

Project for Strengthening Capacity in Non-Revenue Water Management

Non-revenue water management based on realistic NRW reduction plan and strengthening of organizational capacity for expanding NRW reduction activities in Kenya



Photo 1 KEWI training in use of leak detector

1. Project Background and Challenges

1.1 Importance of reducing NRW in Kenya

About 80% of the land in the Republic of Kenya (Kenya) is arid and semi-arid. There is a concern that the amount of available water per head will decline as the population grows and demand for water is expected to increase. For the effective use of water resources, the Government of Kenya has set reduction of Non-Revenue Water (NRW) as a national priority. Furthermore, the Ministry of Water and Sanitation (MWS), in its National Water Services Strategy (2007-2015), set the target for reduction of the national average NRW ratio from 60% to 30%. With the transition of Water Service Providers (WSPs) to financially independent public companies, many WSPs have voluntarily tackled NRW to increase their financial viability. As a result, the national NRW average declined from 60% in 2010 to about 42% in 2015 according to the annual report issued by the Water Service Regulatory Board (WASREB). However, achieving the long term national target of an NRW ratio lower than 20% by 2030 indicated in Vision 2030 is not an easy task. Only 8 out of 84 WSPs managed to achieve an NRW ratio of less than 30%. The reduction of the NRW ratio at national level faces many challenges.

Against this backdrop, the Government of Japan through JICA supported the “Project for Management of Non-Revenue Water in Kenya (2010 to 2014)” (hereafter, the previous project). The previous project supported the preparation of NRW reduction plans by pilot WSPs (Embu, Narok and Kapsabet), the development of Non-Revenue Water Management Standards by WASREB, and the establishment of a short training course on NRW reduction at the Kenya Water Institute (KEWI). Through these activities, the

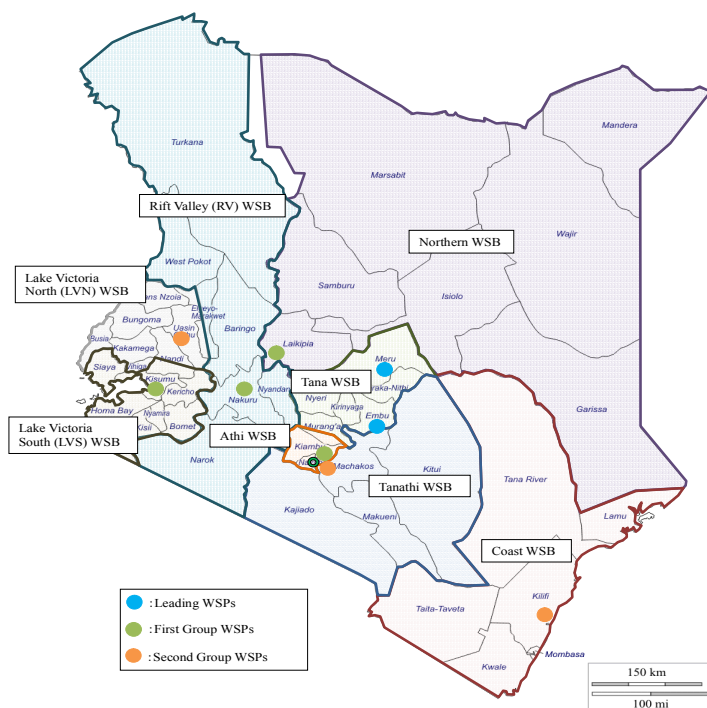


Figure 1. Location of project activities

previous project aimed at building a basic support mechanism for WSPs to formulate NRW reduction plans. However, challenges were observed. Although WSPs were able to formulate NRW plans in the previous project, the plans did not fully take into account the WSPs implementation capacities, including the availability of financial and human resources. Therefore, NRW reduction activities were not adequately implemented.

To tackle these challenges, the “Project for Strengthening Capacity in Non-Revenue Water Management” (hereafter, the Project) was launched in October 2016. Building on the achievements of the previous project, the Project aims to strengthen the skills and capacity of WSPs to formulate and implement viable NRW plans and build an enabling environment by strengthening the organizations that support WSPs in NRW reduction.

2. Project Approach to Tackle the Challenges

2.1 Project Counterparts (C/P)

The counterparts of the Project are: MWS Non-Revenue Water Management Unit (NRW Unit), WASREB, KEWI, and the Kenya Water Service

Providers Association (WASPA: voluntary association of WSPs and the private sector). The NRW Unit was established in MWS in 2016 to support WSPs in their efforts to reduce NRW. Nine pilot WSPs were selected. Meru and Embu WSPs, previously supported by JICA, were positioned as the Leading WSPs, and one WSP from each of the seven regions of the Water Services Board (WSB) was selected from 15 candidate WSPs that were recommended by MWS.

2.2 Project Framework and Implementation Structure

Figure 2 shows the Project's overall goal, purpose, outputs and C/P organizations. The Project will be conducted for 5 years from October 2016 to September

2021. It will be implemented in the following 3 phases:

Phase 1 : October 2016 to September 2017

Phase 2 : October 2017 to September 2019

Phase 3 : October 2019 to September 2021

The Joint Coordination Committee (JCC) meets twice a year. The JCC approves the project work plans and revision of the project schedule, and monitors the implementation of activities and achievements. The Project Implementation Committee (PIC) meets once a month. Representatives of the C/P organizations participate the PIC to report the progress of activities and discuss issues regarding project implementation.

