

[ Attachment]

## **Attachment 1: Minutes of R/D**

**RECORD OF DISCUSSIONS**  
**ON**  
**PROJECT FOR STRENGTHENING NON-REVENUE WATER**  
**CONTROL IN KIGALI CITY WATER NETWORK**  
**IN**  
**THE REPUBLIC OF RWANDA**  
**AGREED UPON BETWEEN**  
**WATER AND SANITATION CORPORATION**  
**AND**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**

Kigali, March 30, 2016

  
Mr. Takahiro Moriya  
Chief Representative  
JICA Rwanda Office  
Japan



  
Mr. James Sano  
Chief Executive Officer  
WASAC  
The Republic of Rwanda



Based on the minutes of meetings on Detailed Planning Survey on the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network (hereinafter referred to as "the Project") signed on February 3<sup>rd</sup>, 2016 between Water and Sanitation Corporation (hereinafter referred to as "WASAC") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with WASAC and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that WASAC, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Republic of Rwanda (hereinafter referred to as "Rwanda").

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on January 14<sup>th</sup>, 2005 (hereinafter referred to as "the Agreement") and the Note Verbales to be exchanged between the Government of Japan (hereinafter referred to as "GoJ") and the Government of Rwanda (hereinafter referred to as "GoR").

Appendix 1: Project Description

Appendix 2: Main Points Discussed



## PROJECT DESCRIPTION

Both sides confirmed that there is no change in the Project Description in the minutes of meetings for Detailed Planning Survey on the Project signed on Feb 3<sup>rd</sup>, 2016.

### I. BACKGROUND

According to the EICV4 (Integrated household living conditions survey) conducted in 2013/2014, access to improved source of drinking water reached 85%(rural:84%, urban:90%). Rwanda has made good progress in extending water supply and sanitation coverage under clear political commitment to three complementary sets of targets: the Economic Development and Poverty Reduction Strategy (EDPRS1 and 2), Millennium Development Goals and Vision2020. Institutional framework has been reinforced through National Policy and Strategy for Water and Sanitation Services (2010). Rwanda has committed itself to reaching targets in water supply and sanitation, with vision to attain 100% service coverage by 2018.

Water and Sanitation Corporation (WASAC) which manages the water and sanitation services in Rwanda is facing with challenges, such as intermittent water supply due to limited supply capacity and the high rate of Non-Revenue Water (NRW). In order to increase supply capacity in Kigali city, WASAC is currently implementing two projects, namely Nzove 2 and Kigali Bulk Water, which are expected to double the WASAC's supply capacity in Kigali city by the end of 2017. In the meantime, two technical co-operation projects, namely OWASUPI and SUSWAS, have been implemented in three (3) branches of WASAC in Kigali with a view to reducing NRW and enhancing WASAC's operational and financial management capacity. In order to reduce water losses and increase water revenues, WASAC needs to address NRW issues in other areas of Kigali city.

Under these circumstances, GoR requested GoJ for a technical cooperation project to strengthen NRW control in four (4) branches of WASAC in Kigali city water network.

### II. OUTLINE OF THE PROJECT

Details of the Project are described in the Logical Framework (Project Design Matrix: PDM) (Annex 1) and the Plan of Operation (Annex 2).

#### 1. Input

##### (1) Input by JICA

##### (a) Dispatch of Experts

- Chief Adviser / NRW management
- NRW reduction planning
- GIS
- Hydraulic analysis



- Leak detection
- Pipe repairing and service pipe connection
- ICT

(b) Training

- Training of counterpart personnel in Japan and in the third countries

(c) Machinery and Equipment

- Leak detection equipment
- Ultrasonic flow meter with data logger
- Gate valve, flow meter, and customer meter for Pilot Project
- Electromagnetic flow meter and pressure gauge for isolating four (4) branches in Kigali
- Equipment for training on pipe repair and service pipe connection
- Mobile GPS
- Vehicles for JICA experts

In case of importation, the machinery, equipment and other materials under II-1-(1)-(c) above will become the property of the GoR upon being delivered C.I.F. (cost, insurance and freight) to the Rwanda authorities concerned at the ports and/or airports of disembarkation.

(2) Input by WASAC

WASAC will take necessary measures to provide at its own expense:

- (a) Services of WASAC's counterpart personnel and administrative personnel as referred to in II-2;
- (b) Suitable office space with necessary equipment;
- (c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;
- (d) Information as well as support in obtaining medical service;
- (e) Credentials or identification cards;
- (f) Available data (including maps and photographs) and information related to the Project;
- (g) Running expenses necessary for the implementation of the Project;
- (h) Expenses necessary for transportation within Rwanda of the equipment referred to in II-1 (1) as well as for the installation, operation and maintenance thereof; and
- (i) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Rwanda from Japan in connection with the implementation of the Project.

2. Implementation Structure

The Project Implementation Structure is given in the Annex 3. The roles and assignments of relevant members are as follows:




(1) WASAC

- (a) Project Director
- (b) Project Manager
- (c) Management team members
- (d) Action team members
- (e) Other counterparts

(2) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to WASAC on any matters pertaining to the implementation of the Project.

(3) Steering Committee

Steering Committee (hereinafter referred to as "SC") will be established in order to facilitate inter-organizational coordination. SC will be held at least once a year and whenever deems it necessary. SC will review the progress, revise the overall plan when necessary, approve an annual work plan, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of SC is shown in the Annex 3.

3. Project Site and Beneficiaries

(1) Project site

- Kigali city

(2) Beneficiaries

- Direct beneficiaries: WASAC and its staff
- Indirect beneficiaries: People living in WASAC service area

4. Duration

Three (3) years from the arrival of the first expert.

5. Reports

WASAC and JICA experts will jointly prepare the following reports in English.

- 1) Monitoring Sheet on semiannual basis until the project completion
- 2) Project Completion Report at the time of the project completion

6. Environmental and Social Considerations

WASAC will abide by "JICA Guidelines for Environmental and Social Considerations" in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

7. Management of Safety for Construction Works

For construction works which will be carried out in the Project, WASAC and JICA will assure the management of safety in accordance with the "Safety Plan" and "Method Statements of Safety" submitted by contractors based on the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects.



### **III. UNDERTAKINGS OF WASAC AND GoR**

1. WASAC and GoR will take necessary measures to:

- (1) ensure that the technologies and knowledge acquired by the Rwanda nationals as a result of Japanese technical cooperation contributes to the economic and social development of Rwanda, and that the knowledge and experience acquired by the personnel of Rwanda from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and
- (2) grant privileges, exemptions and benefits to the JICA experts referred to in II-1-(1)-(a) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Rwanda.

### **IV. MONITORING AND EVALUATION**

JICA and WASAC will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Plan of Operation (PO). The Monitoring Sheets will be reviewed every six (6) months.

Also, Project Completion Report will be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to verify sustainability and impact of the Project. WASAC is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

### **V. PROMOTION OF PUBLIC SUPPORT**

For the purpose of promoting support for the Project, WASAC will take appropriate measures to make the Project widely known to the people of Rwanda.

### **VI. MISCONDUCT**

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, WASAC and relevant organizations will provide JICA with such information as JICA may reasonably request, including





information related to any concerned official of the government and/or public organizations of the Rwanda.

WASAC and relevant organizations will not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

#### **VII. MUTUAL CONSULTATION**

JICA and WASAC will consult each other whenever any major issues arise in the course of Project implementation.

#### **VIII. AMENDMENTS**

The record of discussions may be amended by the minutes of meetings between JICA and WASAC. However, PO may be amended in the Monitoring Sheets.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex 1 : Draft Project Design Matrix (PDM)

Annex 2 : Tentative Plan of Operation (PO)

Annex 3 : Project Implementation Structure



# Project Design Matrix (PDM)

Project title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Project Sites: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Annex 1

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>Overall Goal</p> <p>WASAC conducts NRW reduction measures as planned for Kigali city.</p> <p>Project Purpose</p> <p>WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.</p> <p>Outputs</p> <p>1 Planning capacity of NRW reduction of WASAC is enhanced.</p> <p>2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.</p> <p>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</p> <p>4 4 branches in Kigali establish the system to measure NRW rates accurately.</p>	<p>NRW rate of Kigali city (year 2022 xx %) (to be confirmed during the project)</p> <p>1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure</p> <p>2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC</p> <p>3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction</p> <p>1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project</p> <p>1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.</p> <p>2-1 More than XX number of trainees receive training</p> <p>2-2 WASAC human resource development plan includes training programs prepared by the project</p> <p>3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX% (XX% will be determined after baseline NRW rates are established)</p> <p>3-2 Action team members share experiences at workshops regarding implementation of the pilot projects</p> <p>3-3 The action team prepares a completion report of the pilot project</p> <p>4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month</p>	<p>Annual report of WASAC</p> <p>1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure</p> <p>2 Annual action plan of WASAC</p> <p>3 Budget of WASAC</p> <p>1-1 Records of the project</p> <p>1-2 Records of the project</p> <p>2-1 Records of the project</p> <p>2-2 Records of the project</p> <p>3-1 Records of the project</p> <p>3-2 Records of the project</p> <p>3-3 Survey plans for locations outside the pilot project</p> <p>4-1 Records of the project</p>	<p>The Government policy on NRW remains as highly prioritized</p> <p>The non-revenue water section at WASAC is not subject to large scale reorganization</p> <p>-WASAC staff do not resign after training by the project</p>
<p>Activities</p> <p>1-1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction</p> <p>1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems</p> <p>1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future</p> <p>1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3</p> <p>1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement</p> <p>1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report</p> <p>1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5</p> <p>1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year</p> <p>1-9 The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7</p> <p>1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties</p>	<p>Experts Dispatch</p> <p>Chief Adviser/Non-Revenue Water management</p> <p>Non-Revenue Water reduction planning</p> <p>GIS</p> <p>Hydraulic analysis</p> <p>Leak detection</p> <p>Pipe repairing and service pipe connection</p> <p>ICT</p>	<p>Counterpart</p> <p>Project Director</p> <p>Project Manager</p> <p>Management team members</p> <p>Action team members</p> <p>Other counterparts</p>	

1-11	The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.
1-12	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.
2-1	Training materials on NRW control are prepared.
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.
2-6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.
2-8	Training materials on NRW are reviewed and updated.
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1.
3-2	The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1.
3-4	The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.
3-8	The action team conducts measures for reducing surface leakage (visible leakage).
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.
3-12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.
3-13	The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.
3-14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.
3-15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.
3-16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed at appropriate.
4-4	System input to each of 4 branches is measured.
4-5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

2	<p>Facilities</p> <p>Office space for Japanese experts (about 7 experts) at WASAC.  office furniture, internet connections  Training room with the capacity of about 20 persons  Space for training on pipe repair and service pipe connection (40m<sup>2</sup>)  Store house for equipment</p> <p>Local cost</p> <p>Cost for administering the Project (utilities for experts offices, internet services)  Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment  Cost for operation and maintenance of project equipment  Cost for overtime work, transportation, accommodation and allowance for WASAC staff</p>	<p>-Large scale natural disaster does not occur</p>
3	<p>Training</p> <p>Training in Japan  Training in the 3rd country</p> <p>Equipment provision  Leak detection equipment  Ultrasonic flow meter with data logger  Gate valve, flow meter, and customer meter for Pilot Project  Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali  Equipment for training on pipe repair and service pipe connection  Mobile GPS  Vehicles for Japanese experts</p>	<p>Precipitations</p> <p>GIS data base and hydraulic modeling prepared by ESRI are available as scheduled</p>

**Plan of Operation (PO)**

Annex2

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
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**Plan of Operation (PO)**

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

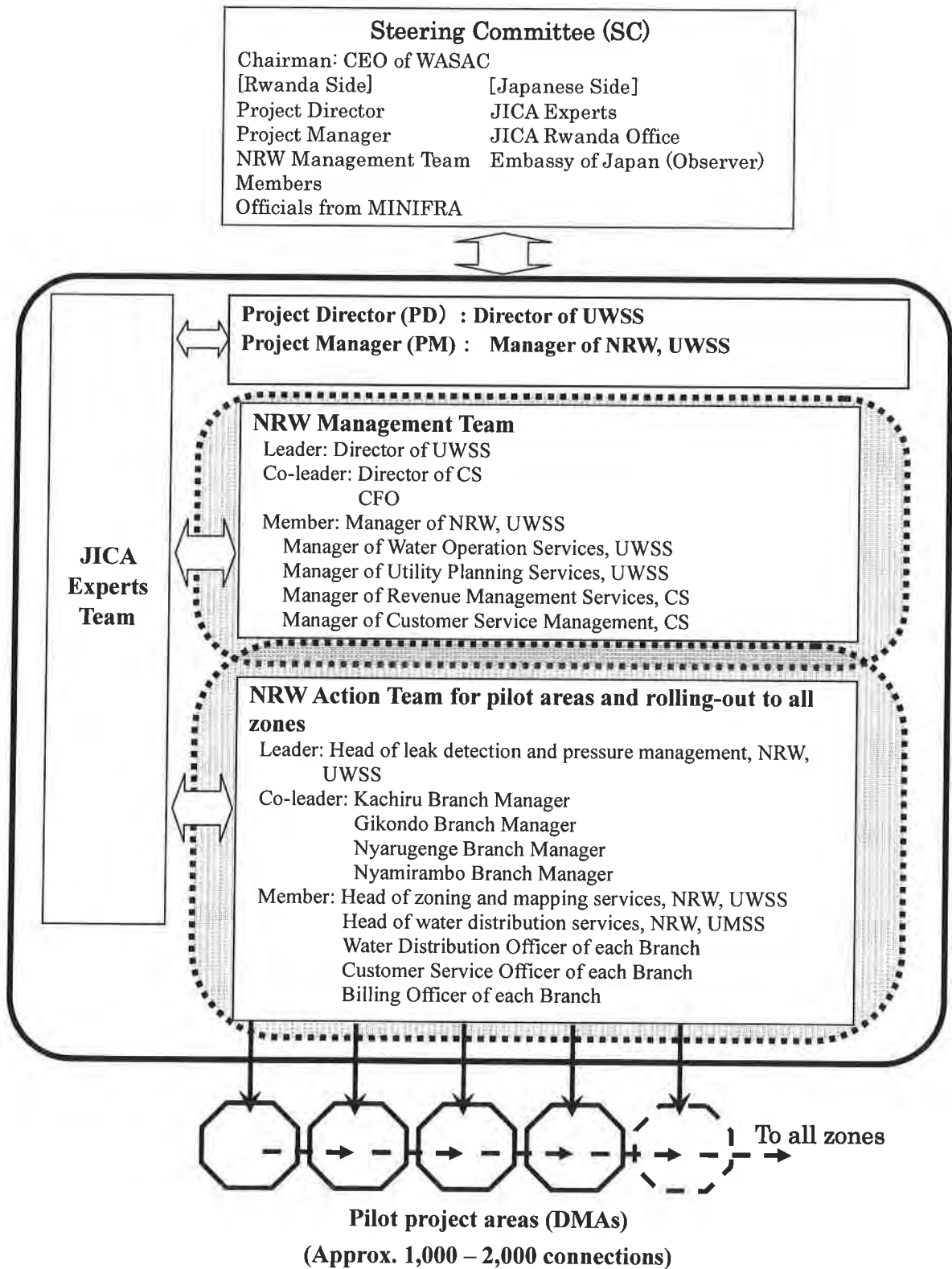
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Monitoring Plan	Year 1												Year 2												Year 3											
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<b>Monitoring</b>																																				
Joint Coordinating Committee																																				
Set-up the Detailed Plan of Operation																																				
Submission of Monitoring Sheet																																				
Monitoring Mission from Japan																																				
Joint Monitoring																																				
Post Monitoring																																				
<b>Reports/Documents</b>																																				
Inception Report																																				
Progress Report																																				
Project Completion Report																																				
<b>Public Relations</b>																																				
Seminars and Workshops																																				

# Project Implementation Structure

Annex 3



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## Appendix 2

### MAIN POINTS DISCUSSED

During the discussion for formulation of the Project Outline, the following issues were agreed.

- 1) The Project will prepare 5-year Strategic Action Plan for NRW reduction in twenty (20) branches of WASAC. And overall goal of the Project should consider the target of NRW rate in the 5-year Strategic Business Plan.
- 2) Inventory survey of water works facilities will be conducted in six (6) branches in Kigali by the Project and other fourteen (14) branches by WASAC with technical advice from the Project.
- 3) In order to conduct Outputs 3 and 4, JICA will provide the necessary equipment, and install flow meter, pressure gauge, and gate valves with support of WASAC, and WASAC will maintain them.
- 4) The Project will establish two (2) District Metered Area(DMA)s in two (2) branches in Kigali, of which locations will be decided at the beginning of the Project in consultation with WASAC (a) with the number of service connections in each DMA of less than 2,000 and (b) with high NRW rate.
- 5) To accelerate the Project activities, the Project will utilize (a) the completed network mappings and hydraulic model as prepared by ESRI, (b) the isolation plans prepared by WASAC for Kigali four (4) branches, and (c) the NRW approach taken by WASAC and their current DMA experiences.



**MINUTES OF MEETINGS  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
WATER AND SANITATION CORPORATION  
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS  
ON  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK**

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and Water and Sanitation Corporation (hereinafter referred to as "WASAC") hereby agree that the Record of Discussions on PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK signed on March 30, 2016 will be amended as follows;

**1. II-1-(1)-(c) Machinery and Equipment**

Before	Amended Version
Electromagnetic flow meter and pressure gauge for isolating four (4) branches in Kigali.	Electromagnetic flow meter and pressure gauge for isolating four (4) branches in Kigali and the installation .
Reason: "installation" changes to JICA's undertakings.	

**2. II-3 Duration**

Before	Amended Version
Three (3) years from the arrival of the first expert.	Four (4) years from the arrival of the first expert.
Reason: Procurement of equipment related to Output4 delays.	

**3. Narrative Summary**

Before	Amended Version
<b>Overall Goal</b>	
Objectively Verifiable Indicators	
NRW rate of Kigali city (year 2022 XX%) (to be confirmed during the project)	NRW rate of Kigali city (year 2022/23 25%) (to be confirmed during the project)
<b>Output 2</b>	
Objectively Verifiable Indicators	
2-1. More than XXX number of trainees receive training.	2-1. More than 300 number of trainees receive training.
<b>Output 3</b>	



<b>Objectively Verifiable Indicators</b>	
3-1. NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)	3-1. NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25 %.
<b>Activity for Output-1</b>	
<p>1-1. A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.</p> <p>1-5. Based on the results of Activity 1-3 and 1-4, the management team prepares a report on the necessary facilities improvement.</p> <p>1-7. The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.</p>	<p>1-1. A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.</p> <p>1-5. Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.</p> <p>1-7. The management team prioritizes and schedules the conducts of specific actions of 5YSP.</p> <p>1-11. The management team facilitates implementation and the monitoring of the 5YSP</p> <p>1-12. The management team drafts the revised New Connection Policy and the Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.</p>
<b>Activity for Output-3</b>	
<p>3-1. An action team is organized to conduct NRW reduction measures at Pilot Area 1.</p> <p>3-2. The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.</p>	<p>3-1. An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.</p> <p>3-2. The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.</p>

<p>3-3. The action team plans and schedules the implementation of the pilot project for Pilot Area 1.</p> <p>3-4. The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.</p>	<p>3-3. The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.</p> <p>3-4. The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.</p> <p>3-12. The Action team conducts measures for reducing high water pressure.</p> <p>3-13. The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.</p> <p>3-19. Action team disseminates the manual and use of survey equipment to the activity of whole branches.</p>
<p><b>Activity for Output-4</b></p>	
<p>4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.</p> <p>4-4. System input to each of 4 branches is measured.</p> <p>4-5. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.</p>	<p>4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.</p> <p>4-4. Chambers are constructed as appropriate.</p> <p>4-5. System input to each of 4 branches is measured.</p> <p>4-6. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.</p>
<p><b>Input</b></p>	
<p><b>Japanese side</b></p>	
<p>1 Chief Adviser/Non-Revenue Water management Non-Revenue Water reduction planning GIS</p>	<p>1 Chief Adviser/Non-Revenue Water management Adviser/Non-Revenue Water management Non-Revenue Water reduction planning (1)</p>

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Hydraulic analysis Leak detection Pipe repairing and service pipe connection ICT	Non-Revenue Water reduction planning (2) GIS Hydraulic analysis Leak detection Pipe repairing and service pipe connection ICT JICA long term expert
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**4. Other terms**

JICA, and Water and Sanitation Corporation (WASAC) agree that Project Design Matrix (PDM) is amended as Annex-1 due to modification stated above. This amendment will become effective as of XX October, 2018

Annex 1: PDM version 5

Annex 2: PO version 5

Annex 3: Record of Discussions (signed on March 30, 2016)

Kigali, 7 November, 2018

  
  
 Mr. Hiroyuki TAKADA  
 Chief Representative  
 JICA Rwanda Office  
 Japan

  
  
 Eng. Aimé MUZOLA  
 Chief Executive Officer  
 WASAC  
 The Republic of Rwanda

Project Design Matrix (PDM)

Annex 1

Project title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network  
 Project Sites: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Version 5

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators		Means of Verification	Important Assumptions
<b>Overall Goal</b>	NRW rate of Kigali city (year 2022/23 25%) (to be confirmed during the project)		Annual report of WASAC	
WASAC conducts NRW reduction measures as planned for Kigali city.				
<b>Project Purpose</b>				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC		The Government policy on NRW remains as highly prioritized.
<b>Outputs</b>				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		The non-revenue water portion at WASAC is not subject to large scale reorganization.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%. 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		WASAC staff do not resign after training by the project.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		
<b>Activities</b>	<b>Input</b>			
	<b>Japanese side</b>	<b>Rwanda side</b>		
1-1 A management team is organized to prepare 5-year Strategic Plan (SYSP) for NRW reduction.				
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart		
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser/Non-Revenue Water management	Project Director		
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Adviser/Non-Revenue Water management	Project Manager		
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of th SYSP.	Non-Revenue Water reduction planning (1)	Management team members		
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Non-Revenue Water reduction planning (2)	Action team members		
1-7 The management team prioritizes and schedules the conducts of specific actions of SYSP.	GIS	Other counterparts		
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Hydraulic analysis			
1-9 The management team prepares the SYSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Leak detection			
1-10 The management team holds seminars and presents SYSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Pipe repairing and service pipe connection			
1-11 The management team facilitate implementation and the monitoring of the SYSP.	ICT			
1-12 The management team drafts the revised New Connection Policy and the Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	JICA Long term expert			
1-13 The management team reviews SYSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.				
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	2 Training	2 Facilities		
2-1 Training materials on NRW control are prepared.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections		*Large scale natural disaster does not occur.
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Training in the 3rd country	Training room with the capacity of about 20 persons		
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.		Space for training on pipe repair and service pipe connection (40m <sup>2</sup> )		
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	3 Equipment provision	Store house for equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Leak detection equipment			
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Ultrasonic flow meter with data logger			
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project			
2-8 Training materials on NRW are reviewed and updated.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali			
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Equipment for training on pipe repair and service pipe connection			
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Mobile GPS			
3-2 The action team grass the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles for Japanese experts			
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.				
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.				
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.				
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.				
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.				
3-8 The action team conducts measures for reducing surface leakage (visible leakage).				
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.				
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).				
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.				
3-12 The action team conducts measures for reducing high water pressure.				
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.				
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.				
3-15 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.				
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.				
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.				
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.				
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.				
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.				
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.				
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.				
4-4 Chambers are constructed as appropriate.				
4-5 System input to each of 4 branches is measured.				
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.				
				<b>Preconditions</b>
				GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.

Plan of Operation (PO)

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																
Chief Adviser / Non-Revenue Water management	█												█												█												█											
Adviser / Non-Revenue Water management	█												█												█												█											
Non-Revenue Water reduction planning (1)	█												█												█												█											
Non-Revenue Water reduction planning (2)	█												█												█												█											
GIS	█												█												█												█											
Hydraulic analysis	█												█												█												█											
Leak detection	█												█												█												█											
Pipe repairing and service pipe connection	█												█												█												█											
ICT	█												█												█												█											
JICA Long term expert	█												█												█												█											
<b>Equipment</b>																																																
Leak detection equipment	█												█												█												█											
Ultrasonic flow meter with data logger	█												█												█												█											
Gate valve, flow meter, and customer meter for Pilot Project	█												█												█												█											
Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	█												█												█												█											
Equipment for training on pipe repair and service pipe connection	█												█												█												█											
Mobile GPS	█												█												█												█											
Vehicles for Japanese experts	█												█												█												█											
<b>Training in Japan</b>																																																
15 persons were trained in Japan	█												█												█												█											
<b>Training in the Third Country</b>																																																
2 persons were trained in Kenya	█												█												█												█											

Outputs and Activities	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>1 Planning capacity of NRW reduction of WASAC is enhanced.</b>																																																
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.	█												█												█												█											
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	█												█												█												█											
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	█												█												█												█											
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	█												█												█												█											
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	█												█												█												█											
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	█												█												█												█											
1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.	█												█												█												█											
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	█												█												█												█											
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	█												█												█												█											
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	█												█												█												█											
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1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	█												█												█												█											
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	█												█												█												█											
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2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	█												█												█												█											
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	█												█												█												█											
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	█												█												█												█											
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	█												█												█												█											
2-8 Training materials on NRW are reviewed and updated.	█												█												█												█											
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	█												█												█												█											
<b>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</b>																																																
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	█												█												█												█											
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	█												█												█												█											



**MINUTES OF MEETINGS  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
WATER AND SANITATION CORPORATION  
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS  
ON  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK**

The Japan International Cooperation Agency (hereinafter referred to as “JICA”) and Water and Sanitation Corporation (hereinafter referred to as “WASAC”) hereby agree that the Record of Discussions on PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK signed on March 30, 2016, and amended by the Minutes of Meetings signed on November 7, 2018, will be amended as follows;

**1. II-4 Duration**

Before	Amended Version
Four (4) years from the arrival of the first expert.	Four (4) years and five (5) months from the arrival of the first expert: i.e. till the end of December 2020.
Reason: Delay of procurement procedure of equipment related to Output4.	

**2. Other terms**

JICA, and Water and Sanitation Corporation (WASAC) agree that Project Design Matrix (PDM) is amended as Annex-1 due to modification stated above. This amendment will become effective as of 15 June 2020

Annex 1: PDM version 5

Annex 2: PO version 5

Annex 3: Record of Discussions (signed on March 30, 2016)

Annex 4: Minutes of Meetings (signed on November 7, 2018)

Kigali, 15 June, 2020

Mr. MARUO Shin  
Chief Representative  
JICA Rwanda Office  
Japan



Eng. Aimé MUZOLA  
Chief Executive Officer  
WASAC  
The Republic of Rwanda



**Project Design Matrix (PDM)**

Project title: Project for Strengthening Non-Revenue Water (NRW) Control In Kigali City W.

Project Sites: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<b>Overall Goal:</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23, 25%)	Annual report of WASAC	
<b>Project Purpose:</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The Government policy on NRW remains as highly prioritized.
<b>Outputs:</b>			
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5-year Strategic Plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project	The non-revenue water section at WASAC is not subject to large scale reorganization.  WASAC staff do not resign after training by the project.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%. 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project	
<b>Activities:</b>	<b>Inputs:</b>	<b>Outputs:</b>	
1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction. 1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems. 1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future. 1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3. 1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP. 1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report. 1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP. 1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year. 1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7. 1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties. 1-11 The management team facilitate implementation and the monitoring of the 5YSP. 1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliance of pipes with the existing pipe standards. 1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year. 1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Japanese side 1 Experts Dispatch Chief Adviser / Non-Revenue Water management Adviser / Non-Revenue Water management Non-Revenue Water reduction planning (1) Non-Revenue Water reduction planning (2) GIS Hydraulic analysis Leak detection Pipe repairing and service pipe connection ICT JICA Long term expert 2 Training Training in Japan Training in the 3rd country 3 Equipment provision Leak detection equipment Ultrasonic flow meter with data logger Gate valve, flow meter, and customer meter for Pilot Project Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali Equipment for training on pipe repair and service pipe connection Mobile GPS Vehicles for Japanese experts	Rwandan side 1 Counterpart Project Director Project Manager Management team members Action team members Other counterparts 2 Facilities Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections Training room with the capacity of about 20 persons Space for training on pipe repair and service pipe connection (40m) Store house for equipment 3 Local cost Cost for administering the Project (utilities for experts offices, internet services) Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment Cost for operation and maintenance of project equipment Cost for overtime work, transportation, accommodation and allowance for WASAC staff	Large scale natural disaster does not occur.
2-1 Training materials on NRW control are prepared. 2-2 Training on NRW management is conducted for the management team and WASAC management as necessary. 2-3 OJT is conducted on the updating of GIS data, using available GIS data base. 2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models. 2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment. 2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted. 2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted. 2-8 Training materials on NRW are reviewed and updated. 2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.			
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2. 3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means. 3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2. 3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2. 3-5 The action team establishes the baseline NRW rate of Pilot Area 1. 3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1. 3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness. 3-8 The action team conducts measures for reducing surface leakage (visible leakage). 3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness. 3-10 The action team conducts measures for reducing underground leakage (invisible leakage). 3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness. 3-12 The action team conducts measures for reducing high water pressure. 3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness. 3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12. 3-15 The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team. 3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties. 3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2. 3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties. 3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary. 4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey. 4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches. 4-4 Chambers are constructed as appropriate. 4-5 System input to each of 4 branches is measured. 4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

**Prerequisites:**

GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.



**Plan of Operation (PO)**

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Month	2016												2017												2018												2019												2020											
		Year 1						Year 2						Year 3						Year 4						Year 5																																			
		8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
<b>Expert</b>																																																													
Chief Adviser / Non-Revenue Water management																																																													
Adviser / Non-Revenue Water management																																																													
Non-Revenue Water reduction planning 1(1)																																																													
Non-Revenue Water reduction planning 1(2)																																																													
Non-Revenue Water reduction planning 2																																																													
GIS																																																													
Hydraulic analysis																																																													
Leak detection																																																													
Pipe repairing and service pipe connection																																																													
ICT																																																													
JICA Long term expert																																																													
<b>Equipment</b>																																																													
Leak detection equipment																																																													
Ultrasonic flow meter with data logger																																																													
Gate valve, flow meter, and customer meter for Pilot Project																																																													
Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali																																																													
Equipment for training on pipe repair and service pipe connection																																																													
Mobile GPS																																																													
Vehicles for Japanese experts																																																													
Pressure Reducing Valve (PRV) and Float Valve (FV)																																																													
On-site Test Meter																																																													
<b>Training in Japan</b>																																																													
15 persons were trained in Japan																																																													
<b>Training in the Third Country</b>																																																													
2 persons were trained in Kenya																																																													
Outputs and Activities	Month	2016												2017												2018												2019												2020											
		Year 1						Year 2						Year 3						Year 4						Year 5																																			
		8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
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*"Dignifying Life"*

Kigali, **23 DEC 2020**  
 No 11.07.024/**3570**/20/ DUWSS - CEO/Jb

**To: Mr. MARUO Shin**  
**Chief Representative**  
**JICA Rwanda Office**

Dear Sir,

**RE: Extension of the project for Strengthening Non-Revenue Water Control in Kigali City Water Network due to the COVID-19 pandemic.**

Reference is made to the record of discussion signed on March 30<sup>th</sup>, 2016 and the amendment by the minute of meeting signed on November 7<sup>th</sup> 2018 and June 15<sup>th</sup> 2020 between WASAC and JICA concerning the Project for strengthening Non-Revenue Water Control in Kigali City Water Network and its extension up to December 2020;

Reference is also made to the suspension of the project activities due to the COVID-19 preventive measures applied since March 2020 to date which did not allow Japanese experts attached to the project to complete remaining activities (mainly the output 4 related to the isolation of Kigali branches);

In line with your letter dated 15<sup>th</sup> December 2020, we would like to take this opportunity to inform you that your request of five (5) Years and five (5) months from the arrival of the first experts till end of December 2021 has been approved in order to complete the remaining project activities.

Sincerely,

**Gisele UMUHUMUZA**  
**A.g Chief Executive Officer**

Copy to:

- Hon. Minister of infrastructure
  - Hon. Minister of Economic planning & Finance
- KIGALI**



Japan International Cooperation Agency

Kigali, December 15, 2020

Ref: JRW20-12022

**Chief Executive Officer**  
**Water and Sanitation Corporation Limited (WASAC)**  
**KIGALI**

**Subject: Extension of the Project Period for Strengthening Non-Revenue Water Control in Kigali City Water Network due to the COVID-19 pandemic**

Dear Sir,

With reference to the above-mentioned project (the Project), some of the project activities have been suspended due to the global spread of the COVID-19 pandemic.

Though JICA has decided to resume its full operations in Rwanda and experts for the Project will return to Rwanda for their activities, there are still uncertainties remained that both sides may not foresee. Assuming that all the Project activities will be resumed from early 2021, it is not realistic to complete all the remained activities by the end of December 2020 which is indicated on the Record of Discussions and its amendments.

In this regards, I would like to propose the following amendment of the Project duration agreed on the Record of Discussions signed on March 30, 2016, and amended by the Minutes of Meetings signed on November 7, 2018 and June 15, 2020:

Before	Amended Version
Four (4) years and five (5) months from the arrival of the first expert. i.e. till the end of December 2020.	Five (5) years and five (5) months from the arrival of the first expert. i.e. till the end of December 2021.

I would appreciate it if you could reply by December 21, 2020.

Japan International Cooperation Agency (JICA) Rwanda Office takes this opportunity to renew to the management of WASAC the assurance of its highest consideration.

Sincerely,

For  
永瀬朝目  
MARUO Shin  
Chief Representative  
JICA Rwanda Office



CC:

- Honorable Minister of Infrastructure (MININFRA)
- Honorable Minister of Finance and Economic Planning (MINECOFIN)

JICA Rwanda Office  
Kacyiru, Umuganda Boulevard, Ebenezer House - Ground Floor  
Po Box 6878 - Kigali, Rwanda  
Tel: +250-(0)78-830-1723/31/32, (0) 78-830-0789  
E-mail : [rw\\_oso\\_rep@jica.go.jp](mailto:rw_oso_rep@jica.go.jp)

# Extension of R/D period for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

JICA  
October 23, 2020

## **Extension of R/D period for the Project for Strengthening Non-Revenue Water Control in Kigali City Water Network**

- Extension Period: 1 year extension  
(from **end of December 2020** to **end of December 2021**)
- The restart date to dispatch project team has not been determined yet, however, the R/D deadline is scheduled in the end of December 2020.  
Hence, we should extend the deadline to above date on the assumption that the dispatch of the project team restarts on April 2021.

<Schedule>

➤ Installment:

Done by August 2021

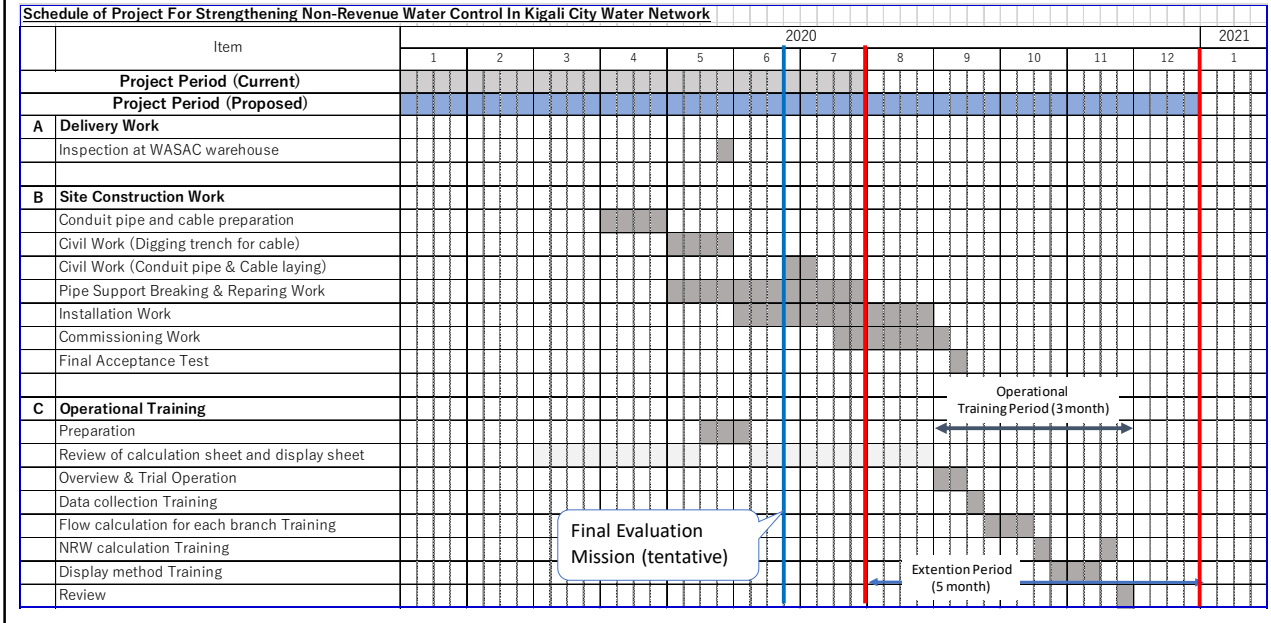
➤ Operational Training Period:

August to October 2021 (3 months)

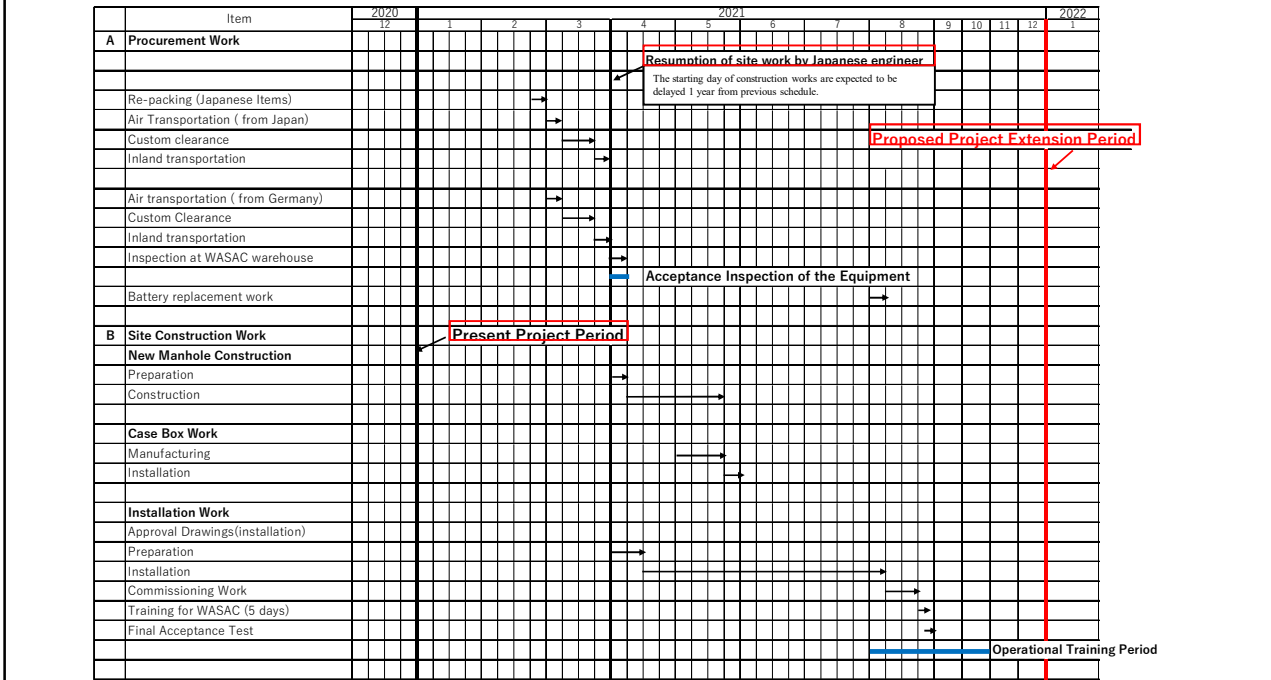
➤ Buffer:

2 months (To mitigate the risk of the delay of installment)

# Present Schedule of the Project



# Proposed Extension Schedule of the Project



**MINUTES OF MEETINGS  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
WATER AND SANITATION CORPORATION  
FOR AMENDMENT OF THE RECORD OF DISCUSSIONS  
ON  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK**

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and Water and Sanitation Corporation (hereinafter referred to as "WASAC") hereby agree that the Record of Discussions on PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK signed on March 30, 2016, and amended by the Minutes of Meetings signed on November 7, 2018, June 15, 2020 and December 23, 2020 will be amended as follows;

**1. II-4 Duration**

Before	Amended Version
Five (5) years and five (5) months from the arrival of the first expert. i.e. till the end of December 2021.	About six (6) years and two (2) months from arrival of the first expert on August 15 2016 to September 30 2022.
Reason: Maintenance works of procured equipment related to Output 4 are planned by September 2022.	

**2. Other terms**

JICA, and Water and Sanitation Corporation (WASAC) agree that Project Design Matrix (PDM) is amended as Annex-1 due to modification stated above. This amendment will become effective as of 17 December 2021

Annex 1: PDM version 6

Annex 2: PO version 6

Kigali, 17 December, 2021

  
  
 Mr. MARUO Shin  
 Chief Representative  
 JICA Rwanda Office  
 Japan

  
  
 Ms. Gisele UMUHUMUZA  
 Acting Chief Executive Officer  
 WASAC  
 The Republic of Rwanda

# Project Design Matrix (PDM)

Project title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City W.  
 Project Sites: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><b>Overall Goal</b></p> <p>WASAC conducts NRW reduction measures as planned for Kigali city.</p> <p><b>Project Purpose</b></p> <p>WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.</p>	<p>NRW rate of Kigali city (year 2022/23, 25%)</p>	<p>Annual report of WASAC</p>	
<p><b>Outputs</b></p> <p>1 Planning capacity of NRW reduction of WASAC is enhanced.</p> <p>2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.</p> <p>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</p> <p>4 4 branches in Kigali establish the system to measure NRW rates accurately.</p>	<p>1 5-year Strategic Plan for NRW reduction is approved by the Minister of Infrastructure.</p> <p>2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC</p> <p>3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction</p> <p>1-1 5-year Strategic Plan is reviewed and updated, taking into account of the results of the Pilot Project.</p> <p>1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.</p> <p>2-1 More than 300 number of trainees receive training.</p> <p>2-2 WASAC human resource development plan includes training programs prepared by the project.</p> <p>3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.</p> <p>3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.</p> <p>3-3 The action team prepares a completion report of the pilot project.</p> <p>4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.</p>	<p>1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure</p> <p>2 Annual action plan of WASAC</p> <p>3 Budget of WASAC</p> <p>1-1 Records of the project</p> <p>1-2 Records of the project</p> <p>2-1 Records of the project</p> <p>2-2 Records of the project</p> <p>3-1 Records of the project</p> <p>3-2 Records of the project</p> <p>3-3 Survey plans for locations outside the pilot project</p> <p>4-1 Records of the project</p>	<p>The Government policy on NRW remains as highly prioritized.</p> <p>The non-revenue water section at WASAC is not subject to large scale reorganization.</p> <p>WASAC staff do not resign after training by the project.</p>
<p><b>Activities</b></p> <p>1-1 A management team is organized to prepare 5-year Strategic Plan (SYSP) for NRW reduction.</p> <p>1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.</p> <p>1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.</p> <p>1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.</p> <p>1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the SYSP.</p> <p>1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.</p> <p>1-7 The management team prioritizes and schedules the conducts of specific actions of SYSP.</p> <p>1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.</p> <p>1-9 The management team prepares the SYSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.</p> <p>1-10 The management team holds seminars and presents SYSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.</p> <p>1-11 The management team facilitate implementation and the monitoring of the SYSP.</p> <p>1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.</p> <p>1-13 The management team reviews SYSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.</p> <p>1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.</p>	<p>1 Experts Dispatch</p> <p>Chief Adviser / Non-Revenue Water management</p> <p>Adviser / Non-Revenue Water management</p> <p>Non-Revenue Water reduction planning (1)</p> <p>Non-Revenue Water reduction planning (2)</p> <p>GIS</p> <p>Hydraulic analysis</p> <p>Leak detection</p> <p>Pipe repairing and service pipe connection</p> <p>ICT</p> <p>JICA Long term expert</p> <p>2 Training</p>	<p>1 Counterpart</p> <p>Project Director</p> <p>Project Manager</p> <p>Management team members</p> <p>Action team members</p> <p>Other counterparts</p> <p>2 Facilities</p>	<p>Rwanda side</p> <p>Japanese side</p>



2-1	Training materials on NRW control are prepared.	
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.	
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.	
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	
2-6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	
2-8	Training materials on NRW are reviewed and updated.	
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	
3-2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	
3-4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.	
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	
3-8	The action team conducts measures for reducing surface leakage (visible leakage).	
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).	
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.	
3-12	The action team conducts measures for reducing high water pressure.	
3-13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	
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3-15	The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	
3-16	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.	
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3-18	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	
3-19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.	
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	
4-4	Chambers are constructed as appropriate.	
4-5	System input to each of 4 branches is measured.	
4-6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.	

<p>Training in Japan</p> <p>Training in the 3rd country</p> <p>3 Equipment provision</p> <p>Leak detection equipment</p> <p>Ultrasonic flow meter with data logger</p> <p>Gate valve, flow meter, and customer meter for Pilot Project</p> <p>Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali</p> <p>Equipment for training on pipe repair and service pipe connection</p> <p>Mobile GPS</p> <p>Vehicles for Japanese experts</p>	<p>Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections</p> <p>Training room with the capacity of about 20 persons</p> <p>Space for training on pipe repair and service pipe connection(40m<sup>2</sup>)</p> <p>Store house for equipment</p> <p>3 Local cost</p> <p>Cost for administering the Project (utilities for experts offices, internet services)</p> <p>Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment</p> <p>Cost for operation and maintenance of project equipment</p> <p>Cost for overtime work, transportation, accommodation and allowance for WASAC staff</p>	<p>Large scale natural disaster does not occur.</p>
	<p>3</p>	
	<p>Preconditions</p> <p>GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.</p>	

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# Plan of Operation (PO)

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	2016												2017												2018												2019												2020												2021												2022											
	Year 1			Year 2			Year 3			Year 4			Year 5			Year 6			Year 7			Year 1			Year 2			Year 3			Year 4			Year 5			Year 6			Year 7																																												
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																																																				
Chief Adviser / Non-Revenue Water management	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Adviser / Non-Revenue Water management	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Non-Revenue Water reduction planning 1(1)	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Non-Revenue Water reduction planning 1(2)	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Non-Revenue Water reduction planning 2	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
GIS	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Hydraulic analysis	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Leak detection	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Pipe repairing and service pipe connection	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
ICT	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
JICA Long term expert	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
<b>Equipment</b>																																																																																				
Leak detection equipment	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Ultrasonic flow meter with data logger	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Gate valve, flow meter, and customer meter for Pilot Project	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Electromagnetic flow meter and pressure gauge and gate valve for Isolating 4-branches in Kigali	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Equipment for training on pipe repair and service pipe connection	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Mobile GPS	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Vehicles for Japanese experts	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
Pressure Reducing Valve (PRV) and Float Valve (FV)	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
On-site Test Meter	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
<b>Training in Japan</b>																																																																																				
15 persons were trained in Japan	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
<b>Training in the Third Country</b>																																																																																				
2 persons were trained in Kenya	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
<b>Outputs and Activities</b>																																																																																				
<b>Month</b>																																																																																				
1 Planning capacity of NRW reduction of WASAC is enhanced.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-1 A management team is organized to prepare 5-year Strategic Plan (SYSP) for NRW reduction.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the SYSP	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	[Gantt chart showing activity from Month 1 to 12 in 2016, 2017, 2018, 2019, 2020, 2021, 2022]																																																																																			

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## **Attachment 2: Minutes of SC**

**MINUTES OF MEETING  
ON THE FIRST STEERING COMMITTEE MEETING  
FOR  
THE PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK IN THE REPUBLIC OF RWANDA**

According to the Record of Discussions (hereinafter referred to as "R/D") for the Project The Project for Strengthening Non-Revenue Water Control in Kigali City Water Network in The Republic of Rwanda (hereinafter referred to as "the Project") signed on the March 30th, 2016 between Water and Sanitation Corporation (hereinafter referred to as "WASAC") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the JICA Expert Team was dispatched by JICA.

The first Steering Committee (hereinafter referred to as "SC") meeting was held by the initiative of WASAC and the JICA Expert Team on the April 3rd, 2017. On this meeting both sides presented Progress of the Work & Work Plan 2 and Work Plan for Phase II which was made based on the Joint Monitoring at Management Meeting for the Project held on March 15th, 2017.

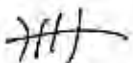
As a result of the discussions, both sides came to understanding concerning the matters referred the following matters;

1. Progress of the Project and Work Plan 2 on Phase I

SC members generally understood the progress of the Project and some delays which have occurred on activities for Output 1 and Output 4, and accepted that these delayed activities should be implemented continuously on the Phase II of the Project.

2. Work Plan for Phase II

SC members generally accepted on the Work Plan for Phase II.



Attachment;

1. Invitation to the first SC meeting
2. Agenda of the first SC meeting
3. Monitoring Sheet ver.2
4. List of Attendants
5. Comments raised from SC members (Memorandum)
6. Presentation Document 1 (Progress of the works of Phase 1 & Approval of Work Plan 2)
7. Presentation Document 2 (Work Plan for Phase 2)
8. Presentation Document 3 (Report of Training result in Japan)
9. Presentation Document 4 (Proposal of Capacity Development Plan for Phase 2)

for 樋田 圭之  
Hirayuki Higuchi

Mr. Shigeo Otani  
Chief Adviser  
JICA Experts Team for the Project



Kigali, April 3rd, 2017

Mr. Methode Rutagungira  
Director of Urban Water and Sanitation  
Services (UWSS)  
Water and Sanitation Corporation (WASAC)  
The Republic of Rwanda



"Dignifying Life"

Kigali, 30 MAR 2017  
N° 11.07.024/17/CEO-WASAC/jb

Chief Representative  
JICA - RWANDA

Dear Sir,

**RE: Invitation to the first steering committee meeting of the project for Strengthening Non-Revenue Water (NRW) control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the 3 years Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

We hereby request your good office to authorise Mr. Nagase TOMONORI, Mrs. AYA KAGOTA and Mr. Jean D 'Amour REBERO to attend the first Steering Committee meeting that will take place at GALAXY Hotel on 03<sup>rd</sup> April 2017 starting from 9:00 am.

The purpose of the meeting is to review the Project progress and the Approval of the next year's Work Plan

The agenda of the meeting is hereby enclosed.

I thank you for your usual cooperation

Yours sincerely,

  
James SANO  
Chief Executive Officer



CC:

- Hon. Minister of Infrastructure- MININFRA
- Hon. Minister of State in Charge of Energy and Water -MININFRA
- Permanent Secretary-MININFRA



**AGENDA OF THE STEERING COMMITTEE**

**PROJECT: STRENGTHENING NRW CONTROL IN KIGALI CITY WATER NETWORK**

**Venue: Galaxy Hotel**

**Date: April 3, 2007**

<b>Time</b>	<b>Activity</b>	<b>Responsible</b>
9:00	Registration	Ms MUTAMBA Jane
9:30	Introduction of participants	Ms MUTAMBA Jane
9:40	Remarks by CEO WASAC	CEO, WASAC
9:50	Remarks by JICA Rwanda representative	Mr. Nagase, JICA Rwanda
10:00	Progress of the work & Approval of Work Plan 2	Mr. Bahige
10:25	Question and Answer	WASAC, JICA team
10:30	Work Plan for Phase 2	Mr. Otani , JICA team
10:40	Question and Answer	WASAC, JICA team
10:45	Report of Training result in Japan	Mr. Byamugisha Bernard
11:00	Question and Answer	WASAC, JICA team
11:05	Proposal of Capacity Development Plan for Phase 2	Mr. Kaji, JICA HQ
11:20	Question and Answer	WASAC, JICA team
11:30	Closing Remarks by WASAC	CEO, WASAC

**AGENDA**  
**FIRST STEERING COMMITTEE ON**  
**THE PROJECT FOR**  
**STRENGTHENING NON-REVENUE WATER CONTROL IN**  
**KIGALI CITY WATER NETWORK**

Venue: Galaxy Hotel

Date: April 3, 2017

Agenda:

- |       |  |                         |
|-------|--|-------------------------|
| 09:00 | Registration   |                         |
| 09:30 | Introduction of participants                               | Mrs. Musabyeyez Jeanne  |
| 09:40 | Remarks by CEO WASAC                                       | Mr. James Sano          |
| 09:50 | Remarks by JICA Rwanda representative                      | Mr. Nagase, JICA Rwanda |
| 10:00 | Progress of the works of Phase 1 & Approval of Work Plan 2 | Mr. Bahige              |
|       | Work Progress  |                         |
|       | Amendment of work schedule of Work Plan 1                  |                         |
|       | Question and Answer  |                         |
|       | Approval of Work Plan 2                                    |                         |
| 10:40 | Report of Training in Japan                                | Mr. Byamugisha Bernard  |
|       | Question and Answer  |                         |
| 11:00 | Work Plan for Phase 2                                      |                         |
|       | Schedule of Work Plan for Phase 2                          | Mr. Otani               |
|       | Proposal of Training in Japan and in Third Country         | Mr. Bahige              |
|       | Proposal of Capacity Development Plan for Phase 2          | Mr. Kaji, JICA HQ       |
|       | Question and Answer  |                         |
| 11:30 | Closing Remarks by WASAC                                   | Mr. Methode             |

TO CR of JICA RWANDA OFFICE

## PROJECT MONITORING SHEET

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City  
Water Network

Version of the Sheet : Ver.2 (Term: August, 2016 – February, 2016)

Name: Shigeo OTANI

Title: Chief Advisor/ Non-Revenue Management

Submission Date: March 14, 2017

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## 1-1-1 Japan Side

## (1) List and Assignment Terms of Japanese Experts

1) 1<sup>st</sup> Phase (as of Feb.28, 2017)

## a. Working in Rwanda

	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/14	2016/12/11	4.0
			2017/1/15	2016/2/28	1.5
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2016/8/14	2016/9/27	1.5
			2017/1/17	2017/2/28	1.5
3	NRW Reduction Plan 1 (1)	Chiaki SUZUKI	2016/8/15	2016/9/13	1.0
			2016/11/10	2016/12/27	1.6
4	NRW Reduction Plan 1 (2)	Hiroyasu YODA	2016/9/7	2016/11/14	2.3
			2017/1/17	2017/2/28	1.5
5	NRW Reduction Plan 2 (1)	Toru TOYODA	2016/8/15	2016/9/28	1.5
			2017/1/17	2017/2/28	1.5
6	NRW Reduction Plan 2 (2)	Nobuyuki TSUTSUI	2016/9/18	2016/12/16	3.0
7	GIS	Eita HORISHITA	2016/8/14	2016/11/11	3.0
8	Hydraulic Analysis	Hiroki OE	2016/8/15	2016/11/12	3.0
9	Leak Detection	Junichi TAKAHASHI			
10	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO			
11	Pipe Repairing and Service Connection (2)	Hiroshi TAKASHIMA	2017/1/17	2017/2/28	1.5
12	ICT	Marcel Brouwer	2016/9/30	2016/12/10	2.4
			2017/2/13	2017/2/13	0.0
Total M/M					30.8

PM Form 3-1 Monitoring Sheet Summary

b. Working in Japan

No.	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/5	2016/8/12	0.25
10	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO	2016/12/5	2016/12/16	0.50
Total M/M					0.75

Details of each expert's assignment are shown in the Plan of Operation.

(2) Training

1) Training in Japan

The following member participated in the training in Japan between January 1, 2016 and February 2, 2017.

Member of 1<sup>st</sup> Training in Japan

	Names	Position
1	RUTAGUMGIRA Methode	Director, Urban Water and Sewerage Services ( Project Director )
2	BAHIGE Jean Berchmans	Manager, Non-Revenue Water ( Project Manager)
3	GATANAZI Felix	Manager, Customer services
4	BYAMUGISHA Bernard	Head of Branch /Nyarugenge
5	MUTAMBA Jane	Head of Branch /Gikondo

Schedule of 1<sup>st</sup> Training in Japan

No	Day		Travel	Type	Contents	Organizer
1	2017/1/21	Sat	Kigali→			
2	2017/1/22	Sun	Yokohama		Arrival	
3	2017/1/23	Mon	Yokohama	Lecture	Training briefing Programme Orientation Distribution management system Courtesy call to the Yokohama City Water Works Bureau	JICA Yokohama Yokohama City Water Works Bureau
4	2017/1/24	Tue	Yokohama	Lecture	Block system of Yokohama City Customer Meter Management	Yokohama City Water Works Bureau
5	2017/1/25	Wed	Yokohama	Practical training, Visit	Mapping system Visit a Water Service Memorial Visit at Water Treatment Plant (Nishiya)	Yokohama City Water Works Bureau WTP of Yokohama City
6	2017/1/26	Thu	Yokohama	Lecture Practical training	Quality control and inspection system of service connection Leakage Detection Survey	Yokohama City Water Works Bureau WTP of Yokohama City
7	2017/1/27	Fri	Yokohama		Discussion, Training Evaluation Closing meeting	JICA Yokohama
8	2017/1/28	Sat	Yokohama→ Kyoto			
9	2017/1/29	Sun	Kyoto→Kobe			
10	2017/1/30	Mon	Kobe	Lecture, Visit	Courtesy call to the Kobe City Water Works Bureau History of the City Water Works Visit to facilities	Kobe City Water Works Bureau
11	2017/1/31	Tue	Kobe	Lecture, Visit	NRW Reduction Measure Pressure Management Water Demand Projection Visit to facilities	Kobe City Water Works Bureau
12	2017/2/1	Wed	Kobe→ Yokohama		Discussion, Training Evaluation Closing meeting	JICA Kansai
13	2017/2/2	Wed	Tokyo→Kigali		Departure	

PM Form 3-1 Monitoring Sheet Summary

No	Field in Charge	Name	Duration	
			From	To
<b>Steering Committee (SC)</b>				
1	Chairman: CEO of WASAC	James Sano	Aug. 2016	Present
2	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
3	Project Manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
4	Management Team		Aug. 2016	Present
5	Officials from MINIFRA		Aug. 2016	Present
<b>Project Director and Manager</b>				
1	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
<b>Management Team (7 persons)</b>				
1	Leader: Director of UWSS	Mr. Methode Rutagungira	Aug. 2016	Present
2	Co-leader: Director of CS	Lucien Ruterana	Aug. 2016	Present
3	Co-leader: Director of CFO	Joseph Ruhinyura	Aug. 2016	Present
4	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
5	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
6	Manager of Revenue Management Services, CS	Désiré Kayiru	Aug. 2016	Present
7	Manager of Customer Service Management, CS	Felix Gatanzizi	Aug. 2016	Present
<b>Action Team (31 persons)</b>				
1	Leader: Head of leak detection and pressure	Désiré Ntamaturano	Aug. 2016	Present
2	Co-Leader: Kachini Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader: Gikondo Branch Manager	Mutanba Jane	Aug. 2016	Present
4	Co-Leader: Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader: Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader: Kanombe Branch Manager	Aimable Ndagijimana	Aug. 2016	Present
7	Co-Leader: Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Head of water distribution services, NRW, UWSS	Jean Claude Manirakiza	Aug. 2016	Present
10	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Present
11	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Head of meter management services	Felicien Niringiyimana	Oct. 2016	Present
14	Water Distribution Officer of each Branch		Aug. 2016	Present
15	Customer Service Officer of each Branch		Aug. 2016	Present
16	Billing Officer of each Branch		Aug. 2016	Present

**(2) Facilities**

Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections

- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection (40 m<sup>2</sup>)

## 2) Training in the 3rd country

Not yet conducted

**(3) List of Equipment Provided for the Project**

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 1	Output 2 Training for pipe repairing and service connection	Materials and equipments for training for pipe repairing and service connection	set	1	Mar., 2017	in Process
Lot 2	Output 3 Pilot Project (2 sets)	Customer mater φ15mm	sets	400	Feb., 2017	completed
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Mar., 2016	in Process
Lot 4	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	June, 2017	in Process
Lot 5	Vehicles for JICA use	Onebox and Pickup	Units	2	Jan., 2017	completed

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity	Schedule	Actual
Lot 6	Output 2: Leak detection equipment (for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	Sets	3	July., 2017	in Process
Lot 7	Survey Equipment for Output 2and 3	Potable GPS	sets	5	Oct., 2016	Completed
		Potable Test Meter	sets	2	Oct., 2016	Completed
		Residual Chlorine Test Meter, Potable Electric conductivity Meter	sets	2	Oct., 2016	Completed

**I-1-2 Rwanda Side****(1) Counterpart**

List and Assignment Terms of Counterparts

- Store house for equipment

### (3) Local Cost

- Cost for administering the Project (utilities for experts offices, internet services)
- Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

## 1-2 Progress of Activities

### 1-2-1: Activities relevant to the entire Project

#### (1) Start-up Meeting of the Project

Start-up Meeting of the Project was held Aug. 16 at Galaxy Hotel in Kigali with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Introduction of JICA experts and Counterparts (C/P)
- Explanation and discussion of draft of Work Plan (WP)
- Confirmation of understanding of the project contents (Implementation Schedule).
- Condition for selection of pilot project area
- Selection of the members of Action teams and other related teams
- Notes for safety measures
- Agenda and facilitator of the Seminar (Kick-Off Meeting) of August 18th.

#### (2) Kick-Off Meeting of the Project

Kick-Off Meeting was held on Aug. 18, 2016 at Galaxy Hotel in Kigali to show the contents of the project to person concerned including all Branch managers of WASAC, MININFRA. The main topics of the meeting were as follows:

- Explanation of Project Objectives
- Project implementation Structure
- Project Implementation Flowchart
- Introduction of NRW reduction of Yokohama City
- Discussion

#### (3) Revision of IC/R

The draft of IC/R was presented by JICA Expert Team at Start-up Meeting of the Project, and Kick-Off Meeting of the Project. It was revised on Sept. 15, 2016 as Ver.1 according to progress of the

meantime,

**[Output 1]**

**1-2-1: Activities of Output 1: Planning capacity of NRW reduction of WASAC is enhanced.**

1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.

