well prepared.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	27	<input type="checkbox"/>
The trainer used specialist terms that had already been explained or were already familiar.	4	<input type="checkbox"/>	2	<input type="checkbox"/>	4	18	<input type="checkbox"/>
The trainer could listen to the participants and answered their questions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	24	2

#### 5. Participants

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The atmosphere among the participants themselves was always cooperative.	<input type="checkbox"/>	28	<input type="checkbox"/>				
I was able to benefit from the experience of other participants.	<input type="checkbox"/>	28	<input type="checkbox"/>				
I will continue to exchange views on this subject with some of the other participants.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	27	<input type="checkbox"/>

#### 6. Achievement of objectives

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
<b>Learning Outcome 1 of the course</b> I have learnt and appreciated the need for addressing the operation & maintenance of wastewater treatment plants and what I can do to improve the performance in the wastewater management and sanitation in our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	26	<input type="checkbox"/>
<b>Learning Outcome 2 of the course</b> I have been empowered on how to	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3	25	<input type="checkbox"/>

improve the performance in the wastewater management and sanitation in our company through increased knowledge and practical exposure.	
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<p><b>What competencies or expertise have you acquired in addition to the training course's explicit outcomes?</b></p> <ul style="list-style-type: none"> <li>• Low cost sanitation solutions in informal settlements – waste as a resource</li> <li>• That grit can affect the biological process of the ponds</li> <li>• One gains knowledge enough to apply in treatment works and improvement in wastewater management &amp; sanitation in our companies</li> <li>• Health and safety</li> <li>• Reuse of effluent and sludge</li> <li>• Have clear performance boosters action plans</li> <li>• Be serious on health and safety in the WWTP</li> <li>• The Kaizen theory and the need to promote the right attitudes</li> <li>• To make my company good and to achieve</li> <li>• Application of the Kaizen rule</li> <li>• The kaizen method of doing things</li> <li>• Wastewater can be reused again</li> <li>• The trainers were experts and would like to have more training courses</li> <li>• Communication skills</li> <li>• Reporting skills</li> <li>• Self confidence</li> <li>• Preparation of action plan</li> <li>• Evaluation and planning at our workplace</li> <li>• How to be a good manager</li> <li>• That I am a person of high integrity</li> <li>• The Kenyans are looking for me to assist them in all areas</li> <li>• Have acquired basic skill in my course which assist my staff on field</li> <li>• O&amp;M of sanitation</li> <li>• Knowledge and attitude on sanitation issues</li> <li>• How to use Kaizen</li> <li>• Knowledge, skills and positive attitudes</li> <li>• The T works we have are not as we think. They can be operated effectively</li> <li>• New ideas</li> <li>• Kaizen application</li> </ul>
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## 7. Organisation

	Very unhappy					Very pleased	No answer
How happy are you with.....	1	2	3	4	5	6	
<ul style="list-style-type: none"> <li>• The overall organisation of the training course?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	24	<input type="checkbox"/>

• Your accommodation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>1</b>	<b>2</b>	<b>24</b>	<b>1</b>
• The catering?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>4</b>	<b>24</b>	<input type="checkbox"/>
• The accompanying programme?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>1</b>	<b>2</b>	<b>24</b>	<input type="checkbox"/>
• The information you received in the run-up to the training course (e.g. organisational details, technical / professional information on the subject ...)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>3</b>	<b>25</b>	<input type="checkbox"/>

**What other information / documents would have you needed as well?**

- Lab practical
- Offering of this training course from certificate level to higher diploma at KEWI
- The notes and computer clip could be added over to us
- Wetlands (comprehensive)
- Clear explanation on major topics
- To have the rooms to meeting other staffs of different companies
- Sewerage construction units
- Pumping
- Laptop
- Awareness on HIV & Aids
- Certificate, but it will come after an action plan has been implemented
- GIZ WAVEplus to conduct a follow up to different WSPs
- To give certificates to show that we have attended the course
- Reference materials and site
- A copy of the whole training on wastewater
- What is expected of us at the end of the training so that participants can prepare adequately, carry flash disks and laptops
- Notes
- On solid waste management
- Soft copies of all the presentations

**Since there are lots of aspects a survey like this cannot cover, we would like to ask you to add any comments or recommendations below that you might have for future training courses.**

- The trainings should be extended to two weeks to avoid hurrying over on some topics
- Yearly training on wastewater management and sanitation course
- Typed notes
- The training contents were simple for everyone to understand and was the real Kenyan situation of our sewerage
- Additional time for training i.e. 2 weeks
- The facilitators should visit all the W/WTPs first before such workshop so that they do not lean on one or participation of water companies
- Extension of uncovered topics

- Operation and maintenance of wastewater training should continue
- Keep building on job related work of staff capacity
- Wastewater analysis
- Please conduct another training to expand what we have learnt
- Extend more trainings in all areas of water sectors
- Give more training to WSP – annually in all areas i.e. treatment, WWT, water supply, non revenue, metering, etc.
- E communication between us
- The training should be conducted yearly
- Have performance indicators for the WWTP
- Include sewer rising main in the programmes
- Wastewater operation and maintenance should be a continuous process
- More time and days needed for the course
- Explain deeper for those with small facilities and even visit one of those facilities
- Incorporate simple designs on low cost sanitary facilities now that sanitation is our core business

Thank you!