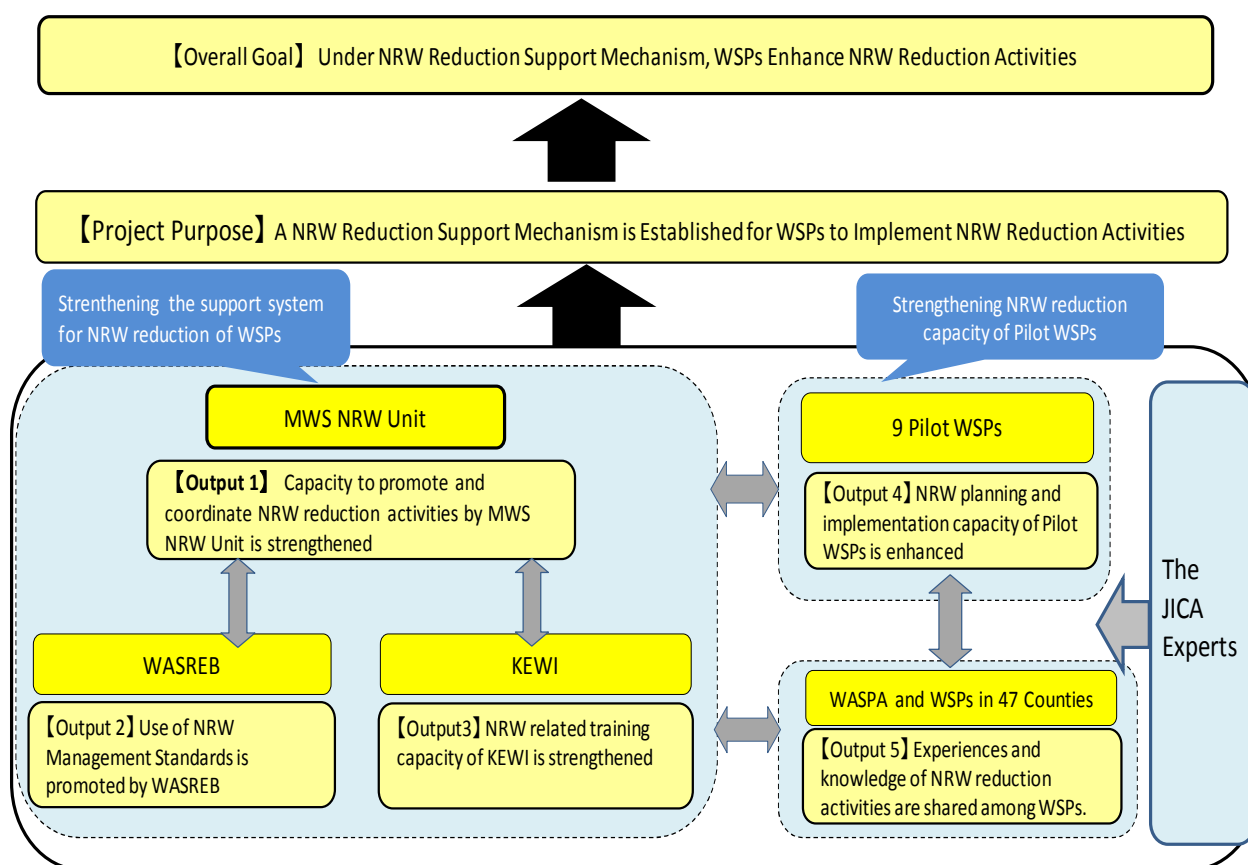


Figure 2 Project purpose, Outputs and Counterparts

2.3 Identification of Challenges and Project Approach through Baseline Survey

To understand the challenges faced by the C/Ps and set the starting point of the Project, a baseline survey was conducted at the beginning of Phase 1. Based on the results of the baseline survey, the Project selected 9 pilot WSPs for the target in Output 4 and the challenges facing the WSPs and the activities to achieve the outputs were determined.

Table1 Pilot WSPs and phases in which their activities are conducted

Phase when the activity starts	Pilot WSP
Phase 1 & 2	Meru, Embu
Phase 2	Kisumu, Nakuru, Nyahururu, Ruiru-Juja
Phase 3	Eldred, Kilify-Mariakani, Mavoko

The identified challenges and activities to tackle the challenges for each output are shown below.

2.3.1 NRW Unit, MWS (Output1)

Challenge: The NRW Unit has a mandate to formulate policy related to NRW reduction and implement sensitization of NRW reduction nationwide. As the NRW Unit was established in Feb. 2016 as a new unit, the tasks and roles of the officers and the activities of the Unit have not been clearly defined. Many of the staff were transferred from other sections and have no experience in conducting sensitization activities.

Solution: The Unit needs to accumulate experiences by establishing an organizational structure and planning and implementing its activities so that it can fulfill its mandate and contribute to the reduction of NRW. The Project aims to build the capacity of the Unit to lead NRW reduction activities at national level through the planning and implementation of sensitization of NRW reduction, and monitoring of the institutions/organizations that support NRW reduction.