The member of the management team is appointed formally in August by CEO, and formation is finished.

1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

- Questionnaire survey has conducted for 20 Branch Offices in September and the answers to the questionnaire are summarized in October. The result was explained for NRW team and discussed it on November 8 .
- Sit visit survey for three Branch Offices, Ruwamagana, Nagatare and Ngoma, was conducted in September to confirm existing activities of WASAC branch offices, the situations of facilities, and evaluate it.
- The site visit survey for remaining 11 Branch offices was started in the middle of February, 2017 and it is going to carry out until the beginning of March.

1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

- Information data of GIS and customer (January 2016- July 2016) were analyzed in October and presented the result for future examination of WASAC.
- Among the matters of the high evaluation that became clear from these findings, the matter which should cover for a Five-years NRW reduction strategic action plan were chosen.
- As high measures of the priorities, Preparation of a conceptual long term develop plan of water supply system, Update all customer data, Update and validate GIS pipe network drawings, Replace/repair malfunctioning customer meters/public standpipes, Carry out priority analysis for pipe rehabilitation, Continue rehabilitation of old pipes based on priority analyses were list upped.
- Development policy of the Five-year plan and table of contents were presented.
- The NRW reduction activities are still being proposed.

1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

- To make clear the contents and the bill of quantity of the priority of countermeasure, an inventory survey will be carried out. Concrete content of the survey was decided in January, 2017 and assumed an investigation was planned to start from February.



## PM Form 3-1 Monitoring Sheet Summary

- Specification for inventory survey about facilities was prepared. As a result of the discussion on these contents (general schematic drawing of water reservoir tank, fact-finding of the stand pipe, sampling survey of customer meters) with WASAC in February, WASAC decided to implement by himself.
- 1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.  
→ Not yet conducted.
- 1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.  
→ Not yet conducted.
- 1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.  
→ Scheduled in March 2017
- 1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.  
→ Scheduled in April 2017
- 1-9 The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.  
→ Scheduled in April 2017
- 1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.  
→ Scheduled in May 2017
- 1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.  
→ Scheduled in April 2018 and in 2<sup>nd</sup> Phase
- 1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.  
→ Scheduled in 2<sup>nd</sup> Phase

### **[Output 2]**

**1-2-2: Activities of Output 2: Basic knowledge, skills and technique on NRW control are acquired**

by WASAC.

2.1 Training materials on NRW control are prepared.

- In reference to past experience project and "The Manager's Non-Revenue Water Handbook for Africa (Guide to Understanding Water Losses) USAID, World Bank, March 2010", "Non-Revenue Water Management (Consulting Developing Countries), Shozo Yamazaki, March 2011", "Factor on NRW and Concept of NRW Reduction (draft manual)" was prepared and submitted to Project Manager of WASAC and NRW team.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

- The training materials for problem presentation on basic measures of NRW management were made, and a seminar was carried out for four times at every week in a project management meeting in October.
- The training was carried out based on "materials for problem presentation on basic measures of NRW management" mentioned above on November 1.

2.3 OJT is conducted on the updating of GIS data, using available GIS data base.

Following works were conducted,

- The technical training on GIS data update of C/P
- Rearranging and reexamination of a workflow affecting GIS update of customer and pipe network data update
- OJT on update of Branch boundary line data
- Activity that GIS data management
- The introduction of the Google Earth applied for GIS
- Introduction of the software of QGIS to 6 Kigali city branches and Google Earth (input to a PC) was performed to make the environment that WASAC can be shared the GIS data not only HQ but also branch offices and could watch freely, and to have operation and utilization of the GIS software fit the staffs other than the GIS team, and to smoothen a shift to future ArkGIS use.
- The reconfirmation of technology transfer contents and the introduction of the ArcGIS Geometric Network analysis (one of the pipe network analysis functions on ArcGIS) was carried out. Construction and editing of the pipe network model and analysis by this function can be carried out.
- The Manuals (GIS Procedure Guide and GIS Operation Manual: Data update on management

for water network and customer information) were distributed to related section of HQ and 6 branch offices.

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Collection of hydraulic analysis-related data, and, the lectures and a seminar of the hydraulic analysis and water pressure management analysis were performed six times for November 8 from September 29 for a GIS team.

- The training of general theory of the hydraulic analysis
- The practice by application EPANET of the hydraulic analysis
- Construction of the use environment of hydraulic analysis software MikeUrban and the training about the usage of it
- Hydraulic analysis of the pilot area

2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

→ Scheduled from March 2017 and in 2<sup>nd</sup> Phase

2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

- A procurement list of the equipment and materials on repairing leaking pipes and installing service connection was prepared.
- Contents of procurement equipment were confirmed and specification and BoQ were decided.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed.
- Notice for competition of quotation was made October 14 and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the equipment is scheduled in March.
- Fact-finding about activities of each branche including laying and repair of the distribution and service connection pipes was started in January 2017. Extraction of the problems with C/P based on these findings and will make the teaching materials for the training in future.
- Training is in preparation, Scheduled from March 2017 and after July 2017

2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are

conducted.

→ in preparation, Scheduled from March 2017 and in 2<sup>nd</sup> Phase

2-8 Training materials on NRW are reviewed and updated.

→ Scheduled in 2<sup>nd</sup> Phase

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

→ Scheduled in 2<sup>nd</sup> Phase

### **[Output 3]**

**1-2-3: Activities of Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.**

3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.

- The member of the action team is appointed formally in August by CEO, and formation is finished in August 2016.

3.2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.

- Selection of two pilot areas (Area 1: Kadobogo (Kiyovu) Kacyiru Branch Area 2: Ruyenzi (Runda) Nyarugenge Branch ) from the proposed candidate sites in September 2016.
- Information data collection of Kigali city and the two pilot areas in September 2016
- Information data update of pilot areas such as population and number of customers

3.3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.

- A work plan of pilot project for area1 and area2 was prepared.
- Preparation of facilities plan for the establishment of pilot area such as location of inlet chamber and design them including requires equipment such as flowmeter, pressure gauge and valves in September
- The detailed design of the chamber at the inlet (flowmeter setting position) was made in September, and trial excavation was conducted for confirm the number of the existing pipe, laying position, depth, type, diameter, and performed final decision of the structure in October.

- The contents, specification and quantity of the equipment to be installed in the chamber were clarified in October.

3.4 The action team hydraulically isolates Pilot Area 1, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1.

#### Procurement of Equipments

- Contents of procurement equipment (flowmeter, pressure gauge, valve, customer meter etc.) were confirmed and specification and BoQ were decided in October.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed in September..
- Notice for competition of quotation was made October 14, and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the equipment is scheduled in March.

#### Construction of Chambers

- Design of four chambers to be installed inlets of the pilot area was performed for the price competition in September.
- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the quotation on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.
- Construction work will be started from March 1, 2017.

The additional investigation for separation of the tertiary pipe in the Kadobogo pilot area was performed. Isolation work was performed by WASAC.

3-5 The action team establishes the baseline NRW rate of Pilot Area 1.

→ Scheduled in 2<sup>nd</sup> Phase

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

→ Scheduled in 2<sup>nd</sup> Phase

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.

→ Scheduled in 2<sup>nd</sup> Phase

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

→ Scheduled in 2<sup>nd</sup> Phase

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

→ Scheduled in 2<sup>nd</sup> Phase

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

→ Scheduled in 2<sup>nd</sup> Phase

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

→ Scheduled in 2<sup>nd</sup> Phase

3-12 The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.

→ Scheduled in 2<sup>nd</sup> Phase

3-13 The action team summaries activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

→ Scheduled in 2<sup>nd</sup> Phase

3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.

→ Scheduled in 2<sup>nd</sup> Phase

3-15 Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.

→ Scheduled in 2<sup>nd</sup> Phase

3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

→ Scheduled in 2<sup>nd</sup> Phase

#### **【Output 4】**

**1-2-4: Activities of Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.**

4.1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

- About 4 branch isolation, the GIS team and the Branch Offices made opinion adjustment with advice of JICA expert, site investigation in order to decide the boundary lines in October.
- Because it was revealed that the movement between branches of the customer registration was necessary about the decision of the boundary line, it was decided to adjust it after boundary line decision.
- Four branch separation boundary lines were established by the end of September, 2016, But it was non-start about movement of customer registration.
- A GIS team clarified re-enrollment about the movement of customer registration (1712 as of September 2016)

4.2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

- Flowmeter setting positions for isolation of 4 branches were examined on the GIS map jointly with NRW team and GIS team in a project progress meeting of October 7.
- After the position decision on the quantity, individual spot investigation was carried out by JICA team and WASAC team to confirm condition of existing distribution pipes. Trial excavation was conducted for 18 places.
- The joint meeting of the NRW and GIS team was held in order to settle site setting position of flowmeter on October 31.
- The technical specifications of the equipments such as electromagnetic flowmeter, mechanical flowmeter, pressure gauge, valves, data loggers and server hardware etc. for the establishment of monitoring system was prepared by the end of November.
- Technical specification and Bill of Quantity for the tender were submitted to the JICA office on December 9.

4.3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

#### Construction of Chambers

- 23 chambers to be installed in the network were designed for the tender in November.
- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the tender on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.

4-4 System input to each of 4 branches is measured.

→ Scheduled in 2<sup>nd</sup> Phase

4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

→ Scheduled in 2<sup>nd</sup> Phase

### **1-3 Achievement of Output**

Achievement status of the Project outputs is observed according to the PDM indicators as the table below indicates:



## PM Form 3-1 Monitoring Sheet Summary

Table: Achievement of Outputs

Outputs	Objectively Verifiable Indicators	Status of the Achievement
1. Planning capacity of NRW reduction of WASAC is enhanced.	<p>1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.</p> <p>1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.</p>	<ul style="list-style-type: none"> <li>*The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP, Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 Branches)</li> <li>*Site visit survey for up-country Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW.</li> <li>*Inventory survey is being conducted by WASAC</li> <li>*Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team.</li> </ul>
2. Basic knowledge, skills and technique on NRW control are acquired by WASAC	<p>2-1 More than XX number of trainees receive training.</p> <p>2-2 WASAC human resource development plan includes training programs prepared by the project.</p>	<ul style="list-style-type: none"> <li>*Training on NRW management was conducted</li> <li>*OJT was conducted on the updating of GIS data base</li> <li>*OJT was conducted on hydraulic analysis, and pressure management</li> <li>*In-room training and OJT on leak detection will be conducted from March 2016 and in the 2nd Phase.</li> <li>*In-room training and OJT on repairing leaking pipes and installing service connection will be conducted from March 2016 and in the 2nd Phase. Procurement of the materials and equipments to be used for the training are being procured.</li> <li>*Implementation of the OJT activity is planned in the 2nd Phase.</li> <li>*Implementation of the activity mentioned in indicators is planned in upcoming steps during the 2nd Phase.</li> </ul>
3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	<p>3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)</p> <p>3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.</p> <p>3-3 The action team prepares a completion report of the pilot project.</p>	<ul style="list-style-type: none"> <li>*Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, Nyarugenge Branch) were selected.</li> <li>*The preparation work in order to setting up DMA is being conducted such as procurement of the equipments and construction of chambers, separation of tertiary distribution pipes and installation of valves in the network.</li> <li>*Implementation of the OJT activity is planned in the 2nd Phase.</li> </ul>
4. 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	<ul style="list-style-type: none"> <li>*Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided.</li> <li>*Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey.</li> <li>*Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. Procurement work has not yet started.</li> <li>*The chambers were designed and construction work is started from March 2017.</li> <li>*The procurement schedule of the equipments is not clear. It is supposed to be the equipment will arrive in July</li> </ul>

### 1-4 Achievement of the Project Purpose

It is somewhat premature to assess the achievement of the Project's purpose because only a half year has passed since Project started.

### 1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

**(1) Pre-Conditions**

Table: Action for Mitigation on Pre-Condition

PDM Pre-Conditions	Current Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule.  In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikeUrban was made by Esri in the end of October.	

**(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)**

Table: Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Not applicable	
2 WASAC staff do not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster does not occur.	1-3 Not applicable	

**(3) Important Assumption on Proceeding Assumptions to Overall Goal**

Table: Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 Not applicable	

**1-6 Progress of Actions undertaken by JICA**

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs.
- Procurement of leak detection equipment is in process. These are procured until July 2017.
- Procurement of electromagnetic flow meter and pressure gauge and gate valve for isolation 4 branches in Kigali is in process.

**1-7 Progress of Actions undertaken by Rwanda side**

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Survey and adjustment to decide to points to be construct the chambers.
- Training in Japan
- Concept Note preparation for decision of branch boundary.
- Inventory survey is caring out by WASAC team.
- DMA formation of Pilot Areas (installation of valves, adjustment of tertiary pipe)
- Joint visit JICA-WASAC of WASAC's upcountry branches.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

No remarkable progress and consideration have been seen.

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

No remarkable progress and consideration have been seen.

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

SUSWAS Project

**2 Delay of Work Schedule and/or Problems (if any)**

**2-1 Detail**

**1) Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)**

Since not enough time was secured to make action plans in the 1<sup>st</sup> Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team.

It needs to be elaborate on to produce a more tangible and practical institutional framework. The role and responsibilities of the management team in the framework for the NRW reduction plan should be confirmed.

**2) Procurement and installation schedule of the equipment of monitoring system (Output 4)**

The construction of the chambers to install equipments of monitoring system has already begun, but the procurement schedule of the equipments is not clear.

## 2-2 Cause

### 1) Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)

Because it is a proposition to complete the construction of two places of pilot areas that is work of Output 3 and to complete a flow measurement system to isolate 4 branches for calculate an individual NRW rate that is work of Output 4 by June, 2017, the work of site survey, details design and the preparation of tenders on procurement of equipment and the chamber construction were conducted with precedence. As a result it works of Output 1 is late.

The predicted number of the setting point for electromagnetic flowmeters was increased, because that it was necessary to include not only the boundary but also the WTP, and the needed time for an investigation.

The distribution pipe position was going to be provided by GIS data, but software of Esri was unfinished, and reliable information was not provided. The trial excavation reached for confirmation of existing pipe position. Time for the review of the branch border and for decide the exact position of electromagnetic flowmeters.

### 2) Procurement and installation schedule of the equipment of monitoring system (Output 4)

The plan of the JICA office is not yet seen.

## 2-3 Action to be taken

A management team meeting will be held in the middle of March to make an orientation.

## 2-4 Roles of Responsible Persons/Organization (JICA, WASAC, etc.)

## 3 Modification of the Project Implementation Plan

### 3-1 PO

As a major modification, the timeline of Activity 1.7-1.10 will be shifted to the beginning of the 2nd phase from the 1st phase. This modification was reflected as PO ver.1 which will be approved by the SC on April 3, 2016.

**3-2 Other modifications on detailed implementation plan**

No major modification was made.

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

**4. Preparation of Rwanda Side toward after completion of the Project**

Not applicable.

**II. Project Monitoring Sheet I & II**

As attached.

## Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 2

Implementing Agency: WASAC

Dated March 14, 2017

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Period of Project: 2019/6/30

Project Site: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nya Model Site)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<b>Overall Goal</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022 xx %) (to be confirmed during the project)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	N/A	
<b>Project Purpose</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization.  WASAC staff do not resign after training by the Project.  Large scale natural disaster does not occur.		It is somewhat premature to assess the achievement of the Project's purpose because only a half year has passed since Project started.
<b>Outputs</b>					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project			<ul style="list-style-type: none"> <li>The relevant information are being collected from existing data and documents. (GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 Branches)</li> <li>Site visit survey for up-country Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW.</li> <li>Inventory survey is being conducted by WASAC</li> </ul>
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project			<ul style="list-style-type: none"> <li>Training on NRW management was conducted</li> <li>OJT was conducted on the updating of GIS data base</li> <li>OJT was conducted on hydraulic analysis, and pressure management</li> <li>In-room training and OJT on leak detection will be conducted from March 2016 and in the 2nd Phase</li> <li>In-room training and OJT on repairing leaking pipes and installing service connection will be conducted from March 2016 and in the 2nd Phase. Procurement of the materials and equipments to be used for the training are being procured.</li> <li>Implementation of the OJT activity is planned in the 2nd Phase.</li> </ul>
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects	3-1 Records of the project 3-2 Records of the project			<ul style="list-style-type: none"> <li>Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, Nyarugenge Branch) were selected.</li> <li>The preparation work in order to setting up DMA is being conducted such as procurement of the equipments and construction of chambers, separation of</li> </ul>

		3-3 The action team prepares a completion report of the pilot project.	3-3 Survey plans for locations outside the pilot project		tertiary distribution pipes and installation of valves in the network.. •Implementation of the OJT activity is planned in the 2nd Phase.
4	4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		•Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided. •Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. •Detailed design was done for preparation of technical specifications of the equipment of a monitoring system. Procurement work has not yet started. •The chambers were designed and construction work is started from March 2017.

Activities		Inputs		Pre-Conditions
		The Japanese Side	The Rwanda Side	
1-1	A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.			
1-2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser / Non-Revenue Water management	Project Director	
1-4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5	Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	GIS	Management team members	• GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.
1-6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	
1-7	The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Leak detection	Other counterparts	
1-8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9	The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10	The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11	The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	<b>&lt;Issues and countermeasures&gt;</b>
1-12	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections Training room with the capacity of about 20 persons Space for training on pipe repair and service pipe connection (40m <sup>2</sup> ) Store house for equipment	By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017.
2-1	Training materials on NRW control are prepared.	Training in the 3rd country		Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.			
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision		
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Ultrasonic flow meter with data logger	3 Local cost	
2-6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for administering the Project (utilities for experts offices, internet Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project	
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.			

2-8	Training materials on NRW are reviewed and updated.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	it was able to carry out about the update of the GIS database which was a subject of the training on schedule.
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1.	Vehicles for Japanese experts		
3-2	The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.			
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1.			
3-4	The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.			
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8	The action team conducts measures for reducing surface leakage (visible leakage).			
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12	The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.			
3-13	The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15	Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.			
3-16	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.			
4-4	System input to each of 4 branches is measured.			
4-5	Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikeUrban was made by Esri in the end of October.











**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : The first steering committee meeting of NRW  
Place : Galaxy Hotel  
Date : 3rd April 2017

Name	Position
REBER Jean d'Amour	Position: WATSAN Program Coordinator / JICA Mobile: 0782574592 E-mail: Rberjean.damour@jica.jp
Marcel Brouwer	Position: ICT team JICA Mobile: 0733400139 E-mail: marcel.brouwer@vitens.nl
Toru Toyoda	Position: JICA Expert Mobile: 078-129-9356 E-mail: toyoda.t@yokohama-ctc.jp
CHIAKI SUZUKI	Position: JICA Expert Mobile: 078-44-9354 E-mail: suzuki-c@yokohama-ctc.jp
Masaharu MATSUMI	Position: Long term Expert Mobile: 0786 824 190 E-mail: matsumi.masaharu@gaia.or.jp
Dominique NUREKEZI	Position: Manager utility Planning Mobile: 0788 352691 E-mail: dnurekezi@wasac.rw
Hiroyuki Higuchi	Position: JICA Expert Mobile: 078-44-355 E-mail: higuchi@kawa-c.co.jp
GASHUGI Innocent	Position: Manager, Water Operations Services Mobile: 0738521483 E-mail: igashugi@wasac.rw
RUTAGUNGIRA Pierrick	Position: Director of Urban Water & Sewerage Services Mobile: 0798403181 E-mail: ruyagungira@wasac.rw
Marcelline Kayitesi	Position: WATSAN Division Manager Mobile: 0788482864 E-mail: marcelline.kayitesi@minifra.gov.rw

LUTERANIA LUCIA	Position: Director of Commercial Services Mobile: 0738303692 E-mail: luterania@udasac.ru
Tomoko NAGASE	Position: SR of JICA Mobile: 0758308525 E-mail: Nagase.Tomoko@jica.go.jp
Aya KAGOTA	Position: Program Manager, JICA Mobile: 0788304704 E-mail: Kagota.Aya@jica.go.jp
Takashi KAJI	Position: DG Mobile: +81352269573 E-mail: kaji.takashi@jica.go.jp
Balthazé A.B	Position: NRW Manager Mobile: 0798307404 E-mail: Balthaze@udasac.ru
Mukhammad Jare	Position: Branch Manager Mobile: 0738307593 E-mail: Muhammad@udasac.ru
Vedaste TANGISAKK	Position: Assistant NRW reduction project Mobile: 0788537229 E-mail: Vedaste@udasac.ru
SHIGEO OTAWI	Position: JICA Advisor Mobile: 0781449355 E-mail: otaw!kactur@y mail.com
	Position: Mobile: E-mail:
	Position: Mobile: E-mail:
	Position: Mobile: E-mail:
	Position: Mobile: E-mail:
	Position: Mobile: - E-mail:

PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK

Attendance List

Title : The first steering committee meeting of NRW.  
Place : Galaxy Hotel  
Date : 3<sup>rd</sup> April 2017.

Name	Position
Célestin Mutambutsa	Position: <u>Leak detection and Pressure management of</u> Mobile: <u>0788638762</u> E-mail: <u>cmutambutsa@wasac.rw</u>
Jeanne MUSABYESEBU	Position: <u>Head of Kayiru Branch</u> Mobile: <u>0788305792</u> E-mail: <u>jeannebyesebu@wasac.rw</u>
BYAMUKISHA Bismillah	Position: <u>Head of branch</u> Mobile: <u>0788307824</u> E-mail: <u>byamukisha@wasac.rw</u>
Jean Paul KAYITARE	Position: <u>Head of zoning &amp; mapping services</u> Mobile: <u>0782271580</u> E-mail: <u>jp kayitare@wasac.rw</u>
Désiré KAYIRU	Position: <u>Head of Billing Management Service</u> Mobile: <u>0788307664</u> E-mail: <u>dkayiru@wasac.rw</u>
Felix Gatwazi	Position: <u>Manager of Customer Service</u> Mobile: <u>0788305791</u> E-mail: <u>fgatwazi@wasac.rw</u>
Sharamanga Patrick	Position: <u>PR Specialist</u> Mobile: <u>0788301314</u> E-mail: <u>psaramanga@wasac.rw</u>
Grimeloro Mely Robin	Position: <u>Secretary</u> Mobile: <u>0788553302</u> E-mail: <u>grmeloro@yahoo.fr</u>
Hiroshi TAKASHIMA	Position: <u>JICA Expert</u> Mobile: <u>0333-828-688</u> E-mail: <u>hiroshi_takahima@ke-911.jp</u>
	Position:

10





5. Comments raised from SC members (Memorandum)

<b>PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK</b>	
<b>Memorandum of meeting</b>	
<b>Name</b>	The First Steering Committee Meeting
<b>Date</b>	2017/04/03, 9:00 – 11:30
<b>Venue</b>	Galaxy Hotel
<b>Participants</b>	<p><b>Official from MININFRA:</b> KAYITESI Marceline</p> <p><b>WASAC:</b> 13 members (RUTANGUNGIRA Methode, RUTERANA Lucien, BAHIGE J Berchmas, GASHUGI Innocent, MUREKEZI Dominique, MWAMBUTSA Celestin, KAYITARE J. Paul, KAYIRU Desire, GATANAZI Felix, MUSABYEYEZU Jeanne, BYAMUGISHA Bernard, MUTAMBA Jane, SHARANGABO Patrick)</p> <p><b>JICA Rwanda Office:</b>( NAGASE Tomonori, AYA Kagota, REBERO J Amour)</p> <p><b>JICA Head Quarter:</b> TAKASHI Kaji</p> <p><b>JICA Long Term Expert on the Project:</b> MASANOBU Mayusumi</p> <p><b>JICA experts:</b> 11 members (MASANOBU Mayusumi, SHIGEO Otani, HIROYUKI Higuchi, HIRAYASU Yoda, TORU Toyoda, HIROSHI Takashima, CHIAKI Suzuki, NOBUYUKI Tsutsui, MARCHEL Brouwer, ITANGISHAKA Vedaste, Gikundiro Rosine Merly)</p>
<b>INTRODUCTION</b>	
<p>The steering Committee meeting on 2017/04/03 was authorized by the instruction of contract paragraph and annex indicating the project outputs, work plan and all stakeholders involved in its implementation signed on March 30<sup>th</sup>,2016 between WASAC and JICA concerning the 3years Project for strengthening Non-Revenue Water Control in Kigali City Water network, the purpose of the meeting was to review the project progress and the approval of the next Work Plan Phase II.</p>	
<p><b>1.The agenda was as follow:</b></p> <ul style="list-style-type: none"> <li>• Introduction of participants</li> <li>• Remarks by WASAC</li> <li>• Remarks by JICA Rwanda representative</li> <li>• Progress of the work Approval of Work Plan2</li> <li>• Question and Answer</li> <li>• Work Plan for Phase 2</li> <li>• Report of Training result in Japan</li> <li>• Proposal of Capacity Development Plan for Phase2 by JICA</li> </ul>	

- Closing Remarks.

## **2.Introduction of Participants**

The Steering Committee meeting started by giving 10 minutes to the participants to introduce themselves.

## **3.Remarks by CEO WASAC**

We heard the CEO remarks through Director of UWSS because CEO was called urgently in other meeting with RDB for the preparation of a very important meeting which will take place in the country. Mr. Methode says that CEO apologizes for his absence but he is supporting the project every day. Mr. Methode started by thanking the representative of MINIFRA, the representative of JICA and everyone present in the meeting for coming on time, and he said that we are having the steering committee this morning to evaluate how far we are, the challenges we are facing and the progress, we have 4 outputs according to those outputs that we are going through all of these and see how we can improve (see the challenges and how we can catch up and speed up)and we will have presentation on progress. And also we will get phase two and have same understanding where we think we can access to achieve our goals on time through knowing where we are by this presentation. After Mr. Methode declares the Steering Committee open officially.

## **4.Remarks by JICA Rwanda representative**

The representative of JICA in Rwanda said that this technical project has been implemented since August,2016 to control NRW in KIGALI city water network and we ensure that the JICA expert team are let this project be successful. Mutual understanding and corporation between JICA and WASAC will make the project to reach its goals. Mr. Nagase conclude by asking all the participants in the meeting to come up with the same understanding and the way how we can improve.

## **5.Progress of the work &Approval of work plan 2 by Mr. Bahige**

Mr Bahige started by emphasizing on the importance of this project due to the fact that WASAC as many utilities cross the world still facing a high level of NRW where 35 % of water produced is being lost. Mr Bahige presented the improvement observed for the last 2 years and WASAC the commitment for NRW reduction at the acceptable level in the 5 coming years. He thanks also the implication of different partners and specially JICA to assist WASAC for the achievement of the NRW reduction

An overall of the project: the main goal is to strength the capacity of WASAC to address or reduce NRW. Mr. Bahige presents 4 Outputs which will help for better understanding how far with the project.

#### OUTPUT 1: PLANNING CAPACITY OF NRW REDUCTION OF WASAC IS ENHANCED

This output consists mainly of the preparation of a five years' strategic action plan that will guide WASAC for the implementation of strategies for NRW reduction in the 5 coming years. The preparation of the 5 years strategic action plan started by assessing the current situation of WASAC, to know root causes of NRW, to make an inventory survey of facilities and to reduce NRW. The NRW project team composed by JICA Experts and WASAC did not meet the deadline until June about the preparation of 5 Years strategic action plan, because it's took more time than expected to get all information that we needed. The idea behind the visit of 20 Branches was to put all things together to help us to identify the strategies we can apply and break them into actions and implement them at each Branch level, senior level also at Head office. The NRW team did a workshop for 3 days on the preparation of five years' strategic action plan and they found that NRW in WASAC is not caused only by leakage from pipe but also existing challenge in Design, compliance of standards, budget constraint, etc... The full report of the assessment of the current situation will be presented as soon as the preparation of the 5 Years strategic plan will be completed. After the presented of the output 1 progress, Mr. Bahige requested the Steering committee to allow the project management team (WASAC team and Japanese Experts) to continue this activity up to August 2017 but the draft report should be presented in June 2017.

#### OUTPUT 2: TRANSFER KNOWLEDGE, SKILLS AND TECHNIQUE&TRAINING, WORKSHOP ON NRW ARE ACQUIRED BY WASAC

This output consists of strengthen WASAC staff capacity trough in house training, on job training and exposure visit in Japan and other countries. In this output training has been already conducted by JICA Experts in GIS & Hydraulic analysis. In this month, also JICA experts is conducting a training in leak detection and pressure management and another expert conducted In-Room training and OJT for pipe repair and service connection. The training in Japan (exposure visit ) was also provided to the project management team where 5 WASAC managers went to japan in January 2017 . Mr. Bahige showed different pictures about the training. One was the training with GIS&Hydraulic calculation , another picture showed the Leak Detection and Pressure Management with another JICA expert team conducted a survey from Nzove WTP to Ntora reservoir and they are being trained how to make leak detection and pressure management.

### **OUTPUT 3: WASAC LEARNED HOW TO CONDUCT NRW REDUCTION MEASURES THROUGH THE IMPLEMENTATION OF PILOT PROJECT**

The output 3 consists of the creation of 2 pilot zones where can be implement strategies for NRW reduction and later extended for the all WASAC entire water network. Two pilot DMAs was created by the help of JICA Experts: **KADOBOGO** (In Kacyiru Branch) and **RUNDA** (In Nyarugenge Branch). The procurement of some equipment has already done like valves to isolate two areas and 400 customer meter for the replacement, chambers are being constructed and 5 bulk water meters water meters are being procured and will be installed to measure NRW and implement strategies for the reduction, All actions which will be implemented in those two areas will also be implemented in other areas. This output is in good progress.

### **OUTPUT 4: ESTABLISH THE SYSTEM TO MEASURE NRW RATE ACCURATELY IN 4 BRANCHES.**

This is about the hydraulically isolation of Branches in Kigali. Already two Kigali branches ( Kanombe and Remera) have been isolated by SUSWAS, this project left with 4 Branches. The isolation will help the Branches to known the water balance for each Branches. This will be possible through the placement of mechanical water flow meter and magnetic water flow meter. Manholes and chamber have been already constructed, but the flow meters it will take more time than expected there will be a delay for 3 months to 6 months because it is under procurement of JICA.

**QUESTION:** Mr. Méthode requested that JICA procure these equipments as soon as possible for to regain the delay of the Output4.

**ANSWER:** Mr. Kaji answered that JICA is on the processing for procurement now and will try to our best for shortening.

### **6.Work plan for phase two by Mr. Otani**

Mr. Otani showed the schedule of work plan for phase two based on the delay of the Project which Mr. Bahige has presented the four output before. Phase one is undergoing up to June and phase two is undergoing from July this year to June 2019 activities which cannot be finished in the phase one will be shifted in the phase two. In the term of output one will be done in August this year and after that an

important seminar will take place to secure the budget. In the term of output two for reduction of NRW activities are carried out on schedule. In the term of output four, Branches will be able to reduce NRW through monitoring system, construction of chamber has been started earlier. Mr. Otani said that between the months of August, and also October / November there will be a training in Japan for WASAC counterpart but now all the details of the training are under consideration.

**QUESTION:** MR. Kaji asked how WASAC will manage to secure the budget after fiscal year budget as the said that the implementation of 5 years action plan will be ready in August and the approve process of 5year action plan? and which organization will approve it?

**ANSWER:** Mr. Methode answered that WASAC can't make the budget if they don't have the five years' strategic action plan so they will have to wait. For 5years strategic action plan and actions to be taken, but he said that each year WASAC have budget of NRW so if the budget isn't enough they will ask for help to JICA. And for the approval process of 5 years action plan, Mr. Methode said that will be a kind of seminar or workshop in the presence of MININFRA by the approval of the board of WASAC.

**QUESTION:**Ms. Marceline from Mininfra asked how this project will help WASAC to distinguish commercial and technical losses, and how it will know the measures and causes.

**ANSWER:** Answered by Mr. Lucien that it is a big challenge for WASAC to know commercial and technical which is assuming now. But by the help of JICA experts they will figure out.

#### **7.Report of Training result in Japan by Mr. Bernard**

He started by thanking JICA to allow them to go in Japan, which is a high developed country to go and learn.

Mr Brenard presented different topics discussed during the training in japan and emphasized in the things that can be easily duplicate in WASAC as presented as follow;

- Distribution management system ( block system )
- Leakage survey methods
- Management of distribution map and mapping system
- Meter reading and Revenue collection

The training started from 23<sup>rd</sup> January to 2<sup>nd</sup> February and visited cities like YOKOHAMA & KOBE cities

and saw many important things they have:

**QUESTION:** Ms. Kagota asked the ones who attend the training in Japan how what they learned will fulfill in WASAC implementation.

**ANSWER:** Mr. Felix said that they learn a lot in Japan which will help in WASAC implementation like as block system, and SCADA system (monitor the leakage through the control system). How to record data they can apply it in WASAC because we can't plan without data after this we can take decision In JAPAN they are good in recording everything is recorded small or big. Japan is advanced in Laboratory system, Pressure management system and outsourcing system so if WASAC can adopt it will help them.

Mr. Lucien added that it was good to think about that to bring what they learn in Japan and use it for the implementation but will be somehow difficult because of many factor (Geographic culture) its needs to be analyzed deeply, analyses all systems, go to actions which should come after many visits need to implement after having knowledge

Mr. Innocent said what can help in the WASAC implementation is the planning process, have data for the planning is the priority and from these we can have budget. He recommended in the next training In Japan they can learn from successful stories of developed countries which had challenges before as Rwanda has now and learned how they came up to be successful.

#### **8.Proposal of Capacity Development Plan for Phase 2 by Mr. Kaji of JICA**

Mr. Kaji asked WASAC team that the project purpose is "WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali City", but why WASAC needs NRW reduction?

Make clear like a plan capacity development e.g.;

**-Why WASAC needs to reduce NRW?**

- ✓ It's a way to increase the production, water supply
- ✓ It will help WASAC by finance and administration side.

After all this WASAC must think what capacity is needed.

**-What kinds of capacity WASAC needs to reduce NRW**

WASAC should look for planning capacity for NRW reduction clarify them and breakdown capacity they

need. For example, for the output 2 and output 3 based on these outputs to breakdown capacity they need to achieve goals is better. In those outputs, they need capacity in Hydraulic, in Pressure Management, in Leak Management and in Pipe Repairing. Which section needs those capacity, the persons in charge this project must be done co-workers, and also needs Capacity assessments for the Member of action team. Beginning of phase two we will talk about capacity development planning and conduct it

#### **9. Closing Remarks by Marceline from MININFRA**

Ms. Marceline closing by thanking everyone who participated in the meeting, and she believes that it was informative fruitful one, few remarks, questions have been asked what we need to reduce NRW, strength the capacity of WASAC in terms of NRW and national target. Reach universal resources by 2020 to ensure all Rwandans have access on clean water. Project emphasis that we are trying to make global target as an African country is our country we will reach our target not only have infrastructure but also have clean water to our people (Rwanda assure new target, establish of water and sanitation services this goal with efficiency & emphasis of the project through JICA).



The country is going forward to our country vision as positioning our service in middle income countries, so there is a lot to do in terms of NRW for WASAC to reduce 25% until 2020, this emphasis that we will have to do our best in terms of capacity building. Thank you for the participation the ministry of infrastructure will be continuing to work with WASAC and JICA and give necessary support as required.




**Technical Cooperation for Strengthening NRW control in Kigali City Water Network**

**Project progress**

**Steering committee meeting**  
Kigali , 03 April 2017

Contents	Summary of the Project
<b>1) Overall Goal</b>	WASAC conducts NRW reduction measures as planned for Kigali city.
<b>2) Project Purpose</b>	WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.
<b>3) Outputs</b>	<b>[Output 1]</b> Planning capacity of NRW reduction of WASAC is enhanced.
	<b>[Output 2]</b> Basic knowledge, skills and technique on NRW control are acquired by WASAC.
	<b>[Output 3]</b> WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.
	<b>[Output 4]</b> 4 branches in Kigali establish the system to measure NRW rates accurately.

WASAC Ltd, February 2017

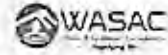


Activities Sub-Activities	Plan Actual	1st Year				2nd Year																			
		I	II	III	IV	I	II	III	IV																
		8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	
1.1 Organize the team for 5-year Strategic Action Plan for NRW reduction preparation	Plan Actual	■																							
1.2 Assess NRW reduction measures currently conducted by WASAC	Plan Actual		■	■	■	■	■	■	■																
1.3 Propose methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan																								
	Actual																								
1.4 Inventory surveys for facilities improvement	Plan																								
	Actual																								
1.5 Prepare a report on the necessary facilities improvement.	Plan																								
	Actual																								
1.6 Identify necessary organizational and institutional changes	Plan																								
	Actual																								
1.7 Prioritization and schedule facilities improvement and organizational and institutional changes identified	Plan																								
	Actual																								
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan																								
	Actual																								
1.9 5-year Strategic Action Plan on NRW reduction preparation	Plan																								
	Actual																								
1.10 Organize seminars and presents 5-year Strategic Action Plan for NRW reduction.	Plan																								
	Actual																								



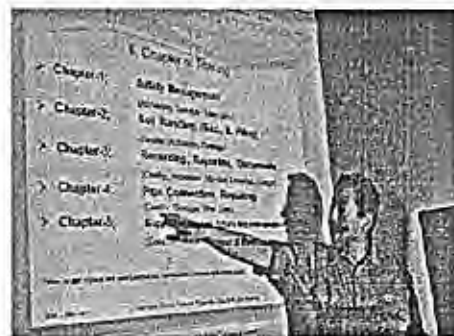


Output 2 : Basic knowledge, skills and technique on NRW control are acquired by WASAC.



Activities	Plan	1st Year				2nd Year				3rd Year			
		Actual	I	II	III	IV	I	II	III	IV	I	II	III
Sub-Activities	Actual	1	2	3	4	1	2	3	4	1	2	3	4
2.1 Training materials on NRW control are prepared.	Plan	■											
	Actual	■											
2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan		■										
	Actual		■										
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan		■										
	Actual		■										
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic model.	Plan		■										
	Actual		■										
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan			■				■					
	Actual			■				■					
2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are	Plan			■				■					
	Actual			■				■					
2.7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan			■				■					
	Actual			■				■					
2.8 Training materials on NRW are reviewed and updated.	Plan											■	
	Actual											■	
2.9 Based on feedback of Activities from 2-4 to 2-8, training programs are developed and training courses are planned.	Plan							■					
	Actual							■					

WASAC Ltd, February 2017



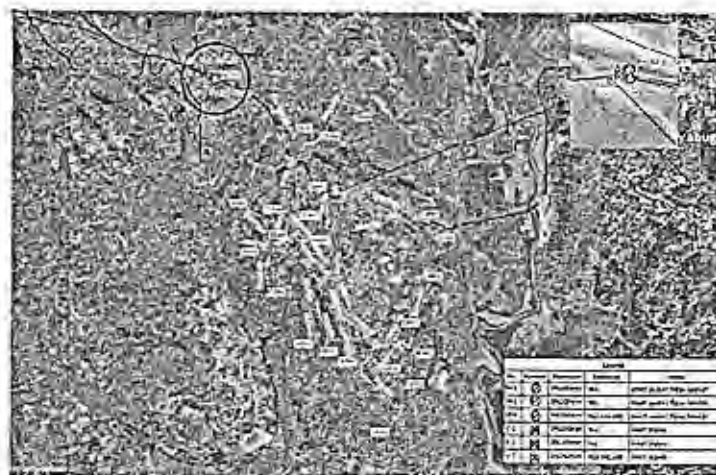




### Kadobogo (Kiyovu) DMA



### Ruyenzi (Runda) DMA





**Output 4: Establish the system to measure NRW rates accurately in 4 Kigali branches ( Isolation of 4 branches )**



Activities	Sub-Activities	Plan	1st Year				2nd Year				3rd Year															
			I	II	III	IV	I	II	III	IV	I	II	III	IV												
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
4.1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary	Plan	■																							
		Actual	■																							
4.2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by	Plan		■																						
		Actual		■																						
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.	Plan			■	■																				
		Actual			■	■																				
4.4	System input to each of 4 branches is measured.	Plan																								
		Actual																								
4.5	Based on the results of Activity 4.4, NRW rates for each branch are calculated and reported	Plan																								
		Actual																								

WASAC Ltd, February 2017



**Location map for 4 branches Isolation**





Total of 32

MAG flowmeters

50	1
80	8
100	4
125	1
150	5
200	7
250	1
300	1
400	3
600	1
<b>Total</b>	<b>32</b>

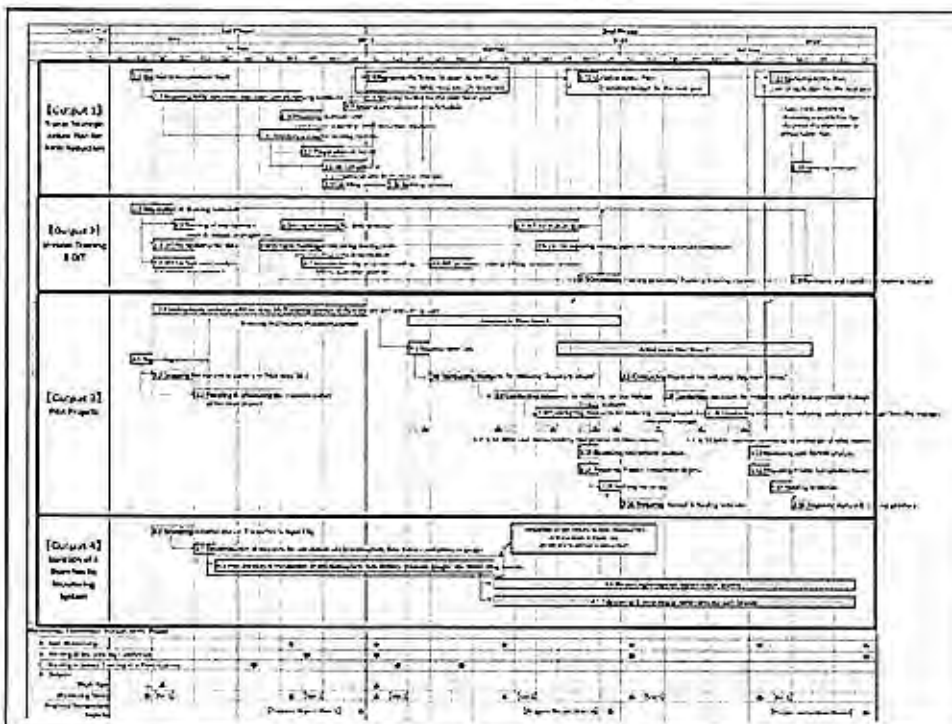
### Summary

Outputs	Progress	Comment
1. Planning capacity of NRW reduction of WASAC is enhanced (SYSAP)	<input type="radio"/>	Delay of 2 months (Up to August 2017)
2. Basic knowledge, skills and technique on NRW control are acquired by WASAC.	<input type="radio"/>	Good progress
3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	<input type="radio"/>	Good progress
4. Establish the system to measure NRW rates accurately in 4 Kigali branches ( Isolation of 4 branches )	<input type="radio"/>	Delay of 6 months (Up to December 2017)

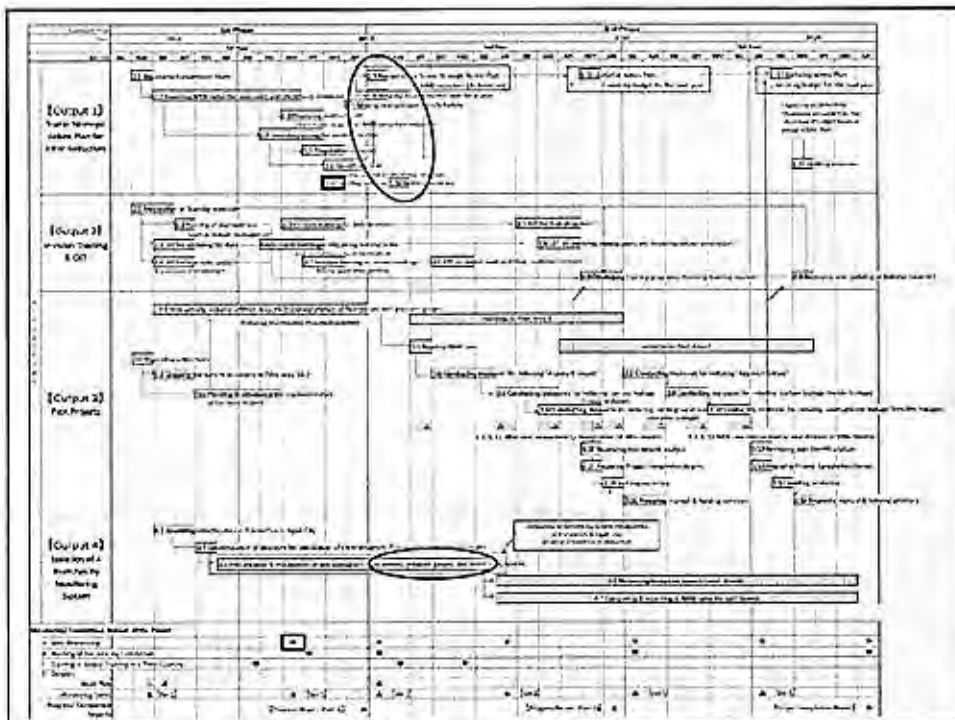
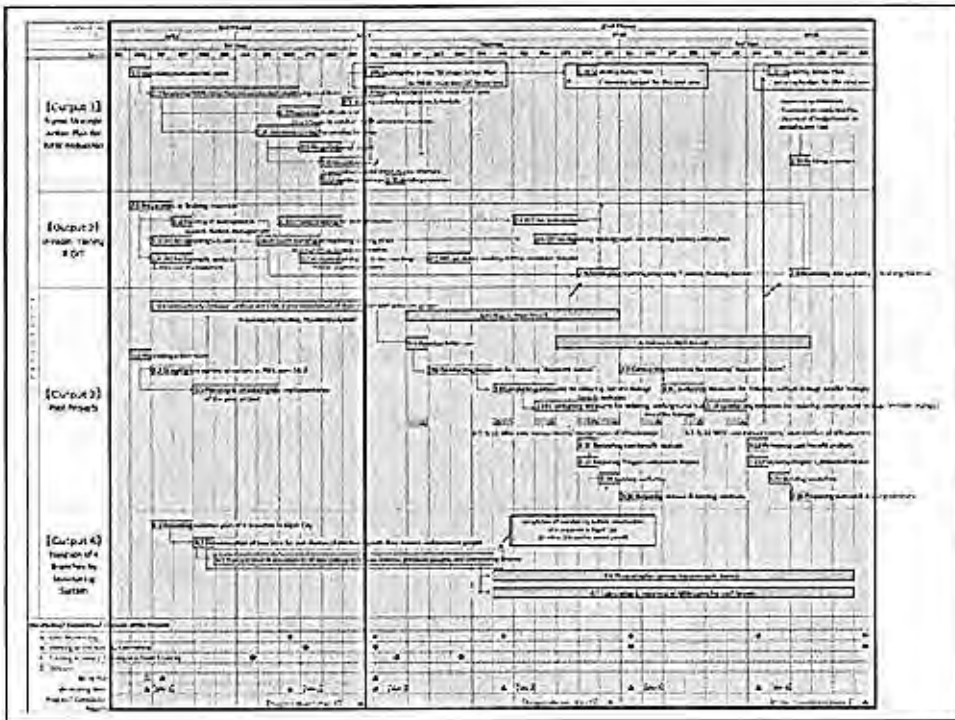


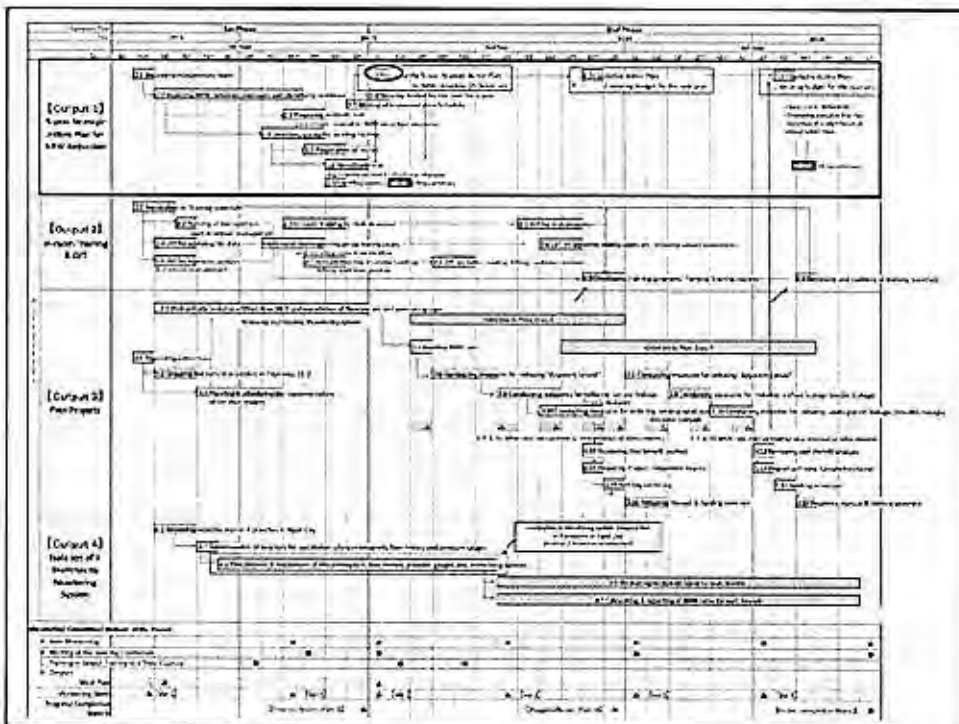
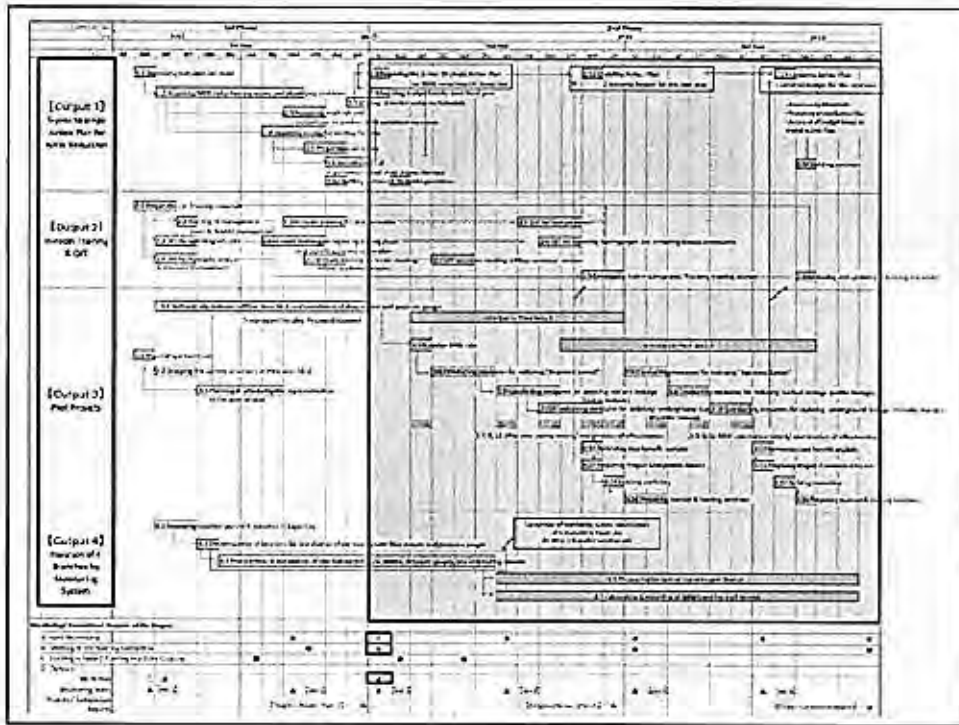
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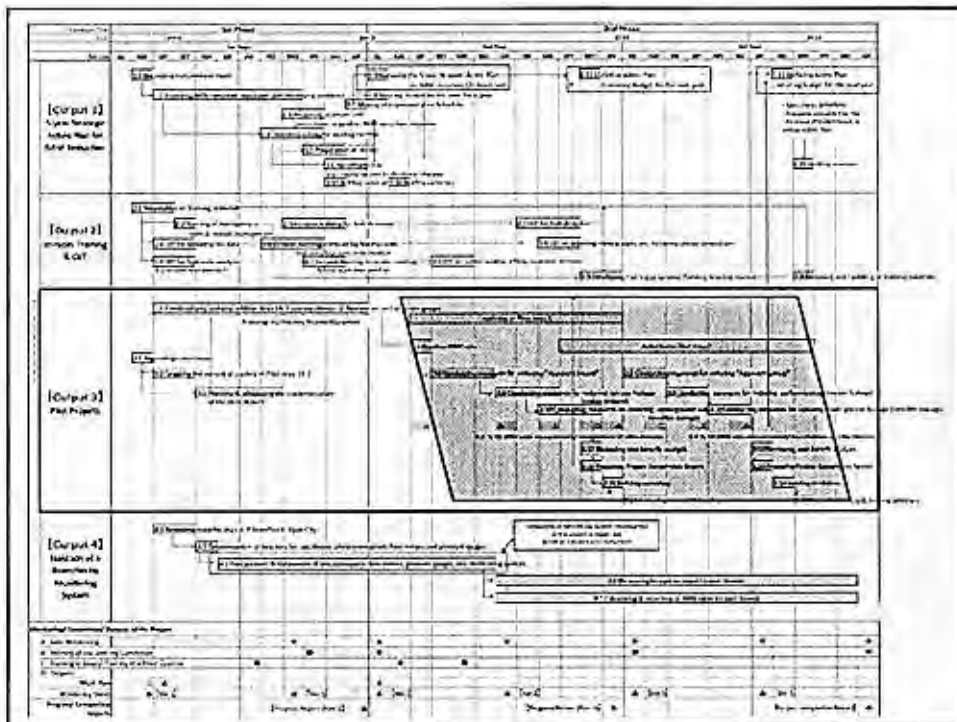
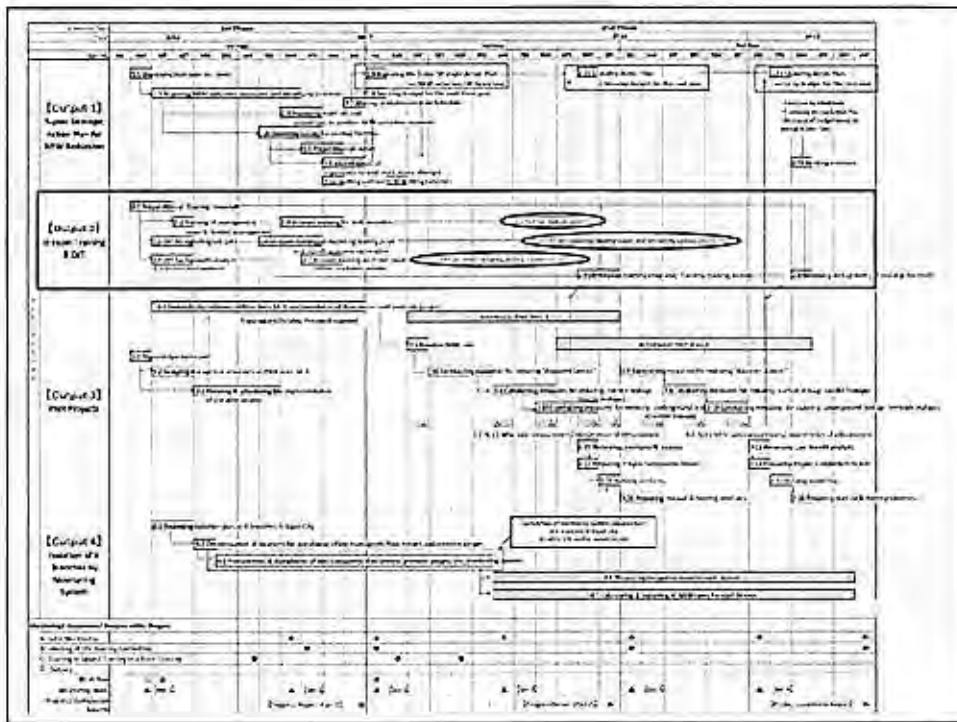
## Schedule of Work Plan for Phase 2









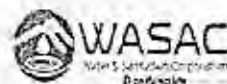




**Thank you very much**



## REPORT OF TRAINING FOR WASAC STAFF IN JAPAN



Duration : January 23, 2017 to February 02 , 2017

Participants : DUWSS , Manager NRW , Manager Customers  
Services, Branch managers ( Nyarugenge and Gikondo)

Training program :

- Distribution management system
- Leakage survey methods
- Management of distribution map and mapping system
- Meter reading and Revenue collection

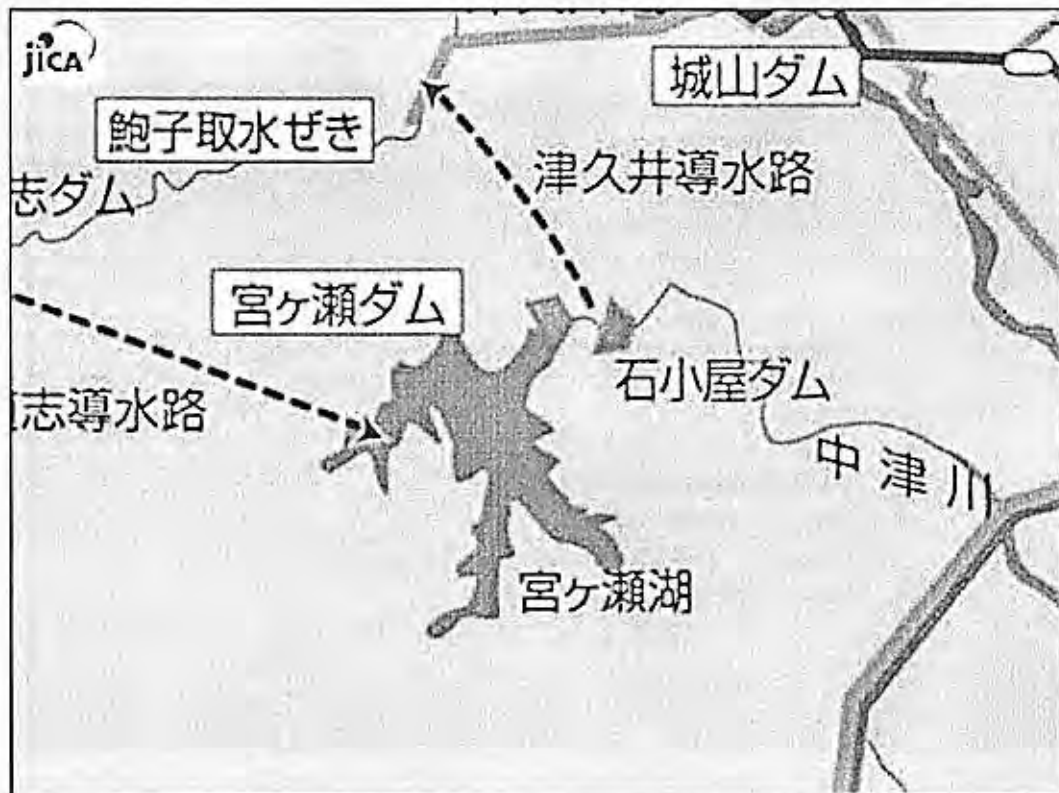




## Water Supply Management



Water sources in Yokohama City:

- Dams
- Rivers
- Wells
- Lakes



### Water Distribution Block System

- Easy understanding of actual water situation
- Improvement of O&M at normal condition
- Improvement of the emergency response

## Water Distribution Block System

- To split and subdivide properly the water distribution zone by distribution series and area characteristic.
  - One Distribution Reservoir in each area
  - Division of Gravity Flow area and Pumping area
- (1) Large one has a distribution reservoir in each distribution area.
- (2) Pumping station is installed in one place.
- The Block system has Large and Middle Blocks

## Water Leakage Management





## Types of Leak detection survey

Touch the tip of acoustic bar to top of the water meter, and listen the leakage noise transmitted to the bar directly with ear.



## Strategy of Leak Prevention

Measures	Items	Activities
Basic Measures		
	Preparation	<ul style="list-style-type: none"> <li>Secure the fund and manpower</li> <li>Develop the drawings for pipeline</li> <li>Set the area for survey</li> <li>Develop the equipment</li> </ul>
	Field Survey	<ul style="list-style-type: none"> <li>Analyze the distribution amount, leakage amount, water pressure, etc.</li> <li>Analyze the leakage including cause</li> </ul>
	Development of pipe materials	Improve the materials for distribution / service pipe, pipe joints, fittings, etc
	Study and research for technology	<ul style="list-style-type: none"> <li>Develop the methods of measuring leakage, detecting buried pipe</li> <li>Develop the methods of detecting / repairing the water leakage</li> </ul>

Water Balance in YWAB Breakdown of Distribution of Water			
System Input Volume (100%)	Revenue Water (91.1%)	Billed metered consumption (including firefighting use)	91.1%
	Non-Revenue Water (8.9%)	Billed unmetered consumption (compensation for damage)	+0.0%
		Unbilled metered consumption (settlement discount)	0.3%
		Unbilled unmetered consumption (used by utility)	0.8%
		Unauthorized consumption (illegal connection)	+0.0%
		Customer meter inaccuracies (faulty meter)	1.9%
		Leakage/over flow	5.9%

### Meter-Reading's Outline

1. Water-Meter's General Info
2. Outline of Customer's I.D.
3. Essential Gadgets for Meter-Reading

- ❖ Meter-Reading Period-> Usually 17 business days
- ❖ Reexamination period-> 2 business days
- ❖ [Obstacle, During water leakage repairs or leaving etc..]

Customer's I.D.