Your GIZ WAVEplus team

Would you like to continue learning and remain in contact with other participants? Then simply visit the GIZ WAVEplus Alumni portal at [www.inwent.org/alumni](http://www.inwent.org/alumni). The Alumni portal offers a learning, information and communication platform for everyone who feels a part of GIZ WAVEplus - current and former participants at GIZ WAVEplus training events, cooperation partners, staff and other people interested in GIZ WAVEplus' work, vision and goals.

## 6.5.2 Part 11: Professional External Experts

**Dear Professional External Partner,**

As you know, we apply a policy of continuous improvement to our training courses. In the spirit of our successful cooperation, we would like to invite you to give us your views on the participants' learning success and evaluate the training from your own perspective. Your experience and insights can help us to align the programme even more to the needs of the participants and, in this way, make an important contribution to the success of such events. For this reason, we would ask you to answer all the questions in the survey.

Thank you for your help and support!

Your WAVEplus team

Please read the following statements and indicate your level of agreement by marking the appropriate box. You have six possible answers ranging from "totally disagree" to "totally agree". If you cannot answer or do not wish to, please tick the "no answer" box.

## 1. General information

Training Course Title:	Wastewater Management and Sanitation	
Venue:	Milele PCEA Guest House and Conference Centre	
Duration:	From: 8 <sup>th</sup> July, 2013	To: 12 <sup>th</sup> July, 2013

## 2. Content relevance and transfer possibilities

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
The participants were very interested in the content of the training.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	3	<input type="checkbox"/>
The content was important for the participants' work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	3	<input type="checkbox"/>
The participants have sufficient expertise at their disposal to apply what they have learnt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	1	2	<input type="checkbox"/>
The participants discussed possible ways of applying what they had learnt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	<input type="checkbox"/>

## 3. Learning Outcomes

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
<b>Learning Outcome 1 of the course.</b> Participants have learned and appreciated the need for enhancing water integrity, transparency, accountability and participation (TAP) in handling of internal and external customers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	<input type="checkbox"/>
<b>Learning Outcome 2 of the course</b> Participants have been empowered to become a champion of change through increased knowledge and to contribute to the desired changes in making our water company embrace water integrity, transparency, accountability and participation (TAP) when handling internal and external customers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	1	2	<input type="checkbox"/>

What factors supported the participants' success in achieving particular learning outcomes?	
Learning Outcome 1	<ul style="list-style-type: none"> <li>• Their participation and the way they were formed in groups</li> <li>• Site visits</li> <li>• Their interest in learning and participation</li> <li>• Training methodology of presentations, group exercises, experience sharing</li> </ul>
Learning Outcome 2	<ul style="list-style-type: none"> <li>• Sharing of experiences</li> <li>• Their interest in learning and participation</li> <li>• Sharing of experiences, field visit</li> </ul>
What factors negatively influenced the participants' ability to achieve particular learning outcomes?	
Learning Outcome 1	<ul style="list-style-type: none"> <li>• Their level of education</li> </ul>
Learning Outcome 2	<ul style="list-style-type: none"> <li>• Their level of education</li> </ul>
Have the participants acquired any other competences or expertise in addition to the course's explicit outcomes?	
<ul style="list-style-type: none"> <li>• Networking with their colleagues</li> <li>• Yes - Action planning and sanitation</li> </ul>	

The course was ...      too long       too short 1      just right 2

#### 4. Group

	Totally disagree					Totally agree	No answer
	1	2	3	4	5	6	
It was a pleasant sized group to teach.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3	1	<input type="checkbox"/>
The group had a positive learning and working atmosphere.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	<input type="checkbox"/>
The participants are the kind of people able to initiate the planned changes in their organisation. (Selection of participants)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	<input type="checkbox"/>
The participants took an active part in shaping the training.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	<input type="checkbox"/>	<input type="checkbox"/>
The atmosphere among the participants themselves was always cooperative.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4	<input type="checkbox"/>	<input type="checkbox"/>
The participants could benefit from each others' expertise and practical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	2

experience.	
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**5. Cooperation with Partners**

	Very unhappy					Very pleased	No answer
How happy are you with.....	1	2	3	4	5	6	
<ul style="list-style-type: none"> <li>The cooperation with WAVEplus?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	3	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>The cooperation with the partner organisation(s)?</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	2	<input type="checkbox"/>

<p>Since there are lots of aspects that can't be covered in a survey like this, we would like to ask you to add any comments or recommendations below that you might have for future events or courses.</p> <ul style="list-style-type: none"> <li>The course was very well executed but there is need of time consideration during field trips</li> </ul>
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Thank you!  
Your WAVEplus team