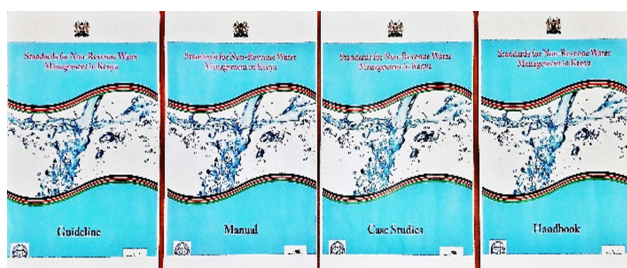


Figure3 4 NRW Management Standard publications

2.3.2 WASREB (Output2)

Challenge: In 2014, as a part of the activities of the previous project, WASREB issued the NRW Management Standards (4 publications: Guidelines, Manual, Handbook, and Case Studies) and distributed them to the WSPs. The results of the baseline study indicated that many activities recommended in the NRW Standards required major investment. For medium and small WSPs who often struggle with operation and maintenance costs, the activities in the Standards may not be easy to implement. An extensive user survey on the usage of the NRW Standards has not been done and there were not any information on whether the NRW Standards are fully used by WSPs. In the Project, WASREB will conduct a user survey of the NRW Standards with a view to revising them. Based on the survey results, WASREB will discuss and implement revision of the Standards in Phase 2 and the revised Standards will be distributed in Phase 3.

2.3.3 KEWI (Output3)

Challenge: KEWI is the only public training institute that specializes in water and sewage services and water resource management in Kenya. KEWI's long term courses offer a diploma and a certificate in these areas.

The previous course developed a short course in Kenya. It specializes NRW management for water service practitioners. The results of the baseline study indicated that the current short course was centered on theory and the opportunity to learn practical skills was limited to demonstrations and site visits. Thus the course does not cater to the WSPs' needs to acquire more practical skills.

Approach: KEWI will review the current NRW short course and formulate an NRW practical course. It also aims at improving the teaching materials and teaching methods. KEWI will collaborate with the Leading Embu and Meru WSPs to conduct the training on the site and incorporate practical skills and technologies. After the training, teaching materials will be produced. Lecturers at KEWI who do not have field experience will participate in the training at WSPs so that they can improve their teaching skills. The training will be evaluated by the practitioners who participated in the course and the teaching materials and methods will be reviewed. The results of the reviews will be reflected in the next training by incorporating the PDCA cycle (Plan, Do, Check, and Action) into KEWI activities.

2.3.4 Pilot Water Service Providers (Output 4)

In terms of WSPs' NRW reduction, the following challenges and issues were identified.

Challenge 1 : NRW Reduction Plan

The results of the baseline study showed that the targeted WSPs either have not established NRW reduction plans or had plans but they were unrealistic and could not be implemented. The plans were also limited to single year plans. Establishment of zoning of the water distribution system or more detailed district metered areas (DMAs), and replacement of aged pipes require medium to long term plans or visions and these were lacking in WSPs' NRW plans.

Challenge 2 : Geographic Information System (GIS)

The study observed that the existence of GIS data varied among the WSPs. Either WSPs had established no GIS database, or if there was a GIS database, layers such as key structures had not been installed in the database. Many of the WSPs did not know about the availability of free or low-cost GIS software that can be used to establish baseline mapping. Especially in the case of medium or small WSPs, they tended to believe that establishing a GIS database involved high

cost so it was a difficult activity. As Project activities, it is suggested to establish a GIS database by maximizing the use of software that is easy to obtain and to use mobile GIS in field activities. Even there were many WSPs that had a GIS database but were not using the database for NRW reduction activities.



Photo 2 Discussion during the baseline study

Challenge 3 : Zoning of Water Distribution System

From the results of the study, it is suggested that all the targeted WSPs should review or establish zoning for the purpose of monitoring the water distribution system.

Challenge 4 : Strategies for Reduction of Commercial Losses

None of the WSPs studied maintain meter accuracy or take enough preventative measures against water theft by large water consumers. Furthermore, it was a serious situation that many consumers were not registered in the customer database or were continuously receiving water bills based on estimates (bills were issued not based on actual readings). It is necessary to enhance the accuracy of the customer database and bill collection based on accurate water billing by prioritizing large consumers.

Challenge 5 : Strategies to Reduce Physical Losses

Many WSPs did not have the necessary equipment such as ultrasonic flow meters (UFM), listening sticks and leak detection equipment for reduction of water losses. On the other hand, many WSPs had advanced equipment like correlators but there were no staff who could use them. In addition, most of the WSPs need to enhance skills and knowledge in prioritizing the areas with frequent occurrence of leakages by conducting leakage detection using the Step Test and/or listening sticks. Regarding the pressure control of the distribution pipes, many WSPs need to enhance the technical skills to measure and analyze the water pressure at many points of the distribution system, conduct hydraulic analysis and install appropriate pressure reducing valves where necessary. Therefore, the Project needs to enhance the capacity to narrow down the areas with frequent occurrence of leakages using basic equipment such as UFM and listening sticks, and to regulate the pressure by analyzing the

data from wide-area pressure measurements.

To tackle the above challenges, the activities in Output 4 aim to improve the daily implementation of NRW reduction in the 3 strategic areas shown below.

Strategy 1 : NRW reduction activities will start from easy but effective activities with current capacity of WSPs. Large infrastructural changes and investments will be considered as mid-term or long-term challenges, and initial activities will be simple activities such as enhancing leakage record management or changing the meters of large consumers.

Strategy 2: The Project will introduce activities that can be widely used in WSPs' daily operation. For example, calibrated buckets to test the accuracy of customer meters in distribution areas and zones, and leakage detection by using listening sticks will be introduced.

Strategy 3: The Project aims to incorporate basic NRW reduction activities into WSP's daily operations by improving the workflow (reporting lines, sharing and storing of data/information among related sections/departments). For instance, the project will assist establishing a workflow of continuously recording leakage points in the GIS database so that it can be used for designing new distribution lines.