### Essential Gadgets for Meter-Reading

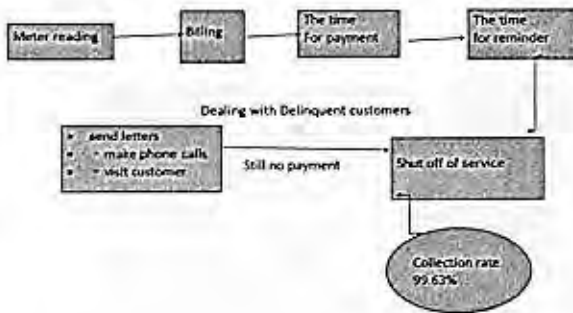


<p><b>Previous: Direct Management</b></p> <p>1. Quality of services</p> <ul style="list-style-type: none"> <li>• Full support</li> <li>• Quick and Precise response</li> <li>• Experience is conveyed</li> </ul> <p>Win!!!</p>	<p><b>Present: Outsourcing</b></p> <p>1. Quality of services</p> <ul style="list-style-type: none"> <li>• Limited support</li> <li>• Limited response</li> <li>• Lack of Experience chronically</li> </ul> <p>Lose !!!</p>
<p>2. Cost</p> <ul style="list-style-type: none"> <li>• Lifelong employment system</li> <li>• Difficult Employment adjustment [reduction]</li> <li>• Labor and Benefit management are needed</li> </ul> <p>Lose!!!</p> <p><b>For the Quality of Services</b></p>	<p>2. Cost</p> <ul style="list-style-type: none"> <li>• Flexible employment status</li> <li>• Employment adjustment become easy</li> <li>• Only contract payment</li> </ul> <p>Win!!!</p> <p><b>For Money Saving</b></p>





## How do we Collect Water Fees?



Thank you!!!

## 1st Steering Committee

### The Project for Strengthening Non-Revenue Water Control in Kigali City Water Network

#### Capacity Development in Phase 2

03 Apr. 2017

Takashi KAJI  
Water Resources Group,  
Global Environment Department, JICA

## PDM

**Project Purpose**: WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali City

- **Output 1**: Planning capacity of NRW reduction of WASAC is enhanced
- **Output 2**: Basic knowledge, skills and technique on NRW control are acquired by WASAC
- **Output 3**: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Projects
- **Output 4**: 4 branches in Kigali establish the system to measure NRW rates accurately

2

**Why WASAC needs to  
reduce NRW?**



**Two Goals**

- To improve efficiency in use of water resources
- To improve management of WASAC

Reduction of NRW is not a goal, but a process to achieve the two goals.

3

**What kinds of capacity  
WASAC needs to reduce NRW?**



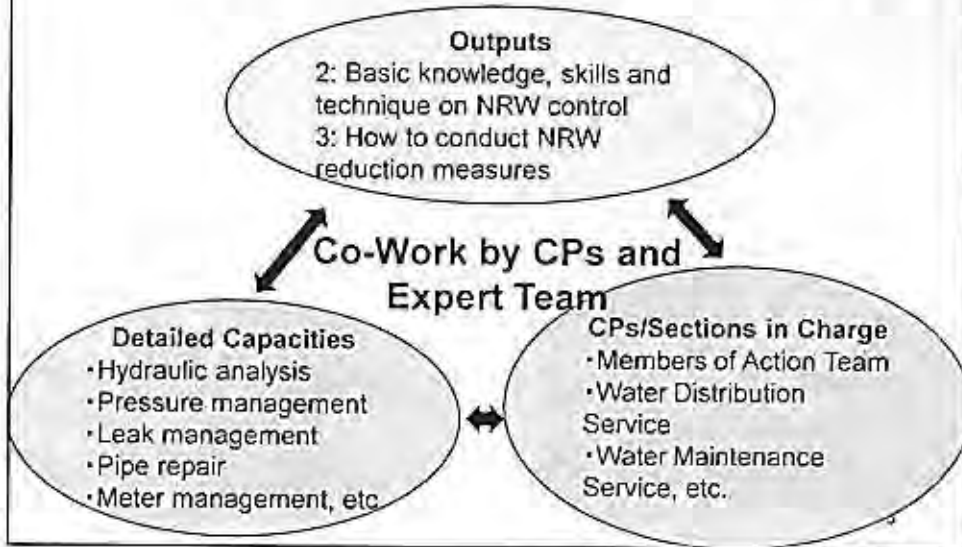
- Planning capacity for NRW reduction (Output 1)
- Basic knowledge, skills and technique on NRW control (Output 2)
- How to conduct NRW reduction measures (Output 3)

What are planning capacity, basic knowledge, skills, and technique for NRW control?

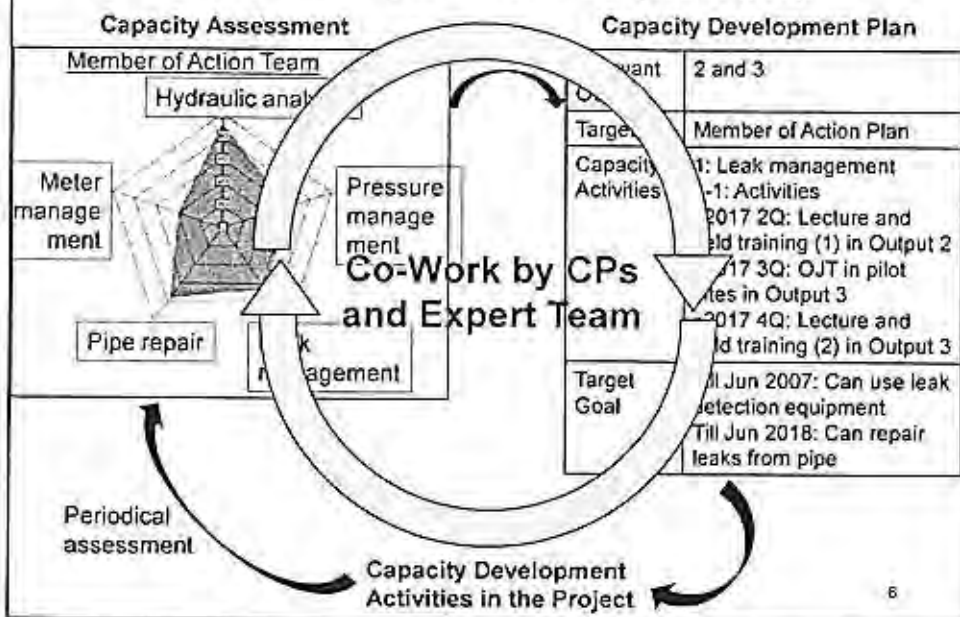
4

# Capacity Development in The Project

## Identification of Necessary Capacities (example)



## Capacity Assessment, Capacity Development Plan, and Implementation (example)





# Evaluation of the Project

## Indicators of PDM

	Indicator
<b>Project Purpose</b>	.....
<b>Output 1</b>	.....
<b>Output 2</b>	1: More than XX number of trainees receiving training 2: WASAC human resource development plan includes training programs prepared by the project
<b>Output 3</b>	1: NRW rates are reduced at each pilot area as follows: Pilot area 1: from XX% to XX%; Pilot area 2: from XX% to XX% .....
<b>Output 4</b>	.....



## Achievement by Capacity Development

<b>Relevant Output</b>	2 and 3
<b>Target</b>	Member of Action Plan
<b>Capacity/Activities</b>	1: Leak management 1-1: Activities -2017 2Q: Lecture and field training (1) in Output 2 -2017 3Q: OJT in pilot sites in Output 3 -2017 4Q: Lecture and field training (2) in Output 3
<b>Target Goal</b>	Till Jun 2007: Can use leak detection equipment Till Jun 2018: Can repair leaks from pipe

**MINUTES OF MEETING  
ON THE SECOND STEERING COMMITTEE MEETING  
FOR  
THE PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK IN THE REPUBLIC OF RWANDA**

According to the Record of Discussions (hereinafter referred to as "R/D") for the Project The Project for Strengthening Non-Revenue Water Control in Kigali City Water Network in The Republic of Rwanda (hereinafter referred to as "the Project) signed on the March 30th, 2016 between Water and Sanitation Corporation (hereinafter referred to as "WASAC") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the JICA Expert Team was dispatched by JICA.

The second Steering Committee (hereinafter referred to as "SC") meeting was held by the initiative of WASAC and the JICA Expert Team on the October 12, 2017. On this meeting both sides presented Monitoring Sheet Ver.3 and Work Plan for Phase 2 which was made based on the Joint Monitoring at Management Meeting for the Project held on August 9, 2017.

As a result of the discussions, both sides came to understanding concerning the matters referred the following matters;

1. Progress of the Project

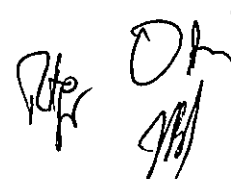
SC members generally understood the progress of the Project based on the result of joint monitoring and some delays which have occurred on activities for Output 1 and Output 4, and accepted that these delayed activities is implemented continuously on the Phase 2 of the Project.

2. 5-Year Strategic Action Plan (5YSAP)

The Final Draft of 5YSAP for NRW reduction was accepted by the SC members. However 5YSAP should be approved by Board of Directors, the Plan can be implemented promptly.

3. Work Plan for Phase 2

SC members generally accepted on the Work Plan for Phase 2 (Ver.3).



#### 4. Project Evaluation

##### 4.1 Verifiable Indicators of PDM

Indicators of Project Design Matrix (PDM) for “Overall Goal”, “Output2”and “Output3” were decided as shown in the Attachment.

##### 4.2 Project Capacity Assessment

SC members generally accepted implementation of the capacity assessment.

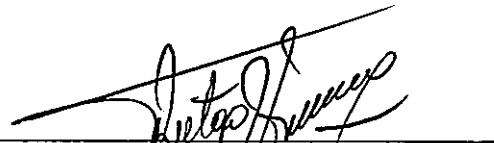
Attachment;

1. Invitation to the second SC meeting
2. Agenda of the second SC meeting
3. Monitoring Sheet ver.3
4. List of Attendants
5. Comments raised from SC members (Memorandum)
6. Presentation Document 1 (Progress of the works)
7. Presentation Document 2 (Output 1-4)
8. Presentation Document 3 (Report of second Training result in Japan)
9. Presentation Document 4 (Work Schedule for Phase 2 and Indicator of PDM)
10. Presentation Document 5 (Capacity Assessment for Phase 2)

Kigali, October 12, 2017



Mr. Shigeo Otani  
Chief Adviser  
JICA Experts Team for the Project



Mr. Methode Rutagunira  
Director of Urban Water and Sanitation  
Services (UWSS)  
Water and Sanitation Corporation (WASAC)  
The Republic of Rwanda



Kigali, 10 OCT 2017  
N° 11.07.024/...../17/DUWSS-CEO/jb

To: Permanent Secretary / MININFRA  
KIGALI

Dear Sir,

**RE: Invitation to the Second steering committee (SC) meeting of the project for Strengthening Non-Revenue Water (NRW) control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the 3 years Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

We hereby request your good office to authorise One official from MININFRA to attend the second (2<sup>nd</sup>) Steering Committee (SC) meeting that will take place at HIGHLAND Hotel on 12<sup>th</sup> October 2017 starting from 9:00 am.

The purpose of the meeting is to review the Project progress and the Approval of the Work plan phase2

The agenda of the meeting is hereby enclosed.

Please accept our appreciation for your usual support

Yours sincerely,

Eng. Aimé MUZOLA  
Chief Executive Officer



CC:

- Hon. Minister of State in Charge of Energy, Water and Sanitation-MININFRA

cl

*"Dignifying Life"*

Kigali, 10 OCT 2017  
N° 11.07.024/...1249/17/DUWSS-CEO/jb

**Chief Representative  
JICA RWANDA**

Dear Sir,

**RE: Invitation to the Second steering committee (sc) meeting of the project for  
Strengthening Non-Revenue Water (NRW) control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the 3 years Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

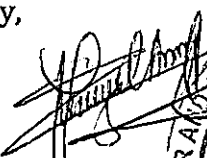
We hereby request your good office to authorise **Mr. Takada HIROYUKI, Mrs. AYA KAGOTA** and **Mr. Jean D'Amour REBERO** to attend the Second (2<sup>nd</sup>) Steering Committee (SC) meeting that will take place at **HIGHLAND Hotel** on 12<sup>th</sup> October 2017 starting from 9:00 am.

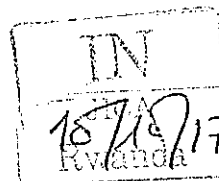
The purpose of the meeting is to review the Project progress and the approval of Work Plan phase 2

The agenda of the meeting is hereby enclosed.

I thank you for your usual cooperation

Yours sincerely,

  
**Eng. Aimé MUZOLA**  
Chief Executive Officer



**CC:**

- Hon. Minister of Infrastructure- MININFRA
- Hon. Minister of State in Charge of Energy, Water and Sanitation-MININFRA
- Permanent Secretary-MININFRA




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**AGENDA OF THE STEERING COMMITTEE**

**PROJECT: STRENGTHENING NRW CONTROL IN KIGALI CITY WATER NETWORK**

**Venue: Highland Hotel**

**Date: October 12<sup>th</sup>, 2017**

Time	Activity	Responsible
9:00	Registration	
9:30	Introduction of participants	
9:40	Remarks by CEO WASAC	CEO, WASAC
9:50	Remarks by JICA Rwanda representative	Mr. Takada/Mr. Nagase, JICA Rwanda
10:00	Purpose of the Steering Committee Progress of the work (Result of the Joint Monitoring)	Mr. Methode, Project Director, DUWSS, WASAC
	Output 1: 5-year Strategic Action Plan for NRW reduction	Mr. Bahige, NRW, WASAC
	Output 2: In-room Training	Mr. Celestin, NRW, WASAC
	Output 3: Pilot projects	Mr. Desire, NRW, WASAC
	Output 4: Isolation of 4 branches	Mr. Jean Paul, GIS, WASAC
11:00	Question and Answer	WASAC, JICA team
11:05	Coffee Break	
11:20	Report of Training result in JAPAN	Mr. Jean Paul, GIs, WASAC
11:35	Question and Answer	WASAC, JICA team
11:40	Work Plan for Phase 2, Project indexes of PDM Capacity Develop Plan	Mr. Otani, JICA team
12:00	Question and Answer	WASAC, JICA team
12:05	Remarks by MININFRA	
12:15	Closing Remarks by WASAC	CEO, WASAC

## PM Form 3-1 Monitoring Sheet Summary

TO CR of JICA RWANDA OFFICE

## PROJECT MONITORING SHEET

**Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in  
Kigali City Water Network**

**Version of the Sheet : Ver.3 (Term: August, 2016 – June, 2017: 1st Phase)**

**Name: Shigeo OTANI**

**Title: Chief Advisor/ Non-Revenue Management**

**Submission Date: August 8, 2017**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## 1-1-1 Japan Side

## (1) List and Assignment Terms of Japanese Experts

## a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda

	Field in Charge	Name	Duration		M/M
			From	To	
Consultant Expert					
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/14	2016/12/11	4.00
			2017/1/15	2016/4/6	2.73
			2017/5/1	2016/5/31	1.03
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2016/8/14	2016/9/27	1.50
			2017/1/15	2017/2/28	1.50
			2017/4/1	2017/6/2	2.07
3	NRW Reduction Plan 1 (1)	Chiaki SUZUKI	2016/8/15	2016/9/13	1.00
			2016/11/10	2016/12/27	1.60
			2017/4/1	2017/5/31	2.03
4	NRW Reduction Plan 1 (2)	Hiroyasu YODA	2016/9/7	2016/11/14	2.30
			2017/1/15	2017/4/10	2.87
5	NRW Reduction Plan 2 (1)	Toru TOYODA	2016/8/15	2016/9/28	1.50
			2017/1/15	2017/4/8	2.80
6	NRW Reduction Plan 2 (2)	Nobuyuki TSUTSUI	2016/9/18	2016/12/16	3.00
			2017/3/18	2017/5/31	2.50
7	GIS	Eita HORISHITA	2016/8/14	2016/11/11	3.00
8	Hydraulic Analysis	Hiroki OE	2016/8/15	2016/11/12	3.00
9	Leak Detection	Junichi TAKAHASHI	2017/3/3	2017/5/31	3.00
10	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO	2017/4/2	2017/6/2	2.07
11	Pipe Repairing and Service Connection (2)	Hiroshi TAKASHIMA	2017/1/15	2017/4/14	3.00
12	ICT	Marcel Brouwer	2016/9/30	2016/12/10	2.40
			2017/2/13	2017/2/13	0.03
			2017/3/1	2017/4/21	1.73
			2017/5/8	2017/5/31	0.80
Total M/M					51.46
JICA Expert					
1	Long-term Expert	Masanobu MAYUSUMI	2017/3/15	2017/6/30	3.50

PM Form 3-1 Monitoring Sheet Summary

b. Working in Japan

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		M/M
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2016/8/5	2016/8/12	0.25
			2017/4/17	2017/4/21	0.25
10	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO	2016/9/26	2016/9/30	0.50
			2016/10/3	2016/10/7	
Total M/M					1.00

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation).

(2) List of Equipment Provided for the Project

Table 1.3 List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1 *	Output 2	Materials and equipments for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	not yet
Lot 2 *	Output 3	Customer mater φ15mm	sets	400	Consultant	Feb. 2017 Completed	not yet
Lot 3 *	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	not yet
Lot 4 *	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	JICA office	Nov. 2017 Scheduled	not yet
Lot 5	Vehicles for JICA use	Onebox and Pickup	Units	2	JICA office	Jan. 2017 Completed	not yet

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 6 *	Output 2: Leak detection equipment (for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Scheduled	not yet
Lot 7 *	Survey Equipment for Output 2 and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items will be used for the training activity during the Project period.

During the Project period, the above mentioned equipment will be utilized and managed by the Project.



## 1-1-2 Rwanda Side

## (1) Counterpart

Table 1.4 List and Assignment Terms of Counterparts

No	Field in Charge	Name	Duration	
			From	To
Steering Committee (SC)				
1	Chairman: CEO of WASAC	James Sano	Aug. 2016	Present
2	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
3	Project Manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
4	Management Team		Aug. 2016	Present
5	Officials from MINIFRA		Aug. 2016	Present
Project Director and Manager				
1	Project Director: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
Management Team (8 persons)				
1	Leader: Director of UWSS	Methode Rutagungira	Aug. 2016	Present
2	Co-leader: Director of CS	Lucien Ruterana	Aug. 2016	Present
3	Co-leader: Director of CFO	Joseph Ruhingura	Aug. 2016	Present
4	Project manager: Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
5	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
6	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
7	Manager of Revenue Management Services, CS	Désiré Kayiru	Aug. 2016	Present
8	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
Action Team (31 persons)				
1	Leader: Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader: Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader: Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Present
4	Co-Leader: Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader: Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader: Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Present
7	Co-Leader: Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Head of water distribution services, WOS, UWSS	Anselme Mugabo Kimenyi	Aug. 2016	Present
10	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Present
11	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Water Distribution Officer of each Branch		Aug. 2016	Present
15	Customer Service Officer of each Branch		Aug. 2016	Present
16	Billing Officer of each Branch		Aug. 2016	Present

Table 1.5 Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Mr. Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Mr. Celestin MWAMBUTSA	Leak detection and pressure management Officer
Output 3	Mr.Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Mr. Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

**(2) Facilities**

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

**(3) Local Cost**

- Cost for administering the Project (utilities for experts offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

**1-2 Progress of Activities**

**1-2-1: Activities relevant to the entire Project**

**(1) Start-up Meeting of the Project for 1st Phase**

Start-up Meeting of the Project was held Aug. 16 at Galaxy Hotel in Kigali with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Introduction of JICA experts and Counterparts (C/P)
- Explanation and discussion of draft of Work Plan (WP)
- Confirmation of understanding of the project contents (Implementation Schedule).
- Condition for selection of pilot project area
- Selection of the members of Action teams and other related teams
- Notes for safety measures
- Agenda and facilitator of the Seminar (Kick-Off Meeting) of August 18th.

The minutes of meeting is attached in Annex 2.

**(2) Kick-Off Meeting of the Project**

Kick-Off Meeting was held on Aug. 18, 2016 at Galaxy Hotel in Kigli to show the contents of the project to person concerned such as Management Team, Action Team, all Branch managers of WASAC and MININFRA. The main topics of the meeting were as follows:

- Explanation of Project Objectives
- Project implementation Structure
- Project Implementation Flowchart
- Introduction of NRW reduction of Yokohama City
- Discussion

**(3) Management Meeting (Joint Monitoring)**

In the joint monitoring conducted at the management team meeting held on March 15, 2017, it was pointed out that the preparation of the 5-year Action Plan for NRW Reduction was delayed for about three months and, therefore, the work plan was reviewed.

Furthermore, it was agreed upon to prepare a draft-version 5-year Action Plan for NRW Reduction by the end of May and report it to the Management Team and all the branch managers at the seminar (to be held on Friday, May 29). As a result of consultation with WASAC, it was agreed upon that the draft version would describe a framework of the project including priority measures, general schedule, and organizations in charge and that the 5-year Action Plan for NRW Reduction would be prepared in June and later. Management Team meetings is to be held once at the end of every month, where the activities carried out by the Action Team are reported, the policies for implementation of the project are approved, and discussions are held regarding coordination between departments in connection with activities, etc. Table below shows the topics discussed.

The minutes of meeting on March 15 is attached in Annex 3.

Table 1.6 Management Team Meetings and Topics Discussed

Meeting	Timing	Themes and topics
No. 1	March 15, 2017	<ul style="list-style-type: none"> <li>•Confirmation of the progress of implementation of the 1st Phase activities</li> <li>•Discussion of the way of proceeding on 5-year strategic action Plan for NRW Reduction</li> </ul>
No. 2	May 12, 2017	<ul style="list-style-type: none"> <li>•Confirmation of the progress of implementation of the 1st Phase activities</li> <li>•Confirmation of the policy for the 2nd Phase activities</li> <li>•Agenda of the seminar for the framework of 5-year strategic action Plan for NRW Reduction</li> </ul>

**(4) Steering Committee**

Steering Committee was held April 3, 2017 at Galaxy Hotel in Kigali with participation of members of Management Team, Action Team and MININFRA. The main topics of the meeting were as follows:

- Report of the Project progress
- Carrying forward works to the 2nd Phase

Followings has been approved that these activities will continue to carry out in 2nd Phase.

Activity of Output 1, the preparation work of 5-year Strategic Action Plan for NRW Reduction, is extended by 3 months to the end of August 2017.

Activity of Output 4, construction of monitoring system, is extended due to the delay in procurement of equipment.

- General explanation of Work Plan 2

The minutes of meeting is attached in Annex 4.

**(5) Weekly Meeting**

As a rule the regular meetings were held at the end of every week, at which the activities for the week were reported, the activities scheduled for the following week were confirmed and pending issue, and matters of concern, requests, etc., were discussed. Also it was utilized as a venue for training, such as explanation of matters proposed by the specialists, etc.

Table 1.7 Action Team meetings and Topics Discussed

Meeting	Timing	Themes and topics
No. 1	August 26, 2016	Work Plan detailed explanation, pilot sites, explanation of procedures relating to hydraulic isolation of the water networks of the branches
No. 2	September 2, 2016	Introduction of the example of DMA in Yokohama City, discussion regarding boundaries between branches (included each branch head), discussion regarding selection of pilot projects
No. 3	September 9, 2016	Selection of pilot sites, coordination of branch surveys outside Kigali City
No. 4	September 19, 2016	Confirmation of pilot site selection survey, confirmation of hydraulic isolation of the water networks of the branches
No. 5	September 23, 2016	Requests for return of branch questionnaires, report on survey outside Kigali city, confirmation of boundaries between branches, use of hydraulic analysis software
No. 6	September 30, 2016	Determination of boundaries between branches, confirmation of procedure for implementation of trial excavation survey for chamber construction, confirmation of pilot site inflow points
No. 7	October 7, 2016	Seminar regarding status of survey regarding hydraulic isolation of water networks of the branches, and proposal of NRW strategy (countermeasures against non-delivery of water and theft of water)
No. 8	October 14, 2016	Seminar regarding confirmation of positions of hydraulic isolation of water networks of the branches, and inventory surveys (confirmation of water meters, customer information and GIS facility information)

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Meeting	Timing	Themes and topics
No. 9	October 24, 2016	Seminar regarding questionnaires on NRW Strategic Action Plan, discussion regarding holding workshops, and analysis and countermeasures relating to public water hydrants and large-scale customers
No. 10	October 28, 2016	Seminar regarding confirmation of positions of hydraulic isolation of branches, and asset management (renewal), DMA construction, and analysis and countermeasures against illegal connections
No. 11	November 4, 2016	Workshop on status of trial excavation surveys for hydraulic isolation of water networks of the branches, and formulation of activity priorities in the NRW Strategic Action Plan
No. 12	November 11, 2016	Status of trial excavation surveys for hydraulic isolation of branches, and recommendations to WASAC regarding the direction of customer service
No. 13	November 18, 2016	Final confirmation of the positions of installation of hydraulic isolation of water networks of the branches
No. 14	November 25, 2016	Final confirmation of the pilot area inflow points, and final confirmation of the equipment, specifications, and chambers
No. 15	January 20, 2017	Explanation of the draft framework of the NRW Strategic Action Plan based on the workshop, discussion regarding formulation of the NRW Strategic Action Plan, implementation of the inventory survey in order to obtain the insufficient data
No. 16	January 27, 2017	Seminar regarding the report on delay of equipment procurement, survey of regional branches, and measures for implementation of the pilot project
No. 17	February 3, 2017	Chamber construction tenders, regional branch survey results
No. 18	February 10, 2017	Seminar on implementation of the WASAC inventory survey, regional branch survey results, chamber construction pending items, and raising awareness
No. 19	February 17, 2017	Seminar on progress of the inventory survey, discussion regarding the draft contents of the NRW Strategic Action Plan, progress of the chambers and equipment procurement, coordination of the Management and SC meetings, and status of high water distribution pressure and methods of analysis
No. 20	February 24, 2017	Seminar regarding results of the regional branch survey, progress of the inventory survey, discussion regarding the method of formulation of the NRW Strategic Action Plan, and the effect and importance of pipe renewal
No. 21	March 3, 2017	Results of the regional branch survey, progress of the inventory survey, discussion regarding the method of formulation of the NRW Strategic Action Plan, chamber construction pending items.
No. 22	March 10, 2017	Results of the regional branch survey, progress of the inventory survey, chamber construction pending items, and seminar introducing the example of NRW reduction measures in Indonesia
No. 23	March 17, 2017	SC meeting coordination, activity progress, and chamber construction pending items
No. 24	March 24, 2017	SC meeting coordination, activity progress, chamber construction pending items, and seminar regarding water meters and their specifications
No. 25	April 19, 2017	Progress of the inventory survey, seminar to reconfirm the method of formulation of the NRW Strategic Action Plan, and the water leakage detection survey and analysis results

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Meeting	Timing	Themes and topics
No. 26	May 3, 2017	Chamber construction pending items, SC seminar, confirmation of the details of the joint seminar on water leak detection and distribution pipe repair
No. 27	May 19, 2017	Chamber construction pending items, progress of the inventory survey, confirmation of the timing for holding the Strategic Action Plan for NRW Reduction Workshop, details of the seminar on high water pressure and hydraulic analysis

**(6) Revision of Work Plan**

The draft of Work Plan was presented by JICA Expert Team at Start-up Meeting of the Project, and Kick-Off Meeting of the Project. It was revised on Sept. 15, 2016 as Ver.1 and on March 13, 2017 as Ver.2 according to progress of the meantime. The Work Plan Ver.2 is attached in Annex 5.

**(7) Project Progress Report (Part 1)**

Project Progress Report was prepared at the end of 1st Phase of the Project. The Project Progress is as attached in Annex 6.

**1-2-2: Training in Japan and in the 3rd Country**

**(1) Training in Japan**

Table 1.8 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5 persons	- Introduction to water service management and NRW - Outline of water facilities in Yokohama and Kobe Cities and other matters
2	August 14 to 30, 2017 (planned)	Business affairs and GIS matter	10 persons	- Introduction to water service management and NRW - Customer information management, meter management and reading, and water service management - Examples of how local governments utilize GIS, purposes of use, and other matters
3	November 2017 (planned)	Technical matter	10 persons	Introduction to NRW, pressure management, leak detection, distribution management, and other matters (under review)

The following member participated in the training in Japan between January 1, 2016 and February 2, 2017.

Table 1.9 Member of 1<sup>st</sup> Training in Japan

	Names	Position
1	RUTAGUMGIRA Methode	Director, Urban Water and Sewerage Services ( Project Director )
2	BAHIGE Jean Berchmans	Manager, Non-Revenue Water ( Project Manager)
3	GATANAZI Felix	Manager, Customer services
4	BYAMUGISHA Bernard	Head of Branch /Nyarugenge
5	MUTAMBA Jane	Head of Branch /Gikondo

Table 1.10 Schedule of 1<sup>st</sup> Training in Japan

No	Day		Travel	Type	Contents	Organizer
1	2017/1/21	Sat	Kigali→			
2	2017/1/22	Sun	Yokohama		Arrival	
3	2017/1/23	Mon	Yokohama	Lecture	Training briefing Programme Orientation Distribution management system Courtesy call to the Yokohama City Water Works Bureau	JICA Yokohama Yokohama City Water Works Bureau
4	2017/1/24	Tue	Yokohama	Lecture	Block system of Yokohama City Customer Meter Management	Yokohama City Water Works Bureau
5	2017/1/25	Wed	Yokohama	Practical training, Visit	Mapping system Visit a Water Service Memorial Visit at Water Treatment Plant (Nishiya)	Yokohama City Water Works Bureau WTP of Yokohama City
6	2017/1/26	Thu	Yokohama	Lecture Practical training	Quality control and inspection system of service connection Leakage Detection Survey	Yokohama City Water Works Bureau WTP of Yokohama City
7	2017/1/27	Fri	Yokohama		Discussion, Training Evaluation Closing meeting	JICA Yokohama
8	2017/1/28	Sat	Yokohama→ Kyoto			
9	2017/1/29	Sun	Kyoto→Kobe			
10	2017/1/30	Mon	Kobe	Lecture, Visit	Courtesy call to the Kobe City Water Works Bureau History of the City Water Works Visit to facilities	Kobe City Water Works Bureau
11	2017/1/31	Tue	Kobe	Lecture, Visit	NRW Reduction Measure Pressure Management Water Demand Projection Visit to facilities	Kobe City Water Works Bureau
12	2017/2/1	Wed	Kobe→ Yokohama		Discussion, Training Evaluation Closing meeting	JICA Kansai
13	2017/2/2	Wed	Tokyo→Kigali		Departure	

**(2) Training in the 3rd country**

Not yet conducted

**1-2-3: Activities of Output****【Activities of Output 1】**

**: Planning capacity of NRW reduction of WASAC is enhanced.**

1-1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.

The member of the management team is appointed formally in August 2018 by CEO, and formation is finished.

1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

- Questionnaire survey has conducted for 20 Branch Offices in September 2016 and the answers to the questionnaire are summarized in October 2016. The result was explained for NRW team and discussed it on November 8, 2016 .
- Site visit survey for three Branch Offices, Ruwamagana, Nagatare and Ngoma, was conducted in September 2016 to confirm existing activities of WASAC branch offices, the situations of facilities, and evaluate it.
- The site visit survey for remaining 11 Branch offices (Musanze, Ruvavu, Gicumbi, Ruhango, Nyanza, Huye, Nyamagabe, Karongi, Rusizi, Bugesera, Muhango) was conducted from the middle of February until the beginning of March, 2017.
- Based on the process shown in table below, information was shared at each meeting and workshop, and WASAC identified the issues regarding measures against non-revenue water.

Table 1.11 Process of Assess NRW Reduction Measures

No	Item	Implementation period	Details
1	Distribution of questionnaires to the 20 branches	Sept. 2016	Organization, outline of water supply facilities, customer information, NRW percentage, flow rate meters, water leakage investigation equipment, pipe repair equipment, water theft, water meters, etc.
2	Analysis of questionnaires	Sept.-Oct.2016	
3	Seminar	Nov. 8, 2016	on the questionnaire analysis results
4	Field surveys and reporting and issue identification at weekly meeting	Sept.2016 to March 2017	Confirmation of questionnaires, visits to facilities, interviews with branch managers, operators, etc., sharing survey results.
5	NRW strategic action plan workshop GPI	March 20-22, 2017	NRW reduction plan: Workshop on identification of issues

From the WASAC side, many issues were identified, such as (1) Organization (low priority for NRW reduction within WASAC, insufficient personnel and budget, insufficient coordination between departments), (2) Systems (NRW reduction procedures, regulations for new water supply connections (existing pipe connections, material selection), insufficient sharing of information between branches), (3) Equipment (insufficient pipe materials, heavy machinery, vehicles, tools, etc.), (4) Knowledge/awareness of the personnel (insufficient specialist technologies, insufficient ownership), (5) Asset management (maintenance, renewal of pipelines and valves). From the specialist side the issues were, a: Design/standards/records (long-term renewal plans, various types of design, material standards, criteria for new connections, drawings, insufficient control documents), b: Management of outsourced construction



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(insufficient inspection after appointment of contractor), c: Accuracy of basic data (GIS, customer data, details of various types of facility, drawings). Also, issues regarding facilities that were recognized in common included systems for measuring NRW percentage, high water distribution pressures (water delivery pipe branches, water delivery pumps, locations of water distribution reservoirs), water leakage surveys, repair of distribution pipe, management of water meters, management of public water hydrants, management of water theft, etc.

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

From the information obtained in Activity 1-2 and the survey of the 6 branches within Kigali City and the existing water supply facilities (field surveys, questionnaires, GIS, water consumption data), the issues were identified, and the countermeasures and orders of priority as of November 2016 are summarized in the Table below.

Table 1.12 Countermeasures against NRW (proposals as of November 2016)

Topic	Measures	Total			Evaluation
		Yes	No	Priority	
Topic-1: WASAC Strategy	○Attention shall be paid not only to customers but also to non-served population	0	0	6	High
	○WASAC should carry out household surveys at 20 branches, visiting non-served households and illegal water users	0	0	7	
	○WASAC shall register illegal water users as normal customers	0	3	2	
	○WASAC shall prepare a conceptual long term development plan	0	0	8	
Topic-2: Needs of Quality Data	○Customer survey at all branches	0	0	8	High
	○On-site meter calibration	0	0	8	
	○Update all customer data	0	0	11	
	○Meter replacement at all branches	0	0	6	
	○Update and validate GIS pipe network	0	0	10	
	○Incorporate as-built drawings, sketches, etc. into GIS	0	0	7	
	○Carry out public standpipe survey	0	0	7	
Topic-3: Outline of Public Taps	○Replace/repair malfunctioning meters (public standpipes)	0	0	10	High
	○Upgrade GIS maps (public standpipes)	0	0	7	
	○Shift the abandoned standpipes to the suburban areas	0	2	3	
	○Study on introduction of industrial water supply systems	0	2	3	
Topic-4: Large Customers	○Carry out questionnaire survey (large)	0	0	7	High
	○Analyze customer behavior, future water demand, etc.	0	0	8	
	○Enhance water saving practices	0	1	4	
	○Replace 200mm PVC with new ones based on F/S	0	1	7	
Topic-5: Asset Management	○Carry out priority analyses for pipe	0	0	11	High
	○Continue rehabilitation of old pipes (i.e., 34km in 2015/2016) based on priority analyses	0	0	11	
	○Proper design (1)-water hammer effects, thrust blocks, BPT/PRV.	0	0	8	
	○Proper design (2)- No large dia. PVC pipes, flexible joints, sand beds, etc.	0	1	6	
	○Introduce 3D zoning system	0	0	6	
	○Inlets to DMA less than 3 in number	0	1	4	
	○Keep space for expansion as multi-function chambers (DMA's inlets flow meter chambers)	0	1	4	
	○Install gate valves properly within service pipe network	0	0	8	
	○Deal transmission mains separately with distribution mains	0	0	8	
	○Service connections only from service pipe network, not from trunk/limb mains	0	0	10	
	○Continue survey on illegal water users	0	0	8	
Topic-6: Illegal Water Users	○Keep close dialogue with them	0	1	4	High
	○Punishment shall be minimized as far as	0	4	2	

Thereafter a series of workshops were held, based on the wishes from the WASAC side for more detailed investigation of the issues and causes. The framework of the 5-year Action Plan for NRW Reduction formulated through the workshops.

Table 1.13 Process of workshop for 5-year Strategic Action Plan for NRW reduction

No	Item	Date	Details
1	GP2	April 5-6, 2017	Workshop to analyze causes, formulate measures, and select components
2	GP3	April 21, 27-28, 2017	Workshop to compare and combine the issues identified by JICA specialists and the issues and measures identified by WASAC
3	GP4	May 5, 12, 15 and 22, 2017	Workshop regarding the selected components, formulation of order of priority of countermeasures, and establishment of framework
4	Seminar	May 29, 2017	The framework for the 5-year Action Plan for NRW Reduction was approved
5	GP5	2nd Phase	Formulation of specific action plan for corresponding measures
6	GP6	2nd Phase	Allocation of organizational roles for action plan, and calculation of preliminary costs

In the table, the methods of dealing with issues were grouped, forming 18 fields (105 countermeasure items), to form the main components of the 5-year Action Plan for NRW Reduction. These were classified based on the International Water Association (IWA) water balance table. Also, an order of priority was set for the 105 countermeasure items, and the year of implementation and sections responsible were formulated. Table of next page shows an overview of the framework of the 5-year Action Plan for NRW Reduction.

The framework for the 5-year Action Plan for NRW Reduction was approved by the seminar held on May 29, 2017.

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Table 1.14 Main components and priority of each method of solving

No.	Components	Sub No.	Countermeasures	Priority	Responsible Section/Branch	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
						Preparation	1st Year	2nd Year	3rd Year	4th Year	5th Year
<b>JICA NRW Reduction Project</b>											
<b>A. System Input Volume</b>											
1	Volume input metering accuracy	1.1	Analysis of current condition of bulk meters	High	Metering section	x	x				
		1.2	Replace fault bulk meter based on the result of meter condition analysis	High	Metering section		x	x			
2	Water production (prevent intermittent supply)	2.1	Planning with projection of future demand	High	Planning unit	x	x	x	x	x	x
		2.2	Increase water production and upgrade of forwarding infrastructures	High	WOP unit	x	x	x	x	x	x
		2.3	Backup generators at pumping stations and WTP ( Long term )	low	WOP unit				x	x	x
<b>B. Commercial Losses</b>											
3	Meter reading and billing (100% billing based on the actual measurement)	3.1	Regular meter reading , meter condition inspection and report	High	Billing section	x	x	x	x	x	x
		3.2	Improve technology for meter reading (Automatic Meter Reading )	High	Metering section			x	x	x	x
		3.3	CFQ's should focus on meter reading , inspection ,reporting	High	Billing section		x	x	x	x	x
		3.4	Regular on site reading inspection by billing inspectors	High	Billing section		x	x	x	x	x
		3.5	Ensure Internet connection availability for all WASAC service areas	High	IT Section		x	x	x	x	x
		3.6	Avail tool and equipment ( meter reading gadget , mobile printers , rain coat, uniforms ...)	High	Billing section		x		x		x
4	Customers meter management (normal, lages and public tap ) (Improve metering accuracy)	4.1	Conduct customer inventory and mapping in all WASAC branches	High	Zoning and mapping Section		x				
		4.2	Update all customer data in CMS	High	IT Section		x	x	x	x	x
		4.3	Meter replacement based on customer inventory result analysis and sampling result test	High	Metering section		x	x	x	x	x
		4.4	Make a plan and implement the investigation of customer meters and installations	High	Inspection and Enforcement Section		x			x	
		4.5	Regular meter test and calibration	High	Metering section		x	x	x	x	x
		4.6	Reinforce supervision and inspection for new connection works	High	DJWSS		x	x	x	x	x
		4.7	Procure Portable meter test equipment ( atleast 2 per branch )	High	Metering section		x				
		4.8	Reinforce the public tap management and their proper location following the masterplan development	High	Customer service management unit		x	x	x	x	x
		4.9	On site inspection of meter reading ( random re-readings ) by branch managers ( atleast twice a month )	High	Branch managers		x	x	x	x	x
		4.10	On site inspection of meter reading ( random re-readings ) by the senior managers ( atleast once a month )	High	WASAC Senior management		x	x	x	x	x
		4.11	Make a plan for meter sealing ( large and commercial customers )	Low	Metering section		x	x	x	x	
		4.12	Procure and install one water test bench per province	High	Metering section		x	x			
5	Customer database update and analysis	5.1	Regular analysis of billing and consumption data	High	Billing section		x	x	x	x	
		5.2	Analysis of estimated bills	High	Billing section		x	x	x	x	
		5.3	Historical analysis of NRW components	High	NRW Unit		x	x	x	x	
6	Illegal Connection	6.1	monthly systematic customer data analysis	High	Billing section		x	x	x	x	
		6.2	Inspection of suspected customer connection based on customer data analysis	High	Inspection and Enforcement Section		x	x	x	x	
		6.3	Disconnection of illegal and inactive connections	High	Billing section		x	x	x	x	
		6.4	Monitoring of lines payment	High	Inspection and Enforcement Section		x	x	x	x	
		6.5	Enhance incentive for informers ( including staff )	High	Inspection and Enforcement Section		x	x	x	x	
		6.6	Customer awareness for illegal connection	High	Marketing section		x	x	x	x	
<b>C. Physical Losses</b>											
7	Pressure management	7.1	Hydraulic analysis for determination of high pressure zones ( starting by branches with high NRW )	High	GIS		x	x	x	x	
		7.2	Determine the acceptable pressure range at customer tap	High	Leak detection and pressure management Section		x				
		7.3	Procure and install pressure gauges in the network	High	Leak detection and pressure management Section		x			x	
		7.4	High pressure zones survey ( from hydraulic analysis )	High	Leak detection and pressure management Section		x	x	x	x	
		7.5	Establish a Proper pressure management plan	High	Leak detection and pressure management Section		x				
		7.6	Pressure reduction activities based on previous result (PRV, BPT, rearrangement of pumping station station and pipeline network)	High	Leak detection and pressure management Section		x	x	x	x	
8	Asset Management (Rehabilitation)	8.1	Inventory ,drawing and mapping of all facilities	High	GIS	x	x	x	x	x	
		8.2	Establish the maintenance and rehabilitation plan ( year 1 ) and implement in next years	High	Operation and maintenance section		x	x	x	x	
		8.3	Prioritisation analysis for network rehabilitation	High	Operation and maintenance section		x				
		8.4	Replacement of aged and leaking pipes based on priority analysis	High	Operation and maintenance section			x	x	x	
		8.5	Monitor the implementation of the maintenance plan	High	Operation and maintenance section			x	x	x	
		8.6	Reinforce the protection (air valves, valves , break pressure tanks installation ) and security of water infrastructures ( manhol covers , fences ... )	Low	Operation and maintenance section		x	x	x	x	
9	Leaks and burst repair	9.1	Prepare ( year 1 ) and implement ( next years ) the plan for leak detection (invisible)	High	Leak detection and pressure management Section		x	x	x	x	
		9.2	Prepare a plan (year 1 ) for visible leakage survey and implement ( next years )	High	Leak detection and pressure management Section		x	x	x	x	
		9.3	Prepare a plan for (year 1) reservoir leaks and overflows monitoring and implement ( next year )	High	Leak detection and pressure management Section		x	x	x	x	
		9.4	Network survey activities ( Flow measurement including Minimum NF)	High	Leak detection and pressure management Section			x	x	x	
		9.5	Reporting, repairing and recording of leakages repairs	High	Leak detection and pressure management Section		x	x	x	x	
		9.6	Extend the leak detection activities in branches	High	Leak detection and pressure management Section		x	x	x	x	
		9.7	Avail leak detection tool and equipment at the branch level	High	Leak detection and pressure management Section		x				
		9.8	Ensure strategic store at branch level	High	DSS		x	x	x	x	
		9.9	Establish water supply monitoring system ( DMA, SCADA ,etc..)	High	Operation and maintenance section		x	x	x	x	
		9.10	Make estimation of water lost trough leakages	High	Leak detection and pressure management Section		x	x	x	x	
		9.11	Make historical analysis of leakages ( location , diameter , material etc..)	High	Leak detection and pressure management Section		x	x	x	x	

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No.	Components	Sub No.	Countermeasures	Priority	Responsible Section/Branch	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
						Preparation	1st Year	2nd Year	3rd Year	4th Year	5th Year
<b>D. Unbilled Authorized Consumption</b>											
10	Unbilled Authorized Consumption	10.1	Verification if all fire hydrants are metered	high	Metering Section		X				
		10.2	Have a plan for network flushing	low	Operation and maintenance section		X				
		10.3	Estimation of water uses in network flushing , reservoir cleaning , fire hydrants	high	Operation and maintenance section		X	X	X	X	X
<b>E. Fundamental Measures</b>											
11	GIS and CMS database	11.1	Update water network maps ( GIS)	High	GIS	X	X	X	X	X	X
		11.2	Avail maps ( soft and hard copies ) and sensitize staff for regular utilisation	High	GIS	X	X	X	X	X	X
		11.3	Establish a procedure of water network maps update	High	GIS		X				
		11.4	Complete customer identification and mapping	High	GIS		X				
		11.5	Link GIS and CMS	low	GIS and IT		X	X			
		11.6	Avail GIS staff up to branch level	low	GIS			X			
		11.7	Branches to enable the updating customer and mapping data base procedure	low	GIS			X			
12	Planning, design and implementation of works	12.1	Develop long term master plan of water network	High	Planning Unit	X	X				
		12.2	Disseminate existing standard and design of water works	High	Standard Section	X	X	X	X	X	X
		12.3	Establish design validation procedures	High	Standard Section		X			X	
		12.4	Ensure compliance of standard and design of water infrastructure	High	Standard Section		X				
		12.5	Enforcement of inspection and supervision works construction including new connection	High	DUWSS		X	X	X	X	X
		12.6	Regular inspection and supervision of works	High	DUWSS		X	X	X	X	X
13	Policy and Standard	13.1	Establish a standard and procedures for meter( installation , location , replacement , protection ), and new connection	High	Metering section		X				
		13.2	Establish standard for distribution pipes installation ( soil handling , pipe installation , protection , etc..)	middle	WOP services		X				
		13.3	Establish and ensure compliance of standard of material procurement ( meter , pipes , fittings , etc..)	High	Standard Section		X	X	X	X	X
		13.4	Customize IWA water balance to WASAC ( to clear understand NRW components )	High	NRW Unit and JICA		X				
		13.5	Review the NRW procedure manual	High	NRW Unit and JICA		X				
14	Awareness	14.1	Raise the awareness of customers and staff about leak reporting	High	Marketing section		X	X	X	X	X
		14.2	Raise staff awareness on NRW reduction and WASAC values	High	Marketing section		X	X	X	X	X
		14.3	Raise up customers awareness (TV and radio show , Open Day , magazines ,school ..)	High	Marketing section		X	X	X	X	X
		14.4	Enhance contractors awareness on NRW	High	Marketing section		X	X	X	X	X
15	Stakeholders management	15.1	Increase the collaboration with local authorities	High	Marketing section		X	X	X	X	X
		15.2	Reinforce inspection of contractors works	High	DUWSS		X	X	X	X	X
		15.3	certification of companies working in water supply sector	High	DUWSS			X	X	X	X
		15.4	Prepare an MOU with road constructor , Districts and other infrastructures agencies	High	DUWSS		X				
		15.5	Mobilize finance for CAPEX form Financial institutions ( loan from commercial banks , ) , Donors , etc...	low	CFO		X	X	X	X	X
		15.6	Mobilize Partners in NRW reduction projects	low	DUWSS		X	X	X	X	X
		15.7	benchmarking visits	low	DUWSS		X	X	X	X	X
		15.8	Collaboration with research centers and universities	low	DUWSS		X	X	X	X	X
		15.9	Involve local authority in infrastructures protection	High	DUWSS		X	X	X	X	X
		15.10	Improve communication with stakeholders	High	DUWSS		X	X	X	X	X
16	Training	16.1	Assess current staff skill gap and prepare appropriate training plan( new connection standard , GIS usage, pipe installation,pressure management , etc..)	High	HR Unit		X	X	X	X	X
		16.2	Set up an internal knowledge transfers mecanism	High	HR Unit		X	X	X	X	X
		16.3	Benchmarking of different branches for NRW reduction	High	NRW		X	X	X	X	X
		16.4	Secure the budget for the training	High	HR Unit		X	X	X	X	X
17	Institution	17.1	Review branch structure ( add more staff )	High	DCS		X				
		17.2	Review the NRW Unit structure	High	DUWSS		X				
		17.3	Establish a sufficient stock at the branch level	High	DSS		X	X	X	X	X
		17.4	Put in place a technical works inspection team	High	DUWSS		X				
		17.5	Reinforce the research and development	low	DUWSS		X	X	X	X	X
		17.6	Put in place incentive measures for NRW reduction	High	DCS		X				
		17.7	Pro- poor consideration in WASAC strategies	low	DCS		X				
		17.8	Continuous improvement and innovation	low	DUWSS		X	X	X	X	X
18	Logistic and quality materials	18.1	Avail enough equipment and logistics ( vehicle , motorcycle , tools,protective equipment , etc...)	High	DSS		X	X	X	X	X
		18.2	Ensure the procurement of quality materials ( for new connection and other water works )	High	DSS		X	X	X	X	X

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Table 1.15 Responsible Section in WASAC for the Implementation of NRW Reduction Action Plan

IWA item	Component	No*	Responsible Section of WASAC
Quantity of system input	1. Volume input metering accuracy	2	Metering Section (DCS)
	2. Water production (prevent intermittent supply)	3	WOP Unit (DUWSS), Utility Planning Unit (DUWSS)
Commercial losses	3. Meter reading and billing (100% billing based on the actual measurement)	6	ICT Section (DSS), Billing Section (DCS), Metering Section (DCS)
	4. Customers meter management (normal and public tap ) (Improve metering accuracy)	12	Zoning and Mapping Section: GIS (NRW of DUWSS), ICT Section (DSS), Inspection and Enforcement Section (NRW of DUWSS), Billing Section (DCS), Customer Service Management Unit (DCS), Metering Section (DCS), Branch Management Unit (DCS)
	5. Customer database update and analysis	3	NRW Unit (DUWSS), Billing Section (DCS)
	6. Illegal Connection	6	Inspection and Enforcement Section (NRW of DUWSS), Billing Section (DCS), Marketing Section (DCS)
Physical losses	7. Pressure management	6	Leak Detection and Pressure Management (NRW of DUWSS), Zoning and Mapping Section: GIS (NRW of DUWSS)
	8. Asset Management (Rehabilitation)	6	Leak Detection and Pressure Management (NRW of DUWSS), Zoning and Mapping Section: GIS (NRW of DUWSS), Operation and Maintenance Service (WO unit of DUWSS)
	9. Leaks and burst repair	11	Operation and Maintenance Service (WO unit of DUWSS), Administration and Logistics Unit (DSS)
Unbilled authorized consumption	10. Unbilled authorized consumption	3	Operation and Maintenance Service (WO unit of DUWSS), Metering Section (DCS)
Basic countermeasures	11. GIS and CMS database	7	Zoning and Mapping Section: GIS (NRW of DUWSS), ICT Section (DSS)
	12. Planning, design and implementation of works	6	WOP Unit (DUWSS), Utility Planning Unit (DUWSS), Standards Section (DUWSS)
	13. Policy and Standard	5	NRW Unit (DUWSS), WOP Unit (DUWSS), Standards Section (DUWSS), Metering Section (DCS)
	14. Awareness	4	Marketing Section (DCS)
	15. Stakeholders management	10	NRW Unit (DUWSS), WOP Unit (DUWSS), Marketing Section (DCS), Chief Financial Officer (CFO)
	16. Training	4	NRW Unit (DUWSS), Human Resource Unit (DSS)
	17. Institution	8	NRW Unit (DUWSS), Directorate Commercial Service (DCS), Metering Section (DCS), Human Resource Unit (DSS), Administration and Logistics Unit (DSS)
	18. Logistic and quality materials	2	Administration and Logistics Unit (DSS)

No\* :Number of countermeasures

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

- To make clear the contents and the bill of quantity of the priority of countermeasure, an inventory survey will be carried out. Concrete content of the survey was decided in January, 2017 and assumed an investigation was planned to start from February.
- Specification for inventory survey about facilities was prepared. As a result of the discussion on these contents (general schematic drawing of water reservoir tank, fact-finding of the stand pipe, sampling survey of customer meters) with WASAC in February, WASAC decided to implement by himself.
- However, apart from the following item c, the status of progress is considerably delayed due to personnel shortages, etc., so completion was not possible in 1st Phase. Therefore it was decided to deal with this by continuing to incorporate the details of this survey into the 5-year Action Plan for NRW Reduction.
  - a. Review and Update of Schematic Transmission Pipeline Map and its Profile
  - b. Review and Update of the Schematic Drawings of Reservoirs and Pumping Stations Interconnected by Transmission Pipes Above
  - c. Survey of public taps and customer meters (Survey of Public Taps)
  - d. Survey of public taps and customer meters (Sample Survey of Customer Meters)

1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of

August 2017.

- 1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of August 2017.

- 1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.

Based on the Work Plan that was amended in April 2017, the report will be produced by the end of August 2017.

- 1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

The budget for this financial year (July 2017 to June 2018) is scheduled to be added and amended with the approval by the WASAC Board of the 5-year Action Plan for NRW Reduction Report that will be prepared by the end of August 2017.

- 1-9 The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.

This will be produced by the end of August 2017 based on the framework for the 5-year Action Plan for NRW Reduction, produced in 1st Phase under "Activity 1-3".

- 1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.

Scheduled to be held at the end of August 2017 when the Non-revenue Water Reduction 5-year Action Plan is prepared based on the Work Plan.

- 1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

This is scheduled to be implemented from May 2018 onwards in accordance with the progress of the pilot activities.

- 1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

The final review of the Non-revenue Water Reduction 5-year Action Plan is scheduled to be carried out from March 2018 onwards.

**【Activities of Output 2】**

: Basic knowledge, skills and technique on NRW control are acquired by WASAC.

2-1 Training materials on NRW control are prepared.

A list of the training materials in each field relating to training of non-revenue water (text, presentation materials, etc.) in 1st Phase are shown in Table below.

Table 1.16 List of training materials

No	Sector	Text & Manual	Contents	Source	Form
1	NRW Overview	NRW Reduction Concept Manual Attachment:	NRW Overview	JICA Team	DOC
		-The Manager's Non-Revenue Water Handbook		USAID, 2008	DOC
		-The Manager's Non-Revenue Water Handbook for Africa		USAID, 2010	DOC
2	GIS	GIS Procedure Guide	Data updating procedures	JICA Team	DOC
3	GIS	GIS Operational Manual	Data updating methods	JICA Team	DOC
4	Leakage detection	Composition of NRW	NRW Overview	JICA Team	DOC
5	Leakage detection	Handling and attention to use Ultrasonic and Electromagnetic Flow Meter	Theory and method of use of electromagnetic and ultrasonic flow meters	JICA Team	DOC
6	Leakage detection	Method and Classification of Leakage Detection	General overview of water leak detection	JICA Team	DOC
7	Leakage detection	Occurrence and transmission of leakage sound	Principles of occurrence of water leakage sound and survey methods	JICA Team	DOC
				USAID, 2008	DOC
				USAID, 2010	DOC
8	Leakage detection	Analysis of acoustic (sound) investigating	Methods of analysis of acoustic surveys	JICA Team	DOC
9	Leakage detection	Manual for Leakage Detection	Manual of procedures for using water leak detectors	JICA Team	DOC
10	Leakage detection	Principle of correlation	Theory of leak noise correlators and survey methods	JICA Team	DOC
11	GIS	Folder Structure and how to open QGIS	Methods of information sharing using QGIS	JICA Team	PP
12	GIS	Utilization of Geographic Information System	Overview of GIS (for users)	JICA Team	PP
13	Hydraulic analysis	Introduction to Hydraulic Analysis 1	Basics of hydraulic analysis and methods of use	JICA Team	PP
14	Hydraulic analysis	Introduction to Hydraulic Analysis 2	Methods of use of EPANET	JICA Team	PP
15	Hydraulic analysis	Introduction to Hydraulic Analysis 3	Methods of use of Mike Urban	JICA Team	PP
16	Reduction plan	High Pressure Area by Branching from Transmission Pipeline and Pump	Methods of survey and analysis of the status in high water pressure areas	JICA Team	PP
17	Pipe repair	In-Room training & OJT of "Piping Works"	Appropriate construction management, earthworks, and recording methods	JICA Team	PP



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No	Sector	Text & Manual	Contents	Source	Form
18	Pipe repair	Pipe connection	Appropriate pipe connections, and issues and points of improvement	JICA Team	PP
19	Pipe repair	Pipe connection -Practice-	Methods of cutting and connecting distribution pipes, and points to note	JICA Team	PP
20	Water leakage detection	Leakage survey in Japan	Examples of water leak detection in Japan	JICA Team	PP
21	Water leakage detection	Equipment to be provided and utilization method	Theory and method of use of the water leak detectors to be provided	JICA Team	PP
22	Reduction plan	Topic-1_WASAC strategy (“To enhance further by adopting people-oriented approach”)	Insufficiency of sensor data, and the necessity for long-term planning		
23	Reduction plan	Topic-2_needs of quality data (Customer Data and Drawings)	The importance of GIS data, customer data, and drawing development	JICA Team	PP
24	Reduction plan	Topic-3_public taps (What’s the existing conditions?)	Issues regarding public water taps, and the necessity for surveys	JICA Team	PP
25	Reduction plan	Topic-4_large customers (Customer behavior largely affects WASAC)	The importance of management of large customers	JICA Team	PP
26	Reduction plan	Topic-5_asset management (What’s the criteria for replacement)	The status of aged pipes and materials, and the necessity for construction of DMAs and renewal in accordance with elevation	JICA Team	PP
27	Reduction plan	Topic-6_illegal water users (Legal or not?)	Analysis of the status of illegal connections using existing data, and why there are illegal connections	JICA Team	PP
28	Reduction plan	Topic-7_summary (What’s your priority measure?)	Proposal of NRW reduction methods and confirmation of order of priority	JICA Team	PP
29	Reduction plan	Topic-8_Five Year NRW Reduction Plan (“Approach and Procedures”)	Framework for NRW reduction proposed by the specialists	JICA Team	PP
30	Organization theory	Topic-9_Development of WASAC	Necessity of change of awareness and organizational improvements	JICA Team	PP
31	Organization theory	Topic-10_Rehabilitation or Extension	Necessity for countermeasures against water leakage and renewal	JICA Team	PP
32	NRW Overview	Topic-11_NRW in City_M_Indonesia	Examples of NRW reduction in Indonesia	JICA Team	PP
33	NRW Overview	Topic-12_Meter and Specification	Types, specifications, and accuracy of water meters	JICA Team	PP

(DOC: Document, PP: Power point)

## PM Form 3-1 Monitoring Sheet Summary

Table 1.17 Register list

No.	Sector	Record	Contents	Source	Form
1	GIS	Check sheet for Customer Data Update	Check sheet for GIS customer data updating	JICA Team	EXL
2	GIS	Check sheet for Water Network Update	Check sheet for GIS pipeline and connection data updating	JICA Team	EXL I
3	Pipe repair	Template Daily Report (pipe works)	Register of the history of distribution pipe repairs	JICA Team	EXL

(EXL: Excel)

2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.

- The training materials for problem presentation on basic measures of NRW management were made, and a seminar was carried out for four times at every week in a project management meeting in October.
- The training was carried out based on "materials for problem presentation on basic measures of NRW management" mentioned above on November 1, 2016.

2-3 OJT is conducted on the updating of GIS data, using available GIS data base.

Following works were conducted.

- The technical training on GIS data update of C/P
- Rearranging and reexamination of a workflow affecting GIS update of customer and pipe network data update
- OJT on update of Branch boundary line data
- Activity that GIS data management
- The introduction of the Google Earth applied for GIS
- Introduction of the software of QGIS to 6 Kigali city branches and Google Earth (input to a PC) was performed to make the environment that WASAC can be shared the GIS data not only HQ but also branch offices and could watch freely, and to have operation and utilization of the GIS software fit the staffs other than the GIS team, and to smoothen a shift to future ArkGIS use.
- The reconfirmation of technology transfer contents and the introduction of the ArcGIS Geometric Network analysis (one of the pipe network analysis functions on ArcGIS) was carried out. Construction and editing of the pipe network model and analysis by this function can be carried out.
- The Manuals (GIS Procedure Guide and GIS Operation Manual: Data update on management for water network and customer information) were distributed to related section of HQ and 6 branch offices.

## PM Form 3-1 Monitoring Sheet Summary

Table 1.18 Overview of GIS instruction activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of status of GIS data development and operation, C/P's wishes, issues, etc.	From August to September, 2016	<ul style="list-style-type: none"> <li>• Development of the WASAC GIS data by ESRI and software introduction were not completed.</li> <li>• Software and data is saved in all the individual PCs.</li> <li>• Skill in the use of the ArcGIS software is comparatively high, but preparation of drawings using GIS has not been implemented.</li> <li>• Skills in data analysis using software other than ArcGIS, such as Excel, etc., is low.</li> <li>• As an organization, use of GIS has not been achieved.</li> </ul>	-
Activity 1	Activities relating to updating GIS data (customer and pipe network data, new customers)	From September to October, 2016	Technical support and consulting was provided for continuous updating of data mainly by the WASAC GIS team, effectively utilizing the GIS data prepared by ESRI and the GIS software.	The C/P has understood the skills and techniques necessary for updating GIS data. Activities will be implemented after delivery of the outputs.
Activity 2	GIS support relating to the hydraulic isolation plan for the 4 branches within Kigali city	From September to October, 2016	For 4 of the 6 branches within Kigali city, excluding the 2 branches associated with the SUSWAS project, GIS support was provided for the investigation and identification of the flow meter installation locations for hydraulic isolation.	The managers can carry out investigations and explanations together with the C/P from the point of view of GIS.
Activity 3	Activities relating to utilization and sharing of GIS data	From September to October, 2016	In order to promote the utilization of GIS data in the whole WASAC organization, GIS data sharing was carried out by QGIS for the 6 branches within Kigali city.	The branch staff has understood the methods of sharing information using QGIS.
Activity 4	Practical technology transfer relating to ArcGIS layouts and data analysis	From September to November, 2016	<ul style="list-style-type: none"> <li>• Instruction was provided on the standard layout techniques together with the method of preparation of "data-driven pages" which was not known by the GIS team.</li> <li>• Instruction was provided on the construction of "geometric networks" and analysis methods for analyzing pipeline networks using ArcGIS.</li> </ul>	Applied techniques regarding layout and data analysis have been understood. Activities will be implemented after delivery of the outputs.

2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

Collection of hydraulic analysis-related data, and, the lectures and a seminar of the hydraulic analysis and water pressure management analysis were performed six times for November 8 from September 29

for a GIS team.