2.3.5 WASPA and all WSPs (Output 5)

The key activities in Output 5 are to share lessons learnt and NRW reduction activities of pilot WSPs and other donors with other WSPs so that NRW reduction activities can be expand in all over Kenya. WASPA has a membership of more than 60 WSPs including pilot WSPs. It holds bi-monthly meetings attended by the managing directors of WSPs. Sharing of information and Project achievements at WASPA meetings is considered as an effective way of sharing information.

Before the Project, there was no formal established relationship between WASPA and MWS. The Project supported the signing of a Framework of Cooperation between them regarding activities including knowledge sharing through WASPA meetings.

3. Results of Project Approach

The results of the baseline study were presented and approved at the second JCC meeting in June 2017 and the Project activities were commenced based on that. The status of activities as of the end of December 2018 is as follows.

3.1 Output 1 : Strengthening the Capacity of NRW Unit

1) Sensitization of NRW reduction

a) Sensitization for county governments

Due to decentralization of the administrative system and revision of the Water Act 2016 in Kenya, County Governments became responsible for monitoring the water service sector. Therefore, it is important to deepen County Government officials' understanding of NRW reduction. As part of sensitization for County Governments, in March 2018, the First Kenya Water Summit was co-organized by MWS and the Council of Governors, the secretariat of the counties. At the Summit, the Project Director (Water Secretary, MWS) presented the current status of NRW in Kenya, and a panel discussion on NRW was held with panelists including Embu WSP and a JICA representative. The Summit was attended by 37 county representatives who were informed about the core issues of NRW reduction.

During the Summit, the Minister of Water and Sanitation and the representative of the County Governments signed the Intergovernmental Cooperation Framework to establish a framework of cooperation by the central and county governments on water sector development.

b) Sensitization activities for citizens

Since none of the NRW Unit staff have experience in conducting sensitization activities, as a first step activity the Project introduced, a poster exhibition themed on NRW reduction was introduced. The first poster exhibition was planned at World Water Day on 18th March 2018. However, the budget for World Water Day was not disbursed before the event and that discouraged the Unit staff. They thought that without a budget, the activities could not be implemented. Although the budget was limited, the staff were encouraged to make the exhibition posters with available materials. These sensitization posters were later used at official MWS events and at the Nairobi International Trade Show (October 1 to 7, 2018) which is the largest trade show in Kenya.



Photo 3 NRW panels at Nairobi International Trade Show

During the Nairobi Show, the Unit co-organized participatory events such as an NRW quiz and a coloring activity for children together with the Nairobi City Water & Sewerage Company. For the preparation of the event, the Unit staff came up with NRW reduction slogans, thus enhancing the ownership of the activities.

c) Sensitization activities of WSPs (Primary school student visits to water treatment plants)

As NRW sensitization activities, Embu and Meru WSPs invited primary school students to their water treatment plants. Through these visits, the students learned about water treatment processes and facilities. They also learned about the cost of producing safe drinking water using chemicals and the efforts of WSPs which operate the plants 24 hours a day. By learning about the efforts of the water companies, the students realized the importance of conserving water. WSPs chose to invite schools from areas with frequent water thefts and students were taught about the importance of reporting water leakages and thefts to WSPs. They were also encouraged to discuss what they learned from the visits and the importance of water conservation at home with their parents and friends.

Prior to the students' visits, Embu and Meru WTPs already received visitors, but the visitors were only taught about the water processes. During the students' visits, staff at the WTPs explained how water consumers such as the students themselves could help water companies by conserving water and reporting water leakages. Through the students, the message would be conveyed to their parents and relatives, indirectly influencing those adults. Embu WSP has decided to continue these activities.



Photo 4. Students visit Meru WSP water treatment plant

2) Production of NRW Annual Report

The production of the NRW Annual Report will help the NRW Unit to sensitize the general public about NRW reduction. The contents of the report include the definition of NRW, the current NRW status in Kenya, and NRW reduction activities by stakeholders including donors. The first report (2017-2018) will be

published in Feb. 2019.

3.2 Output 2 : Revision of NRW Management Standards

WASREB conducted a study on the status of NRW reduction by 9 WSPs. The Editorial Committee for the revision of NRW Management Standards was formed in June 2018. Based on the results of the NRW study and questionnaires to the WSPs on the usage of the NRW management Standards, the Committee will determine how to use the NRW management Standards.

3.3 Output 3 : NRW Practical Training

The results of the baseline study suggested that existing KEWI's NRW short course was centered on theory and did not reflect the needs of WSPs. Based on this result, KEWI designed a new NRW practical short course with Embu and Meru WSPs. In this NRW practical course, lectures on theory are offered at KEWI (1 week) and skills and field trainings are conducted at Embu or Meru WSP (1 week). The first practical course was conducted in June 2017. By Nov. 2018, the practical course had been conducted 4 times. (A total of six courses was planned during the Project implementation.



Photo 5 Learning how to operate equipment at KEWI

Table 2 shows a comparison of the training content of the NRW short course before the Project and the first practical course. The previous short course was designed mainly around lectures on NRW and water losses. In the practical course, the content covers important subjects in NRW management. In the field training, students acquire practical skills in leakage detection and meter accuracy testing, whereas the previous course only offered site visits and demonstrations.

Table 2 Comparison of previous short course and practical course of the Project

	Previous Course	First Practical Course
Training Period	5 days (Theory 4 days and 1 field day at WSP near KEWI)	11 days (Theory 5 days and 6 day field training at Embu or Meru WSP)
Teaching Material	Extracts from existing reports and NRW Standards. No handouts	Teaching materials were produced by lecturers and handed out on the last day
Field Training material	No handouts or presentations	Field training manual produced by the Project
Lecture content	NRW Basics and leak detection	Key subjects of NRW reduction
Field Training contents	Mainly site visit and demonstration	Skills training in leak detection and meter accuracy testing
Evaluation method	Satisfaction survey	Simple quiz before and after the training

Furthermore, in the previous course, the teaching materials consisted of extracts of literatures and the NRW Standards. While in this course, the lecturers created their own teaching materials. For the practical course, a field training manual was created in cooperation with Embu and Meru WSPs and was distributed to the course participants before the course so that the participants could use the knowledge and skills learned from the training in their daily operations.

As a result of review of the second training, textbooks for lectures were produced. From the 4th training, discussion and exercises using case studies were incorporated to enhance the understanding of the participants. Also, textbooks were distributed to the participants. In the 4th training, the lecturers produced teaching plans and clarified the important content, thus the lecturers' performance also gradually improved. In terms of review of the training, previously a simple satisfaction survey was conducted. In the practical course, small tests were conducted before and after the training along with a satisfaction survey, so as to examine the progress of the students. Furthermore, third party evaluations were conducted by people outside of KEWI. In addition, training reviews were held which were attended by the NRW Unit. Based on the reviews, the content of the training was updated based on the PDCA cycle.

3.4 Output 4 : Realistic NRW reduction plans corresponding to the current situation of WSPs and implementation of the plans

Output 4 activities are divided into four groups (A to D) as shown in Figure 4. In August 2017, the project activities were started by the Leading Embu and Meru WSPs. Below are the achievements of the activities so far.

Group A : Formulation of implementable NRW plans and application of PDCA cycle to the implementation

The Activities of Group A are aimed at formulating NRW reduction mid-term and annual plans based on self-assessment by the Pilot WSPs. One of the challenges of formulating plans was the lack of decision-making authority of the NRW unit of WSP which is the key unit for NRW reduction. It could not lead the formation process, so progress was slow. To breakthrough this situation, the JICA experts advised WSP management to promote the NRW unit to an NRW section. In Embu WSP, the NRW unit was upgraded from an ad-hoc unit to a permanent NRW section and additional staff were appointed. This raised the morale of the NRW staff. As of the end of November 2018, all the Pilot WSPs had completed a review of NRW activities in the previous year and 7 WSPs had formulated mid-term and annual NRW reduction plans.

Group B : Activities concerning customer meters

The activities of Group B focused on issues regarding customer meters and customer data such as

meter reading, water billing, increasing the accuracy of customer meters, and leakage and water theft prevention. The Project conducted an analysis of meter reading and the billing data of all the customers (estimated for approx. the past 12 months) of each WSP. The data was categorized by water consumption, meter reading frequency, and number of billings based on estimated readings (not actual readings). The results of the analysis indicated that all WSPs issued more than 50% of billings based on estimation every month. In some cases, billings based on actual readings only accounted for 9% of total billings (Ruiru-Juja WSP). (Table3)

Table 3 Average billing amount and frequency of estimated billing (Ruiru-Juja WSP)

Customer Categories by Consumption		Customers with Billed Consumption Data		Ratios of Customers by the Number of Months when Consumption was Estimated during the 12 Months from June 2017 to May 2018			
		Num.	Percentage	0 Time	Only 1 Time	2 Times	3 Times or More
Very Large	C1: > 300 m ³ /month	19	0.1%	26%	16%	37%	21%
	C2: 101-300 m ³ /month	219	1%	27%	23%	13%	37%
Large	C3: 51-100 m ³ /month	701	3%	20%	15%	12%	53%
	C4: 21-50 m ³ /month	2,796	13%	12%	14%	11%	62%
Medium	C5: 7-20 m ³ /month	14,575	69%	6%	8%	8%	78%
Small	C6: 0-6 m ³ /month	2,721	13%	18%	20%	19%	43%
Total		21,031	100%	9%	11%	10%	70%