- The training of general theory of the hydraulic analysis
- The practice by application EPANET of the hydraulic analysis
- Construction of the use environment of hydraulic analysis software MikeUrban and the training about the usage of it
- Hydraulic analysis of the pilot area

Table 1.19 Outline of training activities for hydraulic analysis and pressure management

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey on WASAC's problems, etc. related to hydraulic analysis	From August to September, 2016	<ul style="list-style-type: none"> <li>- At present, there is not sufficient GIS data of ESRI, which serves as the basic data for carrying out hydraulic analysis. Modeling has not been completed.</li> <li>- WASAC, having no track record of hydraulic analysis, does not sufficiently understand the implementation of hydraulic analysis and has not created an analysis work flow.</li> <li>- WASAC does not have a vision for "what it can and must do" with hydraulic analysis.</li> <li>- The hydraulic analysis application, Mike Urban, is provided as an add-on for the GIS application. Therefore, WASAC hydraulic analysis is to be conducted by two of the persons in GIS.</li> </ul>	-
Activity 1	Training on understanding and implementation of hydraulic analysis	September, 2016	<ul style="list-style-type: none"> <li>- Purpose of hydraulic analysis</li> <li>- Basics of hydraulics</li> <li>- Hazen-Williams formula</li> </ul>	The basic theory has been understood. The actual methods of utilization and the application of these practical methods is insufficient.
Activity 2	Handling of existing data (GIS and water consumptions) required for hydraulic analysis	From September to October, 2016	<ul style="list-style-type: none"> <li>- Flow and handling of data in WASAC</li> <li>- Reliability check for data quality and hydraulic analysis results</li> </ul>	The basic methods of handling have been understood. The actual methods of utilization and the application of these practical methods is insufficient.
Activity 3	OJT on hydraulic analysis modeling and software usage	From October to November, 2016	<ul style="list-style-type: none"> <li>- Use of EPANET</li> <li>- Use of Mike Urban</li> </ul>	The method of using the software has been understood. Activities will be implemented after delivery of results.

2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

One of the high-priority issues in the efforts for NRW control is the management capacity for water volumes and pressures. Specifically, the training must be provided to (1) learn the importance of the bulk meter management regarding the System Input Volume and (2) enhance the management capacity for accurate measuring of the Authorized Consumption.

On-the-job training to measure the sectional flow rate of transmission pipeline for identification of the amount of water leak was conducted. Discharge at the water source plants, aqueducts, bridge-attached pipes and water reservoirs was measured through the training.

Since the proposed equipment procured by JICA for leak detection could not be delivered before the training period in 1st Phase, the training was conducted by using only rented equipment of ultrasonic flow meter, headphone-type leak detector, and electronic leak noise detector.

Table 1.20 Outline of training activities for "Leak detection"

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey on WASAC's problems, etc. related to leak detection	March, 2017	<ul style="list-style-type: none"> <li>- Has not conducted activities for leak detection yet.</li> <li>- Owns but has not used equipment for leak detection.</li> <li>- Has not conducted survey on the amount of water leak nor identified the status quo.</li> <li>- Lacks the concepts of water volume management and pressure management in the NRW control.</li> </ul>	-
Activity 1	OJT and OFF-JT on pressures, flow rates, and leak measurement	From March to May, 2017	<ul style="list-style-type: none"> <li>- Training on the survey method for water leakage (degree of deterioration) based on measurement and metering in transmission pipe system and distribution pipe network (pilot area)</li> <li>- Training on the operation methods for ultrasonic flow meters and pressure gauges</li> <li>- Theories of items and the analysis method for survey results</li> </ul>	The objectives, theory, implementation procedures, measurement methods, and analysis methods have been understood.
Activity 2	OJT and OFF-JT on leak detection technologies	From April to May, 2017	<ul style="list-style-type: none"> <li>- Training on leak detection techniques in Pilot Area 1</li> <li>- Training on house-to-house survey techniques in Pilot Area 1</li> <li>- Headphone-type leak detector and electronic noise detector</li> <li>- Theories of items and analysis method for survey results (Training continued in 2nd Phase)</li> </ul>	The objectives, theory, implementation procedures, measurement methods, and analysis methods have been understood.
Activity 3	OJT and OFF-JT on monitoring and data analysis	From April to May, 2017	<ul style="list-style-type: none"> <li>- Training on flow behavior monitoring techniques in Pilot Area 1</li> <li>- Training on water consumptions, system input, and minimum flow rate at night in Pilot Area 1</li> </ul>	The objectives, implementation procedures and measurement methods have been

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Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
			(Training continued in 2nd Phase)	understood.
Activity 4	Analysis methods for NRW components	-	(Training in 2nd Phase)	-
Activity 5	Check and Repair of existing equipment	From March to May, 2017	- Repair and test usage of equipment owned by WASAC (leak detectors, data loggers, headphone-type leak detectors, leak noise correlators, and ultrasonic flow meters) - (Training on usage in 2nd Phase)	The equipment owned has been repaired.

2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

For the training, the status of repair of leaking water pipes and the status of connection of new pipe connections were confirmed in 6 branches in Kigali city and 1 branch outside Kigali city, and the organization, personnel, and materials and equipment were confirmed, issues were identified as shown in Table below, and the instruction was provided with regard to these issues.

In 2nd Phase when the pilot project will be implemented, more specific instruction will be provided on the contents of the instruction given in 1st Phase. Monitoring will be carried out to determine whether or not the details of the instruction carried out in 1st Phase and the records are being appropriately utilized.

Also, it is considered that some of the items among the issues identified should be incorporated into the 5-year Action Plan for NRW Reduction, such as (1) strengthening the construction supervision system, (2) improvement in pipe repair skills, and (3) strengthening of materials stock, transport vehicles, etc. However for matters such as (1) technical standards and specifications, (2) construction and materials standards, (3) construction of detailed pipe network drawings, etc., countermeasures from a long-term viewpoint are necessary.

The C/P for this field were members of staff of the branches, so it was decided to improve the main issues facing WASAC (construction methods and use of appropriate equipment and materials) by providing instruction through site visits and observation, and the methods of use of the procured equipment in seminars, etc. The necessity of improvement was sufficiently understood through this instruction, and its practical application in earthworks and new connections has already commenced. Entering the checksheets produced is being implemented, so it is important to carry out monitoring and evaluation of the status of implementation. Also, WASAC has started to examine the purchase of some of the new equipment that is necessary for the improvements. Other than these, regarding the necessary staff increases, vehicles, heavy machinery, etc., they are stated in the framework for incorporation into the 5-year Action Plan for NRW Reduction, and investigation of the appropriate quantities, etc., will be carried out in 2nd Phase.

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Table 1.21 Overview of training activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of issues, etc., regarding repair of leaking water pipes and installation of water supply equipment by WASAC (6 branches in Kigali city)	January 2017 April 2017	<ul style="list-style-type: none"> <li>• Standards and specifications have not been developed for installation of pipes, and inappropriate construction is carried out based on empirical rules.</li> <li>• Management drawings are not prepared and stored, so information cannot be shared.</li> <li>• There is insufficient understanding of backfilling earthworks, so construction is being carried out that causes damage to pipes.</li> <li>• The construction tools, vehicles, etc. at branch level are absolutely insufficient.</li> <li>• The methods of connecting pipes and bringing out water hydrants are inappropriate.</li> <li>• Checking of pressure resistance is not carried out after connecting.</li> <li>• Supervision of construction by private contractors is not carried out.</li> </ul>	-
Activity 1	Preparation of training materials in accordance with the issues	From February to March, 2017 May, 2017	<ul style="list-style-type: none"> <li>• Earthwork techniques</li> <li>• Material selection and pipe cutting , boring and connection methods</li> <li>• Construction management such as safety, quality (inspection), schedule control, records, etc.</li> <li>• Register of the history of repairs</li> </ul>	The trainees have carried out seminars using the prepared training materials
Activity 2	Indoor training and OJT using the training materials	From March to May, 2017	<ul style="list-style-type: none"> <li>• Operation control and technology, instruction regarding registers and records (indoors)</li> <li>• Instruction on improvements in pipe repair work at the branches (OJT)</li> <li>• Methods of handling soils (OJT)</li> <li>• Welding of polyethylene pipes (OJT)</li> <li>• Safety measures (OJT)</li> </ul>	The managers from the 6 branches have understood the importance of construction management and records, and the points of improvement regarding distribution pipe connections and repairs.
Activity 3	Indoor training and OJT using the WASAC training yard	May, 2017	<ul style="list-style-type: none"> <li>• Development, maintenance and repair of the training yard</li> <li>• Prevention of leaks, pipe connections, laying pipes (indoors)</li> <li>• Pipe selection methods, calculation methods, utilization of drawings (indoors)</li> <li>• Pipe cutting, welding, drilling, and connection (OJT)</li> <li>• Formulation of work improvement plans by the branch managers</li> </ul>	The managers of the 6 branches have understood the methods of using the equipment, appropriate pipe connections and repair methods, and have summarized the points of improvement. (Implementation on site will be in 2nd Phase)

2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

Instruction in ‘Meter reading, Invoicing of charges, and Customer service’ was commenced after confirming the consistency of the customer data, charge collection data, and GIS customer data, and instruction was provided for the issues identified from surveys on site and interviews with branch heads, etc., as shown in Table below. On the other hand the departments involved in this field are diverse, so instruction was provided individually to key persons in each department, such as GIS personnel, Commercial Services, etc., and regular weekly meetings were held led by the NRW Section, where the various issues and countermeasures were discussed. In addition, for more than about 100 members of staff (branch heads, persons responsible for water operations, pipeline engineers, meter readers) of the 6 branches within Kigali city, which is the frontline of activities in this field, a seminar was held over 3 days from the 9th to the 11th May 2017 on the issues facing WASAC and the methods necessary to deal with these, using lecturers (key persons) selected from Commercial Services. In this seminar, each of the managers of the branches prepared an improvement activity plan by themselves describing what needed to be done in the future, as part of the raising of awareness. They will carry out monitoring during the construction activities of 2nd Phase to confirm that the improvement activities are being implemented.

Table 1.22 Overview of training activities

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
Activity 0	Survey of issues, etc., in WASAC regarding meter reading, invoicing of charges, and customer service	From August to December, 2016	<ul style="list-style-type: none"> <li>• There are no standards or plans for installation and renewal of water meters.</li> <li>• The status of defective water meters has not been determined, payment data has not been analyzed, and the existence of fault data has not been determined.</li> <li>• Management is insufficient, so there are many discarded public water hydrants.</li> <li>• Data possessed by Customer Service is not shared with the NRW Section.</li> <li>• The GIS customer data and the Commercial Services customer data are not linked, and there is a discrepancy of more than 20%.</li> </ul>	-
Activity 1	Identification of data shortages	From January to May, 2017	<ul style="list-style-type: none"> <li>• Implementation of survey of status of public water hydrants</li> <li>• Customer analysis of large-scale customers (2nd Phase)</li> <li>• Recommendations regarding illegal connections</li> </ul>	Implementation schedule to be continued into 2nd Phase.
Activity 2	Instruction on methods of analysis of	From November to December,	<ul style="list-style-type: none"> <li>• Methods of analysis of customer data using Excel</li> <li>• Analysis of fault data</li> </ul>	The methods of analysis have been understood, and the trainees of WASAC



PM Form 3-1 Monitoring Sheet Summary

Category	Instruction item	Implementation period	Problems and details of activities	Outputs and issues
	existing data	2016		Head office have held seminars for branch employees.
Activity 3	Instruction regarding checking of meters	From January to May, 2017	<ul style="list-style-type: none"> <li>• General methods of checking meters</li> <li>• Criteria for judging defective customer meters</li> <li>• Awareness workshop for meter readers (preparation of activity plan)</li> </ul>	The trainees of WASAC Head offices have held seminars for branch employees, and the points of improvement have been summarized.
Activity 4	Instruction regarding new connections	From January to May, 2017	<ul style="list-style-type: none"> <li>• Types of water meters and specifications for water supply hydrants</li> <li>• Meters and installation methods</li> <li>• Awareness workshop for water distribution operators and pipe construction (preparation of activity plan)</li> </ul>	The trainees from WASAC Headquarters have held seminars for branch employees, and the points of improvement have been summarized.
Activity 5	Instruction regarding customer service	From January to May, 2017	<ul style="list-style-type: none"> <li>• Overview of customer service</li> <li>• Awareness workshop for branch heads relating to checking of meters and new connections</li> </ul>	The trainees from WASAC Headquarters have held seminars for branch employees, and the points of improvement have been summarized.
Activity 6	Construction of implementation system within branches for pilot activities	-	(Specific formulation in 2nd Phase in accordance with the pilot activity plan)	-

2-8 Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

This is scheduled to be implemented from May 2018 onward, based on the work plan.

**【Activities of Output 3】**

**: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.**

3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.

- The member of the action team is appointed formally in August by CEO, and formation is finished in August 2016.

3-2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.

- Selection of two pilot areas (Area 1: Kadobogo (Kiyovu) Kacyiru Branch Area 2: Ruyenzi (Runda) Nyarugenge Branch ) from the proposed candidate sites in September 2016.
- Information data collection of Kigali city and the two pilot areas in September 2016
- Information data update of pilot areas such as population and number of customers

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.

- A work plan of pilot project for area1 was prepared.
- Preparation of facilities plan for the establishment of pilot area such as location of inlet chamber and design them including requires equipment such as flowmeter, pressure gauge and valves in September
- The detailed design of the chamber at the inlet (flowmeter setting position) was made in September, and trial excavation was conducted for confirm the number of the existing pipe, laying position, depth, type, diameter, and performed final decision of the structure in October.
- The contents, specification and quantity of the equipment to be installed in the chamber were clarified in October.

3-4 The action team hydraulically isolates Pilot Area 1, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1.

Procurement of Equipments

- Contents of procurement equipment (flowmeter, pressure gauge, valve, customer meter etc.) were confirmed and specification and BoQ were decided in October.
- The procurement preparations such as marketing researches, contract documents, supplier list for competition of quotation were performed in September..
- Notice for competition of quotation was made October 14, and as a result of evaluation of the documents submitted, the contract with a procurement supplier on November 8. The delivery of the

equipment is scheduled in March.

#### Construction of Chambers

- Design of four chambers to be installed inlets of the pilot area was performed for the price competition in September.
- Notice of the price competition to the contractors was made on December 8, 2016 for submission of the quotation on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.
- Construction work has completed in May 25, 2017.
- The additional investigation for separation of the tertiary pipe in the Kadobogo pilot area was performed. Isolation work was performed by WASAC.

3-5 The action team establishes the baseline NRW rate of Pilot Area 1.

The implementation in July 2017 or later is planned based on the work plan.

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

The implementation in July 2017 or later is planned based on the work plan.

3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.

The implementation in January 2018 or later is planned based on the work plan.

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

The implementation in January 2018 or later is planned based on the work plan

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

The implementation in March 2018 or later is planned based on the work plan.

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

The implementation in March 2018 or later is planned based on the work plan.

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

The implementation in May 2018 or later is planned based on the work plan.

3-12 The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.

The implementation in May 2018 or later is planned based on the work plan.

3-13 The action team summaries activities and results from Activities 3-1 to 3-12, prepares the

completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The implementation in May 2018 or later is planned based on the work plan.

- 3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.

The implementation in May 2018 or later is planned based on the work plan.

- 3-15 Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.

The implementation in June 2018 or later is planned based on the work plan.

- 3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

The implementation in July 2018 or later is planned based on the work plan.

#### **【Activities of Output 4】**

**: 4 branches in Kigali establish the system to measure NRW rates accurately.**

4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

- About 4 branch isolation, the GIS team and the Branch Offices made opinion adjustment with advice of JICA expert, site investigation in order to decide the boundary lines in October, 2016.
- Because it was revealed that the movement between branches of the customer registration was necessary about the decision of the boundary line, it was decided to adjust it after boundary line decision.
- Four branch separation boundary lines were established by the end of September, 2016, But it was non-start about movement of customer registration.
- A GIS team clarified re-enrollment about the movement of customer registration (1712 as of September 2016)

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

- Flowmeter setting positions for isolation of 4 branches were examined on the GIS map jointly with NRW team and GIS team in a project progress meeting of October 7.
- After the position decision on the quantity, individual spot investigation was carried out by JICA

team and WASAC team to confirm condition of existing distribution pipes. Trial excavation was conducted for 18 places.

- The joint meeting of the NRW and GIS team was held in order to settle site setting position of flowmeter on October 31.
- The technical specifications of the equipments such as electromagnetic flowmeter, mechanical flowmeter, pressure gauge, valves, data loggers and server hardware etc. for the establishment of monitoring system was prepared by the end of November.
- Technical specification and Bill of Quantity for the tender were submitted to the JICA office on December 9.

4-3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

#### Construction of Chambers

- 23 chambers to be installed in the network were designed for the tender in November 2016.
- Notice of the price competition to the contractors for construction of chambers was made on December 8, 2016 for submission of the tender on January 27, 2017. As the result of evaluation of it, contract was agreed on February 15, 2017.
- Procurement of the equipment to be installed within the concrete chambers decided upon in 'Activity 4.2' is being carried out by the JICA office. The tender notice was published on May 26, 2017, the tender explanation meeting was held on May 30, and a supplier within Rwanda is scheduled to be selected by July 21.
- The concrete chambers in which this equipment will be installed are currently under construction by outsourcing to a local company. Concrete chambers are being constructed at 23 locations, of which construction has been completed at 11 locations in 1st Phase, and construction work will continue at the remaining 12 locations in 2nd Phase. However, delivery of the equipment is likely to be on or after November 2017 in 2nd Phase. After the equipment has been procured, it will be installed by WASAC, under the supervision of the specialists.

4-4 System input to each of 4 branches is measured.

The implementation in January 2018 or later is planned based on the work plan.

4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

The implementation in January 2018 or later is planned based on the work plan.

1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators as the table below indicates:

Table 1.23 Achievement of Outputs

Outputs	Objectively Verifiable Indicators	Status of the Achievement
1 Planning capacity of NRW reduction of WASAC is enhanced.	<p>1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.</p> <p>1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.</p>	<ul style="list-style-type: none"> <li>•The relevant information are being collected from existing data and documents.(GIS data, Customer data, PIP: Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 branches)</li> <li>•Site visit survey for up-countries Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW.</li> <li>•Inventory survey is being conducted by WASAC</li> <li>•Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to elaborated action plans in 2nd Phase together with WASAC management team and action team.</li> <li>•Framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team.</li> <li>•Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices will be listed up as Action Plan for 5-year separately, in June and July 2017.</li> <li>•Budgeted for Action Plan will be estimated in August.</li> <li>•Action Plan will be finalized and seminar to share the result will be held at the end of August 2017.</li> <li>•Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	<p>2-1 More than XX number of trainees receive training.</p> <p>2-2 WASAC human resource development plan includes training programs prepared by the project.</p>	<ul style="list-style-type: none"> <li>•Training on NRW management was conducted</li> <li>•OJT was conducted on the updating of GIS data base</li> <li>•OJT was conducted on hydraulic analysis, and pressure management</li> <li>•In-room training and OJT on leak detection was conducted. Since the proposed equipments for leak detection were not delivered before the timing of the training, only limited rental equipments were used. Another training is planned in the 2nd Phase through the Pilot Project.</li> <li>•In-room training and OJT on repairing leaking pipes and installing service connection was conducted and another training is planned in the 2nd Phase through the Pilot Project. The materials and equipments to be used for the training were procured.</li> <li>•In-room training and OJT on meter reading, billing, customer services will be conducted in the 2nd Phase through the Pilot Project.</li> <li>•The capacity assessment of C/Ps and related sections in Head Office and 6 Branche Offices in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase.</li> <li>•Draft indicators for Output 2-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017.</li> <li>•Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>

## PM Form 3-1 Monitoring Sheet Summary

<p>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</p>	<p>3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)</p> <p>3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.</p> <p>3-3 The action team prepares a completion report of the pilot project.</p>	<ul style="list-style-type: none"> <li>•Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch ) were selected.</li> <li>•The preparation work in order to setting up above two pilot areas (DMAs) was conducted such as procurement of the equipments and construction of chambers for inflow measurement, separation of tertiary distribution pipes for isolation of the area and installation of valves in the network.</li> <li>•Implementation of the OJT activity for Area 1 was planned.</li> <li>•The baseline survey of pilot areas will be implemented for NRW reduction.</li> <li>•Draft indicators for Output 3-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017.</li> <li>•Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>
<p>4 4 branches in Kigali establish the system to measure NRW rates accurately.</p>	<p>4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.</p>	<ul style="list-style-type: none"> <li>•Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided.</li> <li>•Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey.</li> <li>•Detailed design was done for preparation of technical specifications of the equipment of a monitoring system.</li> <li>•The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in 1st Phase and construction of the remaining 12 chambers are in process.</li> <li>•The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017. It is supposed the equipment will arrive in November 2017.</li> <li>•Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert.</li> <li>•Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>

### 1-4 Achievement of the Project Purpose

#### Project Purpose

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

#### Objectively Verifiable Indicators

1. 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.
2. Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.
3. The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

#### Means of Verification

1. 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure
2. Annual action plan of WASAC
3. Budget of WASAC

5-year Strategic Action Plan for NRW reduction is scheduled to elaborate at the end of August 2017. Afterward, the Action Plan should be approved by the Minister of Infrastructure. Action Plan of 6 branches in Kigali City should be reflected in annual action plan of WASAC. The budget for implementing Action Plan of 6 branches in Kigali City should be approved. These conditions of the Indicators will be achievement after elaboration of 5-year Strategic Action Plan, that is after September 2017.

### 1-5 Changes of Risks and Actions for Mitigation

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

#### (1) Pre-Conditions

Table 1.24 Action for Mitigation on Pre-Condition

PDM Pre-Conditions	Current Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule.  In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October.	

#### (2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table 1.25 Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement Planning Unit of UWSS to the direct control of CEO, movement of the GIS section to under the WOS unit.	
2 WASAC staff do not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster dose not occur.	1-3 Not applicable	



**(3) Important Assumption on Proceeding Assumptions to Overall Goal**

Table 1.26 Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 Not applicable	

**1-6 Progress of Actions undertaken by JICA**

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment is in process. These are expected to be procured by July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is in process. These are expected to be procured by November 2017.

**1-7 Progress of Actions undertaken by Rwanda side**

1) Completed

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan

2) In progress

- Inventory survey is caring out by WASAC team.
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Leakage detection work of service connection of customer meter in Pilot Area 1.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

No remarkable progress and consideration have been seen.

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

No remarkable progress and consideration have been seen.

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

SUSWAS Project

**2 Delay of Work Schedule and/or Problems (if any)**

**2-1 Detail**

1) Delay of preparation of 5-year Strategic Action Plan for NRW reduction (Output 1)

Since not enough time was secured to make action plans in the 1<sup>st</sup> Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in 2nd Phase together with WASAC management team and action team.

It needs to be elaborate on to produce a more tangible and practical institutional framework. The role and responsibilities of the management team in the framework for the NRW reduction plan should be confirmed.

In the management team meeting held on March 15, 2017, it was decided that the preparation work of Action Plan continues into 2nd Phase of the project until the end of August 2017 and the work method. The current situation of NRW activities, causes and countermeasures are discussed through the series of workshops held from March to May of 2017. As a result, the framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team.

Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices were listed up as tangible Action Plan for 5-year, separately, in June and July 2017.

Budged for Action Plan will be estimated in August. Action Plan will be finalized and seminar to share the result will be held at the end of August 2017. The Action Plan should be approved by Board of Directors of WASAC and MININFRA .

2) Delay of Inventory Survey (Output 1)

Inventory survey was scheduled to be implemented by local subcontracting on the JICA expart's side as

follows. However as a result of a strong wish by WASAC, it was decided that it will be carried out by WASAC, and the JICA expert will provide support for this.

However, apart from the following item c, the status of progress is considerably delayed due to personnel shortages, etc., so completion was not possible in 1st Phase. Therefore it was decided to deal with this by continuing to incorporate the details of this survey into the 5-year Action Plan for NRW Reduction.

- a. Review and Update of Schematic Transmission Pipeline Map and its Profile
- b. Review and Update of the Schematic Drawings of Reservoirs and Pumping Stations Interconnected by Transmission Pipes Above
- c. Survey of public taps and customer meters (Survey of Public Taps)
- d. Survey of public taps and customer meters (Sample Survey of Customer Meters)

3) Procurement of the equipment for water leak detectors (Output 2)

Since the proposed equipment procured by JICA for leak detection could not be delivered before the training period in 1st Phase, the training was conducted by using only rented equipment of ultrasonic flow meter, headphone-type leak detector, and electronic leak noise detector.

The equipment will be expected to deliver in July 2017.

4) Construction of the chambers for installation of the equipment for monitoring system (Output 4)

The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in 1st Phase and construction of the remaining 12 chambers are in process. The all works will be expected to complete in August 2017.

5) Procurement and installation schedule of the equipment for monitoring system (Output 4)

The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017. It is supposed the equipment will arrive in November 2017. Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert.

6) Indicator of Project Design Matrix (PDM)

Draft indicators for Overall Goal, Output 2-1 and Output 3-1 of the PDM will be proposed during the third Management Team meeting scheduled in August 2017 and will be accepted in the second SC scheduled in September 2017.

Table 1.27 PDM of This Project

Output	Objectively Verifiable Indicators
<b>【Overall Goal】</b>	NRW rate of Kigali city (year 2022 xx %) (to be confirmed during the project)
<b>【Outputs】</b>	
Output 2.	1 : More than XX number of trainees receive training.
Output 3.	1 : NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)

7) Capacity Assessment of the Project

The capacity assessment of C/Ps and related sections in Head Office and 6 Branche Offices in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase.

**3 Modification of the Project Implementation Plan**

**3-1 PO**

As a major modification, the timeline of Activity 1.4-1.10 and Activity 4.3 were shifted to the beginning of the 2nd phase from the 1st phase. This modification was reflected as PO.

Activity 4.4 and 4.5 will be started from March 2018.

**3-2 Other modifications on detailed implementation plan**

No major modification was made.

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

**4. Preparation of Rwanda Side toward after completion of the Project**

Not applicable.

**II. Project Monitoring Sheet I & II**

As attached.

**Project Monitoring Sheet I (Revision of Project Design Matrix)**

**Project Title:** Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network  
**Implementing Agency:** WASAC  
**Target Group:** WASAC staff engaged in Non-Revenue Water reduction  
**Period of Project:** 2018/6/30

**Version 3**

**Dated July 31, 2017**

**Project Site:** 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nya Model Site).

Narrative Summary		Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<b>Overall Goal</b> WASAC conducts NRW reduction measures as planned for Kigali city.		NRW rate of Kigali city (year 2022 xx %)(to be confirmed during the project)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	N/A	
<b>Project Purpose</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.		1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC. 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization.  WASAC staff do not resign after training by the Project.  Large scale natural disaster does not occur.	Structure of WASAC was revised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement Planning Unit of UWSS to the direct control of CEO, movement of the GIS section to under the WWS unit.	
<b>Outputs</b> 1 Planning capacity of NRW reduction of WASAC is enhanced.		1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		<ul style="list-style-type: none"> <li>The relevant information are being collected from existing data and documents (GIS data, Customer data, PIP, Performance Improvement Programme, NRW Action Plan, Questionnaire survey for 20 branches)</li> <li>Site visit survey for up-country Branch offices) was conducted to get fact-findings of WASAC's NRW reduction activity for the cause analysis of NRW.</li> <li>Inventory survey is being conducted by WASAC</li> <li>Since not enough time was secured to make action plans in the 1st Phase three months behind the initial schedule, the Project Team proposed to continue to elaborated action plans in Phase 2 together with WASAC management team and action team.</li> <li>Framework of the Action Plan was finalized in the seminar held on May 29, 2017 by WASAC management team and action team.</li> <li>Detail sub-actions of counter measures, working schedule, Bill of Quantity of the activities at each responsible sections of Head Office and 20 Branch Offices will be listed up as Action Plan for 5-year separately, in June and July 2017.</li> <li>Budget for Action Plan will be estimated in August.</li> <li>Action Plan will be finalized and seminar to share the result will be held at the end of August 2017.</li> <li>Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during</li> </ul>	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.		2-1 More than XX number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		<ul style="list-style-type: none"> <li>Training on NRW management was conducted</li> <li>OJT was conducted on the updating of GIS data base</li> <li>OJT was conducted on hydraulic analysis, and pressure management</li> <li>In-room training and OJT on leak detection was conducted. Since the proposed equipments for leak detection were not delivered before the timing of the training, only limited rental equipments were used. Another training is planned in the 2nd Phase through the Pilot Project.</li> <li>In-room training and OJT on repairing leaking pipes and installing service connections was conducted and another training is planned in the 2nd Phase through the Pilot Project. The materials and equipments to be used for the training were procured.</li> <li>In-room training and OJT on meter reading, billing, customer services will be conducted in the 2nd Phase through the Pilot Project.</li> <li>The capacity assessment of C/Ps and related sections in Head Office and 6 Branches in Kigali city will be carried out through the activities in the 2nd Phase. So, the baseline survey and end line survey for capacity assessment will be carried out in the 2nd Phase.</li> <li>Draft indicators for Output 2-4 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017.</li> <li>Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.		3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		<ul style="list-style-type: none"> <li>Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch) were selected.</li> <li>The preparation work in order to setting up above two pilot areas (DMAs) was conducted such as procurement of the equipments and construction of chambers for inflow measurement, separation of tertiary distribution pipes for isolation of the area and installation of valves in the network.</li> <li>Implementation of the OJT activity for Area 1 was planned.</li> <li>The baseline survey of pilot areas will be implemented for NRW reduction.</li> <li>Draft indicators for Output 3-1 will be proposed by the Expert Team during the third Management Team meeting scheduled on August ** 2017 and will be accepted in the second SC scheduled beginning of September 2017.</li> <li>Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>	
4 4 branches in Kigali establish the system to measure NRW rates accurately.		4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		<ul style="list-style-type: none"> <li>Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided.</li> <li>Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey.</li> <li>Detailed design was done for preparation of technical specifications of the equipment of a monitoring system.</li> <li>The chambers were designed and construction work has been started from March 2017. The 11 chambers were constructed in Phase 1 and construction of the remaining 12 chambers are in process.</li> <li>The tender procedure on procurement of the equipment of monitoring system has been started from May 26, 2017. It is supposed the equipment will arrive in November 2017.</li> <li>Afterward, installation of the equipment will be carried out by WASAC as the training under instruction of JICA Expert.</li> <li>Implementation of the activities mentioned in Objectively Verifiable Indicators are planned in upcoming steps during the 2nd Phase.</li> </ul>	

Activities	Inputs		Pre-Conditions
	The Japanese Side	The Rwanda Side	
1-1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser/Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	
1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team reviews 5-year Strategic Action Plan for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection(40m <sup>2</sup> )	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Ultrasonic flow meter with data logger	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kiculi	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project	
2-8 Training materials on NRW are reviewed and updated.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1.	Vehicles for Japanese experts		
3-2 The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.			
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1.			
3-4 The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the (nets of the Pilot Area 1.			
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team reviews the results from Activities 3-6 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.			
3-13 The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15 Action team conducts activities from Activities 3-1 to 3-14 at Pilot Area 2.			
3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.			
4-4 System input to each of 4 branches is measured.			
4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

-GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.

<Issues and countermeasures>

By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017. Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule.

In the beginning of September, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikeUrban was made by Esri in the end of October.











**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : 2nd STEERING COMMITTEE.  
Place : Highland Hotel  
Date : 12. 10. 2017.

Name	Position	
1. GASHUGU Innocent	Position: Manager, WAS Mobile: 0738521483	E-mail: igashugiu@wasac.rw
2. Venu + MPIMBAZIWA	Position: Senior Engineer/ Urban Water Supply Mobile: +250788550872	E-mail: venuke.mpirimbaziwa@wasac.rw
3. MULINDABIGWIRA Gilbert	Position: Head of Remera Branch Mobile: 0738595969	E-mail: gmulindabigwira@wasac.rw
4. SARANDA Catherine	Position: Head Nyamirambo Branch Mobile: 0782031897/0732031897	E-mail: csaranda@wasac.rw
5. MWIKIZA AKA CLET	Position: Head of KANUMBE Branch Mobile: 0788306793	E-mail: cmwikiza@wasac.rw
6. MUSAHOYE JEANNE	Position: Head of Kayun Branch Mobile: 0788305792	E-mail: jmushoye@wasac.rw
7. VUYISENGE Védaste	Position: Head of Gikondo branch Mobile: 0788775248	E-mail: vuyisenge@wasac.rw
8. Marcel Brouwer	Position: ICT expert ZICA team Mobile: 0031623366102	E-mail: marcel.brouwer@vitens.nl
9. Anicet NSENGIMANA	Position: Assistant Engineering /NRW project Mobile: 0788424344	E-mail: hanicet2009@yahoo.fr
10. Gikundiro Merly Rosiny	Position: Secretary	

	Mobile: 0788553502 gmerly@yahoo.fr	E-mail:
11. Désiré KAYIRU	Position: Head of Billing & Magnet Service Mobile: 0788307664	E-mail: dkayiru@wasac.rw
12. REBERO Jean d'Amour	Position: JICA WADAN Coordinator Mobile: 0788574599	E-mail: Reberojean.damour.ku@jica-go.jp
13. Aya KAGOTA	Position: Program Manager, JICA Mobile: 0788304704	E-mail: Kagota.Aya@jica.go.jp
14. Tomonori NAYASE	Position: Senior Representative JICA Mobile: 0788301925	E-mail: <del>Tomonori</del> Tomonori@jica.go.jp
15. Masanobu MAYUSUMI	Position: JICA Expert Mobile: 0788 824190	E-mail: mayusumi.masanobu@gmail.com
16. Jean Paul KAYITARE	Position: Head of Zoning & Mapping Services Mobile: 0782271580	E-mail: JPkayitare@wasac.rw
17. BYAMUGISHA Bernard	Position: Head of branch Mobile: 078307824	E-mail: bbyamugisha@wasac.rw
18. DESIRÉ NTAMUTURANO	Position: Head of Leak Detection & Pressure Management Mobile: 7250788874664	E-mail: dntamuturanos@wasac.rw
19. Celestin Mwambutsa	Position: Leak detection & Pressure management officer Mobile: 0788638762	E-mail: cmwambutsa@wasac.rw
20. Shigeo OTSU	Position: JICA Expert Mobile: 0781449855	E-mail: <del>otsu</del> shigeo.otsu@gmail.com
21. BAHIGE A. Bouchama	Position: NRW Manager Mobile: 0788307401	E-mail: jbahige@wasac.rw
22. GATANZI Felix	Position: Ag. Commercial Director Mobile: 0788305791	E-mail: fgatanzi@wasac.rw



<b>PROJECT FORSTRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK</b>	
<b>Memorandum of meeting</b>	
<b>Name</b>	The Second Steering Committee (2nd SC)
<b>Date</b>	2017/10/12, 9:45 – 01:00
<b>Venue</b>	HIGHLAND Hotel
<b>Participants</b>	<p><b>Official from MININFRA:</b>MPIMBAZIMANA Venuste</p> <p><b>WASAC:</b> 14members (RUTAGUNGIRA Methode,GASHUGI Innocent, BAHIGE Jean Berchmas, GATANAZI Felix,KAYIRU Desire,MWAMBUTSA Celestin,NTAMUTURANO Desire,KAYITARE Jean Paul,SARANDA Catherine,MULINDABIGWI Gilbert,MUKIZA Anaclet,MUSABYEYEZU Jeanne,TUYISENGE Vedaste BYAMUGISHA Bernand)</p> <p><b>JICA Rwanda Office :</b> 3 members(NAGASE Tomonori, AYA Kagota,REBERO J Amour)</p> <p><b>JICA Long Term Expert on the Project:</b>1 member MASANOBU Mayusumi</p> <p><b>JICA experts:</b>4 members (SHIGEO Otani,MARCEL Brouwer, Gikundirosine Merly,NSENGIMANA Anicet)</p>
<b>INTRODUCTION</b>	
<p>The Steering Committee held on October 12, 2017 was authorized by the instruction of contract paragraph and annex indicating the project outputs, work plan and all stakeholders involved in its implementation signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the 3years Project for strengthening Non Revenue Water Control in Kigali City Water network, the purpose of this meeting is to review the project progress ,the approval of the Work Plan of Phase2 two, indicators in PDM and capacity development.</p>	
<b>1. The agenda was as follow:</b>	
<ul style="list-style-type: none"> <li>• Registration</li> <li>• Introduction of participants</li> <li>• Remarks by CEO WASAC</li> <li>• Remarks by JICA RWANDA representative</li> <li>• Progress of the work(Result of the Monitoring)</li> <li>• Question and Answer</li> <li>• Report of Training result in Japan</li> <li>• Question and Answer</li> <li>• Work Plan for Phase 2</li> <li>• Question and Answer</li> <li>• Remarks by MININFRA</li> <li>• Closing Remarks by WASAC</li> </ul>	
<b>2.Introduction of Participants</b>	

The second Steering Committee was started by giving 10 minutes each participants to introduce themselves.

### **3. Remarks by CEO WASAC**

Unfortunately the CEO didn't not come because of some urgent matters, also the Director of UWSS came later that why we heard the CEO remarks through the Manager of Water Distribution Services. Mr. Innocent started by thanking everyone who participate in today's meeting and a big thanks to JICA for the technical and financial support. He says that the object of this meeting is to share the information about the project, our colleagues will go through the progress of work done in this project so far in their Presentations they will make, and he invites everyone to participate and give the comment. Mr. Innocent conclude by saying that with the help of this project WASAC will be able to reduce NRW to 30% as expected.

### **3. Remarks by JICA Rwanda representative**

Mr. Nagase the representative of JICA in Rwanda began his speech by thanking the representative of MININFRA for coming, also WASAC for their good ownership. The representative of JICA said that the project is to establish 5years strategic action plan for NRW reduction so that the rate of NRW can be reduced, this is possible if everyone understand it and put his/her effort in that. He concluded by saying that JICA will continue to support WASAC in water sanitation.

## **4. Progress of the Work(Result of the Monitoring)**

### **OUTPUT 1:5-year Strategic Action Plan for NRW reduction**

This Output 1 was explained by Mr. Bahige as attachment.

### **OUTPUT 2: In- room Training**

This In-room & on-job Training conducted by JICA Experts and WASAC's staff was presented by Mr. Celestin as attachment.

### **Output 3: Pilot projects**

This output 3 was presented by Mr. Desire Head of Leak Detection and Pressure Management as attachment.

### **Output 4: isolation of 4branches**

This output 4 was presented by Jean Paul as attachment.

## **5. Question and Answer**

**Question:** Mr. Venuste from MININFRA asked that there is some activities which don't require so many things and they delay, he gives the example of leakage even small one, when sometimes to respond for it took time.

**Answer:** WASAC is trying to reduce time to fix the leakage and has been reduced remarkably by various efforts, however, there are still some challenges like lack of number of technician and transportation in branches. Those challenges will be solved according to the 5YSAP, especially should

increase their commitment and pension.

Ms.Kagota from JICA also commented on this, by saying that after preparation of 5YSAP, how to implement the 5YSAP will be the key. MININFRA should continue giving full support to WASAC and get ensure more budget which will used to facilitate the activities of reducing NRW according to the 5YSAP.

**Question:** In Output 2, it was mentioned that many trainings took place, How their works has been changed by using the skills and knowledge they got through the training.

**Answer:** It is still early to say that they perform very well 100% but they are learning from failure and improving day by day, for example they are good in detecting a leakage and repair it and more will come later.

**Question:** Why GIS data are not completely update and how long will take to update those data?

**Answer:** it will take time to be updated 100% but GIS team are doing their best.

## **6 .Report of Training result in JAPAN**

The aim of the project in its output two was capacity building of WASAC staff in NRW reduction that is why JICA has organized trainings for 5 WASAC, staff to learn from the experience of water Bureau in Japan. Mr. Jean Paul Head of GIS presented as attachment V.

## **7. Work plan for Phase2 and Project Evaluation**

Mr.Otani, JICA expert presented as attachment.

## **8.Remarks by MININFRA**

Mr. Venuste thanks every one of its participation of this meeting, and also JICA for the big support, he encourages everyone to make fully support, motivation for this good progress and he ended by saying that MININFRA will continue support WASAC in its work.

## **9.Approval Matters**

Mr. Bahige, Project Manager, asked to all attendances to the SC about approval of Work Plan for Phase 2 and Verifiable Indicators of PDM for "Overall Goal", "Output2", and "Output3", and these were approved.

## **10.Closing Remarks by WASAC**

It's Mr.Methode who made the final closing remark, his words was thanking everyone for their input participation which give hope because everyone understand the goals to implement the project. He said that even if the 5YSAP isn't approved, we all know what we have to do, do it not need to wait for the approval. He concluded by thanking JICA for the help and in case of the delay of activities due to procurement of activities by JICA Mr.Methode said that it won't affect many thing because for sure JICA is wanted to supply best quality.





**Technical Cooperation for  
Strengthening NRW control in  
Kigali City Water Network**

**Steering committee meeting  
Kigali , 12 October 2017**

**Purpose of  
this Steering Committee**

1. Report of Progress of the Project  
based on the result of Joint Monitoring Meeting on August 9, 2017
2. Acceptance of the Work Plan for Phase 2
3. Acceptance of the way of Project Evaluation
  - 3-1 Verifiable Indicators of PDM
  - 3-2 Project Capacity Assessment

## **Progress of the Project**



Contents	Summary of the Project
1) Overall Goal	WASAC conducts NRW reduction measures as planned for Kigali city.
2) Project Purpose	WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.
3) Outputs	【Output 1】 Planning capacity of NRW reduction of WASAC is enhanced.
	【Output 2】 Basic knowledge, skills and technique on NRW control are acquired by WASAC.
	【Output 3】 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.
	【Output 4】 4 branches in Kigali establish the system to measure NRW rates accurately.



### Output 1: Planning capacity of NRW reduction of WASAC is enhanced



Activities	Plan	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
<b>Sub-Activities</b>	Actual												
<b>Output 1: Planning capacity of NRW reduction of WASAC is enhanced.</b>	Actual												
1.1 A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.	Plan												
	Actual												
1.2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	Plan												
	Actual												
1.3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan												
	Actual												
1.4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Plan												
	Actual												
1.5 Based on the results of Activity 1-4, the management team prepares a report on the necessary facilities improvement.	Plan												
	Actual												
1.6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Plan												
	Actual												
1.7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.	Plan												
	Actual												
1.8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Plan												
	Actual												
1.9 The management team prepares the 5-year Strategic Action Plan on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan												
	Actual												
1.10 The management team holds seminars and presents 5-year Strategic Action Plan for NRW reduction (Activity 1-9) for WASAC and other concerned parties.	Plan												
	Actual												



### 3 days workshop for 5YSAP preparation



### Output 2 : Basic knowledge, skills and technique on NRW control are acquired by WASAC.



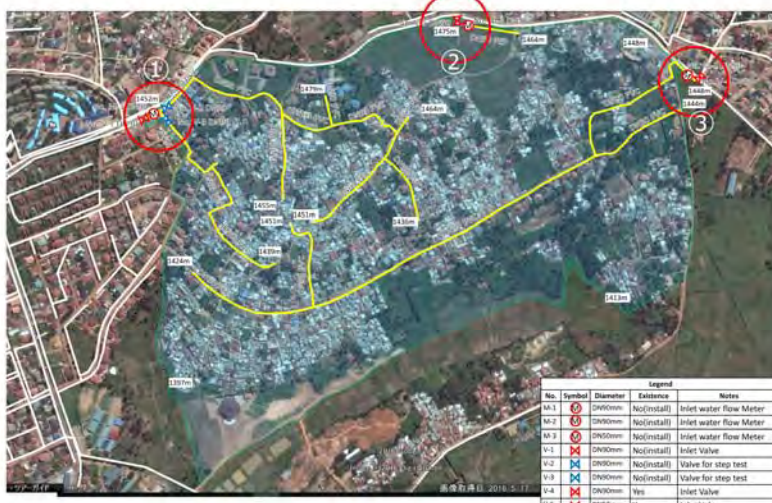
Activities	Plan	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				
		I	II	III	IV	I	II	III	IV	I	II	III	IV	
2.1 Training materials on NRW control are prepared.	Actual	■												
2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Plan		■											
	Actual		■											
2.3 OJT is conducted on the updating of GIS data, using available GIS data base.	Plan		■											
	Actual		■											
2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Plan		■											
	Actual		■											
2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan			■										
	Actual			■										
2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan			■										
	Actual			■										
2.7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan			■										
	Actual			■										
2.8 Training materials on NRW are reviewed and updated.	Plan												■	
	Actual												■	
2.9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan													
	Actual													



### Output 3 : WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

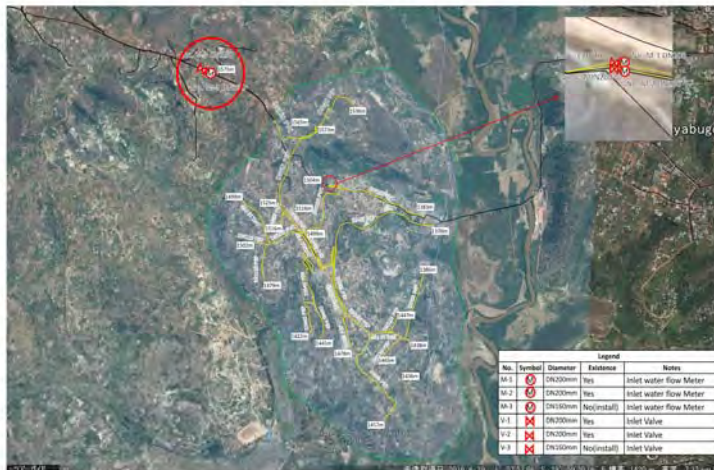
Activities	Plan	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)					
		I	II	III	IV	I	II	III	IV	I	II	III	IV		
3.1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Actual														
3.2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Actual														
3.3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Actual														
3.4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.	Actual														
3.5 The action team establishes the baseline NRW rate of Pilot Area 1.	Actual														
3.6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Actual														
3.7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Actual														
3.8 The action team conducts measures for reducing surface leakage (visible leakage).	Actual														
3.9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Actual														
3.10 The action team conducts measures for reducing underground leakage (invisible leakage).	Actual														
3.11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Actual														
3.12 The action team reviews the results from Activities 3-5 to 3-11, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, and 3-10.	Actual														
3.13 The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Actual														
3.14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.	Actual														
3.15 Action team conducts activities from Activities 3-5 to 3-14 at Pilot Area 2.	Actual														
3.16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.	Actual														

### Kadobogo (Kiyovu) DMA





### Ruyenzi (Runda) DMA





**Output 4: Establish the system to measure NRW rates accurately in 4 Kigali branches ( Isolation of 4 branches )**



Activities	Plan	1st Year (16/17)												2nd Year (17/18)												3rd Year (18/19)											
		I			II			III			IV			I			II			III			IV			I			II			III			IV		
Sub-Activities	Actual	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	
4.1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.	Plan	█	█	█	█	█																															
4.2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.	Plan			█	█	█																															
4.3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.	Plan																																				
4.4 System input to each of 4 branches is measured.	Plan																																				
4.5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.	Plan																																				



**Location map for 4 branches Isolation**







Total of 32

MAG flowmeters

50	1
80	8
100	4
125	1
150	5
200	7
250	1
300	1
400	3
600	1
Total	32

## Summary

Outputs	Progress	Comment (from initial plan)
1. Planning capacity of NRW reduction of WASAC is enhanced (5YSAP)		Delay of 4 months (Up to October 2017)
2. Basic knowledge, skills and technique on NRW control are acquired by WASAC.		Good progress
3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.		Good progress
4. Establish the system to measure NRW rates accurately in 4 Kigali branches ( Isolation of 4 branches )		Delay of 14 months (Up to Aug. 2019)



THANKS



## **WASAC- NRW REDUCTION 5 YEARS STRATEGIC ACTION PLAN**



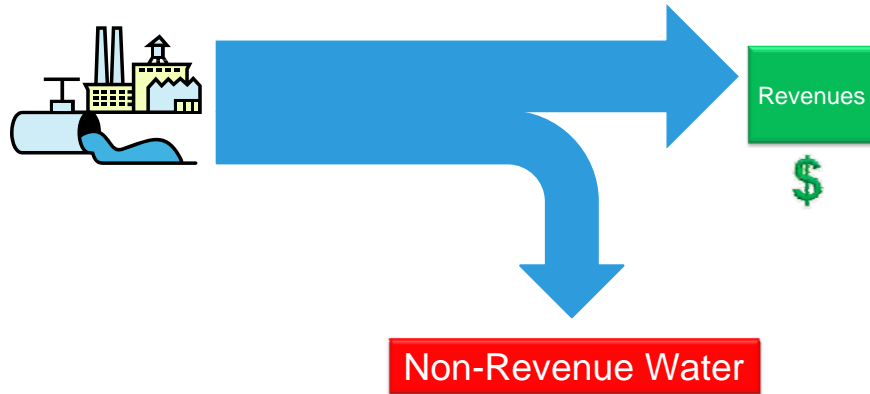
### **Presentation outline**

1. NRW definition and Causes
2. IWA Water balance
3. Diagnosis of the Current situation
4. Proposed strategies
5. Detailed action plan
6. Budget



## Non-Revenue Water

Non-revenue water (NRW) is the water that has been produced but not billed to the customer

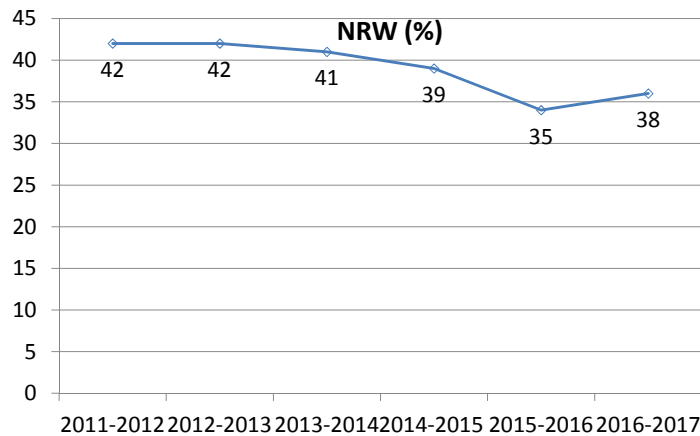


## IWA, WATER BALANCE

	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue water
			Billed Unmetered Consumption	
Supplied Volume		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
	Commercial losses		Metering inaccuracies	
			Error in estimation of unmetered consumption	
			Unauthorized consumption	
			Errors linked to the data acquisition processes	
	Water loss	Technical losses	Leakages on Transmission and Distribution Mains	
			Leakages and Overflows at Storage Tanks	
			Leakages on Service Connections up to point of Customer Meter	



## WASAC , NRW trend ( 2011-2017 )



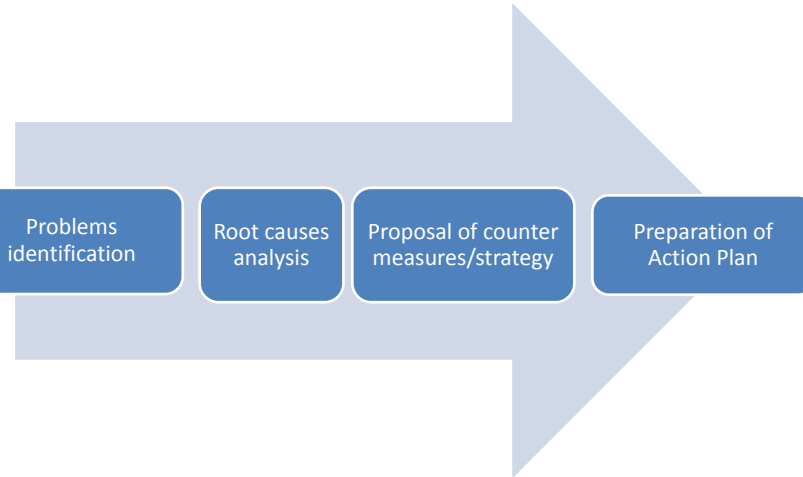
## 5YSAP OBJECTIVES



- Holistic planning and implementation of NRW reduction measures
- “Preventive Action” and not “Reactive” currently
- Sustainability of activities
- Clear Mechanism to effectively monitor NRW programs
- Capacity building
- NRW reduction



## 5YSAP – PREPARATION



### Problems Identification (Technical)



#### Production

- Intermittent supply (frequent rationing )

#### Leaks and burst

- High pressure in the network
- Time response to leaks repair still high:
- Insufficient Leak survey and detection activities
- Sometimes Poor quality of repairs and material

#### Design and mapping

- GIS data not yet completed updated and linked with the billing system
- Design of water network need some improvement

#### Standard

- Less of on-site work and material standard inspection
- Poor quality of materials purchased by customers
- Sometimes no compliance of standard (house connections, material ,trenching and backfilling

#### Asset management

- Aged pipes and less protective equipment
- Preventive maintenance plan not fully implemented
- Pipe replacement planned but not fully implemented



## Problem Identification (Commercial)



### Billing

- Less field inspection by billing Officer and Commercial services staff
- Some Customers not billed

### Data acquisition and analysis

- Error in data acquisition ( meter reading )
- Insufficient data analysis (consumption, billing, zero consumption, etc..)
- Under estimation of consumption

### Metering

- Many aged water meters
- Customer meter accuracy test not practiced on-site
- Water meter blocked by solid particles

### unauthorized consumption

- Less inspection of customer installation
- Illegal water use cases
- Illegal water use to disconnected customers ( inactive connection )



## Problems Identification (ADMISTRATIVE)



### WASAC

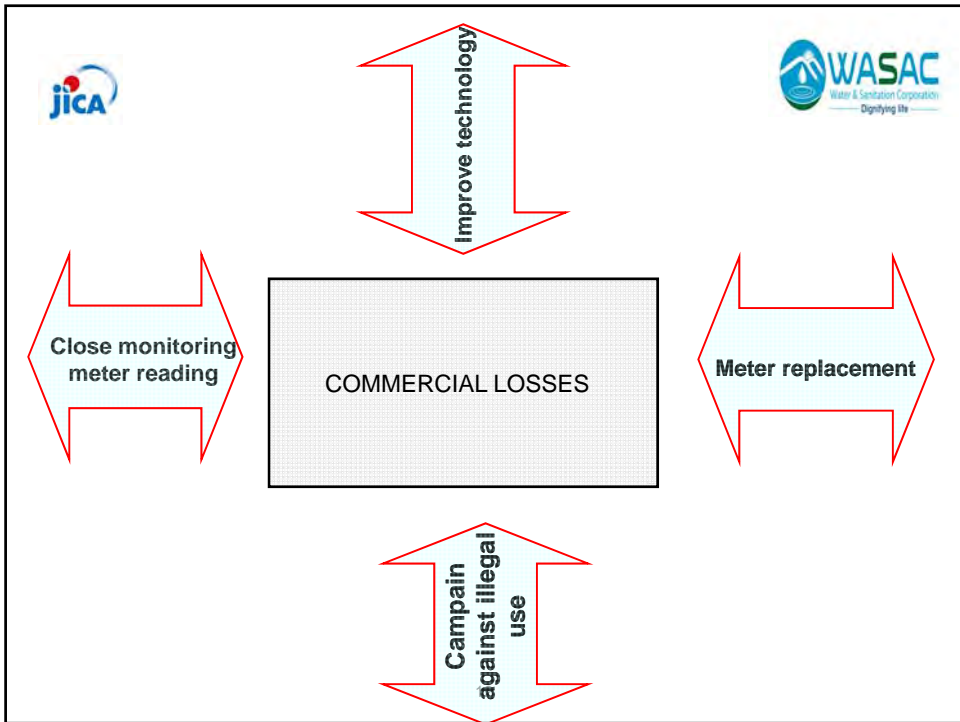
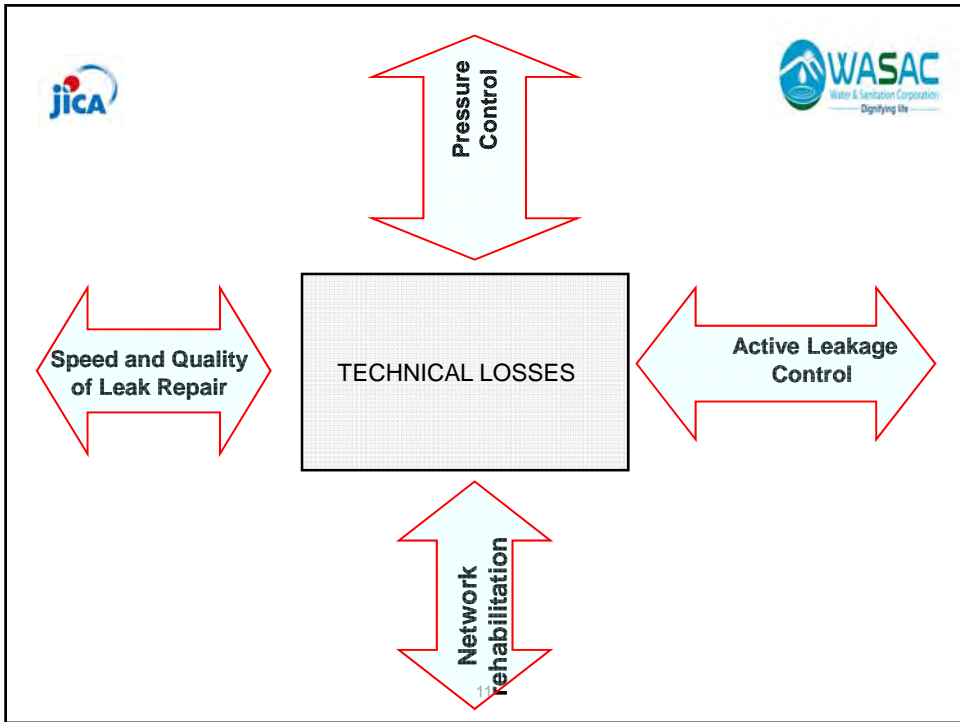
- Budget constraint
- Insufficient logistic means
- Branch structure not really responsive

### CUSTOMERS

- Customers awareness on NRW still not sufficient
  - Vandalism
  - Illegal water usage

### OTHER STAKEHOLDERS

- Poor quality of work done by some contractors
- Lack of stakeholder awareness on NRW
- Pipe damaged other infrastructures developers ( road construction, telecommunication , etc..)







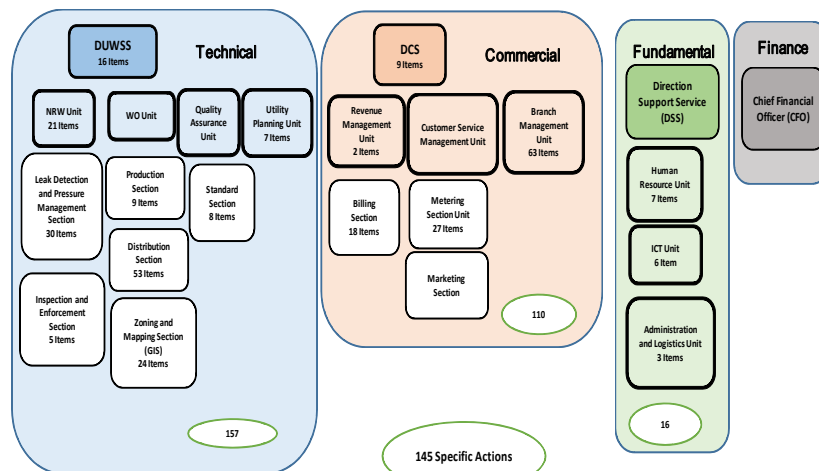
# Detailed Action Plan



- [Final table 5YSAP 28082017.xlsx](#)



## Related Sections for NRW Reduction Activity





## 5YSAP –BUDGET ESTIMATION



Fiscal Year	Estimated Budget	Note
2017/2018	775,540,000	Phase one
2018/2019	818,240,000	
2019/2020	1,041,330,000	
2020/2021	96,2881,250	
2021/2022	996,657,331	
Total	4,596,648,581	



### Implementation and monitoring team



- The DUWSS and Commercial directorates are key for the implementation of this 5YSAP.
- The support services and finance directorate should ensure the full support for the implementation of this 5YSAP.
- The unit/section and team mentioned for specific actions are directly responsible for their implementation.
- The NRW unit will be the driving force for the implementation of all planned activities
- The monitoring of the implementation will be done quarterly



## Next step



- Presentation and the Approval of the 5YSAP by WASAC Management ( October 2017)
- Share the document with other stakeholders
- Implementation of the 5YSAP
- Continuous monitoring



Thank you



**Project :**

**STRENGTHENING NRW CONTROL IN KIGALI CITY  
WATER NETWORK**

**OUTPUT 2**

**In-room & On-job training conducted by JICA Experts  
and WASAC's staff.**

*Tuesday, October 24, 2017*

*JICA-WASAC- Output 2 – Training - By M. Celestin*



**OUTLINES OF THE  
PRESENTATION**



- I. Structure of the project(where is the output 2);**
- II. Objective of the output 2**
- III. Planned trainings**
- IV. Progress and Outputs of trainings**

*Tuesday, October 24, 2017*

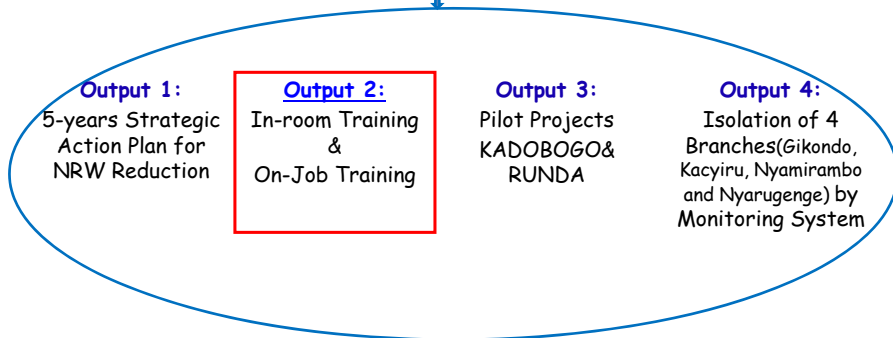
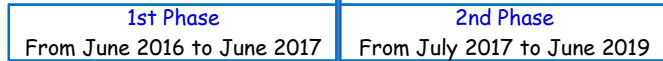
*JICA-WASAC- Output 2 – Training - By M. Celestin*



## I. Structure of the project



### STRENGTHENING NRW CONTROL IN KIGALI CITY WATER NETWORK

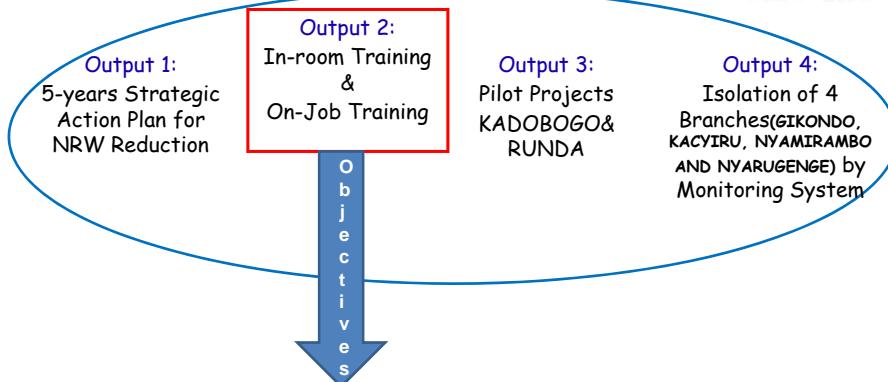


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## II. Objectives of Output 2



- ✓ Acquisition of basic knowledge, skills and techniques on NRW reduction and control through **In-room & On-Job Trainings**.
- ✓ Preparation of training materials for future trainings by WASAC's staff it self.

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### III. Planned Trainings



#### 1st Phase (From June 2016 to June 2017)

1. Training of the project management team(japan),
2. OJT for updating GIS data,
3. OJT for hydraulic analysis and pressure management,
4. In-room training for leak detection
5. In-room training on repairing leaking pipes and installing service connection ...,
6. In-room training on meter reading, billing, customer services ....

#### 2nd Phase (From July 2017 to June 2019)

1. Training of action team (JAPAN)
2. OJT for leak detection
3. OJT on repairing leaking pipes and installing service connection
4. OJT on meter reading, billing, customer services
5. Training in third country (other than Japan and Rwanda)

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### IV. Progress of planned trainings and output of each.



#### 1st Phase ( June 2016 to June 2017)

1. Training of the project management team

- Targeted staff: Directors and Managers
- Number of trainees: 5
- Topics:
  - ✓ Water Distribution management system,
  - ✓ Real and Apparent loss reduction

- Progress: 100% done.
- Output of the training:
  - The 5 trainees gained the appropriate knowledge and skills for the reduction of NRW on its all components.
  - A Five year strategic action plan for NRW reduction have been prepared.

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## V. Progress of planned trainings and output of each.



1st Phase( June 2016 to June 2017)

- 2. OJT for updating GIS data,
- 3. OJT for hydraulic analysis and pressure management,

•Targeted staff: GIS section(AT), Water Engineers and Branch WDO.

•Number of trainees: 32

•Trainers: OWEN, EITA and TSUTSUI

•Topics:

- ✓Hydraulic calculations
- ✓GIS data management(customer and network updates)

- Progress: 100% done.
- Output of the training:

- WASAC GIS Team have acquired the guidelines on the use of ArcGIS for Updating new customers in Geo-Database.
- The Team gained also basic knowledge in Hydraulic Calculations.

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## V. Progress of planned trainings and output of each.



1st Phase( June 2016 to June 2017)

- 4. In-room training for leak detection
- 5. In-room training on repairing leaking pipes and installing service connection ...,

•Targeted staff: NRW Unit, WDOs and Plumbers

Number of trainees: 18

•Trainers: TAKASHIMA, TAKAHASHI, SUZUKI, MOMOZONO and TSUSTUI assisted by NRW Unit Eng.

•Topics:

- ✓Leak detection , Measurement and analyze of minimum night flow in a DMA, etc.
- ✓Pipe works and Thrust block Calculation, etc

- Progress: 100% done.
- Output of the training

- ✓ Improved knowledge on appropriates tools for cutting, welding, drilling different types of pipes of WDOs and technicians from Kigali branches
- ✓ Improved knowledge on how to conduct a leakage survey in distribution areas, to measure and analyze the minimum night flow, to conduct a pre- location of leaking zones, etc.

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## V. Progress of planned trainings and output of each.



### 1st Phase ( June 2016 to June 2017)

#### 6. In-room training on meter reading, billing, customer services ....

• **Targeted staff:** B. Managers, WDOs, CSOs, Plumbers, Meter readers from Kigali branches.

• **Number of trainees:** 94

• **Topics:**

- ✓ **Meter Reading** By Desire KAYIRU & SUZUKI
- ✓ **Meter Conditions**(How to judge whether they are normal or not?) By Felicien NIRINGIYIMANA and Celestin MWAMBUTSA
- ✓ **Customer Service and Service Delivery** By Felix GATANAZI
- ✓ **Standard Service Connections** By Celestin MWAMBUTSA & Anselme MUGABO
- ✓ **Different types of Water meters** By Celestin MWAMBUTSA
- ✓ **Meter installation** By Celestin MWAMBUTSA
- ✓ **Customer Data Analysis** By Jean Paul KAYITARE

• **Progress:** 100% done.

#### • Output of the training

- Meter readers from each Kigali branch got a lot of information about meter readings and meter problems.
- WDOs from each Kigali branch performed their knowledge on how to choose the size, the type, metrological classes(accuracy) of water meters according to customer needs.

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## V. Progress of planned trainings and output of each.



### 2nd Phase (From July 2017 to June 2019)

1. Training of action team (JAPAN)
2. OJT for leak detection
3. OJT on repairing leaking pipes and installing service connection
4. OJT on meter reading, billing, customer services
5. Training in third country(other than Japan and Rwanda)

#### • Progress:

- The first team of 5 WASAC's staff went in JAPAN in August 2017

#### • The output: to be presented by **KAYITARE JEAN PAUL**

- The second team of 5 WASAC's staff will go in JAPAN in Nov. 2017

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## V. Progress of planned trainings and output of each.



### 2nd Phase (From July 2017 to June 2019)

1. Training of action team (JAPAN)
2. OJT for leak detection
3. OJT on repairing leaking pipes and installing service connection
4. OJT on meter reading, billing, customer services
5. Training in third country (other than Japan and Rwanda)

- **Progress:**

OJT for the 2<sup>nd</sup> phase will be done in pilots areas: KADOBOGO and RUNDA DMAs from the beginning of 2018.

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## V. Progress of planned trainings and output of each.



### 2nd Phase (From July 2017 to June 2019)

1. Training of action team (JAPAN)
2. OJT for leak detection
3. OJT on repairing leaking pipes and installing service connection
4. OJT on meter reading, billing, customer services
5. Training in third country

- **Progress: Not yet done.**

It will be done in another country than Japan and Rwanda.

JICA & WASAC will decide the number of trainees and the country in which will be done the training.

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## V. Progress of planned trainings: **Total Trained Staff.**



**1st Phase** (June 2016 to June 2017)      **2nd Phase** (From July 2017 to June 2019)

**Total Trained Staff**

**149**

**Total Trained Staff**

**5**

<https://mega.nz>

Account: [nrw.wasac.jica.team@gmail.com](mailto:nrw.wasac.jica.team@gmail.com)

Password: [www.wasac.rw](http://www.wasac.rw)

Training materials and action plans made during different trainings are on mega site made by JICA Experts.

Every WASAC's staff can excess

Tuesday, October 24, 2017

JICA-WASAC- Output 2 – Training

- By M. Celestin



# END



Thank you  
for your attention!

Tuesday, October 24, 2017

JICA-WASAC- Output 2 – Training

- By M. Celestin



**PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK**

**Output 3**

**Activities in Pilot Area**

*By Desire*

**Outline of the Presentation**

- Introduction
- Selection Criterias of the Pilot area
- Kadobogo Pilot area (Map)
- Current Situation in kadobogo
- Ruyenzi (Map)
- Chamber design and Construction
- Pictures

## Introduction

- **Pilot Area/DMA:** is an area or District Metered Area well isolated and metered in water distribution network.
- It is usually created by closing boundary valves to facilitate in monitoring water input ,output and billing in the area which lead to calculation of Non-Revenue Water rate inside the area.

## Selection Criteria's for Pilot Area

- Possibility of isolation
- 24 hours and 7 days water supply
- Accuracy of distribution map
- Water meter is installed at every houses
- Frequent leakages
- Possibility of leak detection

## Activities before creation of Pilot Area

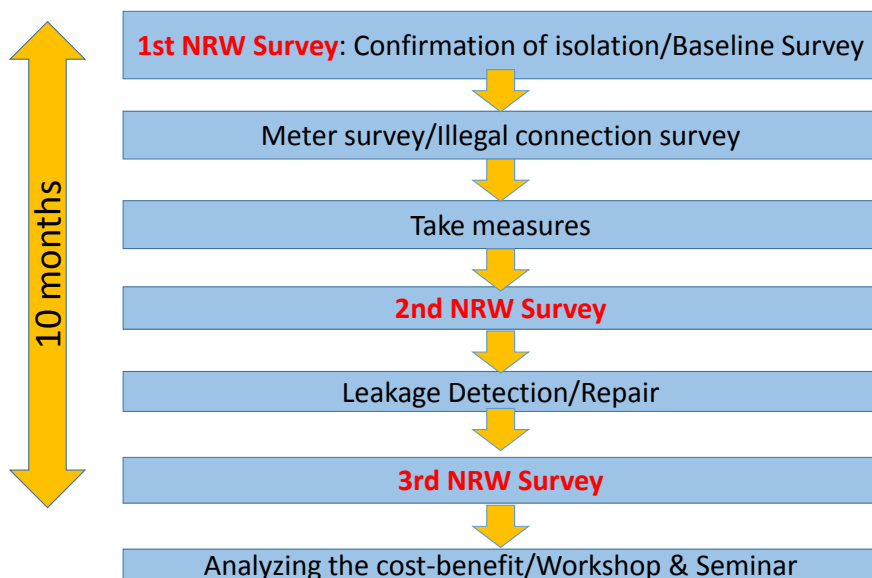
- Preparation of Pilot Area
  - ✓ (1) Establish the Action team
- Site visit, Checking Maps and selection of pilot area
- ✓ (2) Chamber and Plumbing
- ✓ (3) Survey of the current situation
- Analyze the Customer data
- ✓ (4) Prepare the document and Form “Leakage survey report”  
etc.

2017/10/24

NRW WASAC-JICA Presentation

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## Activities carried out in Pilot Area

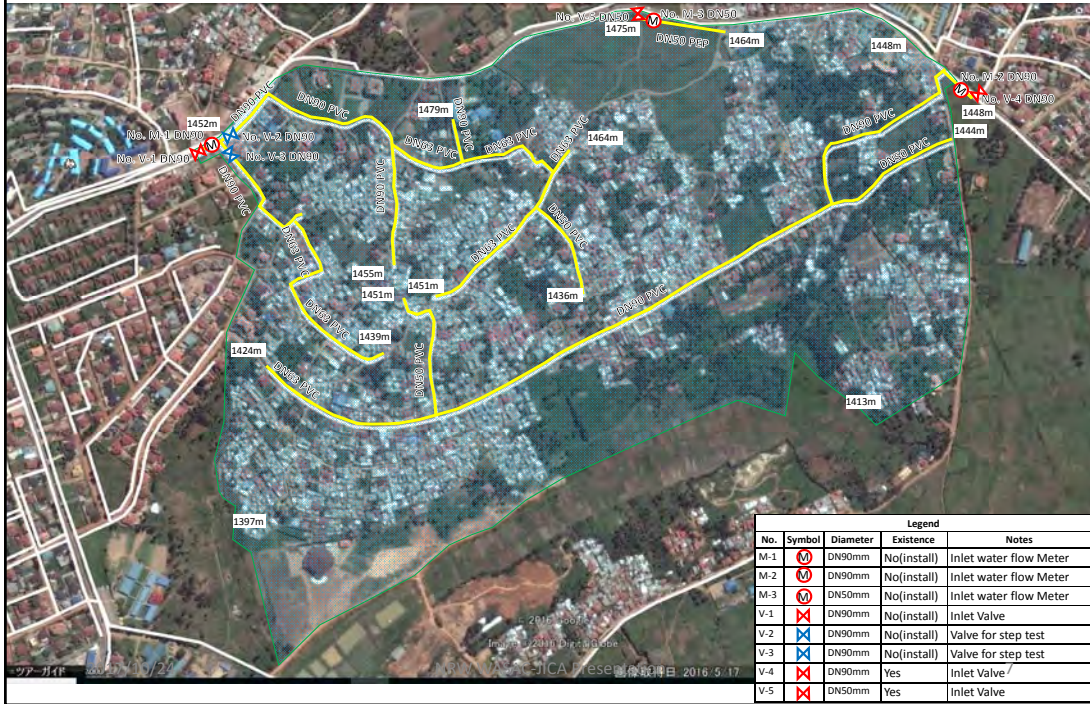


2017/10/24

NRW WASAC-JICA Presentation

6

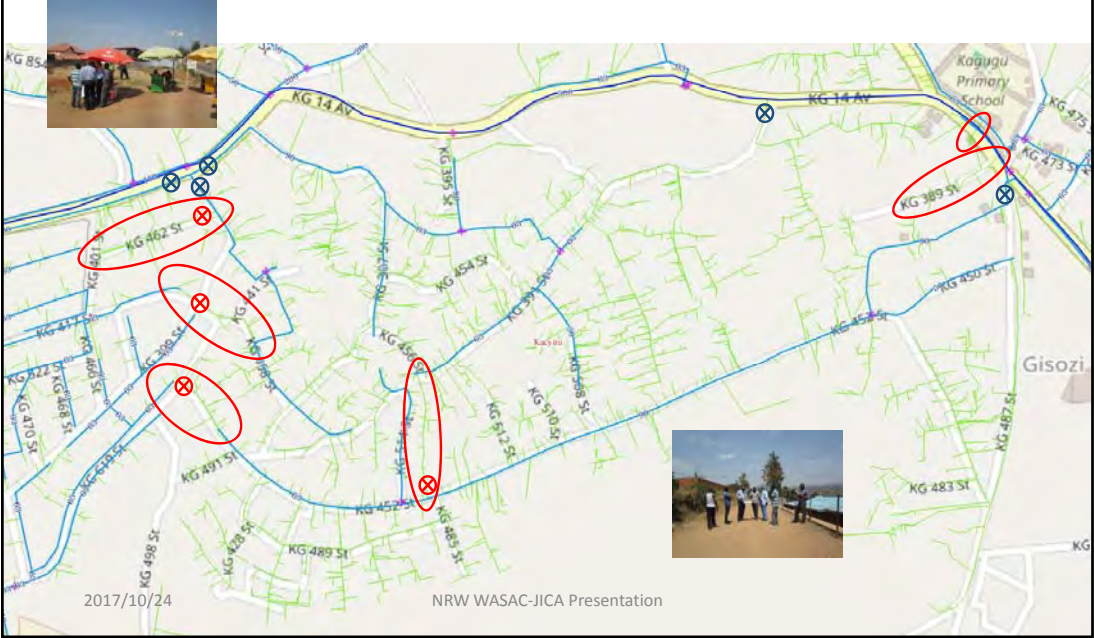
# KADOBOGO Pilot Area



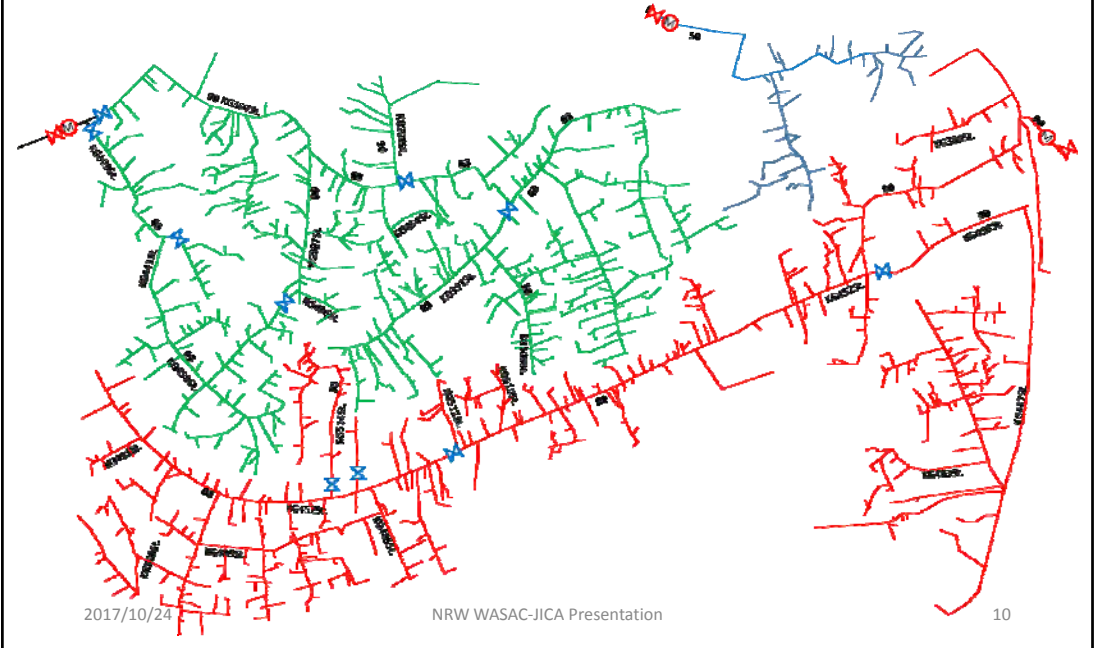
## Data of Pilot Areas

KADOBOGO PILOT AREA (as of July 2016)	
Area	100.4ha
Population	15,329
Served Population (=Number of connections x 5)	4,940
Number of Connections	938
Monthly Water Consumption (m3/month)	13,157
RUYENZI PILOT AREA (as of July 2016)	
Area	648.2ha
Population	32,467
Served Population (=Number of connections x 5)	5,925
Number of Connections	885
Monthly Water Consumption(m3/month)	12,259

# Challenges of KADOBOGO



# Distribution Blocks in KADOBOGO



# Current Situation for KADOBOGO

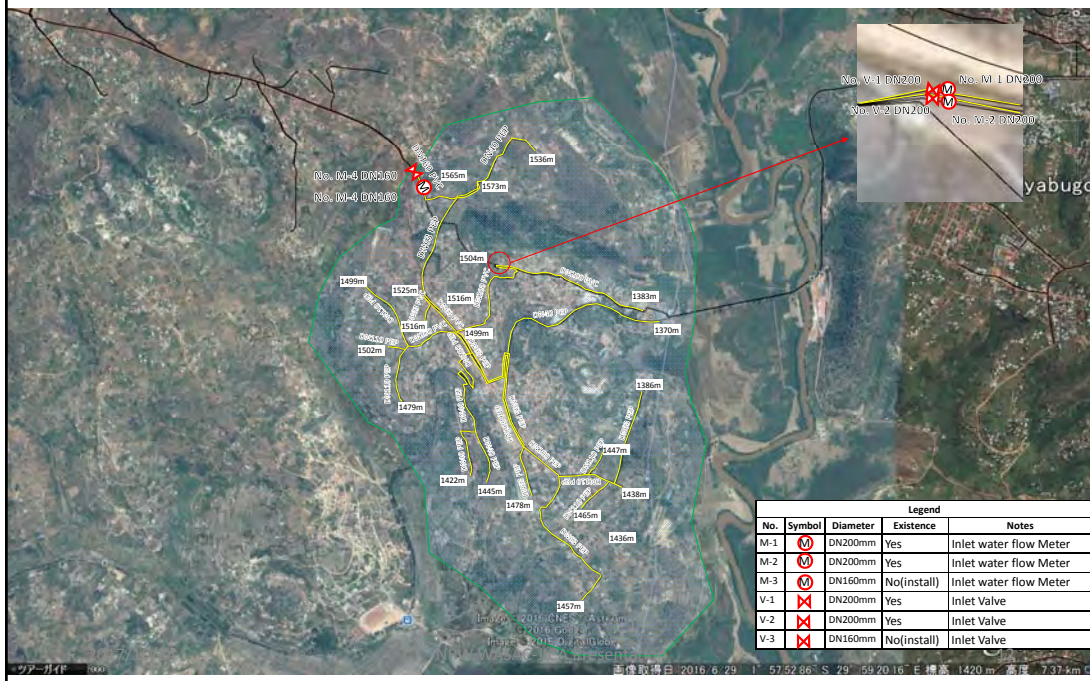
- Meter visited: **1200**.
- Meters tested using Portable Meter test: **638**
- Meters beyond +/- 5% : **149 =23%**
- Replaced meters: **110**
- NRW baseline : **36.3%** (Avairage June-August)
- **Challenges:**
- Some customers do not open their gates.
- Leakages and intermittent supply in the area.

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NRW WASAC-JICA Presentation

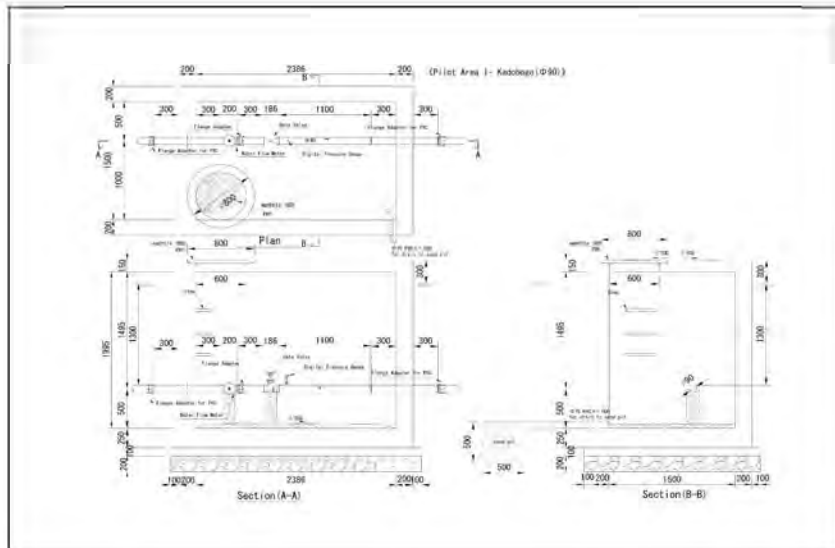
11

# RUYENZI Pilot Area





# Chamber Design & Construction



2017/10/24

NRW WASAC-JICA Presentation

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# Base Concrete



2017/10/24

NRW WASAC-JICA Presentation

14

# Structure of Reinforced Still.



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# Construction of Chamber



Finished

Inside the Chamber

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## Schedule of activities in Pilot Area

- Main activities

1. NRW reduction activities in PM1 & PM2.

- Pilot Area 1: Sep 1, 2017 to Jun 30, 2018
- Pilot Area 2: Apr 1, 2018 to Mar 30, 2019

2. Specific activities plan for each area

- NRW measurement(Isolation test/Baseline survey)
- Survey for water meter, Illegal connection and unauthorized consumption
- NRW measurement( Evaluation)
- Leakage detection and Repair
- NRW measurement ( Re-evaluation)

2017/10/24

NRW WASAC-JICA Presentation

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## “Door to door” leak detection



2017/10/24

NRW WASAC-JICA Presentation

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Thank you for your  
Attention...



## PROGRESS ON THE ISOLATION OF KIGALI WASAC BRANCHES

By Jean Paul San

October 2017

## INTRODUCTION

- Water and Sanitation corporation Ltd (**WASAC Ltd**) in conjunction with **JICA Rwanda**, has initiated the project for Isolation of Kigali Branches .
- The aim of the project is to enable WASAC to control water flow in each Branch ,thus help to Estimate the rate of NRW.
- This Project will include of :
  - Determination of Branch Boundaries in GIS
  - Determination of inter-Crossing pipelines in branch Boundaries in GIS
  - Field Survey For Confirmation of Boundaries with respect to the location of existing network and customers
  - Modifying Boundaries of Kigali Branches where necessary
  - Propose the location of Installation of meters for isolating each Branch
  - Construction of Chambers ( Manholes ) where meters will be installed
  - Installation of Meters for Branch Isolation.
  - Moving the Customers from one branch to another where necessary respect to the Branch Boundaries

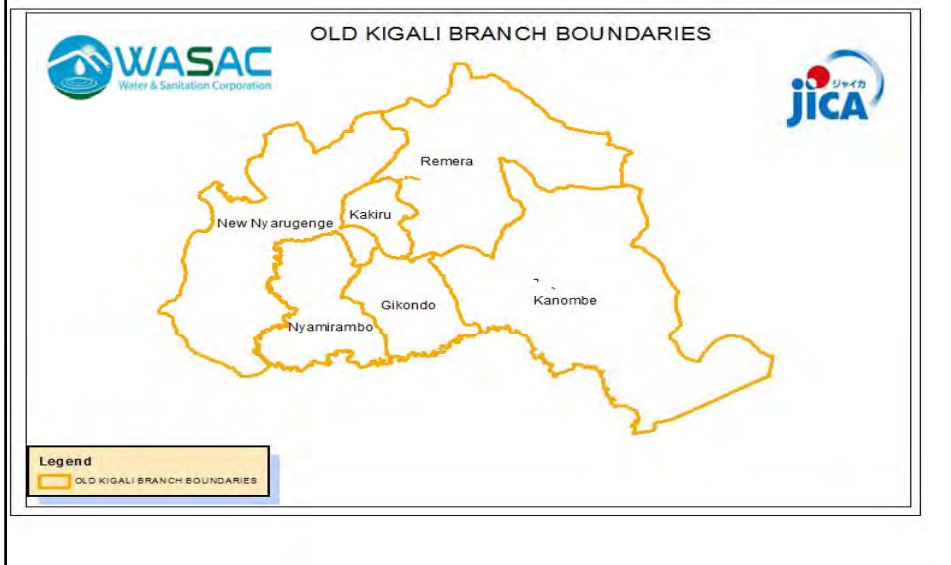


## 1.Criteria used for Determination of Kigali Branch Boundaries

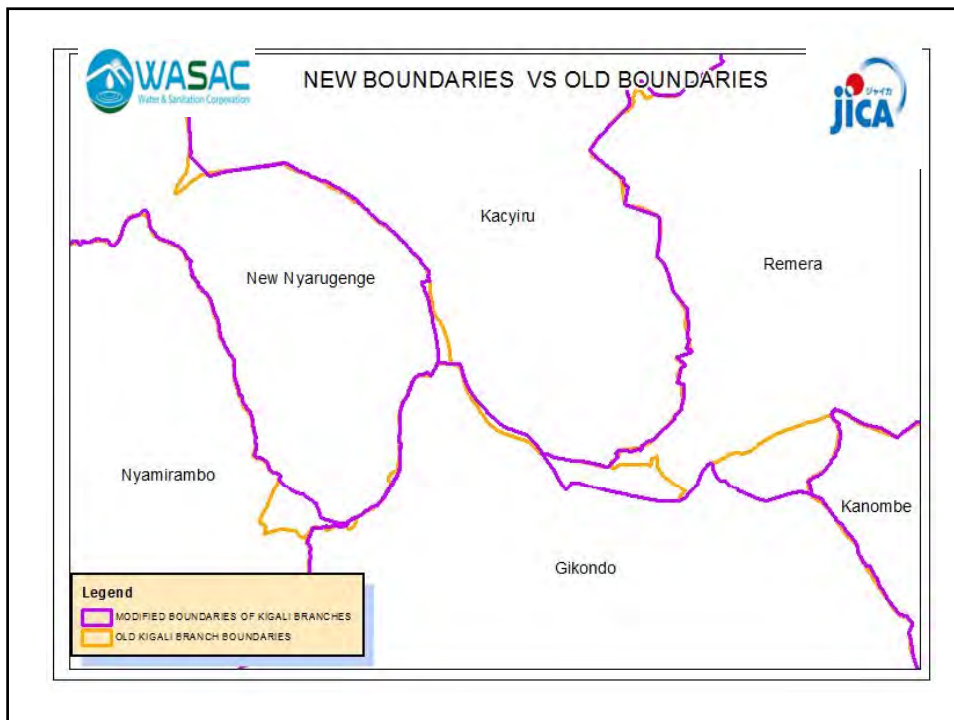
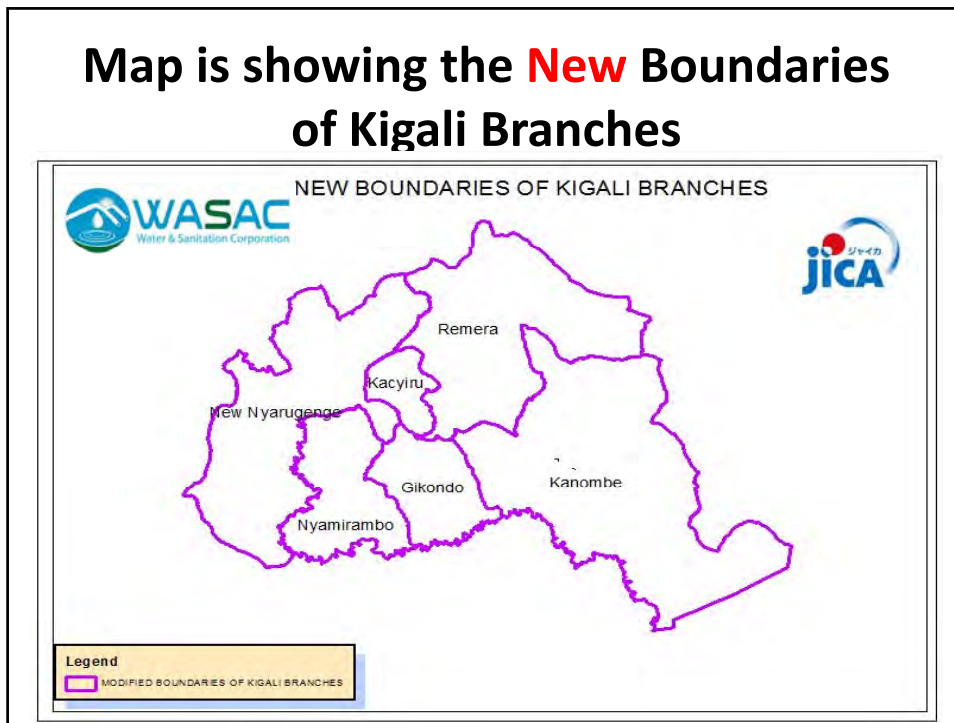
- Hydraulic structure of the existing Network
- Natural or manmade features such as Roads ,rivers, Valleys, wetlands, Water Channels, etc...
- Spatial Distribution of Customers



## The map showing the old boundaries of Kigali Branches



## Map is showing the **New** Boundaries of Kigali Branches

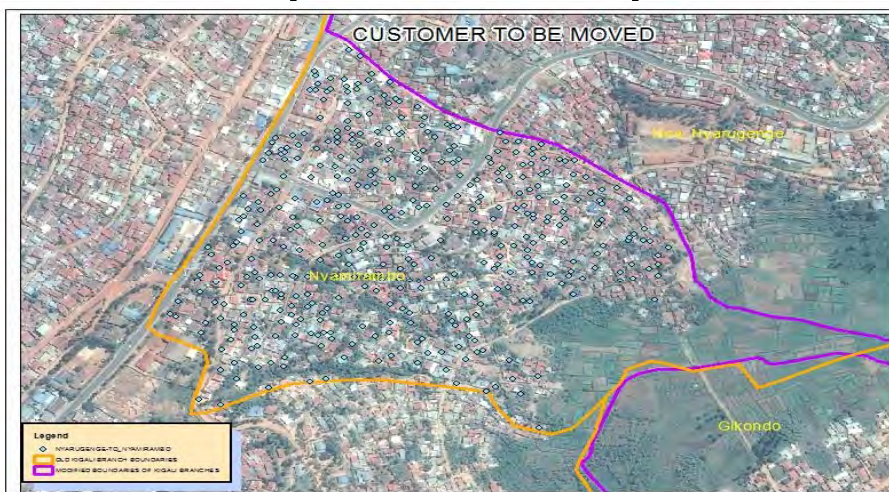


## Shifting of Customers

- where the boundary was changed ,also customers will have to move from one branch to another .this implies that the lists will be given to the respective branch in order to update their Database .



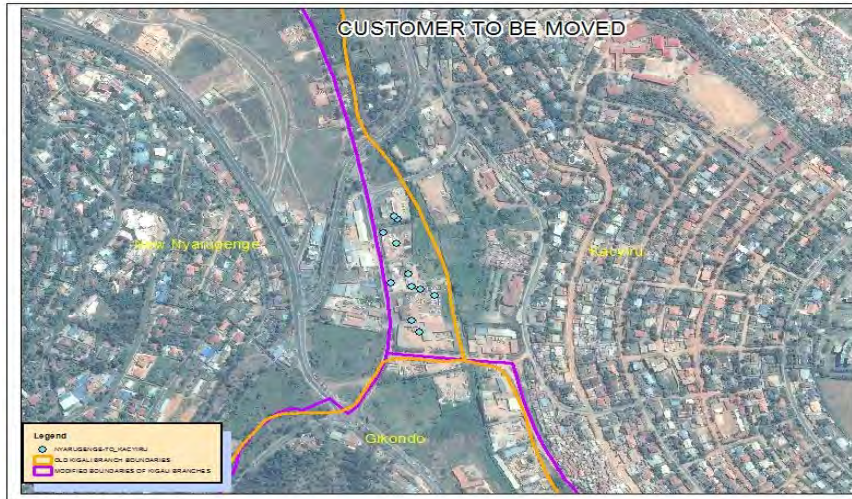
### From Nyarugenge to Nyamirambo (405 Customers)







## From Nyarugenge to Kacyiru (11 Customers)



## From GIKONDO TO REMERA BRANCH 1st part ( 1277 Customers)





## From KACYIRU TO REMERA BRANCH (15 Customers)



## From *KACYIRU TO GIKONDO* (4 Customers)






## MANHOLE (METER CHAMBER ) CONSTRUCTION PROGRESS

**METER TO BE INSTALLED = 32**

**MANHOLE TO BE CONSTRUCTED = 23**



**THANK YOU**



Report on the result of training to Improve NRW control  
in WASAC  
By Jean Paul KAYITARE

## BACK GROUND

The output 2 of the Joint Project of JICA-WASAC is the capacity building of WASAC Staff in NRW Reduction . It is in this regard that JICA has organized the training for strengthening NRW control in Kigali Water city water Network for 5 WASAC Staff to Learn from the Experience of water Bureau Companies in Japan.



## Japanese Water Bureau Methodologies that we can adapt .

They have a culture of using maps in their daily water operations



### Lesson learned from the above methodology

**Challenge** : WASAC Staff have no culture of using Maps in their Daily work

**Action to be taken** : As WASAC GIS Team we are have started the training in GIS for All WASAC Staff in the Basic use of GIS software, make maps available in all different data format as much as possible( e.g :Google earth,web GIS,ArcGIS,QGIS, etc...)

## Japanese Water Bureau Methodologies that we can adapt

- ▶ The pipeline information System contain the scanned related documents to the project (e.g: scanned drawing,BOQ..etc).



### lesson learned from the above methodology:

**Challenge** : We update only digital Data for the as-built of newly constructed pipe line

**Action to be taken** : when updating we will be uploading( hyperlink) all documents related to the project for future reference.

## Japanese Water Bureau Methodologies that we can adapt

They have designed [pressure Zones](#) for each 30 m( example of Kobe water Bureau)

lesson learned from the above methodology:

**Action to be taken** : GIS Team will Start making the model of pressure zones for each reservoir in all WASAC Branches to help in Pressure Management



## Japanese Water Bureau Methodologies that we can adapt

- ▶ In reference to the tariff system of Kobe and Yakohama system, the meter rent is paid according to the size of the water meter.

### Lesson leaned from the above methodology:

- ▶ For WASAC the meter rent is flat for all customers which create unfairness among customers.

**Action :** we will introduce the meter rent based on the size of the meter in the current ongoing tariff review ,this may increase operational revenues

## Japanese Water Bureau Methodologies that we can adapt

- ▶ They have set a plan for older meter replacement after every 8 years(lifespan of meter)

- ▶ **Challenge:** Currently WASAC practices is to replace the meter when it is faulty. There is a lack of plan for meter replacement.

**Action to be taken :** Elaborate a five year replacement plan of old meters and include it as a priority in the annual Commercial action plan

## Japanese Water Bureau Methodologies that we can adapt

- They have portable meter test bench for testing the accuracy of meter on the ground.

**Challenge** : WASAC have one water test bench which is not enough for testing all meters from Branches. This delays water replacement for faulty meters.  
-We received many complains from the customers about meter inaccurate

- **Action** : To request management to procure portable meter test bench for each branch.
- Train technicians on how to use portable meter test bench

## Japanese Water Bureau Methodologies that we can adapt

Japanese network replacement is done after 40years

**Challenge** :In our case we don't have time framework for replacing pipes in network,

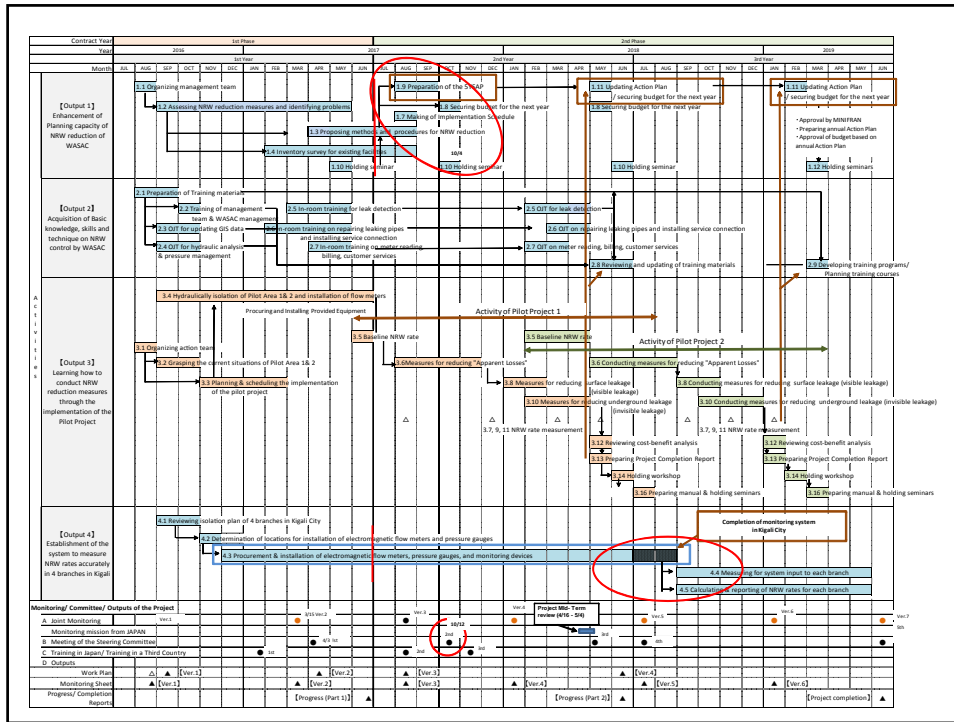
- ▶ **Action** :

WASAC have to set the timeline for network replacement.



## Schedule of Work Plan for Phase 2

Contents	Summary of the Project
1) Overall Goal	WASAC conducts NRW reduction measures as planned for Kigali city.
2) Project Purpose	WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.
3) Outputs	【Output 1】 Planning capacity of NRW reduction of WASAC is enhanced.
	【Output 2】 Basic knowledge, skills and technique on NRW control are acquired by WASAC.
	【Output 3】 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.
	【Output 4】 4 branches in Kigali establish the system to measure NRW rates accurately.



Contract Year	2016												2017												2018												2019											
	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			7th Year			8th Year			9th Year			10th Year			11th Year																	
Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
<b>【Output 1】</b> Enhancement of Planning capacity of NRW reduction of WASAC	1.1 Organizing management team			1.2 Assessing NRW reduction measures and identifying problems			1.3 Proposing methods and procedures for NRW reduction			1.4 Inventory survey for existing facilities			1.5 Preparing the implementation schedule			1.6 Making of implementation schedule			1.7 Preparing the implementation schedule			1.8 Securing budget for the next year			1.9 Preparation of the SYSAP			1.10 Holding seminar			1.11 Updating Action Plan / securing budget for the next year			1.12 Holding seminars			1.13 Updating Action Plan / securing budget for the next year			1.14 Holding seminars			1.15 Updating Action Plan / securing budget for the next year			1.16 Holding seminars		
	2.1 Preparation of Training materials			2.2 Training of management team & WASAC management			2.3 OJT for updating GIS data			2.4 OJT for hydraulic analysis & pressure management			2.5 In-room training for leak detection			2.6 In-room training on repairing leaking pipes and installing service connection			2.7 In-room training on meter reading, billing, customer services			2.8 Reviewing and updating of training materials			2.9 Developing training programs/ Planning training courses			2.10 Reviewing and updating of training materials			2.11 Developing training programs/ Planning training courses			2.12 Reviewing and updating of training materials			2.13 Developing training programs/ Planning training courses			2.14 Reviewing and updating of training materials			2.15 Developing training programs/ Planning training courses					
	3.1 Organizing action team			3.2 Grasping the current situations of Pilot Area 1& 2 of the pilot project			3.3 Planning & scheduling the implementation of the pilot project			3.4 Hydraulically isolation of Pilot Area 1& 2 and installation of flow meters			3.5 Baseline NRW rate			3.6 Measures for reducing surface leakage (visible leakage)			3.7 Measures for reducing underground leakage (invisible leakage)			3.8 Conducting measures for reducing "Apparent Losses"			3.9 Conducting measures for reducing surface leakage (visible leakage)			3.10 Conducting measures for reducing underground leakage (invisible leakage)			3.11 Conducting measures for reducing "Apparent Losses"			3.12 Conducting measures for reducing surface leakage (visible leakage)			3.13 Conducting measures for reducing underground leakage (invisible leakage)			3.14 Conducting measures for reducing "Apparent Losses"								
	4.1 Reviewing isolation plan of 4 branches in Kigali City			4.2 Determination of locations for installation of electromagnetic flow meters and pressure gauges			4.3 Procurement & installation of electromagnetic flow meters, pressure gauges, and monitoring devices			4.4 Measuring for system input to each branch			4.5 Calculating & reporting of NRW rates for each branch			4.6 Measuring for system input to each branch			4.7 Calculating & reporting of NRW rates for each branch			4.8 Measuring for system input to each branch			4.9 Calculating & reporting of NRW rates for each branch			4.10 Measuring for system input to each branch			4.11 Calculating & reporting of NRW rates for each branch			4.12 Measuring for system input to each branch			4.13 Calculating & reporting of NRW rates for each branch											
	3.12 Reviewing cost-benefit analysis			3.13 Preparing Project Completion Report			3.14 Holding workshop			3.15 Preparing manual & holding seminars			3.16 Preparing manual & holding seminars			3.17 Reviewing cost-benefit analysis			3.18 Preparing Project Completion Report			3.19 Holding workshop			3.20 Preparing manual & holding seminars			3.21 Reviewing cost-benefit analysis			3.22 Preparing Project Completion Report			3.23 Holding workshop			3.24 Preparing manual & holding seminars											
<b>【Output 3】</b> Learning how to conduct NRW reduction measures through the implementation of the Pilot Project	3.12 Reviewing cost-benefit analysis			3.13 Preparing Project Completion Report			3.14 Holding workshop			3.15 Preparing manual & holding seminars			3.16 Preparing manual & holding seminars			3.17 Reviewing cost-benefit analysis			3.18 Preparing Project Completion Report			3.19 Holding workshop			3.20 Preparing manual & holding seminars			3.21 Reviewing cost-benefit analysis			3.22 Preparing Project Completion Report			3.23 Holding workshop			3.24 Preparing manual & holding seminars											
	4.1 Reviewing isolation plan of 4 branches in Kigali City			4.2 Determination of locations for installation of electromagnetic flow meters and pressure gauges			4.3 Procurement & installation of electromagnetic flow meters, pressure gauges, and monitoring devices			4.4 Measuring for system input to each branch			4.5 Calculating & reporting of NRW rates for each branch			4.6 Measuring for system input to each branch			4.7 Calculating & reporting of NRW rates for each branch			4.8 Measuring for system input to each branch			4.9 Calculating & reporting of NRW rates for each branch			4.10 Measuring for system input to each branch			4.11 Calculating & reporting of NRW rates for each branch			4.12 Measuring for system input to each branch			4.13 Calculating & reporting of NRW rates for each branch											
<b>【Output 4】</b> Establishment of the system to measure NRW rates accurately in 4 branches in Kigali	4.1 Reviewing isolation plan of 4 branches in Kigali City			4.2 Determination of locations for installation of electromagnetic flow meters and pressure gauges			4.3 Procurement & installation of electromagnetic flow meters, pressure gauges, and monitoring devices			4.4 Measuring for system input to each branch			4.5 Calculating & reporting of NRW rates for each branch			4.6 Measuring for system input to each branch			4.7 Calculating & reporting of NRW rates for each branch			4.8 Measuring for system input to each branch			4.9 Calculating & reporting of NRW rates for each branch			4.10 Measuring for system input to each branch			4.11 Calculating & reporting of NRW rates for each branch			4.12 Measuring for system input to each branch			4.13 Calculating & reporting of NRW rates for each branch											
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Monitoring/ Committee/ Outputs of the Project	Ver.1			Ver.2			Ver.3			Ver.4			Ver.5			Ver.6			Ver.7			Ver.8			Ver.9			Ver.10			Ver.11			Ver.12			Ver.13											
A Joint Monitoring	3/15			Ver.2			Ver.3			Ver.4			Ver.5			Ver.6			Ver.7			Ver.8			Ver.9			Ver.10			Ver.11			Ver.12			Ver.13											
B Monitoring mission from JAPAN	4/3			1st			2nd			3rd			4th			5th			6th			7th			8th			9th			10th			11th			12th											
C Meeting of the Steering Committee	4/3			1st			2nd			3rd			4th			5th			6th			7th			8th			9th			10th			11th			12th											
D Training in Japan/ Training in a Third Country	4/3			1st			2nd			3rd			4th			5th			6th			7th			8th			9th			10th			11th			12th											
Work Plan	▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲											
Monitoring Sheet	▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲								
Progress/ Completion Reports	▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲			▲								

Flowchart for Implementing the Project

# Project Evaluation

## 1. Verifiable Indicators of PDM

### Indicator of PDM of the Project

Narrative Summary	Verifiable Indicators
<b>[Overall Goal]</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022: <b>XX %</b> )
<b>[Project Purpose]</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1: 5-year Strategic Action Plan (5YSAP) for NRW reduction is approved by the MININFRA. 2: Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3: The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan
<b>[Outputs]</b> Output 1. Planning capacity of NRW reduction of WASAC is enhanced.	1: 5YSAP is reviewed and updated, taking into account of the results of the Pilot Project. 2: All the project achievements are shared by WASAC and other concerned parties by holding seminars.
Output 2. Basic knowledge, skills and technique on NRW control are acquired by WASAC.	1: More than <b>XX number of trainees</b> receive training.
Output 3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	2: WASAC human resource development plan includes training programs prepared by the project. 1: NRW rates are reduced at each pilot area as follows: Pilot Area 1: <b>from XX% to XX%</b> and Pilot Area 2 <b>from XX% to XX%</b> . 2: Action team members share experiences at workshops regarding implementation of the pilot projects. 3: The action team prepares a completion report of the pilot project.
Output 4. 4 branches in Kigali establish the system to measure NRW rates accurately.	1: NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.

R/D on March 30, 2016

### Proposed Indicators of PDM

Output	Verifiable Indicators
<b>【Overall Goal】</b>	NRW rate of Kigali city ( year 2022 : <b>25 %</b> ) (to be confirmed during the project)
<b>【Outputs】</b>	
Output 2 .	1 : More than <b>300</b> number of trainees receive training.
Output 3.	1 : NRW rates are reduced at each pilot area as follows: Pilot Area 1: from <b>36%</b> to <b>20%</b> and Pilot Area 2 from <b>XX%</b> to <b>XX%</b> . ( <b>XX%</b> will be determined after baseline NRW rates are established.)

### Proposed NRW Rate in 5YSAP

Financial year July to June	5 Year Strategic Business Plan	Target value of 5 Year Strategic Business Plan	Implementation Year of 5YSAP	Phase of 5YSAP	Actual NRW level value %	Proposed NRW rate in 5YSAP
2015/16	Year 1	38%			35.5%	
2016/17	Year 2	32%		Preparation	38.3 %	38.3%
2017/18	Year 3	28%	Year 1	Phase 1		35%
2018/19	Year 4	26%	Year 2	Phase2		32%
2019/20	Year 5	25%	Year 3			30%
2020/21			Year 4			28%
<b>2021/22</b>			Year 5			<b>25%</b>



## 2. Project Capacity Assessment

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### Why WASAC needs to reduce NRW?



#### **Two Goals**

- To improve efficiency in use of water resources
- To improve management of WASAC

Reduction of NRW is **not a goal, but a process** to achieve the two goals.

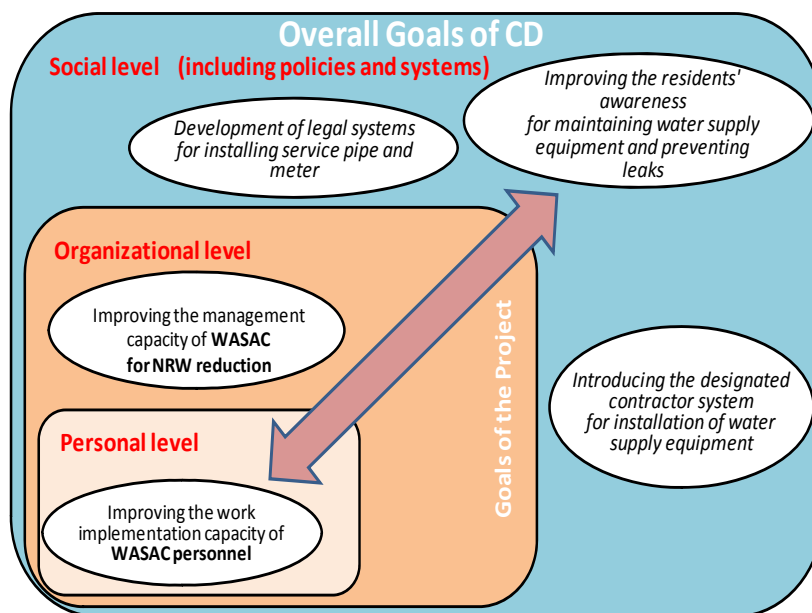
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# Technical Cooperation Project



## Capacity Development Project Personal Level Organizational Level

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## **PDM OF THE PROJECT**

### **Project Purpose:**

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali City

- **Output 1:** Planning capacity of NRW reduction of WASAC is enhanced
- **Output 2:** Basic knowledge, skills and technique on NRW control are acquired by WASAC
- **Output 3:** WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Projects

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## **Procedure of Capacity Assessment**

1. List up of the Required capacity
2. Survey the Baseline of each required capacity
3. Setting up of the Capacity Development Plan which has consistency with the Project  
= Each Output Activity of the Project
4. Performing of the Capacity Assessment at Mid- Term and before the End of the Project.
5. Evaluate on the Improvement level of the capacity through the project

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## What is the Required Capacity ?

Planning capacity for NRW reduction  
(Output 1)



Preparation of  
5-Year Strategic Action Plan (5YSAP)  
for NRW reduction

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## Basic knowledge, skills and technique on NRW control (Output 2) and NRW reduction measures (Output 3)

- 2-2 NRW management
- 2-3 Updating of GIS data
- 2-4 Hydraulic analysis, Pressure management
- 2-5 Leak management
- 2-6 Pipe repair, installation of service connection
- 2-7 Meter and billing management



Training on the Specific Actions in 5YSAP

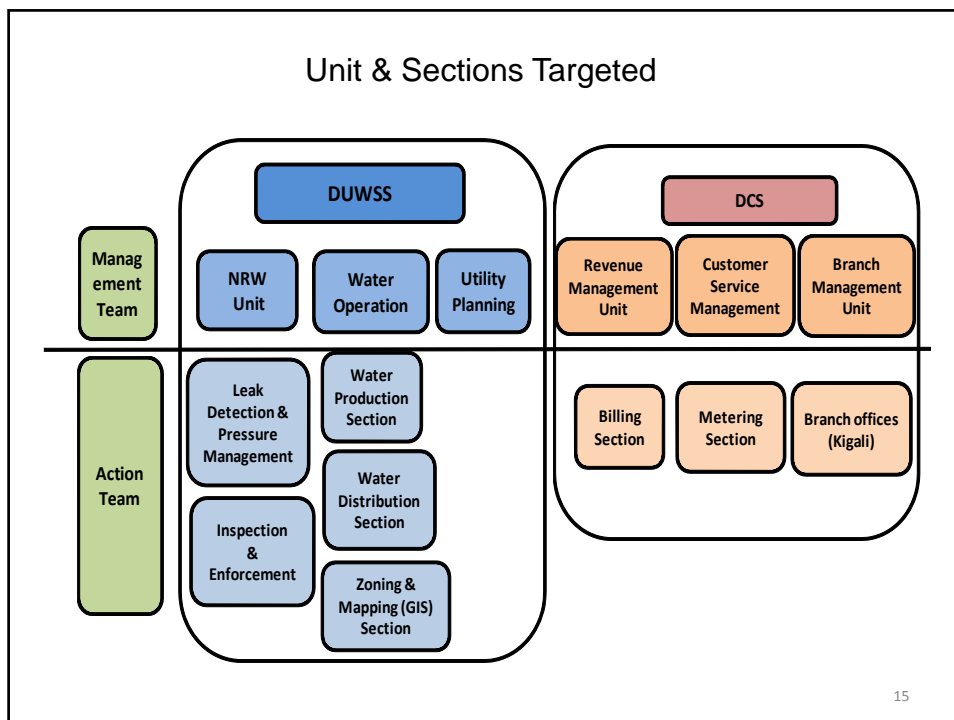
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5-Year Strategic Action Plan for NRW Reduction																							
Gr No.	Components	Sub Gr No.	Countermeasures	Specific actions	PDM Activity	Baseline for CA	Responsible TEAM for Specific actions						Priority	Necessary Resources	Period	Total amount (MYR)	Implementation Schedule and				Comments		
							Responsible Unit	Action Section/Branch				Period					2019/20						
								Dept.	May	June	July						Aug.	May	June	July			
<b>A. System Input Volume</b>																							
A1	Volume input metering accuracy	A1.1	Establish the framework to ensure the system volume input accuracy	Inventory of bulk meters (GIS, EMI, Survey)			WO	Production	Distribution				High	NA	ICT, Project vehicle								
				Visit, analyze and detailed report of all bulk meters condition			2-2	WO	WO	Planning	Production	Distribution			High	Consultant, Staff Logistics	3 months	2,800,000					JICA expert will be required
				Prepare a plan for bulk meter regular check list for the future.				WO	WO	Planning	Production	Distribution			High	Staff	1 month						
<b>B. Commercial Losses</b>																							
B1	Meter reading and billing	B1.1	Ensure correct and accurate meter accuracy	Standardization of CPO's about the implementation of the plan for Regular meter accuracy test.			RF	Utility	Branches				High	Staff, Logistics	Regular	15,000,000							
				Secure customer meter accuracy			2-7	CSW	Planning	Branches				High	Staff, Equipment, Logistics	Regular	4,800,000	100,000	100,000			Meter test by test bench & possible test meter	
				Secure customer meter accuracy (at least 1 per branch)				CSW	Planning					High	Meter test equipment	1 year	50,000,000		50,000,000				
				Secure customer meter accuracy (at least 1 per branch)				CSW	Planning	ICT				High	Staff, Staff	2 years	200,000,000						
B1	Monitoring customer consumption trends	B1.4	Monitoring customer consumption trends	Analysis of customer consumption Database			RF	Utility	Branches				High	NA									
				Plan and visit customer with irregular consumption			2-7	RF	Utility	Branches				High	General expenses	Regular							
				Analysis of estimated bills				RF	Utility	Branches				High	General expenses	Regular							
				Inventory of big customers				RF	Utility	Branches				High	General expenses	Regular							
B2	Customers meter management (normal, large and public tap)	B2.1	Continuous customer mapping and inventory	Weekly meter reading for big customers (at least 200 big customers)			RF	Utility	Branches				High	General expenses	Regular						Routine activity		
				Complete customer inventory and mapping in appropriate Branches				RF	Utility	Branches	GIS	ICT	High	Consultant, GIS staff, Logistic	1 year								On going activity
				Set up and implement a clear customer database update procedures in GIS and CMS			2-3	RF	Utility	Branches	GIS	ICT	High	GIS staff	2 year								
				Update meter installation and replacement policy			2-7	CSW	Planning					High	NA	1 month							2 months for policy set up and Continuous implementation
B2	Ensure the quality of meter installation and replacement	B2.2	Ensure the quality of meter installation and replacement	Implement meter replacement in accordance with the replacement policy			CSW	Planning	Branches				High										
				Supervision and inspection of meter installation for new connection works				CSW	Planning	Branches				High	General expenses	Continuous							Routine activity
				Public tap inventory and assessment of their condition (meter location etc.)				RF	Utility	Branches	GIS			High	General expenses	1 year							
				Balance incentive for billmeters (including staff)				RF	Public & Billmeters					High	Incentive incentives	Continuous	5,000,000	100,000	100,000	100,000			Issue 2 reported illegal cases per month
B3	Prevention of illegal water usage	B3.1	Prevention of illegal water usage	Inspection of suspected customer's and large customer's connections based on customer data analysis			RF	Public & Billmeters	Branches				High	Staff, Logistics	regular	13,200,000	200,000	200,000	200,000				
				Removal of meter protection boxes for large customers				CSW	Planning	Branches				High	Staff, Logistics	Regular	3,700,000		100,000	100,000			
B3.2	Charge fees for continued illegal water usage	B3.2	Monitoring of fees payment				RF	Public & Billmeters	Branches				High	NA	regular								
<b>C. Physical Losses</b>																							

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Gr No.	Components	Sub Gr No.	Countermeasures	Specific actions	PDM Activity	Baseline for CA	Responsible TEAM for Specific actions						Priority	Necessary Resources	Period	Total amount (MYR)	Implementation Schedule and				Comments		
							Responsible Unit	Action Section/Branch				Period					2019/20						
								Dept.	May	June	July						Aug.	May	June	July			
<b>C. Physical Losses</b>																							
C1	Pressure management	C1.1	Determination of high pressure zones	Review, analysis and regular update of existing map of water network, pumping station, WTP installations, etc.			WO	GIS					High	General expenses	Regular						Continuous activity of regular update (ESRI Contract)		
				Hydraulic calculation and modeling			2-4	WO	GIS					High	General expenses	Regular							
				Identification, mapping and dissemination of higher pressure zones			2-4	WO	GIS					High	GIS staff	1 year							
C2	Asset Management (Rehabilitation)	C2.1	Determine the accessible pressure	Make a survey on the existing pressure in the network and on customer taps			RF	LDPM					High	Staff, Logistics	2 months	3,300,000							
				Inventory, drawing and mapping of water facilities				RF	GIS					High	Consultant, GIS staff, Logistic	1 year							On going activity (Esti project)
				Regular update of GIS data			2-3	WO	GIS					High	General expenses	Continuous							
C3	Leaks and burst repair	C3.1	Active leakage control	Inventory of infrastructures to be implemented			WO	Distribution					High		3 months								
				Implement the yearly plan of viable leakage survey (including near-road)				RF	LDPM	Distribution	Branches			High	General expenses	Regular						2160000	
				Train staff for leakage survey and leak detection			2-5	RF	LDPM	Distribution	Branches			High	Staff, Logistics, Equipment	Regular	15,000,000						JICA NRW Project
				Procure and dispatch leak detection equipment to branches				RF	LDPM	Branches				High	Leak detection equipment	2 years	400,000,000						Leak detection for branches
C3.2	Establish water supply monitoring system (DMA, SCADA, etc.)	C3.2	Establish water supply monitoring system (DMA, SCADA, etc.)	Select critical areas to detect invisible leaks			RF	LDPM	Distribution	Branches			High	NA	Continuous	2,100,000							
				Conduct leak detection activities in all branches and make estimation of water lost through leakages			2-5	RF	LDPM	Distribution	Branches			High	Staff, Logistics, Equipment	Continuous	2,100,000						year 1 HQ staff to be trained by JICA. For next years HQ staff will train branches staff
				Complete the isolation of Kigali branches			3	RF	LDPM	GIS	Distribution	Branches	Model	Staff, Equipment	1 year								Ongoing activity (JICA NRW Project)
				Creation of DMA within branches				RF	LDPM	GIS	Distribution	Branches	Model	Development budget	Continuous								Can be financed by the development budget
<b>D. Unbilled Authorized Consumption</b>																							
<b>E. Fundamental Measures</b>																							
E1	GIS and CMS Planning, design and	E1.1	IM GIS and Customer	Retrieve customer data in GIS and CMS			WO	GIS	ICT	RF			High	NA	1 year								
				Ensure the quality of designs and water works				RF	Standard					High	NA	1 month							
E2	WASAC NRW management	E2.1	Customize IWA water balance to WASAC (to clear understand approval of component of the water	Set up an inspection team for works standard compliance			RF	RF					High	NA	1 year						JICA expert will help		
				Review the existing water balance used				RF	RF					High	NA	1 year							

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### EVALUATION OF THE PROJECT

Project Output	Capacity Development	Indicator of Capacity Assessment
Output 1. <u>Management Team</u> Planning capacity of NRW reduction	1.Preparation of 5YSAP, reviewed and updated 2: Holding serial seminars	1: Review and update of 5YSAP 2: Sharing the achievements by holding seminars
Output 2. <u>Management Team &amp; Action Team</u> Basic knowledge, skills and technique	In-room Training and OJT 2-2 NRW Management 2-3 Updating of GIS data 2-4 Hydraulic analysis, Pressure management 2-5 Leak management 2-6 Pipe repair, installation of service connection 2-7 Meter and billing management	Level of actual conditions of the WASAC activities
Output 3. <u>Action team</u> Conduction measures of NRW reduction	Pilot Projects	1: NRW rates reduction rate 2: Sharing experiences at workshops 3: Preparation of a completion report

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**Thank you Very Much!**

**Arigatou Gozaimasu!**

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MINUTES OF MEETING  
OF  
THE 3<sup>rd</sup> STEERING COMMITTEE MEETING  
FOR  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK

HELD AT  
Galaxy Hotel

Kigali, 28<sup>th</sup> Aug 2018



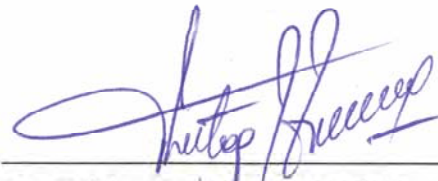
Ms. Izumi SHOJI  
Leader  
JICA Monitoring Mission Team  
Japan



Eng. Aimé MUZOLA  
Chairman of Steering Committee &  
Chief Executive Officer, WASAC  
The Republic of Rwanda



Mr. Shigeo OTANI  
Chief Advisor  
JICA Expert Team  
Japan



Mr. Méthode RUTAGUNGIRA  
Project Director &  
Director of UWSS, WASAC  
The Republic of Rwanda



## **Introduction**

For monitoring, discussion on issues, challenges, solutions and way forward of the PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK (hereinafter referred to as "the Project"), the 3rd meeting of Steering Committee (hereinafter referred to as "SC") was held on 28th August 2018.