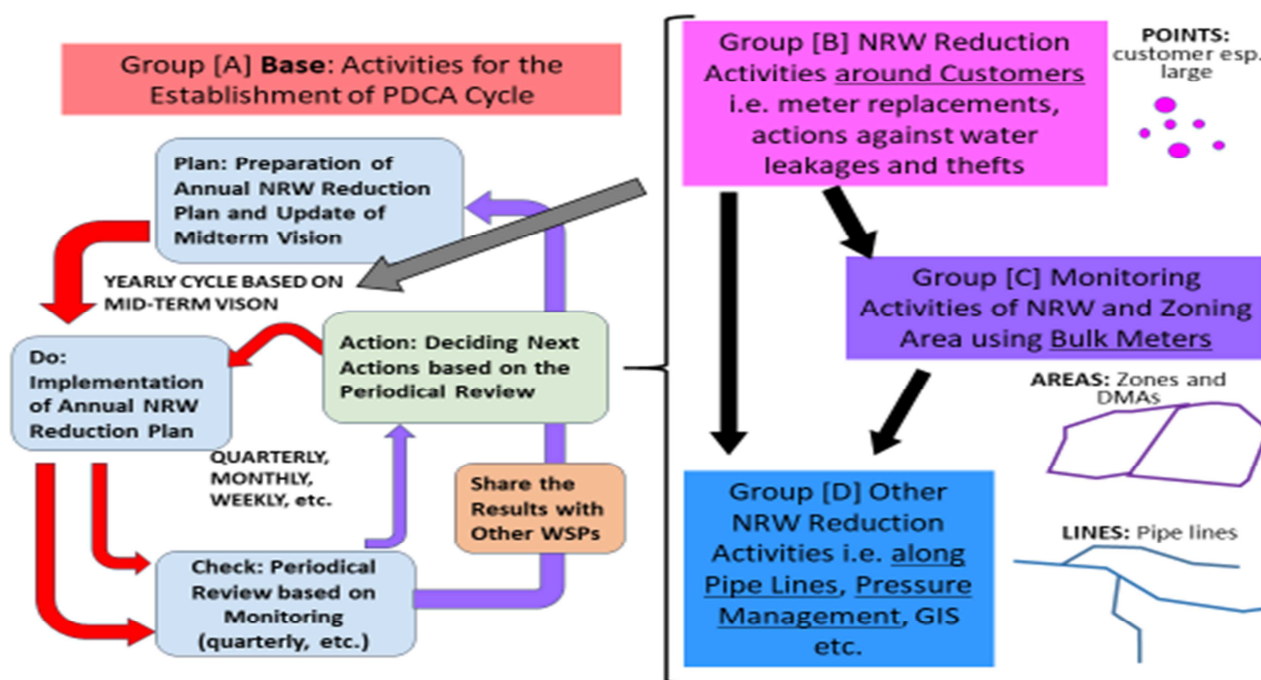


Figure 4 Grouping of NRW Activities of Pilot WSPs

From the results of the analysis, it was apparent that WSPs had not managed the accuracy of the meters of even large consumers who bring potentially high income. The results of the analysis were presented to WSP management and the staff of the commercial section. As a result, many WSPs started to check the accuracy of large consumer meters and replace faulty meters. For instance, Embu WSP replaced or fine-tuned some of the meters of large customers whose bills were issued based on estimates. As a result, the billing amount increased about 240%, and for some consumers the billing ratio increased ten-fold. Through the Project, WSPs are plotting the locations of large customers in GIS using GIS software (MAPinr). The data is shared via smartphone so staff can check the meter accuracy and existence of water theft effectively. (Figure 5)

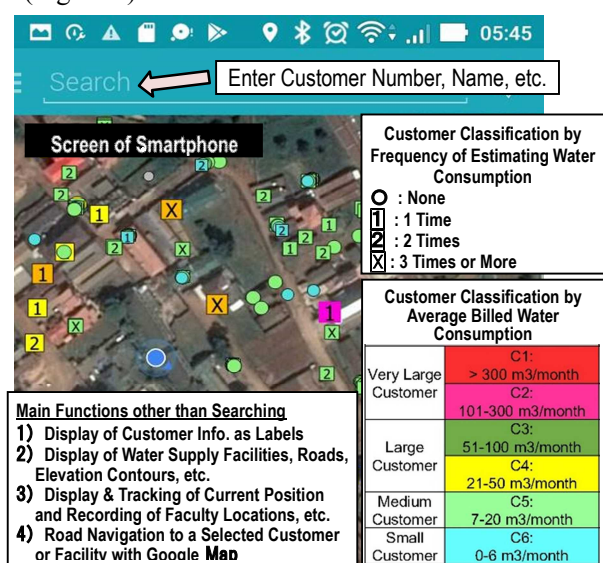


Figure 5 Example of mobile software for customer search

Many WSPs did not check the accuracy of customer meters because they did not have a meter test bench.

They checked the meters when they were requested by the customers. The Project developed meter checking devices using industrial UFM's or calibrated buckets, and handmade meter test units and promoted accurate meter testing. (Photo 6)



Photo 6 Meter accuracy testing using calibrated meter

test bench and they did not check meter accuracy. Currently, they are checking meters by using calibrated buckets. This method requires only a few staff members and there is no need to remove the meters as the meters are checked on site. Out of 18,000 customer meters, they have checked 3,000 meters and replaced broken or faulty meters. Nyahururu WSP is continuing to check meters in this way.

The activities of Group B involve not only the NRW section but other WSP sections too. To enhance the effectiveness of coordination and information sharing, the Project introduced the use of field data collection software such as Open Data Kit (ODK) and KOBO Toolbox. With these tools, the Project is establishing a system for checking and confirming the accuracy of customer data and information (name, meter number, meter type, size, and installation year).

The data collection software can be used on a smartphone, an ICT tool widely available in Kenya. The data collected by smartphone is stored in an online database and shared among managers and staff in real time. (Figure 6)

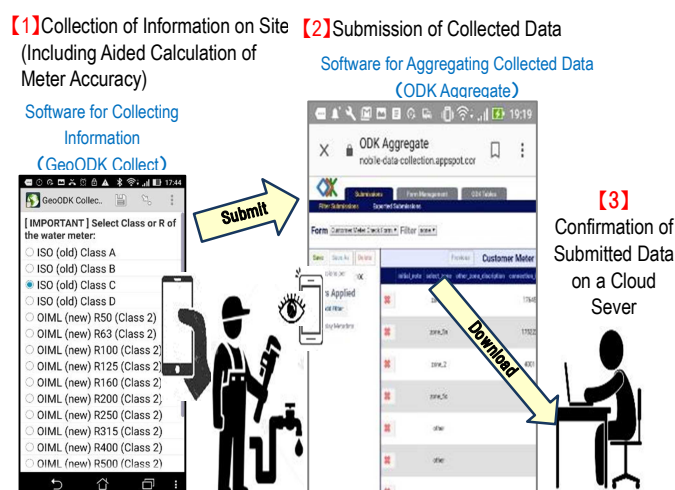


Figure 6 Flow of data collection on site by electrical form, and submission, sharing & use of the data on a cloud server



Photo 7 Meter test unit using industrial UFM

For instance, when a faulty meter is discovered, the location of the customer and information about the meter is shared among staff so that the time required to replace the meter can be shortened, thus increasing the

efficiency of operation. ICT is used to collect facility information such as records of pipe bursts and leakage points. Meru, Nakuru and Kisumu WSPs are using forms introduced by the Project by incorporating them into the existing electronic data forms to increase the efficiency of NRW reduction operations.