### **1. Remarks**

The Chairman, Eng. Aimé MUZOLA, CEO of WASAC opened the meeting by thanking all participants for their attendance and appreciated the Project progress so far. He further expressed his gratitude to JICA for their continuous support in the development of water sector in Rwanda and WASAC in particular. He also recognized the good job done by the members of JICA Monitoring Mission Team (hereinafter referred to as "the Team") and requested all stakeholders to be committed toward the implementation of recommendations of the Team. Additionally, he expressed the necessity to develop the water supply pipe standards.

Mr. Tomonori NAGASE, Senior Representative of JICA Rwanda Office expressed his gratitude to the Project Team members.

The Ministry of Infrastructure representative expressed his gratitude and appreciation of the project progress and emphasized on the importance of NRW reduction on the national target to give clean water to all Rwandans.

### **2. Presentations**

Mr. Méthode RUTAGUNGIRA, Project Director, explained summary of the project progress and shared with the SC members issues, challenges and proposed wayforward. The SC members acknowledged the project progress as attached in Project Monitoring Sheets (refer to Appendix 3).

Ms. Izumi SHOJI, Leader of the Team, at the beginning, expressed her deep appreciation to all Project members for making lots of efforts to progress the Project including approval of 5 Year Strategic Plan (hereinafter referred to as "5YSP") and she explained the delay of equipment related to Output4, then shared the new procurement schedule (refer to Appendix 4) and emphasized on the period of the Project needed to be extended by ONE (1) year. The SC members approved the revised schedule of the monitoring system, especially on Procurement and Installation.

She also presented recommendations from the monitoring mission as per Appendix 5.

Mr. Shin MURAKAMI, Member of the Team explained in details the revised Project Design Matrix (hereinafter referred to as "PDM"), Plan of Operations (hereinafter referred to as "PO") and major points for the Record of Discussion (hereinafter referred to as "RD") Amendment. He then requested the SC members to approve those revisions (refer to Appendix 6).

### **3. Results of the Monitoring of the Project**

SC members confirmed the following matters and recommendations:

#### **3-1. Promote the implementation of 5YSP**

To ensure the successful implementation of 5YSP, the monitoring and the achievement of the project purpose, the SC members recognized the need to strengthen the capacity across organizations (both at headquarters and branch level) including but not limited to the increase of number of staff, logistics and equipment.

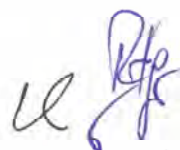
The Team appreciated the increase of the NRW reduction awareness among WASAC staff including branches and recommended them to take responsibility for NRW reduction in the area of operation. In addition, the team recommended the Project to support the implementation of the 5YSP. After the discussion, the Team and WASAC agreed to add a new activity 1-11 in PDM which is related to facilitate the implementation and monitoring of the 5YSP.

Finally, the team suggested to WASAC to prepare a section to analyze data collected from the monitoring system after its installation (Output4) .

#### **3-2. Promote human resource development**

The Team suggested that skills and knowledge acquired through training (GIS data update, hydraulic analysis, water leakage detection, water supply pipe installation, meter test etc.) continues to be applied and disseminated within WASAC. The Team also proposed that WASAC utilizes the training materials for daily tasks, and upgrades those materials with much more practical contents. For the human resource development, SC members recognized the importance of the utilization of the equipment already procured such as water leak detector, devices of pipe connection, etc.

The Team confirmed trainings in Kenya were practical. So, the Team



proposed WASAC to enhance a partnership with water utilities in the region. SC members confirmed to promote cooperation based on the memorandum of understanding with Lilongwe Water Board (hereinafter referred to as "LWB") of Malawi to share each practical technology and to develop human resources.

### **3-3. Eliminate Obstacle Factors**

From the result of activities in pilot area 1, it became clear that high pressure in distribution pipe is one of the main reasons of water leakage. The Team suggested that WASAC including branch offices take responsibility for pressure control. In PDM, new activities 3-12 and 3-13 were added to tackle this issue.

Since the problem of quality of service pipes (material and construction) is also one of the main factors of water leakage, the Team and WASAC concluded to add new activity 1-12 to revise the existing New Connection Policy included in 5YSP. In the pilot area 1, in the purpose of proving the effectiveness of service pipe replacement, WASAC requested JICA to include the procurement of service pipes in specific site of pilot area 1 in this activity. The Team understood necessity of replacing service pipes in pilot areas and requested WASAC to consult with JICA experts and to propose actual plan to replace the service pipes by the end of September 2018.

### **3-4. Ensure effectiveness and continuity of pilot project**

Based on the result of the monitoring, the SC members understood that activities in the pilot areas should be carried out with each measure as independent as possible according to PDM. PDM sets an order of each measure from apparent losses, the surface leakage and then underground leakage separately.

By implementing each measure separately, cost-effectiveness of each activity against NRW reduction can be confirmed. The SC members understood the importance and aim of the activities in the pilot areas, confirmed to follow the measures based on PDM order in pilot area 2. SC members also agreed to apply the findings of pilot activities to other areas, and to reflect those findings in the updated 5YSP. The Team and WASAC agreed to add a new activity 3-19 in PDM to disseminate the manual prepared based on those findings.



### 3-5. Equipment Handover and Management

The Team asked WASAC to complete the handover procedure of procured equipment in the Project and properly manage it after the handover.

### 4. Approval of Revision of RD, PDM, and PO

Based on the results of project monitoring by WASAC (Project Monitoring Sheet) and the recommendation by the Team, SC members approved the points of RD revision. Also SC members agreed that the Amendment of RD will be officially signed at Kigali after approval within JICA.

SC members also approved revision of PDM and PO (refer to Appendix 6) as attachment of RD. Regarding the "Objectively Verifiable Indicator" of Overall Goal, the Team suggested to evaluate achievability of this indicator by next SC after completion of main activities for Output3. If necessary, the other indicators will be finalized at the same SC.

Comparison table of PDM and RD revision is as follows:

#### Comparison Table of RD Revision

Before Revision	After Revision
II-1-(1)-(c) Machinery and Equipment Electromagnetic flow meter and pressure gauge for isolating four (4) branches in Kigali.	II-1-(1)-(c) Machinery and Equipment Electromagnetic flow meter and pressure gauge for isolating four (4) branches in Kigali and the installation.
Reason: "installation" changes to JICA's undertakings.	
3. Duration Three (3) years from the arrival of the first expert.	3. Duration Four (4) years from the arrival of the first expert.
Reason: Procurement of equipment related to Output4 delays.	

#### Comparison Table of PDM Revision

Before Revision	After Revision
<b>Overall Goal</b>	
Objectively Verifiable Indicators	
NRW rate of Kigali city (year 2022 XX%) (to be confirmed during the project)	NRW rate of Kigali city (year 2022/23 25%) (to be confirmed during the project)

Before Revision	After Revision
<b>Output 2</b>	
Objectively Verifiable Indicators	
2-1. More than XXX number of trainees receive training.	2-1. More than 300 number of trainees receive training.
<b>Output 3</b>	
Objectively Verifiable Indicators	
3-1. NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)	3-1. NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25 %.
<b>Activity for Output-1</b>	
<p>1-1. A management team is organized to prepare 5-year Strategic Action Plan for NRW reduction.</p> <p>1-5. Based on the results of Activity 1-3 and 1-4, the management team prepares a report on the necessary facilities improvement.</p> <p>1-7. The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes identified by Activities 1-4 and 1-5.</p>	<p>1-1. A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.</p> <p>1-5. Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.</p> <p>1-7. The management team prioritizes and schedules the conducts of specific actions of 5YSP.</p> <p>1-11. The management team facilitates implementation and the monitoring of the 5YSP</p> <p>1-12. The management team drafts the revised New Connection Policy and the Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.</p>
<b>Activity for Output-3</b>	
3-1. An action team is organized to conduct NRW reduction measures at Pilot Area 1.	3-1. An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.



Oh

Before Revision	After Revision
<p>3-2. The action team grasps the current situations of Pilot Area 1 through reviewing available maps, customer ledgers, surveys, and other necessary means.</p> <p>3-3. The action team plans and schedules the implementation of the pilot project for Pilot Area 1.</p> <p>3-4. The action team hydraulically isolates Pilot Area 1, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1.</p>	<p>3-2. The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.</p> <p>3-3. The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.</p> <p>3-4. The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.</p> <p>3-12. The Action team conducts measures for reducing high water pressure.</p> <p>3-13. The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.</p> <p>3-19. Action team disseminates the manual and use of survey equipment to the activity of whole branches.</p>
<b>Activity for Output-4</b>	
<p>4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.</p> <p>4-4. System input to each of 4 branches is measured.</p> <p>4-5. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.</p>	<p>4-3. Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.</p> <p>4-4. Chambers are constructed as appropriate.</p> <p>4-5. System input to each of 4 branches is measured.</p> <p>4-6. Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.</p>
<b>Input</b>	
<b>Japanese side</b>	
<p>1 Chief Adviser/Non-Revenue Water management</p>	<p>1 Chief Adviser/Non-Revenue Water management Adviser/Non-Revenue Water management</p>

Before Revision	After Revision
Non-Revenue Water reduction planning	Non-Revenue Water reduction planning (1)
GIS	Non-Revenue Water reduction planning (2)
Hydraulic analysis	GIS
Leak detection	Hydraulic analysis
Pipe repairing and service pipe connection	Leak detection
ICT	Pipe repairing and service pipe connection
	ICT
	JICA long term expert

END

### Appendix

1. Invitation to the 3rd SC (MININFRA, JICA office)
2. Agenda of the 3rd SC
3. Project Monitoring Sheet Ver.4
4. Revised schedule of the monitoring system (Procurement, Installation)
5. Project Monitoring Result of the JICA Monitoring Survey Mission (Recommendation)
6. Draft of the revised PDM and PO
7. List of Attendants



**WASAC**  
Water & Sanitation Corporation

*"Dignifying Life"*

Kigali, 24 AUG 2018  
N° 11.07.024/2618/18/DWUSS-CEO/jb

**Chief Representative  
JICA RWANDA**

Dear Sir,

**RE: Invitation to the third steering committee (sc) meeting of the project for Strengthening Non-Revenue Water control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the 3 years Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

We hereby request your good office to authorise **Mr. Nagase TOMONORI, Mr. NAKASHIMA koji** and **Mr. Virgile KWIZERA** to attend the Second (3<sup>rd</sup>) Steering Committee (SC) meeting that will take place at Galaxy Hotel on 28<sup>th</sup> August 2018 starting from 9:00 am.

The purpose of the meeting is to confirm the progress and discuss the changes on PDM and PO

The agenda of the meeting is hereby enclosed.

I thank you for your usual cooperation

Yours sincerely,



**Eng. MUZOLA Aimé**  
**Chief Executive Officer**

CC:

- Hon. Minister of Infrastructure- MININFRA
- Hon. Minister of State in Charge of Energy, Water and Sanitation-MININFRA
- Permanent Secretary-MININFRA

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**WASAC**  
Water & Sanitation Corporation

*"Dignifying Life"*

**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the Steering Committee (SC)**

Venue: Galaxy Hotel

Date: August 28<sup>th</sup>, 2018

Time	Activity	Responsible
9:00	Registration	
9:30	Introduction of participants	
9:35	Remarks by CEO WASAC	CEO WASAC
9:40	Remarks by JICA Rwanda representative	JICA representative
9:50	Progress of the Project	Project Director WASAC
10:40	Procurement and Installation Plan of the Equipment for Monitoring System	Leader of JICA Mission
10:50	Monitoring Result of the JICA Monitoring Survey Mission (Recommendation to WASAC)	Leader of JICA Mission
11:40	Proposal on Revision of PDM, PO and RD	Leader of JICA Mission
11:50	Question and Answer	WASAC, JICA
12:00	Coffee Break	
12:15	Signing of MM on SC	
12:30	Remarks by MININFRA	MININFRA
12:40	Closing Remarks by WASAC	CEO WASAC

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**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the Steering Committee (SC)**

Venue: Galaxy Hotel

Date: August 28<sup>th</sup>, 2018

Time	Activity	Responsible
9:00	Registration	
9:30	Introduction of participants	
9:35	Remarks by CEO WASAC	CEO WASAC
9:40	Remarks by JICA Rwanda representative	JICA representative
9:50	Progress of the Project	Project Director WASAC
10:10	Procurement and Installation Plan of the Equipment for Monitoring System	Leader of JICA Mission
10:20	Monitoring Result of the JICA Monitoring Survey Mission (Recommendation to WASAC)	Leader of JICA Mission
10:50	Proposal on Revision of PDM, PO and RD	Member of JICA Mission
11:00	Question and Answer	WASAC, JICA
11:10	Coffee Break	
11:25	Signing of MM on SC	
11:40	Remarks by MININFRA	MININFRA
11:50	Closing Remarks by WASAC	CEO WASAC

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TO CR of JICA RWANDA OFFICE

## PROJECT MONITORING SHEET

**Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in  
Kigali City Water Network**

**Version of the Sheet : Ver.4 (Term: July, 2017 – July, 2018: 2nd Phase)**

**Name: Shigeo OTANI**

**Title: Chief Advisor/ Non-Revenue Management**

**Submission Date: August 27, 2018**

## I. Summary

## 1 Progress

## 1-1 Progress of Inputs

## 1-1-1 Japan Side

## (1) List and Assignment Terms of Japanese Experts

## a. Working in Rwanda

Table 1.1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1 (1)	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
4	NRW Reduction Plan 1 (2)	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
5	NRW Reduction Plan 2 (2)	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO			
8	ICT	Marcel Brouwer			
Total MM					19.11

Note: Man Month (MM)

## b. Working in Japan

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## PM Form 3-1 Monitoring Sheet Summary

Table 1.2 Assignment Term in Japan

No.	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2018/6/4	2018/6/8	0.25
7	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO	2017/8/1	2017/8/10	0.40
			2017/10/30	2017/11/9	0.40
Total M/M					1.05

Details of each expert's assignment are shown in the Plan of Operation (see Project Monitoring Sheet-II "Plan of Operation").

### (2) List of Equipment Provided for the Project

Table 1.3 List of Equipment

Equipment to be Procured (1): Procurement in Rwanda

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Output 2	Materials and equipment for training for pipe repairing and service connection	set	1	Consultant	May. 2017 Completed	not yet
Lot 2	Output 3	Customer meter DN15mm	sets	400	Consultant	Feb. 2017 Completed	not yet
Lot 3	Output 3: Pilot Project (2sets)	Flow Meter, Gate Valve, Pressure gauge, etc.	set	1	Consultant	May. 2017 Completed	not yet
Lot 4	Output 4: Isolation of 4 Branch	Electric magnetic flow meter, Mechanical flow meter, Pressure gauge, Gate valve, etc.	set	1	JICA office	June 2019 Scheduled	not yet
Lot 5	Vehicles for JICA use	Minibus and Pickup	Units	2	JICA office	Jan. 2017 Completed	not yet

Equipment to be Procured (2): Procurement in Japan

Lot	Item	Contents	Unit	Quantity		Schedule	Handover to WASAC
Lot 6	Output 2: Leak detection equipment (for Two Branches of Pilot project and NRW Team)	Potable Ultrasonic Flow Meter, Flow & Pressure Logger 2ch, Leak Noise Correlator, Leak Detector (Headphone type), Pipe Locator, etc.	sets	3	JICA HQ	Jul. 2017 Completed	not yet
Lot 7	Survey Equipment for Output 2 and 3	Potable GPS, Potable Test Meter, Residual Chlorine Test Meter, Potable Electric conductivity Meter	set	1	Consultant	Oct. 2016 Completed	not yet

Note: Those items are used for the training activity during the Project period.  
The above mentioned equipment except Lot 5 should be handed over to WASAC immediately after delivery and WASAC will maintain them. The equipment of Lot 5 will be managed by the JICA Expert Team during the Project period and shall be handed over to WASAC at the end of the Project period

### 1-1-2 Rwanda Side

#### (1) Counterpart



PM Form 3-1 Monitoring Sheet Summary

Table 1.4 List and Assignment Terms of Counterparts

No	Position	Field in Charge	Name	Duration	
				From	To
<b>Steering Committee (SC)</b>					
1	Chainman	CEO of WASAC	James Sano	Aug, 2016	Sept. 2017
			Aime Muzora	Sept, 2017	Present
2	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
3	Project Manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
4	Management Team			Aug, 2016	Present
5	Officials from MINIFRA			Aug, 2016	Present
<b>Project Director and Manager</b>					
1	Project Director	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Project manager	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug, 2016	Present
<b>Management Team (9 persons)</b>					
1	Leader	Director of UWSS	Methode Rutagungira	Aug, 2016	Present
2	Co-leader	Director of CS	Lucien Ruterana	Aug, 2016	Sept. 2017
			Felix Gatanazi(Acting)	Sept. 2017	March, 2018
			James Mwijukye	March, 2018	Present
3	Co-leader	Director of CFO	Joseph Ruhingura	Aug. 2016	Sept. 2017
			Sams on Hategekimana(Acting)	Sept. 2017	March, 2018
			Ceaser Nkusi Nkwesi	March, 2018	Present
4	Member	Manager of NRW, UWSS	Jean Berchmas Bahige	Aug. 2016	Present
5	Member	Manager of Water Operation Services, UWSS	Innocent Gashugi	Aug. 2016	Present
6	Member	Manager of Utility Planning Services, UWSS	Dominic Murekezi	Aug. 2016	Present
7	Member	Manager of Revenue Management Services, CS	Alex KANSIIME	March, 2018	Present
8	Member	Head of billing and revenue collection, CS:	Désiré Kayiru	Aug. 2016	Present
9	Member	Manager of Customer Service Management, CS	Felix Gatanazi	Aug. 2016	Present
10	Member	Head of Marketing	Marie Therese Masimbi	Jan. 2016	Present
<b>Action Team (31 persons)</b>					
1	Leader	Head of leak detection and pressure management, NRW, UWSS	Désiré Ntamuturano	Aug. 2016	Present
2	Co-Leader	Kachiru Branch Manager	Musabyeyez Jeanne	Aug. 2016	Present
3	Co-Leader	Gikondo Branch Manager	Mutamba Jane	Aug. 2016	Sept. 2017
			Mr.Tuyisenge Vedaste	Sept. 2017	Present
4	Co-Leader	Nyarugenge Branch Manager	Byamugisha Bernard	Aug. 2016	Present
5	Co-Leader	Nyamirambo Branch Manager	Saranda Catherine	Aug. 2016	Present
6	Co-Leader	Kanonbe Branch Manager	Aimable Ndagijimana	Aug. 2016	Sept. 2017
			Mr.Mukiza Anacllet	Sept. 2017	Present
7	Co-Leader: Remera Branch Manager	Remera Branch Manager	Gilbert Mulindabigwi	Aug. 2016	Present
8	Member	Head of zoning and mapping services, NRW, UWSS	Jean Paul Kayitare	Aug. 2016	Present
9	Member	Head of water distribution services, WOS, UWSS	Anselme Mugabo Kimenyi	Aug. 2016	Sept. 2017
			Celestin Mwambutsa	Oct. 2017	Present
10	Member	Leak detection and pressure management Officer	Celestin Mwambutsa	Aug. 2016	Oct. 2017
11	Member	Fraud Investigation Officer	Viateur Munyanshongore	Aug. 2016	Present
12	Member	Mapping Officer	Claudien Mazimpaka	Aug. 2016	Present
13	Member	Head of meter management services	Felecien Niringiyimana	Oct. 2016	Present
14	Member	Water Distribution Officer of each Branch	Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera	Aug. 2016	Sept. 2017
			Kacyiru, Ntarugenge, Nyamiranbo, Kanombe, Remera (replacement)	Oct. 2017	Present
15	Member	Customer Service Officer of each Branch		Aug. 2016	Present
16	Member	Billing Officer of each Branch		Aug. 2016	Present

Table 1.5 Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

**(2) Facilities**

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons
- Space for training on pipe repair and service pipe connection
- Store house for procured equipment

**(3) Local Cost**

- Cost for administering the Project (utilities for expert offices, internet services)
- Cost for overtime work, transportation, accommodation and allowance for WASAC staff

**1-2 Progress of Activities**

**1-2-1: Activities relevant to the entire Project**

**(1) Start-up Meeting of the Project for 2nd Phase**

Start-up Meeting of the Project was held Aug. 9, 2017 with participation of members of Management Team and Action Team. The main topics of the meeting were as follows:

- Submission of Progress report (Part 1), Monitoring Sheet (Ver. 3), Work Plan (Ver. 3)
- Brief explanation of Project implementation for Phase 2
- Schedule of Management Team Meeting (Joint Monitoring) and Steering Committee (SC)

**(2) Management Meeting (Joint Monitoring)**

In the third joint monitoring conducted at the management team meeting held on August 9, 2017, the Work Plan of Phase 2 and Monitoring Sheet (Ver.3) were submitted. The topics for discussion of the past joint monitoring are shown below.

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Table 1.6 Main items checked and actions taken in the joint monitoring

No.	Implementation period	Main items checked and actions taken	Changes to R/D, PDM, PO, etc.
Version 1	September 15, 2016	None in particular	None
Version 2	March 15, 2017	<ul style="list-style-type: none"> <li>• The activities of Output 1 (Activities 1.2 to 1.10) have been extended for about 3 months → To be completed by the end of August 2017</li> <li>• The activities of Output 4 (Activity 4.3) has been extended due to the delay in procurement of equipment → Activities to continue in Phase 2</li> </ul>	PO Version 1 →PO Version 2
Version 3	Aug 9, 2017	<ul style="list-style-type: none"> <li>• Joint Monitoring Progress of each activity (preparation of 5YSP, Technical training, Pilot project, Isolation of 4 branches, Equipment procurement, others)</li> <li>• Work Plan for Phase 2 Outputs</li> <li>• Contents and implementation schedule of the Pilot Project</li> </ul>	PO Version2 →PO Version3
Version 4	Scheduled at August 2018 (before Monitoring Mission)	Progress until June 2018 of Phase2 Achievements, issues and challenges	

**(3) Steering Committee (SC)**

The second Steering Committee meeting was held on October 12, 2017 with the participation of members of the Management Team, Action Team and MININFRA. In the SC meeting, the following items were approved.

1) Project monitoring

Based on Monitoring Sheet Ver.3 submitted on August 9, 2017, the progress of the Project was confirmed. The 5-year Strategic Action Plan (5YSAP) for NRW reduction which was due to be completed in August 2017 was somewhat delayed, but its completion as a draft report by the end of September was approved. After official approval by a WASAC senior management meeting and the board of directors, it was decided to carry out the individual activities with the regular budget from October 2017.

2) Phase 2 Work Plan (Ver.3)

The content of the Phase 2 Work Plan, which was submitted to the Management Team on August 9, was approved.

3) Various indexes of the project

Concrete numerical values were decided for the indicators shown in the table below.

PM Form 3-1 Monitoring Sheet Summary

Table 1.7 PDM of the Project

Narrative Summary	Objectively Verifiable Indicators
<b>【Overall Goal】</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022: xx %)
<b>【Project Purpose】</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1: 5-year Strategic Action Plan (5YSP) for NRW reduction is approved by the MININFRA. 2: Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3: The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan
<b>【Outputs】</b> Output 1. Planning capacity of NRW reduction of WASAC is enhanced.	1: 5YSP is reviewed and updated, taking into account of the results of the Pilot Project. 2: All the project achievements are shared by WASAC and other concerned parties by holding seminars.
Output 2. Basic knowledge, skills and technique on NRW control are acquired by WASAC.	1: More than XX number of trainees receive training. 2: WASAC human resource development plan includes training programs prepared by the project.
Output 3. WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	1: NRW rates are reduced at each pilot area as follows: Pilot Area 1: from XX% to XX% and Pilot Area 2 from XX% to XX%. 2: Action team members share experiences at workshops regarding implementation of the pilot projects. 3: The action team prepares a completion report of the pilot project.
Output 4. 4 branches in Kigali establish the system to measure NRW rates accurately.	1: NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.

Table 1.8 Determinations of Indicators

Output	Objectively Verifiable Indicators
<b>【Overall Goal】</b>	NRW rate of Kigali city (year 2022 <b>25 %</b> ) (to be confirmed during the project)
<b>【Outputs】</b>	
Output 2.	1: More than <b>300</b> number of trainees receive training.
Output 3.	1: NRW rates are reduced at each pilot area as follows: Pilot Area 1: from <b>37% to 20%</b> and Pilot Area 2 from XX% to XX%. (XX% will be determined after baseline NRW rates are established.)

Note: • 25%: Targeted value 25% (2021/22) of five years business plans revised by NRW 5YSP

• 300 people: Estimate it from the training results of first Phase

• 36%: Average NRW rate for June, July and August in Pilot Area 1.

This was corrected to 37% in the review of March 2018.

• 20%: Targeted value that was made from targeted value 25% of business plans for five years

4) Assessment of project capability (capacity assessment: CA)

The capacity assessment on this project shall be implemented in accordance with the work items prescribed in the NRW Reduction 5-year Strategic Plan, and the targeted outputs of this project and the capabilities of

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each of the relevant WASAC departments/sections indicated in the Strategic Plan shall be assessed.

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.1.9 The held time of the SC meeting and the agenda

Time	Holding time	Theme, contents
1st	April 3, 2017	<ul style="list-style-type: none"> <li>• Discussion of the work plan (WP1), approval</li> <li>• Confirmation of the Rwandan side burden matter</li> </ul>
2nd	October 12, 2017	<ul style="list-style-type: none"> <li>• Progress confirmation of the project</li> <li>• Common knowledge of the NRW reduction 5YSP</li> <li>• Approval of the second work plan</li> <li>• About the enforcement of the project evaluation</li> </ul>
3rd	At the time of Project Monitoring in August, 2018	<ul style="list-style-type: none"> <li>• Result of Joint Monitoring</li> <li>• Procurement and Installation Plan of the Equipment for Monitoring System</li> <li>• Monitoring result of the JICA Monitoring Survey Mission</li> </ul>
4th	At the time of project completion, scheduled in May 2019	<ul style="list-style-type: none"> <li>• Result of Joint Monitoring</li> <li>• Monitoring result of the JICA Monitoring Survey Mission</li> </ul>

**(4) Weekly Meeting**

As a rule, PIM meetings are held at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held sixty times as of the end of May 2018 (including thirty times in Phase 1).

**(5) Project Progress Report (Part 1)**

Project Progress Report (Part 2) was submitted to JICA and WASAC at the end of June 2018 and in August, respectively.

**1-2-2: Training in Japan and in the 3rd Country**

**(1) Training in Japan**

Table 1.10 Implementation Statuses of Training in Japan

No	Timing	Field of training	Trainees	Training Themes
1	January 23 to 31, 2017	Management Team	5	<ul style="list-style-type: none"> <li>- Introduction to water service management and NRW</li> <li>- Outline of water facilities in Yokohama and Kobe Cities and other matters</li> </ul>
2	August 14 to 30, 2017	Business affairs and GIS matter	5	<ul style="list-style-type: none"> <li>- Introduction to water service management and NRW</li> <li>- Customer information management, meter management and reading, and water service management</li> <li>- Examples of how local governments utilize GIS, purposes of use, and other matters</li> </ul>
3	Nov. 13 to 30, 2017	Technical matter	5	Introduction to NRW, pressure management, leak detection, distribution management, and other matters

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**(2) Training in the 3rd country**

Training in the 3<sup>rd</sup> country was conducted in Kenya as shown in the table below.

Table 1.11 Training in the 3rd country

No	Timing	Field of training	Trainees	Training Themes
1	May 7 to 10, 2018	Management Team	2	An introduction and discussion of activity on NRW reduction carried out in each other's countries.

**1-2-3: Activities of Output****【Activities of Output 1】 :****Planning capacity of NRW reduction of WASAC is enhanced.**

1-1 A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.

The member of the management team and action team were appointed formally and teams were organized in August 2016 by CEO, but CEO of WASAC Mr. James Sano retired on September 1, 2017, and Mr. Aime Muzora who was a director of MININFRA took office as a successor. Following this, there were personnel changes and the resignation of the WASAC staff in September and had the effect in a management team and action team partly.

## a. Management Team

The directors of commercial and financial departments resigned, and successors took office.

Table 1.12 Movement of Management Team

Section	Predecessor	Acting	New appointment
Director CS	Lucien Ruterana	Felix Gatanazi	James Mwijukye
Director CFO	Joseph Ruhinyura	Samson Hategekimana	Ceaser Nkusi Nkwesi

## c. Action Team

There was the transfer of two directors of Gikondo and Kanombe, and five WDO of Kacyiru, Nyarugenge, Nyamirambo, Kanombe, Remera. But three peoples of the WDO are relieved between the branches in the Kigali city.

Table 1.13 Movement of Action Team

Branch	Predecessor	New appointment
Branch Manager		
Gikondo	Mutamba Jane	Tuyisenge Vedaste (from Bugesera)
Kanombe	Aimable Ndagijimana	Mukiza Anaclet (from Nyagatare)
WDO		
Kacyiru	Claudien Ruwabuneza	Alexis Dushimimana (from HQ)
x Nyarugenge	Damascene Nsengimana	Etienne Rutagengwa (from Remera)
Nyamirambo	Pierre Claver Mukimbiri	Noel Kanamugire (from HQ)
Kanombe	Antoine Muhawenimana?	Pierre Claver Mukimbiri (from Nyamirambo)
Remera	Etienne Rutagengwa	Damascene Nsengimana (from Nyarugenge)

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1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.

Problems and causes about NRW have been extracted in workshops which were held in succession in the first Phase.

Table 1.14 Process of Assess NRW Reduction Measures

No	Item	Implementation period	Details
1	Distribution of questionnaires to the 20 branches	Sept. 2016	Organization, outline of water supply facilities, customer information, NRW percentage, flow rate meters, water leakage investigation equipment, pipe repair equipment, water theft, water meters, etc.
2	Analysis of questionnaires	Sept.-Oct.2016	
3	Seminar	Nov. 8, 2016	on the questionnaire analysis results
4	Field surveys and reporting and issue identification at weekly meeting	Sept.2016 to March 2017	Confirmation of questionnaires, visits to facilities, interviews with branch managers, operators, etc., sharing survey results.
5	NRW strategic action plan workshop GP1	March 20-22, 2017	NRW reduction plan: Workshop on identification of issues

1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.

From the information obtained in Activity 1-2 and the survey of the 6 branches within Kigali City and the existing water supply facilities (field surveys, questionnaires, GIS, water consumption data), the issues were identified, and the countermeasures and orders of priority as of November 2016 were summarized.

Thereafter a series of workshops were held, based on the wishes from the WASAC side for more detailed investigation of the issues and causes. The framework of the 5YSP for NRW Reduction formulated through the workshops.

Table 1.15 Process of workshop for 5YSP for NRW reduction

No	Item	Date	Details
1	GP2	April 5-6, 2017	Workshop to analyze causes, formulate measures, and select components
2	GP3	April 21, 27-28, 2017	Workshop to compare and combine the issues identified by JICA specialists and the issues and measures identified by WASAC
3	GP4	May 5, 12, 15 and 22, 2017	Workshop regarding the selected components, formulation of order of priority of countermeasures, and establishment of framework
4	Seminar	May 29, 2017	The framework for the 5-year Action Plan for NRW Reduction was approved
5	GP5	August and September, 2017	Formulation of specific action plan for corresponding measures. Preparation of Final Draft Report of 5YSP
6	GP6	October 4, 2017	Joint workshop (management team, action team, 6 branch managers), discussion of Final Draft

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In the table, the methods of dealing with issues were grouped, forming 5 main components and grouped in 42 countermeasures (133 specific actions), to form the main components of the 5YSP. These were classified based on the International Water Association (IWA) water balance table. Also the year of implementation and sections responsible were formulated. The framework for the 5YSP was approved by the seminar held on May 29, 2017.

1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.

The inventory survey was carried out by the GIS team of WASAC, and the preparation of the schematic layout drawing of the distribution reservoir facilities was completed in October, 2017. However, as a result of on-site verification of the results, many deficiencies were recognized and the work need to be performed a second time because the results would not withstand actual use. It is desirable that this work is performed in the 5YSP activities.

1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.

The final draft report of 5YSP was completed in the end of September, 2017, and the report was discussed in the workshop which called a branch manager and the main staff of the Kigali city 6 Branch on October 4. With that in mind, in the second SC held on October 12, 2017, under participation of MNINFRA and the management team and the action team of WASAC, common knowledge and the agreement formation of 5YSP (Final Draft) was planned between all related sections. Afterwards, furthermore discussions were carried out mainly by NRW unit to make it practice, and a monitoring plan of implementation of 5YSP was added.

- Workshop : October 4, 2017
- Steering Committee : October 12, 2017

1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.

WASAC management recognized the importance of the institutional reorganization and currently the structure is been revised by senior management. This new structure is also intended to enhance NRW management mainly by emphasizing on some activities such as data analysis, water leak detection, water leak repairs, etc., which is insufficient at present.

A monitoring team consisting of six senior managers has been appointed by WASAC management to carry out monitoring of the implementation of the 5YSAP.

1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP

The yearly implementation schedule of each specific action was prepared. As a future issue, it is required the detail action plan including the procurement of the logistics (survey, repairing, vehicle etc.) at each section of the head office and branch offices.

The specific action in 5YSP which is able to be performed in the annual action plan of each branch will be implemented sequentially for the time being.

Project manager and a JICA expert visited all 20 branches from early April to early July of 2018 to explain contents and the templates of monthly report of 5YSP.

1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.

The budget for the financial year (July 2018 to June 2019) was scheduled to be added and amended with the approval of the 5YSP Report by the WASAC Board. There is not influence in particular about the implementation for the time being, because most of the activity for NRW reduction was in the normal budget (Utility Budget: Flow expense and OPEX: maintenance expense)

1-9 The management team prepares the 5YSP that summarizes the achievements from Activities 1-1 to 1-7.

The management meeting collected all managers of DUWSS, all section heads was held on November 14, 2017, and the latest edition of the report was explained. It was decided to change its name from "5-year strategic action plan (5YSAP)" to "5-year strategic plan (5YSP)" in the meeting. A result was reported to CEO and each Branch Manager on the next day.

A report was submitted to the Senior Management Team by the project director Mr. Methode on December 15, and the report was approved in the Senior Management Meeting held on February 12, 2018. 5YSP was finally officially approved by the WASAC Board of Directors on April 27, 2018. After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1 year relative to the schedule, and will be commenced in fiscal year 2018/2019.

1-10 The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.



5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

1-11 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.

5YSP is updated as necessary. It is scheduled to be updated in October, 2018 and March, 2019, based on the result of the Pilot Projects for Output 3.

1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.

It is scheduled for March 2019.

**【Activities of Output 2】 :**

**Basic knowledge, skills and technique on NRW control are acquired by WASAC.**

2-1 Training materials on NRW control are prepared.

The training materials (text, presentation materials, etc.) in each field were prepared at each time.

2.2 Training on NRW management is conducted for the management team and WASAC management as necessary.

Awareness of NRW management has been deepened by implementation of training in Phase 1, and, through the series of workshops held in the process of formulating the 5YSP.

Table 1.16 Output of Training in NRW Management

Required Capacity	Training Item	Achievements and Challenges
Understanding of definition of NRW and components of NRW	General items	Sufficient understanding of the components of NRW, in accordance with the definitions of the IWA.
Preparation of NRW reduction action plan	5YSP	Understanding of the details of countermeasures and activities through the process of study of the preparation of the 5YSP.
Implementation, management and monitoring of NRW reduction action plan	5YSP	Preparation of activity monitoring report format.
Evaluation of NRW reduction activities	Pilot Project capacity (Cost-benefit analysis)	Implementation of training in accordance with the progress of the Pilot Project.
Analysis of NRW components	Pilot Project capacity (Water distribution analysis)	Implementation of training in accordance with the progress of the Pilot Project.

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Preparation of NRW reduction measures manual	Pilot Project capacity (Implementation manual)	Implementation of training in accordance with the progress of the Pilot Project.
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2.3 OJT is conducted on the updating of GIS data, using available GIS data base.

Training relating to updating of GIS data has already been completed (Phase 1 August to November 2016). The timing of development of WASAC GIS data (pipe network data, customer data) by ESRI and introduction of software (ArcGIS) was unclear, so it was not possible to commence specific activities using ArcGIS. In addition, the GIS Team has comparatively high individual skills in the use of the ArcGIS software, but the organization itself cannot fully utilize the software. As the results of implementing the training as indicated in the following table based on this situation, the WASAC staff involved in the work regarding GIS fully understood the processes of setting for updating the GIS data and know-how in connection with these operations.

Table 1.17 Output of Training in GIS

Required Capacity	Training Item	Achievements and Challenges
GIS data updating (customer data, pipe network data)	<ul style="list-style-type: none"> <li>Continuous updating of GIS data (customer and pipe network data, new customers)</li> <li>Updating data using Manuals (GIS Procedure Guide and GIS Operation Manual)</li> </ul>	<p>Degree of achievement: B</p> <p>Training was carried out into reassessment and improved efficiency of the current flow for updating in WASAC, using usable data. The staff understood the skills and techniques necessary for updating of data.</p> <p>In the future, it will be necessary to change the updating procedures in accordance with circumstances, such as completion of the ESRI work, etc., but the staff will be capable of dealing with these.</p> <p>The target of the technology transfer was only 5 members of the GIS Team, but the technologies can be spread to other members by utilizing the manuals that have been provided.</p>
Sharing and practical use of GIS data	<ul style="list-style-type: none"> <li>Utilization and sharing of GIS data in WASAC</li> <li>GIS data sharing by QGIS and Google Earth</li> <li>Use of drawings created using GIS</li> </ul>	<p>Degree of achievement: B</p> <p>Training in utilization and sharing was carried out for a total of 20 members of staff for whom there is a possibility that they will be involved with GIS in the future. The response of the staff members to the introduction of the QGIS data set was good and significant. There were major advantages in that each member of staff could immediately look up elevations, etc., on their PC, and in addition, there is the awareness effect that they will become familiar with the use of GIS.</p>
Transfer of applied technology related to layout and data analysis by ArcGIS	<ul style="list-style-type: none"> <li>Method of preparation of “data-driven pages”</li> <li>Method of constructing and analyzing an [ArcGIS Geometric Network], for analyzing pipe networks using ArcGIS</li> </ul>	<p>Degree of achievement: B</p> <p>These two applied functions of ArcGIS were introduced to 2 or 3 members of the GIS team, and an extremely good response was obtained. On this occasion, it was not possible to provide instruction on these functions to the practical use level, but it can be greatly utilized in the work of the staff in the future.</p>

Notes) A: The training target has been sufficiently achieved, and activities can be carried out systematically without problem.  
 B: The training target has been virtually achieved, and if there is a wish to implement the plan at management level then there is the potential for systematic development.  
 C: There is a moderate level of achievement, and with the accumulation of work experience in the future, there is a prospect

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of development at the individual level.  
 D: The degree of achievement is insufficient, and further training is necessary.  
 E: There is no potential for growth.

2.4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.

The training was carried out in Phase 1 from August to November 2016. Before this, there were no personnel or departments within WASAC with experience of hydraulic analysis. Moreover, as a result of the delay in developing GIS data, software dedicated to hydraulic analysis (Mike Urban) has not been licensed and introduced. Therefore, training was carried out on the basic theory and using alternative software, for C/P personnel responsible for GIS and design having the role of constructing DMA and that are expected to utilize software in the future.

Table 1.18 Output of Training in Hydraulic Analysis

Required Capacity	Training Item	Achievements and Challenges
Understanding of purpose of use of hydraulic analysis	<ul style="list-style-type: none"> <li>Understanding and purpose of hydraulic analysis (What to do with hydraulic analysis ? )</li> </ul>	Degree of achievement: C The vision of hydraulic analysis goes beyond each of the individual components of the technology, so it is substantially advanced and difficult. It is difficult to become proficient through lectures, and even if there has been two-way discussion, ultimately each individual must diligently gain insight.
Understanding of general basics of hydraulic analysis	<ul style="list-style-type: none"> <li>Basic knowledge of hydraulic analysis</li> <li>Understanding of Hazen-Williams formula</li> </ul>	Degree of achievement: B The general basics of hydraulic analysis have been understood. However, the amount of practice is insufficient, so the ability to apply it to practical work is insufficient.
Handling of existing data (GIS, water consumption) required for hydraulic analysis	<ul style="list-style-type: none"> <li>Flow of data in WASAC and handling of data</li> <li>Quality of data and reliability of hydrological analysis results</li> </ul>	Degree of achievement: C Repeated lectures were given on the organized flow of data in WASAC. The analysis practices were carried out using actual data in order to demonstrate to WASAC staff how difficult it is to achieve success. Degree of achievement: B The importance of the quality of data has been understood. However, this is a long-term organizational issue, and is not a problem that can be immediately solved by the GIS Team alone. Whether or not WASAC can construct an effective data collection system remains to be seen.
Understanding of ways of using hydraulic analysis software	<ul style="list-style-type: none"> <li>How to use EPANET</li> <li>How to use simple conversion application to join EPANET and WASAC GIS</li> <li>How to use Mike Urban</li> </ul>	Degree of achievement: A Regarding the methods of use of hydraulic analysis apps with EPANET and Mike Urban, staffs have been using PCs for a long time, so they quickly became proficient in the use of analysis apps. Staffs have become proficient in the basics and manuals have been provided, so in the future they will be able to proceed with practical examples while investigating on their own.

2.5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.

Water volume control and water pressure control are important items for water leak control. In the case of water volume control, the amount of water leakage in the water supply pipes and main



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distribution pipes can be generally determined by measuring the flow rates in pipeline segments using exposed pipes such as raised aqueduct or pipes attached along a bridge. It is also possible to determine the amount of water leakage by measuring the Quantity Minimum Night Flow (Qmnf) of a distribution pipe network at each DMA (District Metered Area), and to narrow down the location of the water leak by carrying out a step test or direct measurement on the pipeline (modified step test).

Table 1.19 Output of Training in Leak Detection

Required Capacity	Training Item	Achievements and Challenges
Leakage point detection work	<ul style="list-style-type: none"> <li>Capable to understand water leak surveys/functions of leak detector, and to operate the equipment.</li> <li>Capable to understand the general basics of the method of detection of sound source for water leak detection.</li> <li>Capable to understand purposes of water leak surveys, purposes of use of detector, as well as to choose suitable equipment in accordance with the circumstances on site.</li> <li>Capable to choose the equipment suitable for sound source detection on metal pipes, non-metal pipes, small-diameter pipes, large diameter pipes, distribution pipes, and water supply pipes.</li> </ul>	<p>Degree of achievement: B</p> <p>There are no problems regarding the use of water leak detector, but further proficiency can be expected by further efforts through practical work. The trained staff can provide training to other members of staff.</p> <p>There are no vehicles only used for surveys, and the survey system has to be put together ad hoc.</p> <p>This technology is still new and requires time for the team to get more experience.</p> <p>The number of staff in WASAC dedicated to leak detection is low.</p> <p>The complexity of the site ( not always paved road and not well known network).</p> <p>Some equipment (correlators) are not fitting with the majority of WASAC existing network condition.</p>
Water volume control	<ul style="list-style-type: none"> <li>Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement.</li> <li>Capable to collect and visualize flow rate data before analysis.</li> <li>Capable to conduct surveys of water leak amount by the nighttime minimum flow rate method.</li> <li>Capable to determine important zones for water leak detection by sub-zone step tests and direct measurement.</li> <li>Capable to estimate water leak quantities between two locations by measuring the flow rates at some different points.</li> </ul>	<p>Degree of achievement: B</p> <p>The theory of measurement and methods of use of ultrasonic flow rate meters have been understood.</p> <p>The trainees identified the water leak quantities by measuring the nighttime minimum flow rate and carrying out a step test on the WASAC pipeline and confirmed the effectiveness of the method of tracking the area where the water leak exists, as well as understood how to carry out these operations. They are now capable of using these methods in practice on their own judgment.</p>
Water pressure control	<ul style="list-style-type: none"> <li>Capable to carry out continuous measurement (monitoring) over a long period using a data logger. Capable to understand the basic of signal measurement.</li> <li>Capable to collect and visualize water pressure data before analysis.</li> <li>Capable to understand the basics of water pressure data signal measurement.</li> <li>Capable to understand the relationship between high water pressure and NRW.</li> </ul>	<p>Degree of achievement: C</p> <p>The general basics of measurement and the method of use of water pressure gauges were understood. Monitoring can be carried out using a data logger.</p> <p>In undulating topography, there are many areas with excess pressure, but dynamism and motivation of trainees are insufficient for active risk management.</p>
Formulation of plans for water leak detection operations	<ul style="list-style-type: none"> <li>Capable to understand water leak surveys and detection methods and choose effective methods in accordance with the circumstances of the water distribution pipe network.</li> <li>Capable to understand the relationship between water pressure and flow rate.</li> <li>Capable to evaluate the distribution pipe network,</li> </ul>	<p>Degree of achievement: D</p> <p>The ability to formulate water leak survey plans for water distribution networks has not been achieved. In order to carry out an effective water leak survey, it is necessary to form DMAs in the distribution network, and as such, a more detailed study should be carried out for appropriate layout of reservoirs, etc., and</p>

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	<p>make judgments of what part is functionally impaired, and formulate improvement measures.</p> <ul style="list-style-type: none"> <li>• Capable to elaborate plans of water leak surveys with awareness of the 5YSP.</li> </ul>	<p>development of distribution network. It is necessary to select areas available for water leak surveys, and it is needed to carry out work to hydraulically isolate the area.</p>
Maintenance of water leak detector	<ul style="list-style-type: none"> <li>• Capable to decide on the storage location of the equipment, and to store the equipment in an orderly manner.</li> <li>• Capable to appoint a person responsible for the storage, in order to prevent loss of equipment, and to maintain records of issuing the equipment.</li> </ul> <p>Capable to carry out minor maintenance such as replacement for poor connection of dry or other batteries.</p>	<p>Degree of achievement: D</p> <p>One room in WASAC Headquarters is used for storage of the equipment, but the space is narrow, and the arrangement is not tidy.</p> <p>A control record register has been prepared for issuing equipment, but it is not being properly used.</p> <p>A person responsible for maintenance has not been appointed.</p> <p>The point of contact for repairs whenever there is a breakdown of equipment has not been determined.</p>

WASAC did not possess the practical techniques for systematic measures against losses, but as a result of this training, members of staff of the NRW Section have learned the methods of using water leak survey and detection equipment, and the methods of carrying out surveys and detection using this equipment. In particular, through the activities of the Pilot Project, WASAC has acquired the techniques of detecting visible water leaks, which it could not achieve previously, and this is a major breakthrough. The invisible water leakage as a percentage of the NRW in the WASAC water distribution network is extremely high, and it is expected that these techniques will contribute greatly to the NRW reduction activities of WASAC.

The training enabled WASAC to have the minimum necessary equipment for water leaks survey and detection, and to foster technicians capable to carry out water leak survey and detection, although the number of them is small, so in the future it will be necessary to extend this practically to specific activities in the WASAC branches.

The NRW Section does not systematically plan leak detection work. It is desirable that an overall plan be formulated in accordance with the 5YSP for the activities of WASAC as a whole, while utilizing the experience accumulated in the Pilot Project of this Technical Cooperation Project. To this end, it is necessary to create an implementation mechanism by carrying out reorganization at Headquarters or at branch level, for carrying out survey and detection.

2.6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.

The training in this field was mainly carried out for members of staff in the branches, so the six branches in Kigali were visited sequentially, the status of work was closely examined, and OJT was carried out on methods of constructing water supply pipes.

The majority of locations where water leaks occur are on water supply pipes. Therefore, the emphasis in training was put on the following points in construction, and training was provided in thermal welding of HDPE pipe, proper hole drilling using drills (non-water supply suspension cutting method), proper cutting of screw threads using dies, methods of wrapping Teflon tape, measurement of water pressure and

measurement of residual chlorine after drilling, backfilling of pipes, etc.

- When a branch is formed from a water distribution pipe using a saddle, a hole is formed in the water distribution pipe using a heated steel rod. High pressure occurs, if the hole is too small, which causes damage to the saddle packing and cracking on the pipe wall.
- PVC pipe or HDPE coils are joined by forming screw threads. Therefore, the pipe wall pressure is reduced.
- When cutting screw threads (with a die), water is used and not oil.
- Sealing tape (Teflon) is wound too much. The screw threads do not come into close contact because of this excess of winding, which causes division at the screws. Moreover, workers do not peel old sealing tape, but wind over it.
- The chippings of pipe material that occur after pipe repair are not removed, mud that falls into the pipe during operations is not removed, and connections are made while this remains. Pipe cleaning is not carried out. This causes blockage of meters.
- The pressure resistance of pipe material is not uniform when a mixture of PN16 and PN10 is used.
- The quality of the pipe material is poor, so longitudinal splitting of PVC and HDPE pipes occurs due to high water pressure.
- After carrying out a repair, water is not applied in order to check whether there is a water leak.
- Vehicles are driven even on small, unpaved roads, which can cause damage to pipes due to insufficient depth or inappropriate backfill. The excavated soil such as clay in which consolidation settlement can easily occur or gravel is used as backfill, and this can cause new pipe cracking and water leakage. Sufficient compaction of the pipe foundation is not carried out, and this causes water leaks.
- Procurement of pipe materials and excavation of the pipe route for laying these pipes are carried out by consumers, and quality is not ensured.
- When carrying out water leak repairs or connections of a new water supply pipe, there are no valves nearby so it is not possible to shut off the water, and this causes lost water.

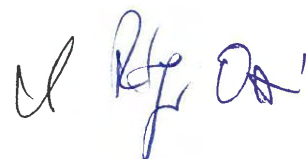
2.7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.

In the Pilot Project, emphasis was placed on the accuracy of the customer meters used as the main cause of the apparent loss of NRW, and in-situ calibration of the meters and replacement of the meters in accordance with the result is proceeding. At WASAC previously meters were only replaced in the event of a breakdown, and assessment of accuracy on the WASAC test bench was only carried out when the meter had been procured and when there was a complaint from a customer.

As a result of the activities of the Pilot Project, the following issues became apparent, and training in methods to deal with these is scheduled to be continued by OJT.

- 1) Appropriate processing of data on water consumption amount (occurrence of NRW in the process of water metering and consumption)

- When a meter was replaced, the amount of water used between when the meter was read and when it was replaced or the estimated amount of water was lost in terms of accounting. Correction of the programming of the CMS system for customer data management is required.
  - The criteria of the method of estimating the volume of water consumption when it was not possible to read the meter are unclear.
- 2) Establishment of methods of analyzing customer data
- The purpose of monitoring and analyzing the quantity of water consumption for each customer is not recognized (detection of abnormal data, water consumption volume processing errors, meter faults, detection of suspected theft of water, etc.)
  - A database for analysis of customer data has not been prepared. Even though there is GIS customer data and Commercial Services Department customer data, they have not been linked, so their uses are limited. Therefore, it is an urgent task to prepare a unified database for all branches.
  - There is no manual for the methods of analysis of customer data. Almost all of those responsible in each of the branches are beginners in the use of Excel and Access software, and at present are occupied with basic operations such as data input, calculation, etc. In addition to improvement in basic capabilities, it is necessary to provide training to improve the capabilities of the members of staff to deal with data modification, cross tabulation, methods of detecting abnormal data, preparation of graphs, determining customer properties, and other simple analysis methods.
  - The operability for processing a large amount of data with the Excel software is limited, and the potential for making a mistake is large, so it is desirable that this is dealt with by programming such as a Customer Management System (CMS), etc., as the method for processing and analyzing complex customer data.
- 3) Meter calibration method, and establishing criteria for replacement of meters
- Customer meters with problems in measurement accuracy (about 20% of all customer meters) are used over the long term, and are left as they are.
  - From the lessons learned in Pilot Project 1, the criteria for the calibration operations on site using a simple test meter were reviewed, and it was planned to implement them in Project 2. At the same time, the criteria for meter replacement were justified based on the calibration results.
- 4) Allocating POC numbers to customer addresses
- A POC label (seal/metal plate) is applied to the customer residence.
  - Preparation of POC map (plotting on GPS map, conversion to GIS data).
  - In order to automatically add the POC of the new customers that are increasing every month to the pilot area (DMA) customer list, a DMA code for the pilot area is allocated to the POC data of the CMS.
  - In order to link to the GIS customer data, it is necessary to collect the required customer data at the same time as the new customer contract. It is necessary to create a system to be implemented responsibly by a branch WDO or a technician.



5) Dealing with disconnection, and abandoned public water taps

- In the case of customers for whom measures have been taken to stop their water supply, the risk of illegal use of the water supply increases, so it is necessary to carry out tracking surveys after taking measures to stop their water supply. As the survey method, interview surveys for each household are proposed in order to confirm the local situation and the items required for each customer, etc.
- Since water supply to a public water tap is suddenly interrupted because of non-payment of charges (2 weeks or more), many customers act repulsively, and there is a strong possibility that it can cause illegal use and illegal connections, etc. Even if there is a need to stop the water supply, sufficient care should be taken with respect to the users.

2-8 Training materials on NRW are reviewed and updated.

Updating will be carried out through implementation of the pilot project of Output 3, after March, 2019.

2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.

Updating will be carried out through implementation of the pilot project of Output 3, after March, 2019.

**【Activities of Output 3】**

**: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.**

**A. Project Preparation**

3-1 The action teams are organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.

The counterparts were formally appointed by the CEO, and formation of the Action Team was completed in August 2016. However, as stated previously, there was relocation of personnel in September 2017, and this had some effect.

3-2 The action team grasps the current situations of Pilot Area 1 and Pilot Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.

Selection of two pilot areas (Area 1: Kadobogo of Kacyiru Branch, Area 2: Ruyenzi of Nyarugenge Branch ) from the proposed candidate sites in September 2016. Information data of two pilot areas were collected in September 2016. Afterward, information data of pilot areas such as POC list and boundary

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were updated.

Customer list (POC: Point of Connection) and the POC location map of the pilot area (Kadobogo) were provided from the Kacyiru Branch and GIS section respectively. However, in local findings through the site work such as onsite meter test and leakage inspection, it became clear that some POCs which did not match with the local situation were included in POC list and/or the POC location map, and adversely, the POCs which should be existed in the area were not included. This correction took long time because of the difficulty to confirm POC number onsite.

It was decided that the NRW rate which has been calculated so far at each sub-zone are reviewed again after a list of POC were revised. As a lesson, preparation of a list of POC and the POC location map are basics of the project work. These are extremely important information to conduct the routine onsite work of WASAC such as meter reading, meter test, meter investigation and leakage survey. It was proposed to stick the seal which displayed a POC number on the gate of each house

3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Pilot Area 2.

A work plan of pilot project for area1 and Area 2 was prepared.

3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flowmeters and pressure gauges at the inlets of the Pilot Area 1 and 2.

Construction of chamber and installation of the measuring equipment in the chamber has completed in May, 2017.

**B. Activity of the Pilot Area 1**

3-5 The action team establishes the baseline NRW rate of Pilot Area 1

The boundary reconfirmation and correction by the hydraulic isolation work was made in December, 2017. The measurement of the inflow of pilot area 1 and 2 was started in June, 2017 and NRW rate of each month have been calculated. However, about baseline of NRW, it was reviewed after the correction of the POC list. As the baseline the mean of 2 months June and July, 2017 was adopted.

Table 1.20 Base line of Pilot Project 1

Items	Unit	June, 2018	July, 2018	Average
Connection	Number			
Input Discharge	m3	19,054	20,389	19,722

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Billed water	m3	11,345	13,412	12,379
NRW	m3	7,709	6,977	7,343
NRW Rate	%	40.5%	34.2%	37.2%

3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.

The onsite meter test was carried out from August 27, 2017 through December 29, 2017. The meter with value of the error more than  $\pm 5\%$  and defaulted were replaced with new meter during the period from September 8, 2017 to May, 2018.

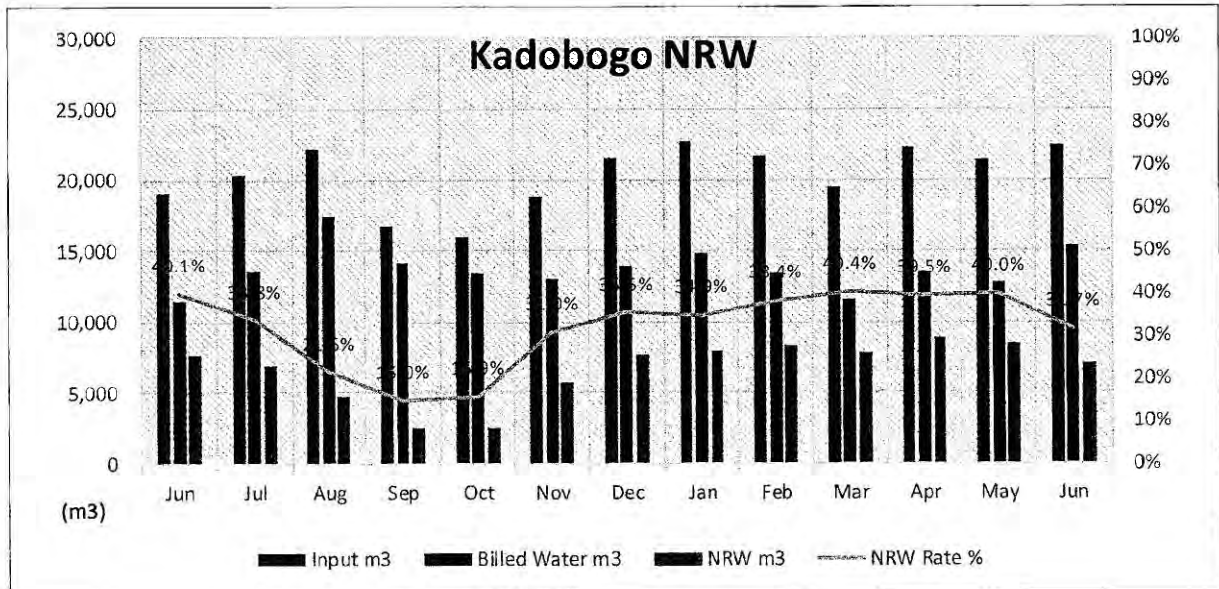
Table 1.21 Onsite meter test results

Sub-Zone	Normal	Error > $\pm 5\%$	Meter Blocked	Faulty Meter	Illegals	No Meter	Leaks	Stop Valve Blocked	Disconnected
PM1	428	117	9	40	3	2	2	13	1
PM2	34	9	0	0	0	0	0	0	0
PM3	319	80	3	35	2	0	1	10	6
Total	781	206	12	75	5	2	3	23	7

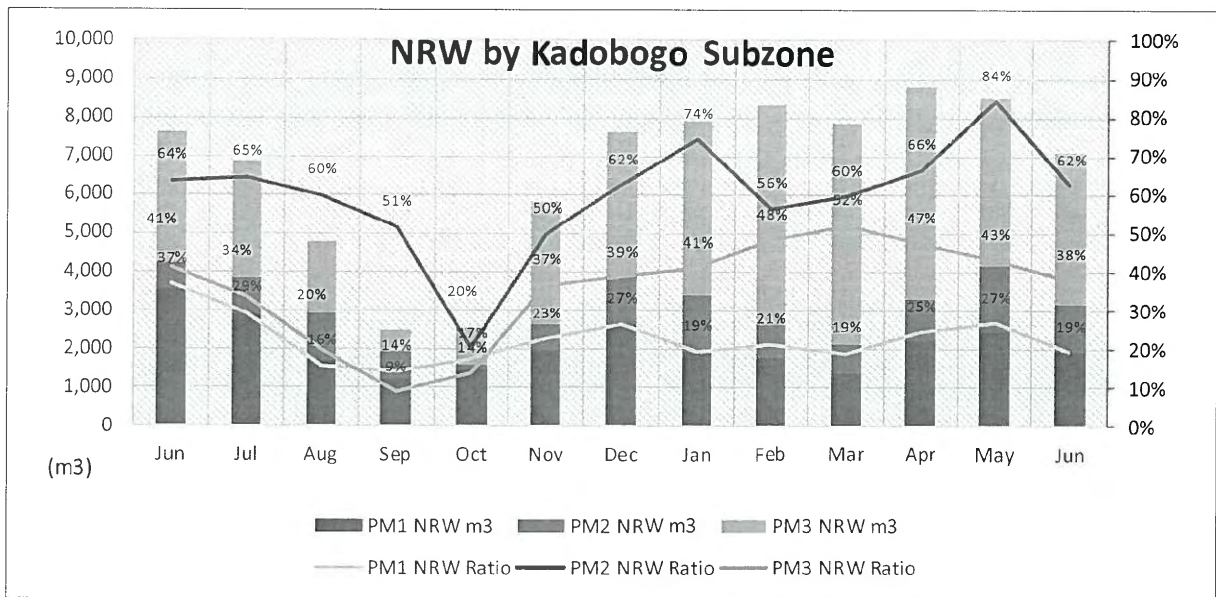
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness

NRW rate is calculated every month from June 2017.

NRW Rate in Kadobogo



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PM Number	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<b>Billed water</b>	11,404	13,500	17,374	14,245	13,397	12,959	13,908	14,765	13,351	11,579	13,499	12,822	15,340
PM1	6,086	6,947	9,089	7,286	6,882	6,786	7,122	7,710	6,602	5,808	6,790	6,684	8,182
PM2	381	506	839	666	668	692	768	531	664	503	557	322	742
PM3	4,935	6,047	7,446	6,294	5,847	5,501	6,018	6,524	6,085	5,268	6,152	5,816	6,416
<b>Input Volume</b>	19,054	20,389	22,169	16,762	15,936	18,793	21,555	22,694	21,677	19,439	22,328	21,373	22,445
PM1	9,634	9,847	10,771	8,491	8,332	8,741	9,706	9,577	8,391	7,179	8,995	9,134	10,134
PM2	1,049	1,429	2,087	1,373	837	1,378	2,044	2,061	1,519	1,243	1,659	2,030	1,978
PM3	8,371	9,113	9,311	6,898	6,767	8,674	9,805	11,056	11,767	11,017	11,674	10,209	10,333
<b>NRW</b>	7,650	6,889	4,795	2,516	2,539	5,834	7,647	7,929	8,326	7,860	8,829	8,551	7,105
PM1	3,546	2,900	1,682	1,205	1,450	1,975	2,584	1,867	1,789	1,371	2,205	2,450	1,952
PM2	668	923	1,248	707	169	685	1,276	1,530	855	740	1,102	1,708	1,236
PM3	3,436	3,066	1,865	604	920	3,173	3,787	4,532	5,682	5,749	5,522	4,393	3,917
<b>NRW ratio</b>	40.1%	33.8%	21.6%	15.0%	15.9%	31.0%	35.5%	34.9%	38.4%	40.4%	39.5%	40.0%	31.7%
PM1	36.8%	29.5%	15.6%	14.2%	17.4%	22.6%	26.6%	19.5%	21.3%	19.1%	24.5%	26.8%	19.3%
PM2	63.7%	64.6%	59.8%	51.5%	20.2%	49.8%	62.4%	74.2%	56.3%	59.5%	66.4%	84.1%	62.5%
PM3	41.0%	33.6%	20.0%	8.8%	13.6%	36.6%	38.6%	41.0%	48.3%	52.2%	47.3%	43.0%	37.9%

The NRW rate that decreased once tends to increase after November, 2017. As this reason, the following possibility was assumed.

- ① Consumption of water was not billed by the omission of list of the new customer of the pilot area.
- ② Because of the defect of calculation method with the replacement of the meter, consumption of water that was measured by the previous meter was not considered.
- ③ Actual progress of the replacement work of the defective meter is late than a branch report, and effect expression by the meter replacement is late.
- ④ Many leaks of water occur frequently routinely without the basic countermeasure to high water pressure and to use of poor quality pipe. Leaks left as it is for a long term especially in the case of invisible leakage without being repaired.
- ⑤ Correspondence of the Kacyiru branch to the leak of water discovered and illegal use is late.
- ⑥ Increase of illegal use of water by the increased disconnected customer.

3-8 The action team conducts measures for reducing surface leakage (visible leakage).

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It was carrying out from December, 2017. The visible leakage was found routinely. Because it is necessary to repair it immediately when a leak of water is found, its repair work has taken simultaneously with apparent loss measures.

3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.

NRW rate is calculated every month from June 2017.

3-10 The action team conducts measures for reducing underground leakage (invisible leakage).

The measurement work of leakage abundance started by NRW team in January, 2018 and the team chose an area with much quantity of leakage. Then, "the modified step test" was conducted on March 22, and the identification of the leakage spot was succeeded in that day. The NRW team succeeded in discovery of big leakage points continuously afterward.

3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.

NRW rate is calculated every month from June 2017.

3-\* The action team conduct measures for reducing high pressure.

Some high pressure zones have been identified within the pilot area, the procurement of PRV and the construction of manhole is under preparation.

3-\* The action team measures NRW after conduction Activity 3-12 and examines their effectiveness.

Not yet

3-12 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.

The implementation in September 2018 or later is planned based on the work plan.

3-13 The action team summaries activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.

The implementation in November 2018 or later is planned based on the work plan.

3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.



The implementation in December 2018 or later is planned based on the work plan.

**C. Activity of the Pilot Area 2**

3-15 Action team conducts activities at Pilot Area 2.

**1) Preparation Works**

The customer POC number survey was carried out on site in March and April 2018 collecting positional coordinate data using mobile GPS. Based on the results, the POC positions were input onto GIS distribution pipe maps that were prepared superimposed on Google Maps, to produce the POC position maps. Based on these maps, the operation of confirming the hydraulic isolation in areas and zones within the areas was carried out, to determine the boundaries. In the course of this work, the POC list and the POC position maps were readjusted.

Based on the lessons learned from Pilot Area 1, in Pilot Areas 2 it was decided to apply the POC seals prepared in the Project to the customer residences. It was also decided to investigate methods of taking high-pressure reduction measures prior to carrying out the measures against actual water leaks. The implementation policy was as follows.

- Calculate the baseline NRW rate value based on the POC list completed at the end of April 2018.
- Carry out continuous calculation of the NRW rate every month.
- Install PRV after studying measures against high pressure and verifying the positions to install PRV. Carry out water pressure measurement for this purpose.
- Set tertiary pipe areas in three locations for analysis of water distribution rate, and measure the nighttime flow rate.
- Conduct a meter survey at all customer locations, and implement meter calibration in selected locations.
- Replace defective meters with new ones.
- Conduct a minimum nighttime flow rate survey and step tests in each zone.
- Detect water leak locations and carry out repair work.
- Complete the work by December 2018, and carry out evaluation in January 2019.

**2) Measurement of the baseline NRW rate**

From the below table, it can be seen that the NRW rate in April 2018 was extremely high at 72.3%. The baseline NRW rate prior to the NRW reduction activities was taken to be the average value of the NRW rate in the recent two months 64.4% and 72.4% (March, April), which is 68.4%.



Table1.22 Ruyenzi NRW rate

Table-Ruyenzi NRW Analysis					
DMA Number		Jan*	Feb*	Mar	Apr
Billed water		21,574	17,441	19,486	17,540
	RY1	14,084	11,762	12,849	11,845
	RY2	2,900	2,097	2,666	2,543
	RY3	4,590	3,582	3,971	3,152
Input Volume		55,992	53,704	54,812	63,327
	RY1	34,610	33,840	38,085	45,469
	RY2	12,580	11,560	7,480	8,790
	RY3	8,802	8,304	9,247	9,068
NRW		34,418	36,263	35,326	45,787
	RY1	20,526	22,078	25,236	33,624
	RY2	9,680	9,463	4,814	6,247
	RY3	4,212	4,722	5,276	5,916
NRW ratio		61.5%	67.5%	64.4%	72.3%
	RY1	59.3%	65.2%	66.3%	73.9%
	RY2	76.9%	81.9%	64.4%	71.1%
	RY3	47.9%	56.9%	57.1%	65.2%
<b>Water Transmitted</b>					
		<b>Jan*</b>	<b>Feb*</b>	<b>Mar</b>	<b>Apr</b>
Gihara	Total	15,218	15,766	18,003	14,472
Res.	Area	6,416	7,462	8,756	5,404
	Bisheny	NA	NA	1,265	631
Note: Water transmitted to Bisheny area in January and February from RY1 are not considered in the values of input volume and NRW of the same months.					

#### D. Manual and Seminar

3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.

The implementation in November 2018 or later is planned based on the work plan.

#### 【Activities of Output 4】 :

**4 branches in Kigali establish the system to measure NRW rates accurately.**

4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.

Four branch separation boundary lines were established by the end of September, 2016. The review of the hydraulic isolation plan is completed in the 1st Phase. About the decision of the boundary of 4 branches (Nyarugenge, Gikondo, Kacyiru, Nyamirambo), a close inspection was made by the collaboration with a WASAC GIS team, WDO of the branches and the JICA expert team.

The result of the close inspection was discussed in a project management meeting of October 7,

2016, and the position of the boundary line was settled.

As a result, there is the boundary position correction between existing branches to some extent, and the adjustment between branches of the customer registration with it is required.

The number of the movement of the customer between the branches is almost just what to show it in table below. The adjustment work on the customer registration list will be performed together in the process of equipment procurement schedule for the construction of hydraulic isolation systems.

Table 1.23 The number of the movement of the customer

Before movement	After movement	Customers
Kacyiru	Gikondo	4
Kacyru	Remera	15
New Nayrugenge	Kacyiru	11
New Nayrugenge	Namirambo	435
Gikondo	Remera	1314
TOTAL		1779

4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.

The flow rate monitoring system for measuring the amount of water distributed to each branch in order to calculate the NRW consists of devices for measuring data (flow rate, pressure) installed on site, and data collection equipment installed at WASAC Headquarters. The data measured on-site is transmitted to the data collection equipment via a mobile telephone transmission network (GPRS). The data collection equipment is a server that carries out data collection, accumulation, and display. However, its scale is the minimum necessary, and it does not include software for analysis and statistical processing of the collected data, or preparation of graphics. The data information is in text format, so WASAC process it in an Excel table, and calculate the NRW rate for each branch.

In addition, the system of the SUSWAS project (27 places of electromagnetic flowmeters) is to be compiled into the system of this project.

The review of the hydraulic isolation plan has completed and the locations to install an electromagnetic flowmeter and pressure gauge were determined in the joint meeting held between NRW, GIS and O&M team on October 31, 2016.

4-3 Electromagnetic flowmeters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.

- Among 23 places of concrete chambers to install procurement equipment in it, the chambers of 22 places are completed at a stage in the end of April, 2018. The remaining one chamber is under construction.

Table 1.24 Status of construction of the Chamber (As of the end of July 2018)

No. of Chamber	Status	Note
M1, M2, M4, M5, M6, M12, M13, M15, M17, M19, M23	Completed on May 25, 2017	1st Phase
M7, M8, M9, M10, M11, M14, M16, M18, M20, M21	Completed on August 3, 2017	2nd Phase
M22	Completed on October 13, 2017	2nd Phase
M3	Under the construction	Expected to complete in September 2018

- The tender for procurement of the monitoring system equipment being implemented by JICA was officially announced on May 26, 2017, but the business conditions of the tenderers were not good enough and the technical specification of the equipment did not satisfy the requirements, so in October 2017 it was terminated unsuccessfully. Thereafter, JICA Headquarters decided to carry out a re-tender, and at present, tender preparations are being made in Japan. It was decided to implement a lump-sum contract that includes the installation work.
- The overall procurement schedule is delayed by more than one year from the Plan of Operation (PO) decided in RD, and the reasons for this delay and the future schedule was explained to the head of the DUWSS by JICA Headquarters on April 17, 2018. WASAC expressed regret regarding this delay.
- Regarding the details of the equipment, time has passed since the local tender was carried out in May 2017, so a survey was carried out again regarding the local situation.
- The monitoring system is expected to complete by the end of June, 2019.

#### 4-4 System input to each of 4 branches is measured.

The measurement of distribution volume in each branch will be started after construction of monitoring system. It is expected that the measurement of the quantity of water distribution in each branch in the Kigali city with the system will be conducted after July 2019. The NRW rate is calculate based on measured distribution quantity.

#### 4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.

The calculation of NRW rate in each branch will be started after construction of the monitoring system.

### 1-3 Achievement of Output

Achievement status of the Project outputs is observed according to the PDM indicators. Refer to

Project Monitoring Sheet I (PM Form 3-2).

#### **1-4 Achievement of the Project Purpose**

##### **Project Purpose**

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

##### **Objectively Verifiable Indicators**

1. 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.
2. Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.
3. The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction

##### **Means of Verification**

1. 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure
2. Annual action plan of WASAC
3. Budget of WASAC

5YSP for NRW reduction was approved by the Board of Directors of WASAC on April 27, 2018. Afterward, the Action Plan should be approved by the Minister of Infrastructure. Action Plan of 6 branches in Kigali City should be reflected in annual action plan of WASAC. The budget for implementing Action Plan of 6 branches in Kigali City should be approved.

#### **1-5 Changes of Risks and Actions for Mitigation**

No major changes have been seen in the PDM important assumptions; therefore, there was no need to carry out special actions for mitigation so far.

##### **(1) Pre-Conditions**



Table 1.25 Actions for Mitigation on Pre-Condition

PDM Pre-Conditions	Current Situation	Action for Mitigation
1 GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.	1-1 By a delay, a latest work version of ArcGIS for the Kigali city was delivered in WASAC in the end of September 2016. But pipeline network information was insufficient and was in condition to continue revising data until a plan of delivery date in March, 2017.  Therefore it was not able to utilize ArcGIS effectively for the decision of electromagnetic flowmeter setting position for 4 branch isolation work. But it was able to carry out about the update of the GIS database which was a subject of the training on schedule. In the beginning of September 2017, WASAC has already owned a license of MikeUrban. However, it was not available it because of some trouble between Esri and WASAC. In addition, it was not able to build the hydraulic analysis model of the whole Kigali City because ArcGIS was not completed. Temporary delivery of MikUrban was made by Esri in the end of October 2017.	

(2) Important Assumption on Proceeding Assumptions (from Outputs to Project Purpose)

Table 1.25 Action for Mitigation on Important Assumption (from Outputs to Project Purpose)

Table 1.26 Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The non-revenue water section at WASAC is not subject to large scale reorganization.	1-1 Structure of WASAC was devised on March 2, 2017, but does not lead to the enforcement as of June 2017. On the project, it is thought that there is not the substantial influence. Movement of the GIS section to under the WOS unit.	
2 WASAC staff dose not resign after training by the Project.	1-2 Not applicable	
3 Large scale natural disaster does not occur.	1-3 Not applicable	

(3) Important Assumption on Proceeding Assumptions to Overall Goal

Table 1.26 Action for Mitigation on Importance Assumptions (from Project Purpose to Overall Goal)

Table 1.27 Actions for Mitigation on Important Assumption

PDM Importance Assumption	Current Situation	Action for Mitigation
1 The Government policy on NRW remains as highly prioritized.	1-1 NRW still high priority	

*CP* *RF* *OM*

### **1-6 Progress of Actions undertaken by JICA**

- Two project vehicles were provided to the Project for use by JICA Expert Team and CPs in January 2017.
- Procurement of leak detection equipment was procured in July 2017.
- Procurement of equipment such as electromagnetic flow meter, pressure gauge and gate valve for monitoring system of 4 branches in Kigali is behind the schedule.

### **1-7 Progress of Actions undertaken by Rwanda side**

- Appointment of Management Team and Action team
- Isolation plan of 4 branches, decision of boundary line between branches.
- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5-year Strategic Action Plan for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

### **1-8 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

None

## **2 Project challenges**

### **2-1 Detail**

The issues regarding project implementation and operation and the findings of technical matter are as follows.

1. The preparation of the 5YSP took long than expected, almost additional one-year compared to the initial plan. The 5YSP was approved by WASAC Board of Directors on April 27, 2018, and it was decided that its implementation will start from fiscal year 2018/2019. Meanwhile, dissemination to 20 branches staff has been completed, and it has been recommended to branches its consideration in the preparation and implementation of the annual plan and budget.





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The implementation of some activities planned in the 5YSP is already started and will require close monitoring and updating the contents in order to reflect lessons learned from the activities performed in the Pilot areas and NRW monitoring system, etc.. However, remaining time of the present project period is not enough to consider its result for the update of the 5YSP. In addition, the successful implementation of the 5YSP will requires some institutional reorganization and more support (logistic means, equipments etc...)

2. About a construction of the Monitoring System, we observed some delays caused by unsuccessful tender in Rwanda, insufficient JICA budget. However, the completion of the installation of the monitoring system is estimated in June 2019, there will not be time for practicing measurements and reflection time of the lessons learned from result of measuring water balance to 5YSP.
3. It is important that awareness of the NRW activities should be recognized throughout the whole WASAC organization. Depending on the department, there is a tendency towards low awareness and participation in the Project due to being busy with day-to-day work. WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities.
4. One of the lessons learned from Pilot Project 1 was that although not initially envisaged as being a major factor, invisible water leakage was a major source of loss. The importance of measurement of flow rate in DMAs was recognized. Because of this, identifying the areas with large water leakage by means of the step test was necessary, but it was sometimes affected by the not accurate service pipe distribution drawings, and the absence of valves on branch distribution pipelines point.
5. Leak detection still challenging mainly because of ground (not always paved road) and network condition (sometimes no valve for a long distance). In addition the number of staff trained for leak detection still low and sometimes difficulties from Japanese expert to transfer knowledge about detection
6. A feature of the topography of Kigali is its severely undulating topography. Residences have been formed on the slopes and bottoms of hills, so the water supply and distribution facilities are extremely complex. The facilities have been developed only for the purpose of transmission and distribution of water, and countermeasures against water pressure have not been taken into consideration. Therefore, there are high water pressures in the distribution pipes, and as a result, water leakages can easily occur. Even when the leak location is repaired, new leaks frequently occur because of this reason, sometimes together with the sub-standard of pipe, so it is recognized that countermeasures against high water pressure are indispensable. Control of pressure reduction is extremely important as a preventative measure.
7. In almost all cases, leakages are reported on service pipe. From the installation location conditions, pipes that are easy to lay such as polyethylene are widely used. However, procurement of the pipe that is used is done by the customer, the material quality is frequently poor (from various aspects such as price, and local availability), and material is not selected by taking into account pressure resistance.

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PM Form 3-1 Monitoring Sheet Summary

Quality of the installation works such as pipe connection and backfill of the pipe are also frequently not well done. Therefore, in many cases, the pipe cannot resist high-pressure and consequently causing water leaks. The importance of preventative measures such as compliance with standardized equipment, uniform materials, appropriate construction, etc.. should be recognized. Therefore, as the permanent solution it is necessary to consider pipe procurement and installation methods under WASAC responsibility, while prohibiting the procurement of the materials by customers. (Radical Treatment/Preventive measure)

The issues regarding project implementation and operation are as summarized in the table below.

Table 2.1 Issues regarding project implementation and operation

Item	Subject	Issue	Countermeasure
1. Activity on each Output			
Output 1 1-4	Inventory survey of facilities condition	Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017. However, the results were not sufficient.	Inventory of the facility and equipment will be summarized in the 5YSP.
1-6	Organizational change	Some activities for NRW reduction such as customer data analysis, management of data collected by monitoring system, meter management, leak survey and high pressure control, examination of WASAC policy on service pipe management etc. are not yet sufficiently performed under the current organizational structure. There is need to review the organizational structure to ensure successful implementation of the 5YSP.	The change of organizational structure is under review by senior management.  WASAC top management need to emphasis on the importance of involvement of each WASAC staff in NRW reduction activities.
1-7	Specific action plan and budget	The dissemination of the 5YSP to 20 branches has been completed, but it is necessary that each branch customize its implementation, and establish a budget plan. Remaining time in the present project period is not enough.	The 5YSP should be reflected in the Branch annual action plan and budget.
1-8	Budget	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX) However, the allocated budget still not sufficient	Look for other financing mechanism/partners
1-11	Implementation schedule	Commencement of 5YSAP is delayed by one year relative to the original schedule of PO. Updating the contents is now required in order to reflect the lessons learned from the activities of the Pilot Project and monitoring of water balance in Branch areas in the project period. However, the remaining time in present project period is not enough.	Extension of project period is required.

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PM Form 3-1 Monitoring Sheet Summary

1-11	Monitoring on the implementation of SYSP	The time is not enough in the remaining project period.	Extension of project period is required.
Output 2 2-2 to 2-7	Trainings (from 2.2 to 2.7)	Capacity Assessment of the new knowledge acquired through training has not yet been conducted	This should be conducted soon by the project.
Output 3 3.6	Improvement of CMS system	Billing quantity of the replaced mater and DMA code giving are not reflected.	ICT team should modify programming of CMS immediately.
3-10	Leakage survey and repair	Invisible water leakages were succeeded in the detection from the latter half of March 2018. A leakage occurs in sequence even if leakages were repaired, because of high pressure and poor quality of pipe material.	Pressure reduction measures should be taken immediately. Leakage survey will be continued after taking pressure reduction measures.
3-11	NRW ratio of Pilot Area 1	The NRW ratio as of June 2018 is 31.7%. It decreased from 40.3% of May by 8.6%, because of the invisible and visible leakages repair. However, there is still difference from the targeted value.	The achievement of 20% of targeted value is expected by the pressure reduction measures and continuous leakage repairs.
3.5	NRW rate baseline of Pilot Area 2	In Area 2, baseline of NRW rate 68.4% was decided as mean value of March 2018 and April 2018. The rate is too high. Many visible leaks are observed. The poor quality of pipes and high pressure is probably the main cause of this high rate.	The way of pressure control should be considered for Pilot Area 2 also. Procurement of the PRV equipment and construction of the chambers should be speed up.
*****	Proof of effect of the activities	The effect of the activities, pressure reduction and replacement of poor quality service pipe, have not been yet demonstrated.	In Pilot Area 2, these should be proved.
*****	High pressure control of Pilot Area	High water pressure is probably the main cause of leakage. High water pressure has not been managed in the network.	The PRVs should be installed at each sub-zone in Kadobogo for pressure control. Procurement of the PRV equipment and construction of the chambers should be speed up.
*****	Quality of the service pipe	Sub-standard on the quality and installation of service pipe is main cause of leakage.	WASAC should change the present policy and develop the new standard. Set up the study team or committee.
3-11	Calculation of Amount of NRW and NRW rate	Calculation of NRW amount and NRW rate is not yet performed by the Action Team	WASAC side should managed after completion of the installation of monitoring system
3-16	Dissemination of the effect of pilot project result	The remaining time of the present project period is not enough to share and disseminate its results.	Extension of project period is required.

PM Form 3-1 Monitoring Sheet Summary

Output4 4-3	Construction of the Monitoring System	We observed some delays caused by unsuccessful tender in Rwanda, insufficient JICA budget, However, the completion of the installation of the monitoring system is estimated in June 2019, there will not be time for practicing measurements and reflection time of the lessons learned from result of measuring water balance to 5YSP.	The procurement and installation work by JICA should speed up.  This issue will be discussed in the Monitoring Mission of JICA HQ which is scheduled in August 2018.
4-2	Re-registration of the customer transferred due to the change of new proposed branches boundaries	Movement by the change of boundary line made by the hydraulic isolation.	Commercial department and GIS team will conduct before completion of the monitoring system.
4-4 and 4-5	Training of data management after construction of the monitoring system	However, project completion will be expected in June 2019, so there will not be time for practicing measurements after construction of the system in the project period.	JICA is considering the extension of the project period for one year.
4-4 and 4-5	Clarification of the Unit in charge of monitoring system operation and data management	Unit in charge of the monitoring system management (hard & soft) is not yet clarified.	Responsible unit should be clarified.
2. General			
	Awareness of the NRW activities	It is important that awareness of the NRW activities be shared throughout the whole organization of WASAC. Depending on the department, there is a tendency towards low awareness of participation in the Project due to being busy with day-to-day work.	The actions of the management team and the project monitoring need to be more active. Joint Monitoring should be conducted at least every three months by the management team.
	Equipment handover	Handover procedure is delaying. Lot 1: Equipment for training on pipe repair and service pipe connection Lot 2: Pilot Projects (Customer Meter) Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter) Lot 4: Isolation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve) Lot 5: Vehicles for Japanese experts Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.) Lot 7: Mobile GPS, Potable Test meter etc.	Acceleration of the handover procedure in WASAC

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**3 Modification of the Project Implementation Plan**

**3-1 Project Design Matrix (PDM)**

1) Objectively Verifiable Indicators

The undetermined numbers xx were decided or amended in the steering committee (SC) as showing table below.

Table 3.1 Objectively Verifiable Indicators

Item	Version 1 (2 <sup>nd</sup> SC: October 12, 2017)	Version 2 (3 <sup>rd</sup> SC: August 28, 2018)
Overall Goal	NRW rate of Kigali city (Year 2022 25%)	Year 2022/23 25%
Outputs 2-1	More than 300 number of trainees receive training	same as it is
Outputs 3-1	Pilot Area1: from 36% to 20% Pilot Area2: from xx% to xx%	from 37% to 20% from 68% to 25%

Note: Baseline of NRW rate of Pilot Area 1 was amended from 36% to 37%, because of correction on customer list in March 2018.

2) Modification of PDM

As a major issue, the timeline of Activity of 4.3, procurement and installation of the equipment of monitoring system, is extremely delaying for about 1.5 years. Therefore, activities 4.5 and 4.6 are not able to start in the present project period. It is expected that these activities are started from July 2019.

Table 3.2 Modification of PDM

Item	Issue	Solution
Title of the project	None	-
Duration of the Project	<ul style="list-style-type: none"> <li>• (1-11)The period for update 5YSP by the knowledge and lesson getting through monitoring of water balance is not able to conduct in the present project period, because of the delay of the activity Output 4.</li> <li>• (3-16)The period for disseminate the manual and use of survey equipment to the activity of other branches is not enough.</li> <li>• (4-4, 5)The activities of 4-4, 4-5 are not able to conduct in the present project period.</li> </ul>	Project period should be extended for one year.
Project site(s)	None	No change
Target group(s)	None	No change
Implementation structure	None	No change
Overall goal,	None	No change
Project purpose	None	No change
Outputs	None	No change
Activities	Items shown in the table below are proposed.	See Table 3.3 below
Input	None	No change

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Table 3.3 Postscript and Correction on the Activities in PDM

Item	Original	Modification
Word change	5-year Strategic Action Plan	5-year Strategic Plan (5YSP)
Description change of Activity 1-5	Based on the results of Activity 1-4, the management team prepares on the necessary facilities improvement.	Activity 1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP.
Description change of Activity 1-7	The management team prioritizes and schedules the conducts of facilities improvement and organizational and identified by Activities 1-4 and 1-5.	Activity 1-7 The management team prioritizes and schedules the conducts of specific actions of 5YSP.
Insertion of the sentence as Activity 1-11	-	Activity 1-11 The management team facilitate implementation and the monitoring of the 5YSP
Simultaneous work of Area 1 and Area 2 (from Activity 3-1 to 3-4)	Area1	Area 1 and Area 2
Insertion of the sentence as Activity 3-12 on a activity for high water pressure management	-	Activity 3-12 The action team conducts measures for reducing high water pressure.
Insertion of the sentence as Activity 3-13 on high water pressure management	-	Activity 3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.
Insertion of the sentence as Activity 3-19	-	Activity 3-19 Action team disseminate the manual and use of survey equipment to the activity of other branches.
Separation of the activities described in Activity 4-3 to "Procurement and installation of the equipment"	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches and chambers are constructed as appropriate	Activity 4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.
Separation of the activities described in Activity 4-3 to "Construction of the chambers"		Activity 4-4 Chambers are constructed as appropriate.

**3-2 Plan of Operation (PO)**

1) Indicators

Table 3.4 Indicators

Item	Version 1 (2 <sup>nd</sup> SC: October 12, 2017)	Version 2 (3 <sup>rd</sup> SC: August 28, 2018)
Training in Japan	xx persons will be trained in Japan	15 persons were trained in Japan
Training in the Third Country	xx persons will be trained in xx	2 persons went to an exposure visit in Kenya

2) Modification of PO

PO is modified based on the modification of PDM described above.

Table 3.5 Modification of PO

Item	Original	Modification
Correction of the Term	Joint Coordination Committee	Steering Committee
Project Period	Year 1, 2 and 3	Postscript of the column Year 4
Activities 1-11 and 1-12	None	Implementation in Year 4
Activity 3-19	None	Implementation in Year 4
Activities 4-5, 4-6	Implementation in Year 2 and 3	Implementation in Year 4

**II. Project Monitoring Sheet I & II**

As attached.

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**Project Monitoring Sheet I (Revision of Project Design Matrix)**

**Project Title:** Project for Strengthening Non-Rewenue Water (NRW) Control in Kigali City Water Network

**Version 4**

**Implementing Agency:** WASAC

**Dated August 27, 2018**

**Target Group:** WASAC staff engaged in Non-Rewenue Water reduction

**Period of Project:** 2019/6/30

**Project Site:** 6 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyari Model Site).

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<b>Overall Goal</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the second SC of October 12, 2017 (36% as of the end of June, 2018)	
<b>Project Purpose</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization. WASAC staff do not resign after training by the Project. Large scale natural disaster does not occur.	SYSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware. The workshop at every branch to explain the contents of SYSP and how to implement was carried out by Project Manager from April to July 2018. But, SYSP is not yet totally reflected in annual action plan of each branch. The management of WASAC has not yet see the impact of NRW reduction by the result of the pilot project. However, the management has already recognized the effect of the SYSP, and the budget still not yet enough.	
<b>Outputs</b>					
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		Pilot project 1 (Area 1: Kadobogo, Kacyiru Branch) has not yet completed. Seminar will be planned to take place after completion of the Pilot Project 1.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		About 482 cumulative number of trainees (55 Times) were received training as of the end of May, 2018. Training programs will prepared after the completion of the pilot project	
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%. 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		-Two pilot areas (Area 1: Kadobogo, Kacyiru Branch, Area 2: Ruyenzi, New Nyarugenge Branch) were selected. [Area1] -The baseline of the NRW rate 36% of Area 1 was decided in the SC of October 12, 2017, but it was revised to 37% because of mistake on the POC list. -Implementation of the CJT for Area 1 has been started from June, 2017, and is still carrying out. -Pressure reduction measure was added as the measure other than "Apparent Loss" and "Leakage detection and repair". Settling of PRVs are in process -NRW rate of June, 2018 is 32%. [Area2] -Preparation work for Area2, POC test and Hydraulic isolation, was completed. -The baseline of the NRW rate 68% of Area 1 was decided as the average of March and April. -NRW rate of June, 2018 is 59%. Poor quality of pipes and high pressure must be the main cause of this high NRW rate. consequently the necessity of pipe replacement was recognized by the project. -Workshop will be planned after evaluation of the Pilot Project 1. (scheduled in January, 2019) Completion report will be prepared after evaluation of the Pilot Project 1. (scheduled in January, 2019)	
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		-Isolation plan of 4 branches prepared by WASAC was reviewed and boundary line was decided. -Exact locations for the installation of electromagnetic flowmeters and chambers which flowmeters are installed are determined by field survey. -The 22 chambers has been constructed as of October, 2017 and remaining one is under construction. -The tender procedure on procurement of the equipment of monitoring system is delaying.	

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Activities	Inputs		Pre-Conditions
	The Japanese Side	The Rwanda Side	
1-1 A management team is organized to prepare 5-year Strategic Action Plan (SYSP) for NRW reduction.			
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser / Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of 5YSP on the necessary facilities improvement.	GIS	Management team members	
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	GIS data should continue to be updated
1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes-specific actions of SYSP, identified by Activities 1-4 and 1-5.	Leak detection	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-12 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-1 Training materials on NRW control are prepared.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.		Space for training on pipe repair and service pipe connection(40m)	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	Store house for equipment	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Leak detection equipment		
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Ultrasonic flow meter with data logger	3 Local cost	
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet services)	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-8 Training materials on NRW are reviewed and updated.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Vehicles for Japanese experts		
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.			
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.			
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.			
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-11* The action team conducts measures for reducing high water pressure.			
3-11** The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-12 The action team reviews the results from Activities 3-5 to 3-11*, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-11**.			
3-13 The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-14 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-13 to WASAC and other concerned parties.			
3-15 Action team conducts activities from Activities 3-6 to 3-14 at Pilot Area 2.			
3-16 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and chambers are constructed as appropriate.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches, and Chambers are constructed as appropriate.			
4-4 System input to each of 4 branches is measured.			
4-5 Based on the results of Activity 4-4, NRW rates for each branch are calculated and reported.			

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Project Monitoring Sheet II (Revision of Plan of Operation)

Version 4

Dated August 27, 2018

Project Title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Inputs		Actual	1st Year (16/17)				2nd Year (17/18)				3rd Year (18/19)				Remarks	Monitoring			
			I	II	III	IV	I	II	III	IV	I	II	III	IV		Achievements	Issue & Countermeasures		
<b>Expert</b>																			
Chief Adviser/Non-Revenue Water Management	Ootani	Plan																	
Adviser/Non-Revenue Water Management	Higuchi	Actual																	
NRW Reduction Plan 1(1)	Suzuki	Plan																	
NRW Reduction Plan 1(2)	Yamaguchi	Actual													Mr. Suzuki retired at the end of March, 2018.	Mr. Yanoguchi was assigned as the successor.			
NRW Reduction Plan 2(1)	Yoda	Plan																	
NRW Reduction Plan 2(2)	Toyoda	Actual																	
NRW Reduction Plan 2(2)	Tsutsui	Actual																	
Geographic Information System: GIS	Horishita	Plan																	
Hydraulic Analysis	Ooe	Actual																	
Leak Detection	Takahashi	Actual																	
Pipe Repairing and Service Connection(1)	Nomazono	Actual																	
Pipe Repairing and Service Connection(2)	Takahashi	Actual																	
Information and Communication Technology: ICT	Browne	Plan													Because effective time of ICT is undetermined, dispatch time is undecided.	Schedule will be fixed at the SC which will be held in August 2018.			
Long Term Expert	Makusuma	Actual																	
<b>Equipment</b>																			
Lot 1: Equipment for training on pipe repair and service pipe connection		Plan													delivered in May 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
Lot 2: Pilot Projects (Customer Meter)		Actual													delivered in March 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
Lot 3: Pilot Projects (Gate valve, flow meter, and customer meter)		Plan													delivered in May 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
Lot 4: Installation of 4 Branches (Electromagnetic flow meter, pressure gauge and gate valve)		Actual													pending	not yet procured	Acceleration of the handover procedure in WASAC. Re-bidding procedure by JICA is in process		
Lot 5: Vehicles for Japanese experts		Plan													delivered in January 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
Lot 6: Leak Detection Equipment (Ultrasonic flow meter, data logger, Leak noise correlator, etc.)		Actual													delivered in July 2017, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
Lot 7: Mobile GPS, Potable Test meter etc.		Actual													delivered in October 2016, in use in the Project	not yet handed over	Acceleration of the handover procedure in WASAC		
<b>Training in Japan</b>																			
15 persons will be trained in Japan (5, 5, 5)		Plan													Completed on schedule	None			
<b>In-country/Third country Training</b>																			
2 persons will be trained in Kenya		Actual													Completed in May 2018	None			
<b>Activities</b>																			
<b>Sub-Activities</b>																			
<b>Output 1: Planning capacity of NRW reduction of WASAC is enhanced.</b>																			
1.1	A management team is organized to prepare 5-year Strategic Action Plan (SYSP) for NRW reduction.	Plan													Expert	WASAC	Members of the Team were appointed in August 2016. Some change in September 2017.	None	
1.2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	Actual													Expert	WASAC	Questionnaire survey, Site visit survey for Branches. Discussion in a series of Workshops. Assessment of root causes of identification problems.	None	
1.3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Plan													Expert	WASAC	Discussion in a series of Workshops. Framework of Action Plan was approved in the seminar on May 29, 2017.	None	
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Actual													Expert	WASAC	Facility schematic drawing of reservoirs were prepared by GIS Team in October 2017.	The results were not sufficient. Inventory of the facility and equipment will be summarized in the SYSP or Master Plan.	
1.5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of SYSP	Plan													Expert	WASAC	Draft Final report of SYSP was approved at the second SC on Oct. 12, 2017	None	
1.6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Actual													Expert	WASAC	The organization recognized the importance of the organizational change and the structure is under review by senior management	The budget may be the constraint for the implementation of the new proposed structure	
1.7	The management team prioritizes and schedules the conducts of specific actions of SYSP.	Plan													Expert	WASAC	A yearly implementation schedule for each specific actions and its priority were prepared.	None	
1.8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Actual													Expert	WASAC	Most of the activities for NRW reduction fall under the regular budget (Utility Budget and OPEX).	The budget has been secured through ADB loan, the implementation may	
1.9	The management team prepares the SYSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Plan													Expert	WASAC	SYSP was officially approved by the Board of Directors on April 27, 2018.	None	
1.10	The management team holds seminars and presents SYSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Actual													Expert	WASAC	SYSP was shared at the SC on October 12, 2017. Approved SYSP by both management and BoD explained at each Branch from April to July 2018.	None	
1.11	The management team reviews SYSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	Plan													Expert	WASAC		Not yet	None
1.12	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Actual													Expert	WASAC		Not yet	None
<b>Output 2: Basic knowledge, skills and technique on NRW control are acquired by WASAC.</b>																			
2.1	Training materials on NRW control are prepared.	Plan													Expert	WASAC		Completed	None
2.2	Training on NRW management is conducted for the management team and WASAC management as necessary.	Actual													Expert	WASAC		Completed	Capacity assessment not yet completed
2.3	OJT is conducted on the updating of GIS data, using available GIS data base.	Actual													Expert	WASAC		Completed	Capacity assessment not yet completed
2.4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Actual													Expert	WASAC		Completed	Capacity assessment not yet completed

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2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Plan																	Expert	WASAC	Completed	Capacity assessment not yet completed
		Actual																				
2.6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Plan																	Expert	WASAC	Completed	Capacity assessment not yet completed
		Actual																				
2.7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Plan																	Expert	WASAC	in process	None
		Actual																				
2.8	Training materials on NRW are reviewed and updated.	Plan																	Expert	WASAC	Not yet	None
		Actual																				
2.9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Plan																	Expert	WASAC	Not yet	None
		Actual																				

Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.

A. Preparation		Plan	Actual	Expert	WASAC		
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Plan		Expert	WASAC	Member of the Team were appointed in August 2017	Some of the members resigned or transferred in September 1997.
		Actual					
3.2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Plan		Expert	WASAC		Completed
		Actual					None
3.3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	Plan		Expert	WASAC		Completed
		Actual					None
3.4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Plan		Expert	WASAC	Flow meters and pressure gauges were installed in the meter chambers by May 2017.	None
		Actual				Procurement of Equipment and Construction of	None
B. Activity of Pilot Area 1 Kadobogo		Plan	Actual	Expert	WASAC		
3.5	The action team establishes the baseline NRW rate of Pilot Area 1.	Plan		Expert	WASAC	Baseline: Mean value of June, July 2017 Original: 35.0% Revised: 37.2%	Calculation data of NRW rate had a problem, because of the inappropriate POC list. Baseline NRW rate was revised after revision of POC list.
		Actual					
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.	Plan		Expert	WASAC	The meters which should be changed were 351 as a result of on-site meter test (total connection 1,240). In this, 301 were replaced.	It took 4 months for on-site calibrations test. The improvement of the work standard was demanded for shortening at work period.
		Actual					
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan		Expert	WASAC		in process, effort will be evaluated about the replaced meters
		Actual					There is some difficulty to measure the effects separately in time as in 3.7, 3.9 and 3.11.
3.8	The action team conducts measures for reducing surface leakage (visible leakage).	Plan		Expert	WASAC		in process
		Actual					When water leaks are discovered it is necessary to carry out repairs immediately, so meter replacement and repair of leaks were carried out in parallel
3.9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.	Plan		Expert	WASAC		in process
		Actual					Same as Item 3.7
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Plan		Expert	WASAC	Invisible water leakages detections were successfully implemented in March 2018 in pilot area 1	It is still challenging for leak detection due to the ground condition, number of equipment and few number of people trained.
		Actual					
3.11	The team measures NRW after conducting Activity 3-10 and examines their effectiveness.	Plan		Expert	WASAC	The NRW ratio as of June 2018 is 31.7% in pilot 1. It decreased from 40.3% of May by 8.6%, because of the invisible and visible leakages repair.	None
		Actual					
3.**	The action team conducts activities for reducing high water pressure.	Plan		Expert	WASAC	Pressure Reduction Valve (PRV) in PM2 was adjusted. PRV in PM3 is in preparation for installation.	The construction of manhole for the protection of PRVs to be installed is delaying
		Actual					
3.**	The action team measures NRW after conducting Activity 3.** and examines their effectiveness.	Plan					Not yet
		Actual					None
3.12	The action team reviews the results from Activities 3-5 to 3.** and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3.**.	Plan		Expert	WASAC		The works conducted in the pilot project and expended cost for that works will be summarized for cost-benefit analysis.
		Actual					Not yet
3.13	The action team summarizes activities and results from Activities 3-1 to 3-12, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.	Plan		Expert	WASAC		Not yet
		Actual					None
3.14	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-14 to WASAC and other concerned parties.	Plan		Expert	WASAC		Not yet
		Actual					None
C. Activity of Pilot Area 2 Ruyenzi		Plan	Actual	Expert	WASAC		
3.2	Preparation Work (POC data compilation) (Review)	Plan		Expert	WASAC		POC member cost has been put on customers entrance gates
		Actual					Completed
3.4	Preparation Work (Hydraulic Isolation of Pilot Area) (Review)	Plan		Expert	WASAC		Completed
		Actual					None
3.6	The action team establishes the baseline NRW rate of Pilot Area 2.	Plan		Expert	WASAC	Baseline: Mean value of March, April 2018 Original: 68.4%	None
		Actual					
3.**	The action team conducts measures for reducing high water pressure	Plan		Expert	WASAC	The six locations for PRV installation were decided.	Procurement of the equipment and construction of the chambers should be speed up.
		Actual					
3.**	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.	Plan		Expert	WASAC		Delay of procurement of PRVs and construction of Manhole
		Actual					Not yet
3.6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 2.	Plan		Expert	WASAC	General meter physical inspection for all customers 1,623 is in progress, on site meter test and replacement not yet started.	Delay
		Actual					
3.7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.	Plan		Expert	WASAC		Not yet
		Actual					Delay
		Plan		Expert	WASAC		

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Project Monitoring Result of  
the JICA Monitoring Mission

for

PROJECT FOR STRENGTHENING  
NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK

Izumi SHOJI  
Leader of JICA Monitoring Mission/  
Senior Deputy Director  
Water Resources Team 2, Water Resources Group  
Global Environment Department  
Japan International Cooperation Agency

28 Aug 2018

Outline

1. About Monitoring Mission
2. Procurement Schedule of Monitoring System
3. Findings and Recommendations



1. About Monitoring Mission

*[Handwritten signatures]*

1-1. Members of the Mission

Name	Job title	Occupation	Period
1 Ms. Izumi SHOJI	Leader	Senior Deputy Director Water Resources Team 2, Water Resources Group	22 Aug - 28 Aug
2 Mr. Shin MURAKAMI	Project Management	Global Environment Department Japan International Cooperation Agency  Deputy Director Water Resources Team 2, Water Resources Group  Global Environment Department Japan International Cooperation Agency	20 Aug - 28 Aug

Appendix 4 and 5

## 1-2.Objectives of Monitoring Mission

- To confirm the progress of the Project by implementing on-site monitoring, interviews.
- To discuss the monitoring results with Project team.
- To discuss extension of Project term due to delays of procurement of equipment related to Output4.
- To make advance agreement with WASAC on revision of RD, PDM, and PO.
- To join the 3rd Steering Committee (SC), and make agreements by Minutes of Meetings(MM)

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## 1-3.Schedule of the Monitoring

Date		Leader (Ms. SHOJI)	JICA	Project Management (Mr. AURAMAMI)
1	2018/8/19 Sun			15:10 Arrival at Kigali (ORI1387)
2	2018/8/20 Mon			Internal Meeting at JICA office Courtesy/Call for WASAC, and Explanation of schedule
3	2018/8/21 Tue			Internal Meeting / Making draft of MM
4	2018/8/22 Wed			Monitoring (Interview, site survey)
5	2018/8/23 Thu			Monitoring (Interview, site survey)
6	2018/8/24 Fri			Meeting on MM with WASAC
7	2018/8/25 Sat			Monitoring W-SAT (Japanese Volunteers) site at NGOMA
8	2018/8/26 Sun			Monitoring for RWASOM
9	2018/8/27 Mon			Meeting on MM with WASAC
10	2018/8/28 Tue			Discussion and Signing on MM in Steering Committee Meeting with JICA office, Report to EOJ

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## 2-1.Procurement Schedule

- Sep: Field Survey by JICS (10-21 Sep)
- Sep-Oct: Documentation of Tender
- Nov-Dec: Tender and Making Contract
- Jan-Apr: Production and Transportation
- May-Jul: Installation of the Equipment
- Aug- : Data Collection and Analysis

Project Term finishes in July 2019. We need one year extension of the term

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## 2. Procurement Schedule of Monitoring System

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## 2-2. Field Survey for Equipment Installation

- Procurement consultant, Japan International Cooperation System(JICS), will implement Field Survey.
- One person (Mr. Yamasaki), 10 working days (from 10 to 21 Sep. )
- He will collect following info:
  - Connection interface between logger and GPRS modem
  - IP protocol to be incorporated into GPRS modem and server at WASAC headquarters side
- Your support is indispensable to make this survey successful.

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## 3. Findings and Recommendations

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### 3. Findings and Recommendations

#### 3-1. Promote Implementation of 5YSP

#### 3-2. Promote Human Resource Development

#### 3-3. Eliminate Obstacle Factors

#### 3-4. Ensure Cost Effectiveness of NRW Reduction Measures by Pilot Project

#### 3-5. Equipment Handover and Its Management

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### 3-1. Promote Implementation of 5YSP

- To increase the capacity across the organization both WASAC HQ and branch level. (staff, logistics, equipment)
- To encourage WASAC staff including branches to be responsible for NRW reduction in the area in charge.
- To add new activity to facilitate the implementation and monitoring of 5YSP.
- To prepare a section to analyze the data to be collected from the monitoring system of Output4.

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### 3-2.Promote Human Resource Development

- To utilize skills and knowledge acquired through trainings in the Project and disseminate them within WASAC.
- To ensure development of training programs by upgrading current training materials with more practical contents.
- To utilize the equipment procured in the Project.
- To enhance a partnership with water utilities in the region (ex. Kenya, Malawi) for developing human resources.

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### 3-4.Ensure Cost Effectiveness of NRW Reduction Measures by Pilot Project

- To measure cost-effectiveness, activities in the pilot area 2 should be carried out with each measure as independent as possible according to PDM.
- To apply the findings of pilot activities to other areas.
- To reflect the findings of pilot activities in the 5YSP.
- To mobilize enough staff from HQ and Branch Offices.

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### 3-3.Eliminate Obstacle Factors

- To add new activities to tackle high water pressure of distribution pipes.
- To add a new activity to improve the quality of service pipes (material and construction). The existing New Connection Policy in needed to be revised as stated in 5YSP.
- To confirm the effectiveness of replacing service pipes, a new activity in specific site of pilot area 1 can be added. Actual plan needs to be proposed by the end of Sep.

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### 3-5.Equipment Handover and Its Management

- To complete the handover procedure of procured equipment in the Project.
- To properly manage it after the handover.

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5. Project Design Matrix (PDM)

Project title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Project Sites 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<b>Overall Goal</b>			
WASAC conducts NRW reduction measures as planned for Kigali city	NRW rate of Kigali city (year 2022-23) 21.5% (to be confirmed during the project)	Annual report of WASAC	
<b>Project Purpose</b>			
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC. 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction.	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure. 2 Annual action plan of WASAC. 3 Budget of WASAC.	The Government policy on NRW remains as highly prioritized.
<b>Outputs</b>			
1 Planning capacity of NRW reduction of WASAC is enhanced	1-1 5-year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project. 1-2 Records of the project.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project. 2-2 Records of the project.	The non-revenue water section at WASAC is not subject to large scale reorganization.
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 31.5 to 21.5 and Pilot Area 2 from 35.5 to 21.5. (NRW rate determined after baseline NRW rates are established.) 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project. 3-2 Records of the project. 3-3 Survey plans for locations outside the pilot project.	WASAC staff do not resign after training by the project.
4 4 branches in Kigali establish the system to measure NRW rates accurately	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project	
<b>Activities</b>	<b>Input</b>		
1-1 A management team is organized to prepare 5-year Strategic Action Plan (SAP) for NRW reduction	<b>Japanese side</b>	<b>Rwanda side</b>	
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser / Non-Revenue Water management	Project Director	
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Asst. Non-Revenue Water management	Project Manager	
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the SAP report on the non-revenue water management.	Non-Revenue Water reduction planning (1)	Management team members	
The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Non-Revenue Water reduction planning (2)	Action team members	
1-7 The management team prioritizes and schedules the conducts of facilities improvement, and organizational and institutional changes specific activities of SAP identified by Activities 1-4 and 1-5.	GIS	Other counterparts	
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Hydraulic analysis		
1-9 The management team prepares the SAP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	Leak detection		
1-10 The management team holds seminars and presents SAP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	Pipe repairing and service pipe connection		
The management team facilitates implementation and the monitoring of the SAP.	ICT		
1-11 The management team drafts the revised Non-Revenue Water Policy and the Standard Enforcement Policy in order to secure the management team will facilitate training and monitoring of standard compliance of pipe with the existing pipe facilities.	JICA Long-term expert		
1-13 The management team reviews SAP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.			
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	2 Training	2 Facilities	Large scale natural disaster does not occur.
2-1 Training materials on NRW control are prepared.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections	
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	Training in the 3rd country	Training room with the capacity of about 20 persons	
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.		Space for training on pipe repair and service pipe connection (40sqm)	
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	3 Equipment provision	Store house for equipment	
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Leak detection equipment		
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Ultrasonic flow meter with data logger	3 Local cost	
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet services)	
2-8 Training materials on NRW are reviewed and updated.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	Cost for import tax, value added tax, customs, storage, inland transportation and others for importing project equipment	
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	Equipment for training on pipe repair and service pipe connection	Cost for operation and maintenance of project equipment	
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Mobile GPS	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles for Japanese experts		
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.			
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.			
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.			
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8 The action team conducts measures for reducing surface leakage (visible leakage).			
3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12 The action team conducts measures for reducing high water pressure.			
3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14 The action team reviews the results from Activities 3-5 to 3-10, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15 The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19 Action team disseminates the manual and use of survey equipment to the activity of other branches.			
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches and chambers are constructed as appropriate.			
4-5 System input to each of 4 branches is measured.			
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			

0 RHR DAs

Appendix 6

Plan of Operation (PO)

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																
Chief Adviser / Non-Revenue Water management	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Adviser / Non-Revenue Water management	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Non-Revenue Water reduction planning (1)	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Non-Revenue Water reduction planning (2)	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
GIS	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Hydraulic analysis	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Leak detection	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Pipe repairing and service pipe connection	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
ICT	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
JICA Long term expert	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
<b>Equipment</b>																																																
Leak detection equipment	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Ultrasonic flow meter with data logger	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Gate valve, flow meter, and customer meter for Pilot Project	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Equipment for training on pipe repair and service pipe connection	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Mobile GPS	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
Vehicles for Japanese experts	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
<b>Training in Japan</b>																																																
15 persons were trained in Japan	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
<b>Training in the Third Country</b>																																																
2 persons were trained in Kenya	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															

Outputs and Activities	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>1 Planning capacity of NRW reduction of WASAC is enhanced.</b>																																																
1-1 A management team is organized to prepare 5-year Strategic Action Plan (5YSP) for NRW reduction.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP report on the necessary facilities.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes specific actions of 5YSP, identified by Activities 1-4 and 1-5.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-11 The management team facilitate implementation and the monitoring of the 5YSP	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-12 The management team drafts the revised New Connection Policy and the Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliance of pipes with the existing pipe standards.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
<b>2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.</b>																																																
2-1 Training materials on NRW control are prepared.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
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2-8 Training materials on NRW are reviewed and updated	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															
<b>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</b>																																																
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	[Gantt chart showing activity from Jan to Dec in Year 1, 2, 3, and 4]																																															

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**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : STEERING COMMITTEE MEETING

Place : GALAXY HOTEL

Date : 28<sup>th</sup> 08. 2018.

Name	Position
DESIRE NTAMUTURANO	Position: Head of Leak Detection of Pressure Management Mobile: +250788874664 E-mail: dntamuturano@wasac.rw
SARANDA Catherine	Position: Head of Ngamirambo branch Mobile: 0732031897 E-mail: csaranda@wasac.rw
BYAMUGISHA Bernard	Position: Head of branch at YAMUKIRI Mobile: 0788307824 E-mail: byamugisha@wasac.rw
KWIZERA Virgile	Position: WATSAN Program Officer (JICA RUANDA) Mobile: 0784865730 E-mail: Virgile.Kwizera-RW@jica.go.jp
KWIZERA De'Lucy	Position: Director Urban Water & Sewerage Service Mobile: 0788403181 E-mail: kwizera@wasac.rw
Dominique MUREKEZI	Position: Manager of Utility Planning Mobile: 0788352691 E-mail: dmurekezi@wasac.rw
SHIGEO OTANI	Position: JICA Expert Mobile: 0781449555 E-mail: otani@wasac.rw
BATHIGE Jean	Position: DRW Manager Mobile: 0788307401 E-mail: bathige@wasac.rw
Musambu MAYUSUMU	Position: JICA Expert Mobile: 0788 824190 E-mail: mayusumu@wasac.rw
Epkeendero Merly Rossine	Position: Secretary

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Secretary NAW JICA	Mobile: 0788553502	E-mail: gamely@yahoo.fr
Koji NAKASHIMA	Position: JICA RWANDA Mobile:	E-mail: NAKASHIMA.KOJI@jica.go.jp
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NYIRABU NORI Theodosie	Position: Commercial services officer Kacyiru Mobile: 0788585335	E-mail: tnyirabuneli@wasac.rw
TOYISENGE VEDASTE	Position: Head of Kikondo Branch Mobile: 0788775248	E-mail: vtuyisenge@wasac.rw
GASHUGI Innocent	Position: Manager, WAS Mobile: 0788521483/0738521483	E-mail: igashugi@wasac.rw gutoqa@gmail.com
Emmanuel NATEGEZAMANA	Position: Senior Engineer / Rural water supply Mobile: 0788620930	E-mail: emmanuel.nategezamana@wasac.rw
Aime Nyela	Position: CFO Mobile: 0788539399	E-mail: amnyela@wasac.rw
	Position:	E-mail:

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5. Project Design Matrix (PDM)

Project title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Project Sites: 4 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge)

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Summary of the Project (Narrative Summary)	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	
<b>Overall Goal</b>				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23 25%) (to be confirmed during the project)	Annual report of WASAC		
<b>Project Purpose</b>				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The Government policy on NRW remains as highly prioritized	
<b>Outputs</b>				
1 Planning capacity of NRW reduction of WASAC is enhanced	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project	The non-revenue water section at WASAC is not subject to large scale reorganization.	
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC	2-1 More than 300 number of trainees receive training 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1 from 37% to 20% and Pilot Area 2 from 66% to 25%. <del>Costs will be determined after baseline NRW rates are established.</del> 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		
4 4 branches in Kigali establish the system to measure NRW rates accurately	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		
<b>Activities</b>	<b>Input</b>			
	<b>Japanese side</b>	<b>Rwanda side</b>		
1-1 A management team is organized to prepare 5-year Strategic Action Plan (SYSP) for NRW reduction. 1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems. 1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future. 1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3. 1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the SYSP report on the necessary facilities improvement. The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report. 1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes specific actions of SYSP identified by Activities 1-3 and 1-5. 1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year. 1-9 The management team prepares the SYSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7. 1-10 The management team holds seminars and presents SYSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties. 1-11 The management team facilitate implementation and the monitoring of the SYSP. 1-12 The management team drafts the revised Non Connection Policy and the Standard Enforcement Policy in addition, the management team will facilitate training and monitoring of standard compliance of pipes with the existing one standard. 1-13 The management team reviews SYSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year. 1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	1 Experts Dispatch  Chief Adviser/Non-Revenue Water management  Adviser/Non Revenue Water management  Non-Revenue Water reduction planning (1)  Non-Revenue Water reduction planning (2)  GIS  Hydraulic analysis  Leak detection  Pipe repairing and service pipe connection  ICT  JICA Long term expert  2 Training  Training in Japan  Training in the 3rd country  3 Equipment provision  Leak detection equipment  Ultrasonic flow meter with data logger  Gate valve, flow meter, and customer meter for Pilot Project  Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali  Equipment for training on pipe repair and service pipe connection  Mobile GPS  Vehicles for Japanese experts	1 Counterpart  Project Director  Project Manager  Management team members  Action team members  Other counterparts  2 Facilities  Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections  Training room with the capacity of about 20 persons  Space for training on pipe repair and service pipe connection (40m)  Store house for equipment  3 Local cost  Cost for administering the Project (utilities for experts offices, internet services)  Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment  Cost for operation and maintenance of project equipment  Cost for overtime work, transportation, accommodation and allowance for WASAC staff	Large scale natural disaster does not occur	
2-1 Training materials on NRW control are prepared. 2-2 Training on NRW management is conducted for the management team and WASAC management as necessary. 2-3 OJT is conducted on the updating of GIS data, using available GIS data base. 2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models. 2-5 In-room training and OJT on leak detection for the pilot project are conducted with provided equipment. 2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted. 2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted. 2-8 Training materials on NRW are reviewed and updated. 2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.				
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2. 3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means. 3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2. 3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2. 3-5 The action team establishes the baseline NRW rate of Pilot Area 1. 3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1. 3-7 The action team measures NRW after conducting Activity 3-6 and examines its effectiveness. 3-8 The action team conducts measures for reducing surface leakage (visible leakage). 3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness. 3-10 The action team conducts measures for reducing underground leakage (invisible leakage). 3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness. 3-12 The action team conducts measures for reducing high water pressure. 3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness. 3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12. 3-15 The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team. 3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties. 3-17 Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2. 3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties. 3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.				
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary. 4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey. 4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches and chambers are constructed as appropriate. 4-4 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches and chambers are constructed as appropriate. 4-5 System input to each of 4 branches is measured. 4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.				
				<b>Preconditions</b>
				GIS data base and hydraulic modeling prepared by ESRI are available as scheduled.

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Appendix 6

Plan of Operation (PO)

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Annex2

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																
Chief Adviser / Non-Revenue Water management	[Gantt chart showing activity from Year 1 to Year 4]																																															
Adviser / Non-Revenue Water management	[Gantt chart showing activity from Year 1 to Year 4]																																															
Non-Revenue Water reduction planning (1)	[Gantt chart showing activity from Year 1 to Year 4]																																															
Non-Revenue Water reduction planning (2)	[Gantt chart showing activity from Year 1 to Year 4]																																															
GIS	[Gantt chart showing activity from Year 1 to Year 4]																																															
Hydraulic analysis	[Gantt chart showing activity from Year 1 to Year 4]																																															
Leak detection	[Gantt chart showing activity from Year 1 to Year 4]																																															
Pipe repairing and service pipe connect on	[Gantt chart showing activity from Year 1 to Year 4]																																															
ICT	[Gantt chart showing activity from Year 1 to Year 4]																																															
JICA Long term expert	[Gantt chart showing activity from Year 1 to Year 4]																																															
<b>Equipment</b>																																																
Leak detection equipment	[Gantt chart showing activity from Year 1 to Year 4]																																															
Ultrasonic flow meter with data logger	[Gantt chart showing activity from Year 1 to Year 4]																																															
Gate valve, flow meter, and customer meter for Pilot Project	[Gantt chart showing activity from Year 1 to Year 4]																																															
Electromagnetic flow meter and pressure gauge and gate valve for iso ating 4 braches in Kigali	[Gantt chart showing activity from Year 1 to Year 4]																																															
Equipment for training on pipe repair and service pipe connection	[Gantt chart showing activity from Year 1 to Year 4]																																															
Mobile GPS	[Gantt chart showing activity from Year 1 to Year 4]																																															
Vehicles for Japanese experts	[Gantt chart showing activity from Year 1 to Year 4]																																															
<b>Training in Japan</b>																																																
15 persons were trained in Japan	[Gantt chart showing activity from Year 1 to Year 4]																																															
<b>Training in the Third Country</b>																																																
2 persons were trained in Kenya	[Gantt chart showing activity from Year 1 to Year 4]																																															

Outputs and Activities	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>1 Planning capacity of NRW reduction of WASAC is enhanced.</b>																																																
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1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP report on the necessary facilities.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-7 The management team prioritizes and schedules the conducts of facilities improvement and organizational and institutional changes specific actions of 5YSP identified by Activities 1-4 and 1-5.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-9 The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-10 The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-11 The management team facilitate implementation and the monitoring of the 5YSP.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-12 The management team drafts the revised New Connection Policy and the Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-13 The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	[Gantt chart showing activity from Year 1 to Year 4]																																															
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	[Gantt chart showing activity from Year 1 to Year 4]																																															
<b>2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.</b>																																																
2-1 Training materials on NRW control are prepared.	[Gantt chart showing activity from Year 1 to Year 4]																																															
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.	[Gantt chart showing activity from Year 1 to Year 4]																																															
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.	[Gantt chart showing activity from Year 1 to Year 4]																																															
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	[Gantt chart showing activity from Year 1 to Year 4]																																															
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2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	[Gantt chart showing activity from Year 1 to Year 4]																																															
2-8 Training materials on NRW are reviewed and updated.	[Gantt chart showing activity from Year 1 to Year 4]																																															
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<b>3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.</b>																																																
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	[Gantt chart showing activity from Year 1 to Year 4]																																															

Handwritten notes: "Handwritten notes and signatures in the left margin, including 'Handwritten notes' and 'Handwritten notes' written vertically.





**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : STEERING COMMITTEE MEETING  
Place : GALAXY HOTEL  
Date : 28th 08 2018

Name	Position
DESIRE NTAMUTURANO	Position: Head of Leak Detection & Pressure Management Mobile: +250782274664 E-mail: dntamuturano@wasac.rw
SARANDA Catherine	Position: Head of Nyamirambo branch Mobile: 0732031897 E-mail: csaranda@wasac.rw
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KWIZERA Virgile	Position: WATSAN Program Officer (JICA Ruwanda) Mobile: 0784865730 E-mail: Virgile.Kwizera-Rw@jica.go.jp
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Dominique MUREKEZI	Position: Manager of Utility Planning Mobile: 0783552691 E-mail: dmurekezi@wasac.rw
SHIGEO OTANI	Position: JICA Expert Mobile: 0781449555 E-mail: otaki@kyowaco.jp
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Musambu MAYUSUMU	Position: JICA Expert Mobile: 0788841190 E-mail: musambu@wasac.rw
Epheundiro Pierly Rosine	Position: Secretary

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Secretary NRU (JICA)	Mobile: 0788553502	E-mail: gmedy@yahoo.fr
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TOYISENGE VEDASTE	Position: Head of Gikondo Branch Mobile: 0788775248	E-mail: vtoyisenge@wasac.rw
GASHUGI Innocent	Position: Manager, WAS Mobile: 0788521483 / 0788521483	E-mail: igashugi@wasac.rw guntoca@gmail.com
Emmanuel HATEGIZAMANA	Position: Senior Engineer Rural water supply Mobile: 0788620930	E-mail: emmanuel.hategizamana@wasac.rw mimifa.gov.rw
Aime Myela	Position: CEO Mobile: 0788539399	E-mail: ammyela@wasac.rw
	Position:	E-mail: "
	Mobile:	E-mail:

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MINUTES OF MEETING  
OF  
THE 4<sup>th</sup> STEERING COMMITTEE MEETING  
FOR  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK

HELD AT  
Karisimbi Hotel

Kigali, 22<sup>nd</sup> May 2019

Ms. Izumi SHOJI  
Leader  
JICA Monitoring Mission Team  
Japan



Eng. Aimé MUZOLA  
Chairman of Steering Committee &  
Chief Executive Officer, WASAC  
The Republic of Rwanda

Mr. Shigeo OTANI  
Chief Advisor  
JICA Expert Team  
Japan

Mr. Méthode RUTAGUNGIRA  
Project Director &  
Director of UWSS, WASAC  
The Republic of Rwanda

For monitoring, discussion on issues, challenges, solutions and way forward of the PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK (hereinafter referred to as "the Project"), the 4<sup>th</sup> meeting of Steering Committee (hereinafter referred to as "SC") was held on 22<sup>nd</sup> May 2019.