There are many cases in which consumers whose connections were terminated due to non-payment of water bills were connected illegally and used water without payment. In Meru, it is estimated that 70% of such consumers were illegally connected and using water. The JICA experts recommended managing those consumers as a priority activity. As a result, the WSPs are taking measures such as protecting the customer meter joints with plastic seals to ensure illegal consumers cannot be reconnected. Newly employed meter readers were trained using the meter reading manual of Tokyo Waterworks.

Group C : Zoning and NRW Monitoring of Distribution System.

As for the activities of Group C, the Project supports the establishment of zoning of the distribution sections covering the entire distribution line (including installation of bulk meters, and separation and zoning of the distribution system) and an NRW monitoring system (including adding an NRW monitoring system to the existing water billing system).

For zoning, the Project supported the insertion of data on the distribution pipes into GIS and studied the structure of the existing system and confirmed the location and accuracy of bulk meters.

For the monitoring system to be functional at zone level, the Project promoted all customer locations to be plotted in GIS and recommended improving the zoning system in Meru, Embu, Nyahururu and Kisumu WSPs. Figure 7 shows the example of Embu.

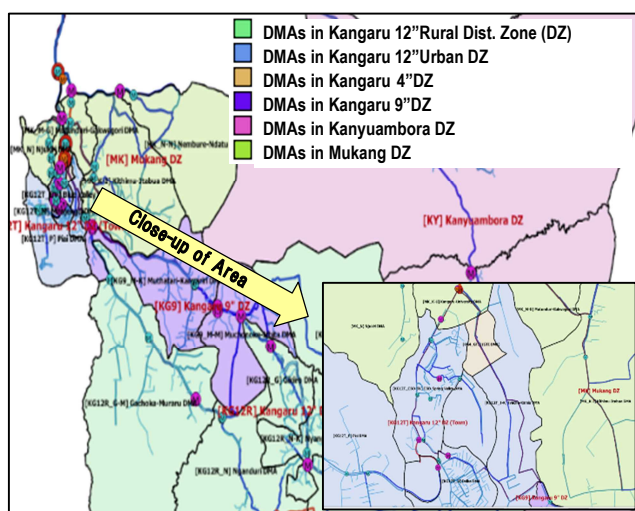


Figure 7 Planned zoning of water distribution system in

JICA experts are teaching WSP staff to use, edit and share monitoring templates on Google Sheet in the

cloud server so that the volume and ratio of NRW in each DMA and distribution area can be calculated and daily readings of bulk meters can be checked to detect any irregularities in water distribution.

There are, however, challenges. In Embu WSP, a bulk meter for measuring the water produced at the treatment plant has air bubbles, so the NRW ratio cannot be measured accurately. It is taking a lot of time to solve this problem and Embu WSP is facing a challenge to establish an NRW monitoring system.

Group D : Leakage Reduction in Distribution System

The activities of Group D are aimed at increasing skills in identifying locations where frequent leakages occur in a pilot area by conducting a modified step test using data from the minimum night flow measurement (MNF). After conducting the step test in the pilot area, Nakuru WSP narrowed down the locations to several smaller areas where frequent leakages were occurring. Then they conducted targeted leakage detection and pipe repair. Within about 2 weeks, the MNF record was reduced by about 60% in the pilot area. In some areas, leakages went down to zero. (Figure 8)

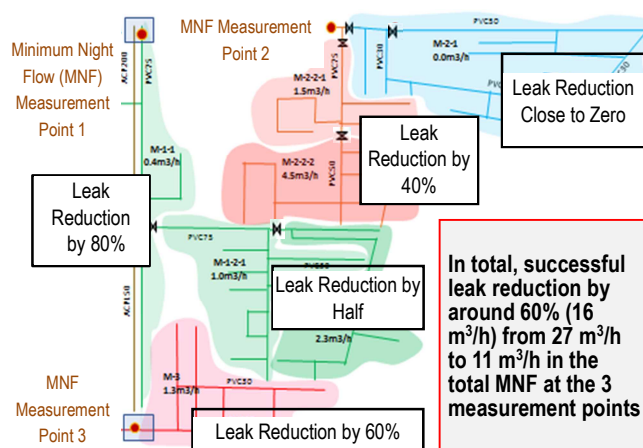


Figure 8 Successful example of leak reduction

Based on this result, Nakuru is expanding MNF and step tests to other locations and has achieved similar positive results, so now they are continuing to expand the detection further.

The Project also conducted activities to formulate plans to install pressure reducing valves and measure the water pressure in a wider area using a simple analogue pressure gauge to record the maximum pressure in Embu, Meru and Nyahururu WSPs which have a high variation in altitude. Hydraulic analysis of distribution lines was conducted in Meru to improve water pressure management by dividing areas with different altitudes upstream and downstream.

Also, the Project is building a data storage system on pipe bursts, leakage points and magnitudes, and highest water pressure using tools such as ODK.

3.5 Output 5 : Sharing Project Achievements and Case Studies through WASPA

At the beginning of the activities in Output 5, MWS and WASPA signed a Framework of Cooperation in May 2017. WASPA holds bi-monthly meetings that are attended by the managing directors of member WSPs, and benchmarking workshops in thematic areas such as NRW, customer service, finance and pro-poor services 4 times a year.

The activities for Output 4 have been presented twice in the NRW thematic group in benchmarking workshops. In October 2018, the JICA expert demonstrated leakage detection in WASPA training in Embu, sharing the skills and case studies with WSPs other than the Pilot WSPs.

The Project aims to share the skills and technologies developed or used in Output 4 by making a short video on topics such as customer meter accuracy testing using calibrated buckets to share widely with WSPs in Kenya.

4. Lessons and Innovations of Project Implementation

4.1 Establishing a Support Mechanism for NRW Reduction in Water Service Sector

This Project aims to establish a mechanism for NRW reduction in Kenya's water service sector. (Figure 9) The JICA experts support strengthening the capacity of the Pilot WSPs in NRW reduction planning and implementation (Output 4). The results of Output 4, its process and case studies will be incorporated into the revision of the NRW Standards (Output 2). The improved NRW practical course at KEWI will provide opportunities for WSP staff to gain practical skills in NRW reduction (Output 3). MWS will play a role in coordinating the support organizations for NRW reduction (actors), formulate policies and prepare and distribute budgets. MWS will conduct sensitization activities and release an NRW management report which includes cross-cutting information from various actors. (Output 1)

The Project objective is considered achieved when WSPs continue formulating realistic NRW reduction plans and implement them, and the capacities of supporting organizations for NRW reduction are enhanced.

At this point, the results of project activities are on an Output basis.

Already the activities of Output 4 such as analysis of the use of estimation for billing has been used by WSPs other than the Pilot WSPs. When each Output is achieved, the aggregate results of the Outputs are

expected to lead to the achievement of the Project purpose.

4.2 Visualization and activities to increase motivation

In Output 4, the results of analysis of the past year's meter reading and billing data of all the customers and categorization by frequency of billing by estimation were visualized and presented to the WSP managements and customer service departments. Until then, the customer service staff viewed the cause of NRW as water leakages. The presentation of the results made the commercial and customer service sections realize that their involvement is also important for the reduction of NRW.

Prioritizing activities such as meter accuracy checks and replacement of meters targeted at large consumers brought visible results and enhanced the motivation of staff to reduce NRW.

As for leakage detection, introduction of the step test and repair of leakages demonstrated the effects of leakage reduction activities in Nakuru WSP, so the WSP decided to continue and expand the activities voluntarily. Experiencing the positive results of their actions motivated the staff to continue the activities.

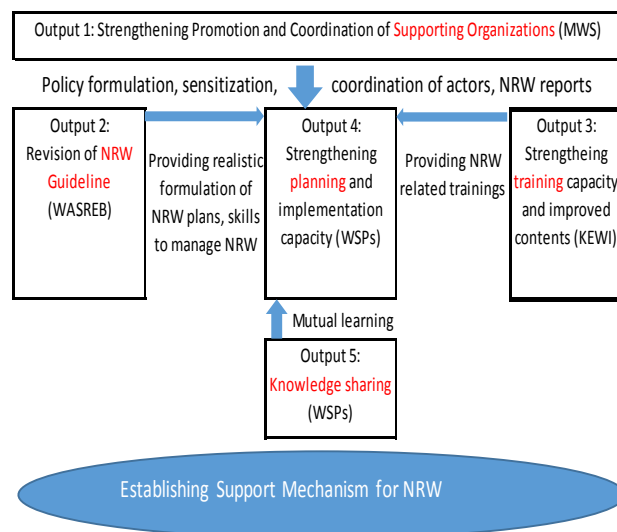


Figure 9 Establishing a support mechanism in the water service sector

4.3. Increasing effectiveness through the use of ICT

In Output 4, smartphone or low-cost applications are used to collect and share information. Using mobile GIS software which can be used with smartphones helps to prioritize where activities should take place (e.g. areas, customers, pipelines, etc.) in a flexible way so it is not limited only to pilot areas but it can be expanded to all service areas. Also, the collected data is continuously stored in the cloud server and shared.

When the need to replace a meter is identified, its location is shared so that the staff in charge of replacement can act on it immediately. This will increase the efficiency of operations.

4.4. Promoting activities that can be implemented with a low budget

Lack of an adequate budget affects the motivation of MWS or WSP staff. In Kenya, the organizations do not always receive full allocation or disbursement of the necessary budget for their activities. NRW Unit staff tend to be discouraged from taking action when there is no budget. To counter this attitude, the Project is encouraging activities that can be conducted with little or no budget, such as making NRW posters by themselves. By using calibrated buckets or a meter test unit using industrial UFM, WSPs with no meter test bench can easily test meter accuracy. Free mobile GIS software or field data collection tools such as ODK and Kobo Toolbox can change the mindset of WSP staff who believe that introducing GIS involves high cost.

4.5 Obtaining skills required for expanding NRW activities

Until now, WSPs conducted leakage detection at DMA level but did not extend it outside of DMA. Through the activities of the Project, WSPs learned field-based activities such as step tests and gained positive results as with the example of Nakuru WSP (Figure 8) that now has the ability to narrow down locations with frequent leakages from a relatively wide area and strategize their leakage detection activities themselves.

(Project period: Oct. 2016 – Sep. 2021)