As a result of the discussions, both sides came to understanding concerning the matters referred the following matters;

1. Progress of the Project

SC members generally understood the progress, issues and it's countermeasures of the Project based on the result of joint monitoring of 15<sup>th</sup> and 20<sup>th</sup> May, 2019. Project activities will be implemented continuously in the Year 4<sup>th</sup> of the Project.

2. Rescheduling of Equipment Procurement and Installment for Output 4

JICA mission team proposed rescheduling of equipment procurement and installment as attached (4. Proposal of Rescheduled Plan Concerning Output 4). The SC members accepted the new schedule. For the required training period after installation of the monitoring system, extension of the Project period might be considered. However, it should be carefully discussed at the SC which will be held in October, 2019.

3. Additional Activities

WASAC proposed the following three activities as additional activities of Output 1 to accelerate the 5YSP activities and enhance the impact and sustainability of the Project. JICA has understood the necessity of the request, and basically agreed to include them into the existing activities of the Project.

- ✧ Pressure control outside pilot area (to be included in Activity 1-11)
- ✧ Reservoir Survey and implementation of correlative measure (to be included in Activity 1-4)
- ✧ Procurement of on-site test meters (to be included in Activity 1-11)

4. Revised Work Plan for Phase 2

SC members generally accepted on the revised Plan of Operation (PO) which was considered current progress of the activities and JICA's proposal on the Output 4.

W. S. L. R. K. S.

Attachment

1. Invitation to the 4th SC
2. Agenda of the 4th SC
3. Monitoring Sheet ver.6
4. Proposal of Rescheduled Plan Concerning Output 4
5. Revised PO
6. List of Attendants
7. Presentation Document 1 (Progress of the Project)
8. Presentation Document 2 (Effect of the Pilot Project Activities)
9. Presentation Document 3 (Proposal of Additional Activities)

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**Plan of Operation (PO)**

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																
Chief Adviser / Non-Revenue Water management	[Gantt chart showing activity from Q1 Year 1 to Q4 Year 4]																																															
Adviser / Non-Revenue Water management	[Gantt chart showing activity from Q1 Year 1 to Q4 Year 4]																																															
Non-Revenue Water reduction planning (1)	[Gantt chart showing activity from Q1 Year 1 to Q4 Year 4]																																															
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Kigali, 20 MAY 2019  
N° 11.07.024/1332/19/DUWSS-CEO/Jb

**Chief Representative  
JICA RWANDA**

Dear Sir,

**RE: Invitation to the fourth steering committee (sc) meeting of the project for  
Strengthening Non-Revenue Water (NRW) control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.


The Steering Committee (SC) meeting is scheduled on **Wednesday 22<sup>nd</sup> May 2019 from 07:30 am at KARISIMBI Hotel**

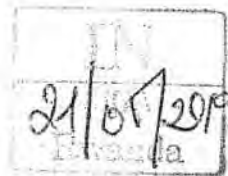
The purpose of the meeting is to review the Project progress

The agenda of the meeting is hereby enclosed.

I thank you for your usual cooperation

Yours sincerely,

  
**Eng. MUZOLA Aimé  
Chief Executive Officer**





**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the 4<sup>th</sup> Steering Committee (SC)**

Venue: Karisimbi Hotel

Date: May 22, 2019

Time	Activity	Responsible
7:30	Registration	
8:00	Introduction of Participants	
8:05	Remarks by CEO WASAC	CEO WASAC
8:10	Remarks by JICA Rwanda Representative	JICA Representative
8:15	Progress of the Project (Effect of the Pilot Project Activity)	JICA Expert
8:35	Equipment Procurement and Installation Schedule of Output 4	JICA Monitoring Mission
8:45	Next step of the Project (Proposal of Additional Activity on Output 1)	Project Manager
9:55	Question and Answer	WASAC, JICA
10:10	Signing of MM on SC	WASAC CEO, Director, JICA Mission & Expert
10:15	Closing Remarks by WASAC CEO	CEO WASAC
10:20	Remarks by MININFRA	MININFRA

**Project Monitoring Sheet I (Revision of Project Design Matrix)**

Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

Version 6

Implementing Agency: WASAC

Dated May 20, 2019

Target Group: WASAC staff engaged in Non-Revenue Water reduction

Period of Project: 2020/7/30

Project Site: 6 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugenge, Remera and Kanombe )

Model Site:

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
<b>Overall Goal</b>				
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 ( 36 % on the average of Q3 , 2018/19)
<b>Project Purpose</b>				
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure. 2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC 3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction	1 5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure 2 Annual action plan of WASAC 3 Budget of WASAC	The non-revenue water section at WASAC is not subject to large scale reorganization. WASAC staff do not resign after training by the Project. Large scale natural disaster dose not occur.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware. NRW reduction Branches annual budgets are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed. The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.
<b>Outputs</b>				
1 Planning capacity of NRW reduction of WASAC is enhanced.	1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project. 1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	1-1 Records of the project 1-2 Records of the project		Pilot projects (Kadobogo of Kacyiru Branch, Ruyenzi of New Nyarugenge Branch ) have not yet completed. Seminar will be planned to take place after preparation of the completion report of the Pilot Project.
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2-1 More than 300 number of trainees receive training. 2-2 WASAC human resource development plan includes training programs prepared by the project.	2-1 Records of the project 2-2 Records of the project		482 cumulative number of trainees were received training. Training programs will prepared after the completion of the pilot project
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%. 3-2 Action team members share experiences at workshops regarding implementation of the pilot projects. 3-3 The action team prepares a completion report of the pilot project.	3-1 Records of the project 3-2 Records of the project 3-3 Survey plans for locations outside the pilot project		Pilot Area 1: 12% (Q3) Pilot Area 2: 54% (Q3) Workshop will be planned after evaluation of the Pilot Project 1 & 2. Workshop will be planned after evaluation of the Pilot Project 1 & 2.
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		•Boundary line for Isolation of 4 branches was decided. •Exact locations for the installation of electromagnetic flowmeters were decided. •The 23 chambers has been constructed. •The tender procedure on procurement and installation of the equipment is delaying.

Activities		Inputs		Pre-Conditions
		The Japanese Side	The Rwanda Side	
1-1	A management team is organized to prepare 5-year Strategic Plan (5YSP) for NRW reduction.			
1-2	The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city), and identifies problems.	1 Experts Dispatch	1 Counterpart	
1-3	Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.	Chief Adviser / Non-Revenue Water management	Project Director	
1-4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.	Non-Revenue Water reduction planning	Project Manager	
1-5	Based on the results of Activity 1-3 and 1-4, the management team prepares a draft of the 5YSP.	GIS	Management team members	
1-6	The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and prepares a report.	Hydraulic analysis	Action team members	GIS data should continue to be updated
1-7	The management team prioritizes and schedules the conducts of specific actions of 5YSP.	Leak detection	Other counterparts	
1-8	WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.	Pipe repairing and service pipe connection		
1-9	The management team prepares the 5YSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.	ICT		
1-10	The management team holds seminars and presents 5YSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.			
1-11	The management team facilitates implementation and the monitoring of the 5YSP.			
1-12	The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.			
1-13	The management team reviews 5YSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.	2 Training	2 Facilities	
1-14	Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.	Training in Japan	Office space for Japanese experts (about 7 experts) at WASAC, office furniture, internet connections Training room with the capacity of about 20 persons Space for training on pipe repair and service pipe connection (40m <sup>2</sup> )	
2-1	Training materials on NRW control are prepared.	Training in the 3rd country		
2-2	Training on NRW management is conducted for the management team and WASAC management as necessary.			
2-3	OJT is conducted on the updating of GIS data, using available GIS data base.	3 Equipment provision	3 Local cost	
2-4	OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.	Equipment for training on pipe repair and service pipe connection	Store house for equipment	
2-5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Gate valve, flow meter, and customer meter for Pilot Project	Cost for administering the Project (utilities for experts offices, internet services) Cost for import tax, value added tax, customs, storage, inland transportation, and others for importing project equipment	
2-6	In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.	Leak detection equipment	Cost for operation and maintenance of project equipment	
2-7	In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.	Equipment for survey (Mobile GPS etc.)	Cost for overtime work, transportation, accommodation and allowance for WASAC staff	
2-8	Training materials on NRW are reviewed and updated.	Pipes and related fittings for service pipe replacement in Kadobogo		
2-9	Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.	PRV fittings in pilot area		
3-1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.	Electromagnetic flow meter and pressure gauge and gate valve for isolating 4 branches in Kigali		
3-2	The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	Vehicles and photocopy for Japanese experts		
3-3	The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	4 Facility provision		
3-4	The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	Chambers (4) for Pilot areas		
3-5	The action team establishes the baseline NRW rate of Pilot Area 1.	Chambers (23) for Equipment Monitoring System		
3-6	The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.			
3-7	The action team measures NRW after conducting Activity 3-6 and examines its effectiveness.			
3-8	The action team conducts measures for reducing surface leakage (visible leakage).			
3-9	The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.			
3-10	The action team conducts measures for reducing underground leakage (invisible leakage).			
3-11	The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.			
3-12	The action team conducts measures for reducing high water pressure.			
3-13	The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.			
3-14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.			
3-15	The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.			
3-16	The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.			
3-17	Action team conducts activities from Activities 3-5 to 3-16 at Pilot Area 2.			
3-18	Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.			
3-19	Action team disseminates the manual and use of survey equipment to the activity of whole branches.			
4-1	Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.			
4-2	Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field survey.			
4-3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.			
4-4	Chambers are constructed as appropriate.			
4-5	System input to each of 4 branches is measured.			
4-6	Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.			









**Plan of Operation (PO)**

Project title: Project for Strengthening Non-Revenue Water Reduction in Kigali City Water Network

Schedule of Major Japanese Inputs	Year 1												Year 2												Year 3												Year 4											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Expert</b>																																																
Chief Adviser/Non-Revenue Water management	[Gantt chart showing activity from Jan to Dec in Year 1 and Year 2]																																															
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3-2 The action team grasps the current situations of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other necessary means.	[Gantt chart showing activity from Jan to Dec in Year 1]																																															
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.	[Gantt chart showing activity from Jan to Dec in Year 1]																																															
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the inlets of the Pilot Area 1 and Area 2.	[Gantt chart showing activity from Jan to Dec in Year 1]																																															
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.	[Gantt chart showing activity from Jan to Dec in Year 1]																																															





**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : The 4th Steering Committee  
Place : Karibembi Hotel  
Date : 2nd 10/01/2019

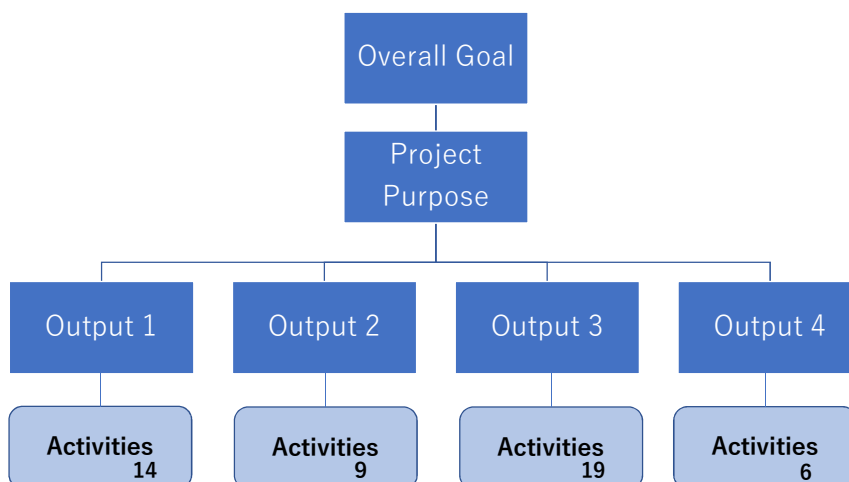
Name	Position
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Izumi SHOJI	Position: Senior Deputy Director, JICA HQ Mobile: E-mail: Shoji.Izumi@jica.go.jp
Koji Nakashima	Position: Program Manager / Representative, JICA Rwanda Mobile: 0788-30-4704 E-mail: Nakashima.Koji@jica.go.jp
Vénuste MPIMBAZIMANA	Position: Urban Water Supply Senior Engineer Mobile: 0788550872 E-mail: venuste.mpimbazimana@wacac.gov.rw
Jésire NTAMUTURANO	Position: Head of LOPM Mobile: 7850788874664 E-mail: dntamuturano@wacac.gov.rw
Virgile KWIZERA	Position: WATSAN Program Officer Mobile: 0784869720 E-mail: VirgileKWIZERA-Rw@jica.go.jp
Jean Paul KAVITARE	Position: Head of Zoning & Mapping subcell Mobile: 0782271580 E-mail: Jpkavitare@wacac.gov.rw
Felicien Niringiyimana	Position: Head of Meter M.S Mobile: 0788557335 E-mail: Felicien.niringiyimana@wacac.gov.rw
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Gekundiro Marly Acosim	Position: Secretary NRW Project / WACAC - JICA

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		E-mail: ootani@kcc.co
MWIJUKYE JAMES	Position: Director commercial	Mobile: 0788305361
		E-mail: mwijukye@wasac.rw
RUTAGUNGIRA Nethede	Position: Director of Urban Water & Sewerage Services -	Mobile: 0788403191
		E-mail: mrutagunfir@wasac.rw
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		E-mail: fgatanga2@wasac.rw
SARANDA Catherine	Position: Head Nyarugenge Branch	Mobile: 0782031897
		E-mail: csaranda@wasac.rw
Masanda MAYUSUMI	Position: JICA expert	Mobile: 0780824130
		E-mail: mayusumi.masanda@gmail.com
Aime Muzola	Position: CEO/wasac	Mobile: 0788539399
		E-mail: amuzola@wasac.rw
Emmanuel NTIRENGANYA	Position: Technician operator Kacyiru Branch	Mobile: 0788626513
		E-mail: ntiremos99@gmail.com
LOBGA Monia	Position: Water Production Manager	Mobile: 0788874552/0788874552
		E-mail: mlobga@wasac.rw
CASHUGI Innocent	Position: Manager, Water Operation Services	Mobile: 0785521483
		E-mail: incashugi@gmail.com
	Position:	E-mail:
	Mobile:	E-mail:

# Progress of the Project

May 22, 2019

## Project Structure by PDM (Project Design Matrix)



## Contents of the Project

### 【Overall Goal】

WASAC conducts NRW reduction measures as planned for Kigali city.

### 【Project Purpose】

WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.

### 【Project Period】

August 2016 to July 2020 (4 years)

## Overall Goal & Project Purpose in PDM

Narrative Summary	Verifiable Indicators	Achievement
<b>Overall Goal</b>		
WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23 : 25 %)	Indicators of PDM for Overall Goal was decided with 25% in the 2nd SC of October 12, 2017 ( 36.1% on the average of Q3 , 2018/19)
<b>Project Purpose</b>		
WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	1 5-year Strategic Action Plan for NRW reduction (5YSP) is approved by the Minister of Infrastructure.	5YSP was approved by the Board of Directors of April 27, 2018. The MININFRA is aware.
	2 Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC.	Annual budgets of Branches are incorporated in the company NRW reduction budget. In the future more specific actions for NRW reduction is needed.
	3 The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction.	The impact of NRW reduction in the pilot area is recognised and some activities are being replicated outside pilote area.

## Achievement of Outputs

Narrative Summary		Verifiable Indicators	Achievement
Outputs			
1	Planning capacity of NRW reduction of WASAC is enhanced.	1.1 SYSP is reviewed and updated, taking into account of the results of the Pilot Project.	Pilot projects (Kadobogo of Kacyiru Branch, Ruyenzi of New Nyarugenge Branch ) have not yet completed.
		1.2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.	Seminar will be planned to take place after preparation of the completion report of the Pilot Project.
2	Basic knowledge, skills and technique on NRW control are acquired by WASAC.	2.1 More than 300 number of trainees receive training.	482 cumulative number of trainees were received training.
		2.2 WASAC human resource development plan includes training programs prepared by the project.	Training programs will be prepared after the completion of the pilot project.

Narrative Summary		Verifiable Indicators	Achievement
Outputs			
3	WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	3.1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2 from 68% to 25%.	Pilot Area 1: 12% (Q3) Pilot Area 2: 54% (Q3)
		3.2 Action team members share experiences at workshops regarding implementation of the pilot projects.	Workshop will be planned after evaluation of the Pilot Project 1 & 2.
		3.3 The action team prepares a completion report of the pilot project.	Completion report will be prepared after evaluation of the Pilot Project 1 & 2.
4	4 branches in Kigali establish the system to measure NRW rates accurately.	4.1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	<ul style="list-style-type: none"> <li>• Boundary line for Isolation of 4 branches was decided.</li> <li>• Exact locations for the installation of electromagnetic flowmeters were decided.</li> <li>• The 23 chambers has been constructed.</li> <li>• The tender procedure on procurement and installation of the equipment is delaying.</li> </ul>

## Issues and Countermeasures of the Activities

**Output 1: Planning capacity of NRW reduction of WASAC is enhanced.**

	Activities	Achievements	Issue	Countermeasures
1.4	The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1.3.	The inventory surveys is being updated. So far, this inventory shows that some facilities (floaters valves , PRVs ) requires replacement/installation.	Complexity of the task to all WASAC infrastructures.	Completion of the survey and replacement of defected or missing equipment.

## Issue and Countermeasures of the Activities

**Output 2: Basic knowledge, skills and technique on NRW control are acquired by WASAC.**

	Activities	Achievements	Issue	Countermeasures
2.5	In-room training and OJT on leak detection for the pilot project are conducted with provided equipment.	Done	Capacity Assessment of the new knowledge acquired through training has not yet been conducted.	This will be done after the completion of the pilot project.

## Issue and Countermeasures

**Output 3: WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.**

Activities		Achievements	Issue	Countermeasures
3.10	The action team conducts measures for reducing underground leakage (invisible leakage).	Done	Some leak detection equipment not appropriate for the majority of the existing water network condition (lack of some facilities such as valves, etc.)	Use those equipment efficiently where they can be applied more training on sophisticated one.
3.14	The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-6, 3-8, 3-10 and 3-12.	Done	The cost- benefit analysis not yet completed . There is worry of sustainability after the end of the project .	Cost benefit analysis will be completed after the completion of the pilot area 2. For the sustainability of NRW reduction in the pilot area 1, WASAC should ensure the availability of necessary budget for the continuation of routine activities within the pilot area.
3.14	The team reviews the results of Activities, and undertakes cost-benefit analysis of NRW for each Activity.	Not yet done	The target is not yet reached, poor quality of pipes and high pressure still the main cause of not yet reaching the target (25%).	Continue NRW reduction in this pilot with more attention. The activities such as pressure control , leakages survey and pipe replacement should continue in the year 4 .

## Issue and Countermeasures

**Output 4: 4 branches in Kigali establish the system to measure NRW rates accurately.**

Activities		Achievements	Issue	Countermeasures
4.3	Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.	Not yet done	Delay of procurement of equipment of the monitoring system.	JICA should speed up the procurement process.





# Effect of the Pilot Project Activities

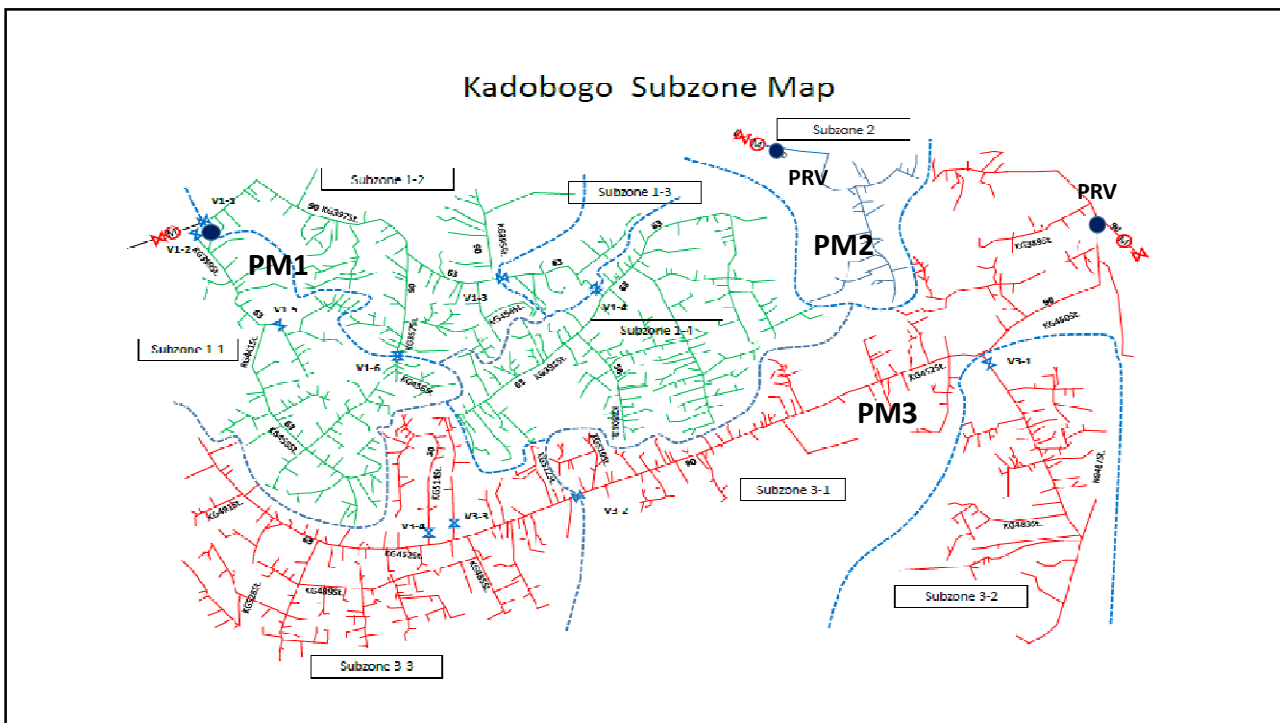
May 22, 2019

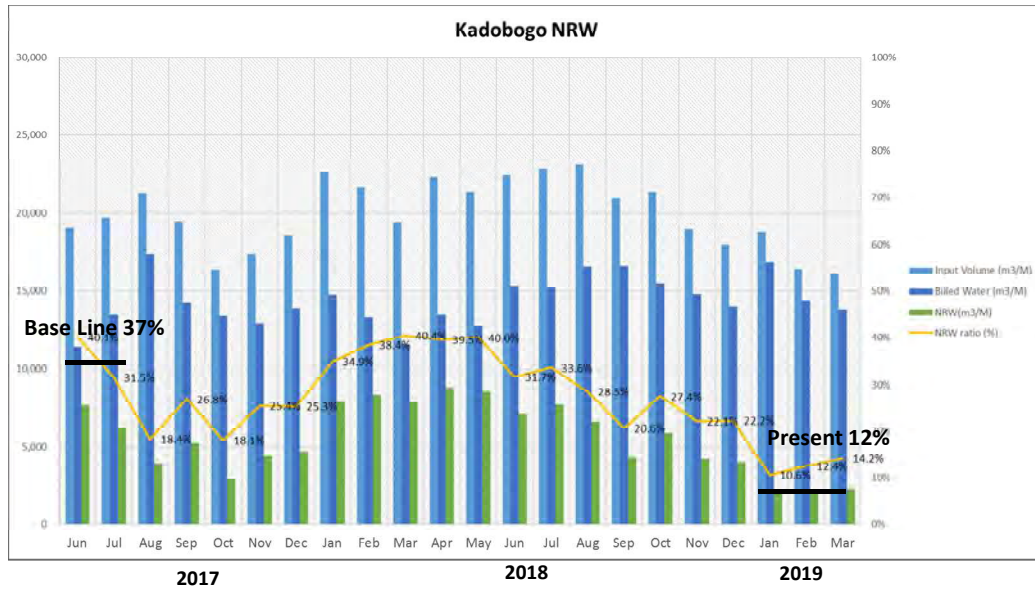
## Evaluation of Project Activity

1. Trends in NRW Rate Reduction
2. Trends in the Number of Leakage Repair
3. Trends in Qmnf Reduction
4. Effect of Meter Replacement
5. Cost Benefit Analysis
6. Activity with High Priority for NRW Reduction

# 1. Trends in NRW Rate Reduction

Pilot Area	Kadobogo	Ruyenzi
Base Line	37%	68%
Target	20%	25%
As of Q3 (2018/19)	12%	54%

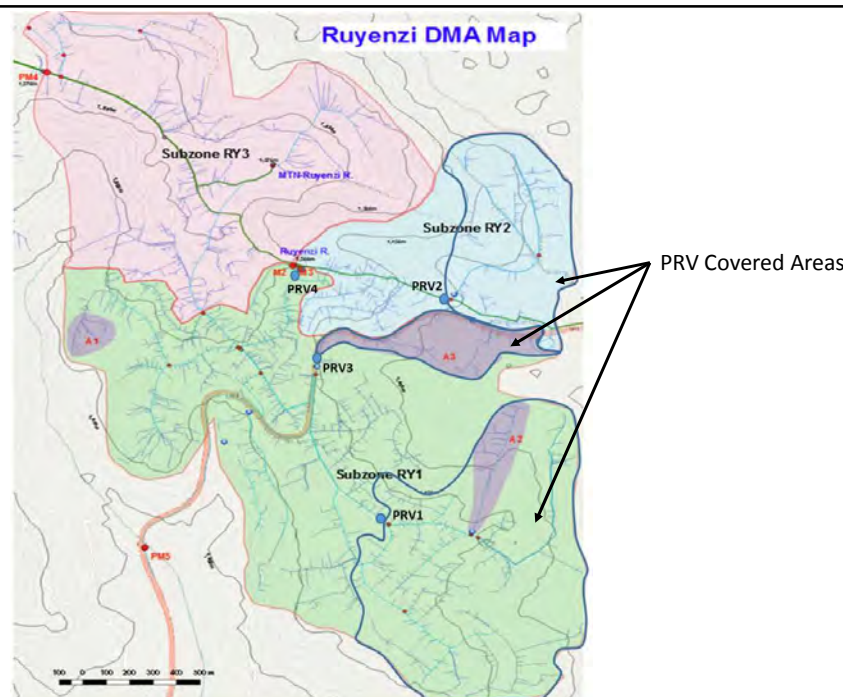


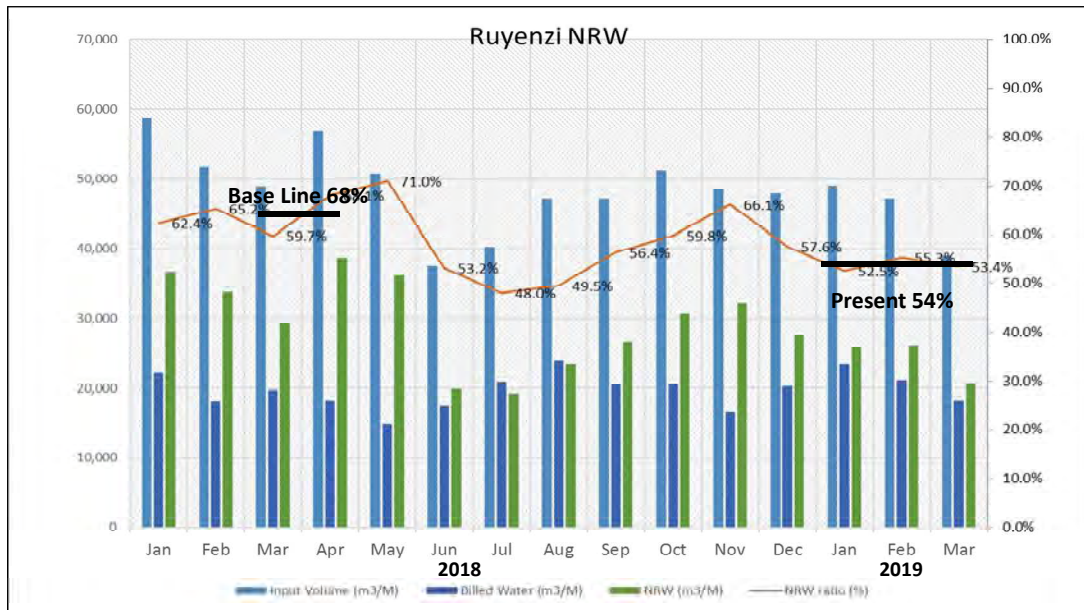


2017

2018

2019





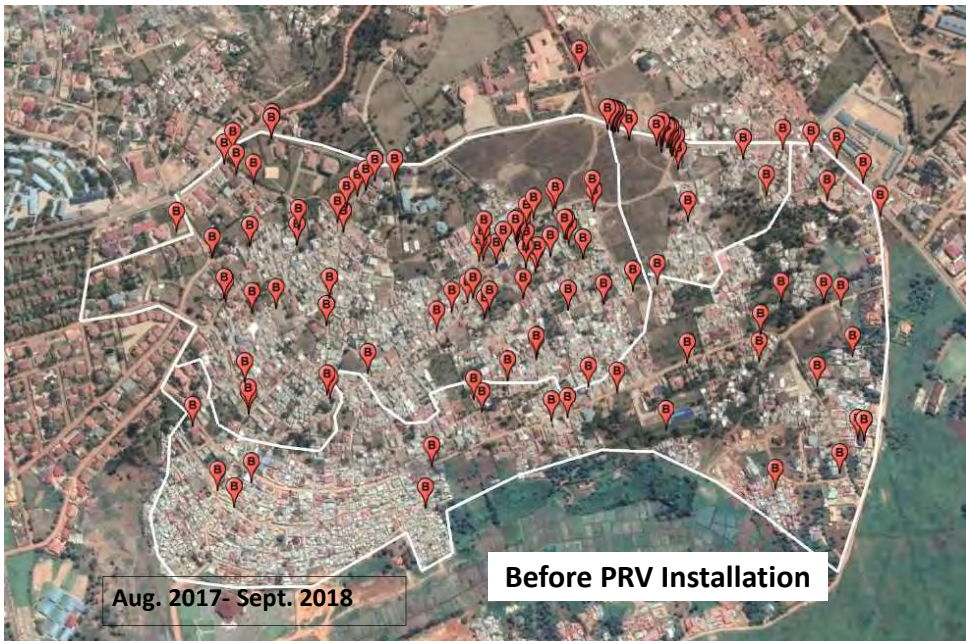
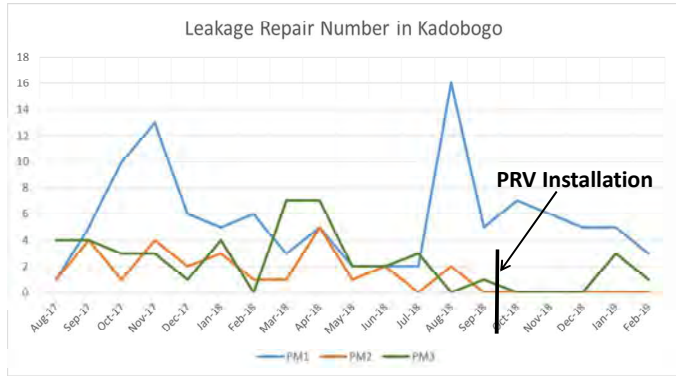
## 2. Trends in the number of Leakage Repair

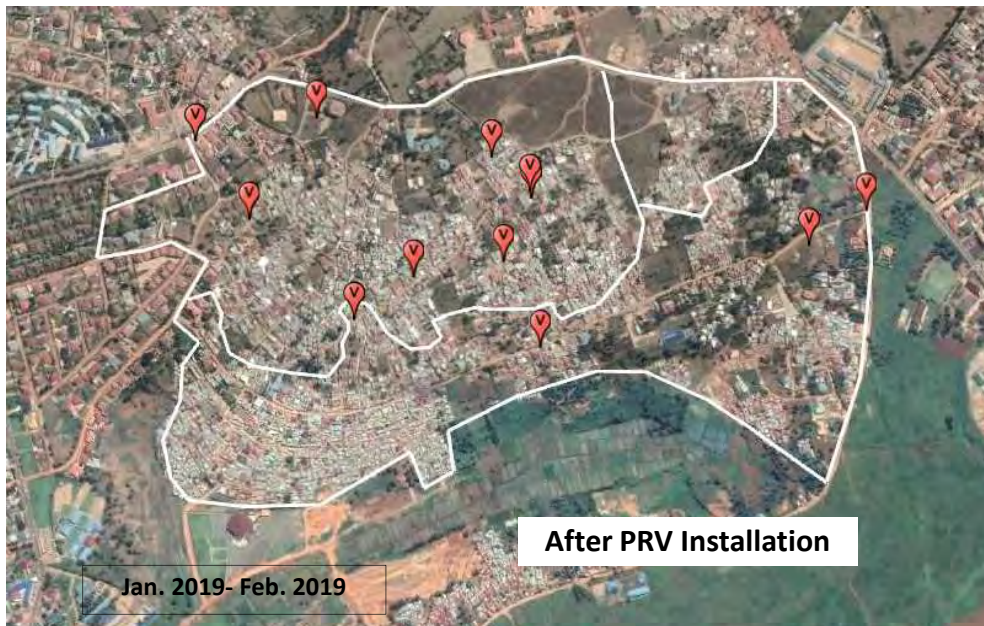
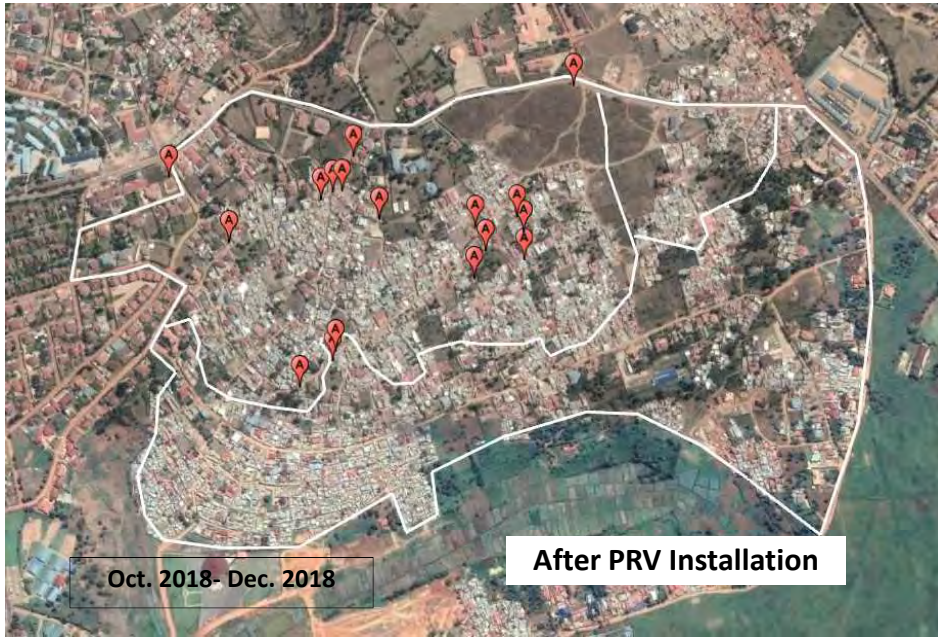
### Kadobogo

**Kadobogo Pilot Area**

**Leakage Repair Number**

Month	PM1	PM2	PM3	Total
Aug-17	1	1	4	6
Sep-17	5	4	4	13
Oct-17	10	1	3	14
Nov-17	13	4	3	20
Dec-17	6	2	1	9
Jan-18	5	3	4	12
Feb-18	6	1	0	7
Mar-18	3	1	7	11
Apr-18	5	5	7	17
May-18	2	1	2	5
Jun-18	2	2	2	6
Jul-18	2	0	3	5
Aug-18	16	2	0	18
Sep-18	5	0	1	6
Oct-18	7	0	0	7
Nov-18	6	0	0	6
Dec-18	5	0	0	5
Jan-19	5	0	3	8
Feb-19	3	0	1	4
<b>Total</b>	<b>107</b>	<b>27</b>	<b>45</b>	<b>179</b>
<b>Average</b>	<b>5.6</b>	<b>1.4</b>	<b>2.4</b>	<b>9.4</b>
Sept. 2018	5.8	1.9	2.9	10.6
Oct. 2018	5.2	0.0	0.8	6.0

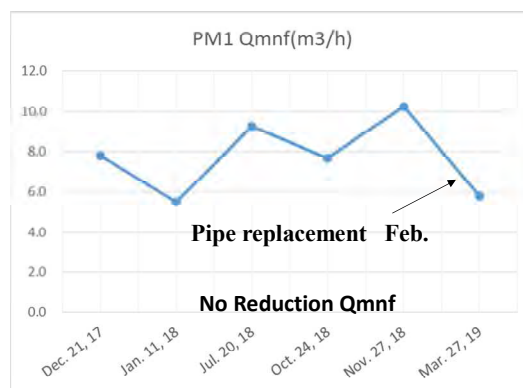




### 3. Trends in Qmnf Reduction

#### Trend of Qmnf Reduction in PM1

PM1	Qmnf (m3/h)	P (bar)
Dec. 21, 17	7.8	-
Jan. 11, 18	5.5	10.5
Jul. 20, 18	9.2	
Oct. 24, 18	7.7	10.0
Nov. 27, 18	10.2	10.0
Mar. 27, 19	5.8	6.5

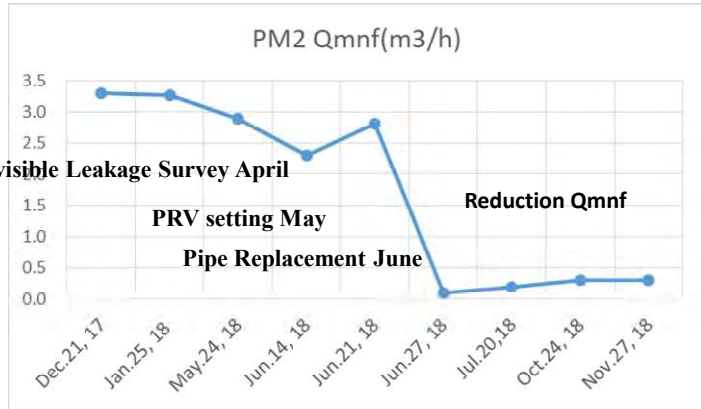


**No Installation of PRV in PM1 Kadobogo**



## Trend of Qmnf Reduction in PM2

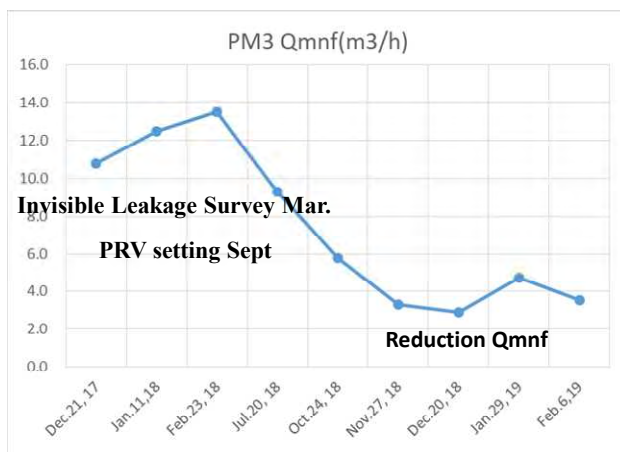
PM2	Qmnf (m3/h)	P (bar)
Dec.21, 17	3.3	2.0
Jan.25, 18	3.3	
May.24, 18	2.9	
Jun.14, 18	2.3	4.0
Jun.21, 18	2.8	
Jun.27, 18	0.1	
Jul.20,18	0.2	
Oct.24, 18	0.3	2.5
Nov.27, 18	0.3	2.5



**Installation of PRV in PM2**

## Trend of Qmnf Reduction in PM3

PM3	Qmnf (m3/h)	P (bar)
Dec.21, 17	10.8	9.6
Jan.11,18	12.5	
Feb.23, 18	13.5	7.8
Jul.20, 18	9.3	
Oct.24, 18	5.8	5.5
Nov.27, 18	3.3	2.5
Dec.20, 18	2.9	2.5
Jan.29, 19	4.7	
Feb.6,19	3.5	



**Installation of PRV in PM3**

## Effect of Pressure Management by PRV Minimum Night Flow (Qmnf) Measurement

**Kadobogo (Oct. 2018)**

Qmnf Measurement	PM2		PM3	
	Pressure	Flow Rate	Pressure	Flow Rate
1. Baseline	7.0 bar	0.74 m3/h	7.5 bar	9.44 m3/h
2. Effect Measurement	2.5 bar	0.31 m3/h	2.0 bar	5.80 m3/h
3. Reduction Volume		0.43 m3/h		3.64 m3/h
4. Reduction Rate		58%		39%

**Ruyenzi (Oct., Nov., 2018)**

Qmnf Measurement	PRV1		PRV2		PRV3	
	Pressure	Flow Rate	Pressure	Flow Rate	Pressure	Flow Rate
1. Baseline	9.1bar	7.48 m3/h	8.7 bar	3.74 m3/h	4.0bar	1.84 m3/h
2. Effect Measurement	2.5 bar	1.50 m3/h	6.0bar	2.60 m3/h	0.8bar	0.78 m3/h
3. Reduction Volume		5.98 m3/h		1.14 m3/h		1.06 m3/h
4. Reduction Rate		80%		30%		58%

## Effect of Pipe Replacement 800m, DN 1", DN3/4" Minimum Night Flow (Qmnf) Measurement

**Kadobogo PM1 (Feb. 2019)**

Measurement	Flow Rate	Note
1. Baseline	5.38 m3/h	before replacement
2. Effect Measurement	3.10 m3/h	after replacement
3. Reduction Volume	2.28 m3/h	
4. Reduction Rate	42%	

## Effect of PRV, Pipe Replacement and Leakage Repair

- ✓ It was proved in the Pilot Project that the activity such as high pressure reduction, pipe replacement and leakage repair are very effective for the NRW reduction.
- ✓ Reduction of high pressure should be performed before leakage repairs. Otherwise leakages repeat again.
- ✓ To sustain the effect of pressure reduction, continuous monitoring of pressure and maintenance of PRV should be taken.

## 4. Effect of Meter Replacement

Kadobogo

- On-site Meter Test : Sep. 2017- Dec. 2017 (4 months)
- Meter Replacement: mainly Dec. 2017- Apr. 2018 (5 months)

Ruyenzi

- On-site Meter Test : Sep. 2018 - Nov. 2018 (3 months)
- Meter Replacement : Dec. 2018 - Jan. 2019 (2 months)

## Result of On-site Meter Test

### Kadobogo

Meter Error Tested					Defected	Total Surveyed
Intolerable			Tolerable	Total		
<-5%	5%<	Sub Total				
149	90	239	845	1,084	88	1,172
12%	8%	20%	72%	92%	8%	100%

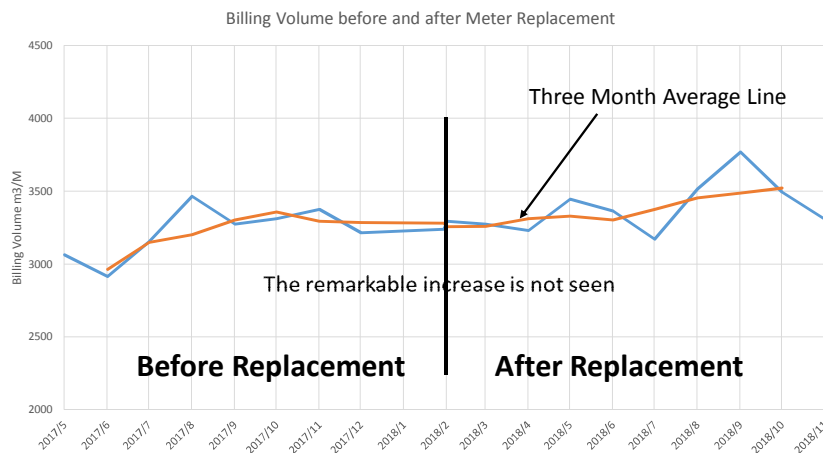
### Ruyenzi

Meter Error Tested					Defected	Total Surveyed
Intolerable			Tolerable	Total		
<-5%	5%<	Sub Total				
46	40	86	321	407	6	413
11%	10%	21%	78%	99%	1%	100%

Note: Big customer w hoses billing is more than 20m3/month in June, July & August, 2018

## Effect of Meter Replacement

Adjusted the replaced month to same Feb. 2018



## Kadobogo

2017/6	2017/7	2017/8	2017/9	2017/10	2017/11	2017/12	2018/1	2018/2	2018/3	2018/4	2018/5	2018/6	2018/7	2018/8	2018/9	2018/10
39	23	24	36	0	0	23	17	14	14	13	10	13	14	13	13	19
7	9	7	7	5	5	5	5	5	4	4	7	0	0	27	9	7
10	10	0	10	12	8	10	5	10	12	14	7	10	12	9	26	10
10	10	0	10	10	11	11	5	10	11	10	7	11	8	10	9	9
0	30	7	6	0	0	0	10	9	0	0	0	0	0	20	0	25
5	8	8	8	10	8	10	10	5	0	11	6	11	10	9	10	8
64	44	36	36	36	29	30	38	47	36	31	38	54	39	42	23	22
9	10	18	12	8	7	16	10	11	8	10	9	12	8	8	10	13
11	14	10	0	19	12	0	0	20	10	9	13	13	11	15	12	13
11	19	29	35	11	18	21	20	21	45	38	31	57	34	37	126	53
8	8	7	0	18	0	13	11	7	8	14	8	9	7	8	10	8
13	0	6	18	20	20	20	20	13	16	0	39	15	16	20	20	16
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6	0	0	54	18	0	28	0	36	25	22	15	18	22	22	20	15
14	9	9	9	16	15	15	9	17	9	11	5	10	10	10	10	10
15	16	11	11	9	10	10	10	11	16	13	16	18	20	23	23	20
19	20	20	23	21	19	15	22	16	18	12	15	12	14	14	13	18
0	23	10	10	11	0	15	15	0	17	0	20	10	10	21	15	14
9	10	16	10	11	11	13	10	7	6	9	13	12	8	10	11	9
94	101	184	165	156	25	177	92	118	67	145	80	182	113	108	200	142
23	19	23	25	20	17	17	21	26	18	15	19	20	17	20	23	22
49	35	31	40	35	33	28	39	41	33	32	41	35	31	40	44	43
0	14	5	0	0	8	4	7	6	6	6	6	5	2	5	4	6
7	5	5	6	4	5	2	3	5	5	5	5	6	7	7	6	0
0	31	15	0	32	11	5	20	0	27	8	0	0	37	13	11	13
17	25	16	17	24	20	12	19	22	22	18	16	16	18	21	16	15
8	8	8	6	8	7	8	8	0	20	0	0	0	0	0	0	0

This table shows a part of calculation sheet.

### Monthly Average Billing Volume (m3/month)

Before Replacement	After Replacement	Increase Volume	Increase Ratio
3,314	3,334	20	0.60%

## Meter Test Result

- ✓ The meter setting coverage rate of WASAC is high.
- ✓ However the meter test and meter replacement were carried out with expending much worker and time, the NRW reduction effects was relatively small.
- ✓ When there is the meter error of the plus side, it becomes the opposite effect for NRW reduction.
- ✓ The replacement of the meter should be intended to maintain equitable service of the billing collection for the customer.

## Meter to be Replaced

- ✓ **The meter which should be replaced or repaired are**
  - **Defected meter**
  - **Blocked meter**
  - **Aged meter**
  
- ✓ **About the following meter should be tested and it should be replaced if there is an error more than  $\pm 5\%$ .**
  - **Meter abnormality is found by the analysis of billing volume.**
  - **When the customer make a complain about a billing amount.**

## 5. Cost Benefit Analysis

### Conditions of the Analysis

- ✓ **Cost, Benefit: With Project – Without Project**
- ✓ **Evaluation Index of the Project Effect**
  1. NPV: Net Present Value
  2. B/C: Cost Benefit Ratio (CBR)
- ✓ **Discount Rate for the NPV calculation = 6.0%**
  1. CPI Rwanda = 5.00% (average for the past 10 years)
  2. Interest Rate= 6.53% (ditto)
  3. Inflation= 3.82% (ditto)
- ✓ **Evaluation Period : every 1 year**

✓ Project Effect

1. Water Charge of Selling of Surplus Water

Water charge unit price: Average of 2018

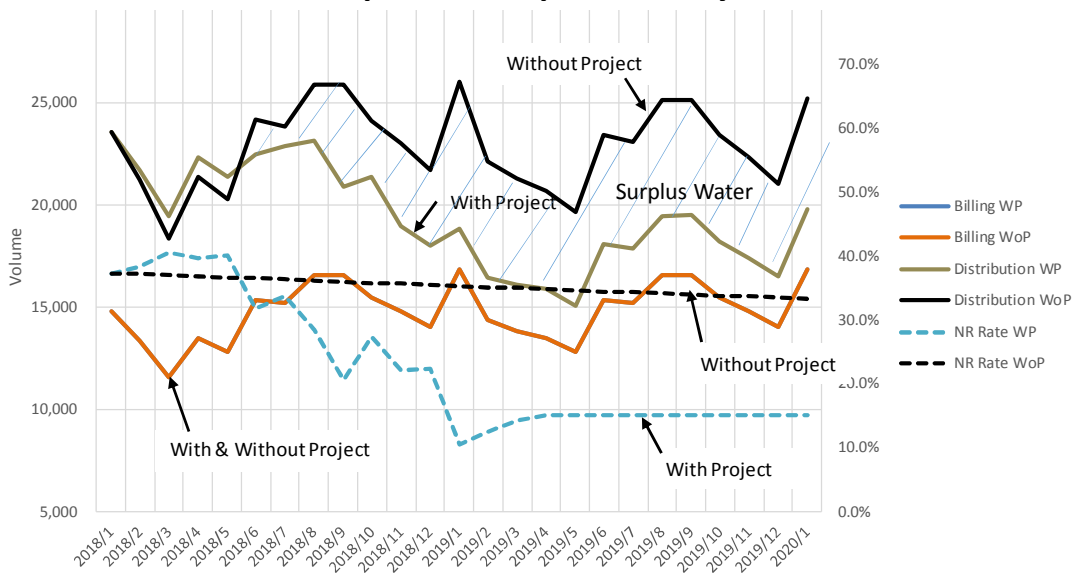
Kacyiru Branch : 567 RWF

Nyarugenge Branch: 592 RWF

2. Reduction of Production Cost

Unit cost of production Nzove : 319 RWF

**Schematic Chart of Surplus Water produced by NRW Reduction Activities**



## Without Meter Replacement

### Project Effect Case 1-1

#### Selling of Surplus Water made by NRW Reduction Activities

Year		Effect of the Project (RWF)			
Project	Year	Benefit	Cost	NPV	B/C
	2018	9,792,908	37,521,482	-27,728,574	0.3
1	2019	48,484,569	37,306,840	11,177,728	1.3
2	2020	84,986,136	37,104,349	47,881,788	2.3
3	2021	119,421,577	36,913,318	82,508,259	3.2
4	2022	151,907,842	36,733,101	115,174,741	4.1
5	2023	182,555,262	36,563,085	145,992,177	5.0
10	2028	311,653,343	35,846,915	275,806,428	8.7

Cost Recovery Year

### Project Effect Case 1-2

#### Saving of Production Cost by Deducting Surplus Water

Year		Effect of the Project (RWF)			
Project	Year	Benefit	Cost	NPV	B/C
	2018	5,509,590	37,521,482	-32,011,892	0.1
1	2019	27,277,914	37,306,840	-10,028,926	0.7
2	2020	47,814,070	37,104,349	10,709,721	1.3
3	2021	67,187,801	36,913,318	30,274,482	1.8
4	2022	85,464,906	36,733,101	48,731,805	2.3
5	2023	102,707,458	36,563,085	66,144,373	2.8
10	2028	175,339,359	35,846,915	139,492,444	4.9

## With Meter Replacement

### Project Effect Case 2-1

#### Selling of Surplus Water made by NRW Reduction Activities

Year		Effect of the Project (RWF)			
Project	Year	Benefit	Cost	NPV	B/C
	2018	9,792,908	60,572,920	-50,780,012	0.2
1	2019	48,484,569	60,358,278	-11,873,710	0.8
2	2020	84,986,136	60,155,787	24,830,350	1.4
3	2021	119,421,577	59,964,756	59,456,821	2.0
4	2022	151,907,842	59,784,539	92,123,303	2.5
5	2023	182,555,262	59,614,523	122,940,739	3.1
10	2028	311,653,343	58,898,353	252,754,990	5.3

### Project Effect Case 2-2

#### Saving of Production Cost by Deducting Surplus Water

Year		Effect of the Project (RWF)			
Project	Year	Benefit	Cost	NPV	B/C
	2018	5,509,590	60,572,920	-55,063,330	0.1
1	2019	27,277,914	60,358,278	-33,080,364	0.5
2	2020	47,814,070	60,155,787	-12,341,717	0.8
3	2021	67,187,801	59,964,756	7,223,044	1.1
4	2022	85,464,906	59,784,539	25,680,367	1.4
5	2023	102,707,458	59,614,523	43,092,935	1.7
10	2028	175,339,359	58,898,353	116,441,006	3.0



## Cost Recovery Period of Individual Activity

### Kadobogo

Activity	Area	Cost Recovery Month			Qmnf Effect
		Month	NPV (RWF)	B/C	m3/h
Pipe Replacement	PM1	8th	1,186,196	1.2	2.28
PRV Setup	PM2	6th	258,324	1.3	0.43
	PM3	2nd	1,177,220	1.7	3.64

### Ruyenzi

Activity	Area	Cost Recovery Month			Qmnf Effect
		Month	NPV (RWF)	B/C	m3/h
PRV Setup	PRV1	1st	342,168	1.2	5.98
	PRV2	10th	308,829	1.1	1.14
	PRV3	3rd	373,155	1.4	1.06

## Result of Cost and Benefit Analysis

It was proved that the cost of activity such as high pressure reduction, pipe replacement and leakage repair were recovered in short period, and produce benefit expansion.

- ✓ Selling surplus water : from 1st year after project
- ✓ Saving production cost : from 2nd year after project

## 6. Activity with High Priority for NRW Reduction

### Result of the High Priority Activity

- High Pressure Management by PRV
- Replacement of Substandard Service and Distribution Pipe



- ✓ High NRW Reduction Effect
- ✓ Preventive and Minimize Effect to Leakage

- Customer Meter Routine Management



- ✓ Provision of Fair Service for the Customer

**Murakoze Cyane!!**

# Proposal of additional activities

Methode Rutagungira  
Director of UWSS, WASAC / Project Director



## Background

Pilot activities are going to the end with important findings.

At the same time, 5YSP is going to the second year when more tangible results are expected.

Therefore, the activities which given to the priority based on the findings of pilot activities should be expanded to outside pilot area.

To accelerate the 5YSP activities and enhance the impact and sustainability of the project, the following activities are proposed as additional activities in the project.



## Proposed activities

1. Pressure control outside pilot area
2. Reservoir Survey
3. Procurement of on-site test meters



## Pressure control outside pilot area

### [Objectives]

The effectiveness of the pressure control was proved in pilot area. WASAC staff need to enhance experiences to control the pressure outside DMAs. by conducting this activities, WASAC can easily expand this activities to whole WASAC supply area.

### [Activities]

- Identification of high pressure area and frequent leakage pipes in Kigali
- Planning for pressure reduction (GIS, Survey, Qmnf)
- Implementation of the plan (Manhole, PRVs, valves, pipe replacement)
- Impact analysis



## Reservoir Survey

### [Objectives]

Many Inadequate use of the reservoirs were confirmed through pilot area and 5YSP implementation, which causes the high pressure supply and water loss by overflow.

by conducting this activities, WASAC can easily plan and implement the rehabilitation plan for the reservoirs.

### [Activities]

- Site survey for all reservoirs in Kigali
- Development of a inventory for the reservoirs, which indicates the functionality of the facility and necessary measures for improvement.
- Replacement of some equipment for quick impact.



## Procurement of on-site test meters

### [Objectives]

According to the result of pilot activities, about 25% of the customer meters were not accurate enough to follow the WASAC's standards.

by conducting this activities, WASAC can accelerate the on-site meter testing and improve the customer satisfaction.

### [Activities]

- Procurement of 12 on-site test meters for 6 Kigali branches
- Training of the staff in charge in Kigali branches

Japanese products are preferable.



<b>PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK</b>	
<b>MEMORANDUM OF THE SC MEETING</b>	
<b>Name</b>	The Fourth Steering Committee (4 <sup>th</sup> SC)
<b>Date</b>	2019/05/22, 8:45 – 10:15
<b>Venue</b>	Karisimbi Hotel
<b>Participants</b>	<ul style="list-style-type: none"> <li>- <b>Eng Aimé MUZOLA , WASAC –CEO</b></li> <li>- <b>Maruo SHIN : JICA- Chief Representative</b></li> <li>- <b>MPIMBAZIMANA Venuste , MININFRA representative</b></li> <li>- <b>IZUMI Shoji : JICA Monitoring Mission from JAPAN</b></li> <li>- <b>NTAGUNGIRA Methode : Project Director</b></li> <li>- <b>BAHIGE Jean berchmans : Project Manager</b></li> <li>- <b>MAYUSUMI masunobu : JICA – Long term Expert</b></li> <li>- <b>SHIGEO Otani : JICA Expert</b></li> <li>- <b>MWIJUKYE James : Commercial Director</b></li> <li>- <b>GATANAZI Felix : Manager , Commercial Services</b></li> <li>- <b>GASHUGI Innocent : Water operation services</b></li> <li>- <b>KOJI Nakashima, : JICA –RWANDA Office</b></li> <li>- <b>KWIZERA Virgile : JICA –RWANDA office</b></li> <li>- <b>Other WASAC and JICA staff : see attendance list</b></li> </ul>
<p>➤ <b>The agenda was as follow:</b></p> <ul style="list-style-type: none"> <li>• Registration</li> <li>• Introduction of participants</li> <li>• Remarks by CEO WASAC</li> <li>• Remarks by JICA RWANDA representative</li> <li>• Progress of the Project (Effect of the Pilot Project Activity)</li> <li>• Equipment Procurement and Installation Schedule of Output 4</li> <li>• Next step of the Project (Proposal of Additional Activity on Output 1)</li> <li>• Question and Answers</li> <li>• Remarks by MININFRA</li> <li>• Closing Remarks by WASAC CEO</li> </ul> <p>➤ <b><u>Opening remarks by CEO WASAC</u></b></p> <p>WASAC–CEO, Eng Aimé MUZOLA started by thinking JICA for the continuous support to improve water and sanitation services through different Projects. He thanked also MININFRA for the assistance and support to ensure that the project is delivering expected</p>	

results. He invited all participant for a fruitful discussion on project result, challenges and way forward.

➤ **Remarks by JICA RWANDA representative**

Mr. SHIN Maruo started his speech in thanking the CEO, the representative of MININFRA, colleagues, experts.

He said regarding the NRW reducing, Japan has several experience in different places in Asia, Kenya....so Japanese experts have technical experience that why this project of NRW was introduced here in Rwanda.

For this Project, so far it going well like in 3years implementation, so many trainings have taken place for WASAC's staffs, but we say there are more challenges.

Mr. Maruo concluded by saying that we should consider sustainability of actions after this project, also as the master plan project is starting the lesson from NRW project can support.

➤ **Progress of the Project**

Mr. Otani reported the progress of the project based on the result of Joint Monitoring which were held on 15<sup>th</sup> and 20<sup>th</sup> of May, 2019 by Management Team and JICA experts.

Here bellow the summary of result presented :

**Output 1**

The output 1 which is related to the development of the 5YSP was completed and now and implementation. It was recommended to continue to support the implementation of the 5YSP and the lessons learned through the Pilot Project.

**Output 2**

About the basic knowledge, skills and technique, many staffs of the WASAC were already trained, not only the HQ but also Branch staffs in Kigali city, and the result is going to use in the daily activity. Training program will be prepared based on the feedback of the activities conducted in the Pilot Projects. Capacity assessment will be done later

**Output 3**

This is about the Pilot Project. In the activities of pilot area 1, the baseline of NRW Rate was 37% and now average of Q3 in 2018/19 (January –March 2019) NRW rate achieved 12% for the target 20%.



In the pilot area 2, very high pressure is observed to this area. In addition, the existing network is quite complex. So, the leakage survey and detection work are difficult. From the baseline of 68%, the NRW have reduced so far up to 54%

#### **Output 4**

Activity of the monitoring systems construction in 4 branches in Kigali City is still delaying due to the delay of procurement equipment

##### ➤ **Effect of the Pilot Project Activities**

Mr. Otani reported the impact of the Pilot Project activities such as PRV installation, pipe replacement, leakage survey & repair and customer meter test & replacement. Cost benefit analysis the pilot project will be detailed after the completion of the pilot project 2.

##### ➤ **Equipment Procurement and Installation Schedule of Output 4**

For this, Mrs. IZUMI Shoji said that there is a big delay due to the delay of tender procedure in Japan. She explained the proposed schedule of the procurement as follow.

1. Documentation of tender by the end of August 2019
2. Tender term in August 2019
3. Production and transportation in Dec 2019
4. Custom clearance in Dec 2019
5. Installation of test in March 2020

The steering committee agreed the proposed schedule and recommended to have another Steering committee meeting in October 2019 to evaluate the progress of the installation of the monitoring system and examine the project necessity for project extension.

##### ➤ **Next step of the Project**

Mr. Bahige explained that to accelerate the 5YSP activities and enhance the impact and sustainability of the project, the following activities are proposed as additional activities in the project.

#### **1. Pressure control outside pilot area**

From the pilot area results, it has been confirmed the impact of pressure control in the reduction of NRW. It is in this context that WASAC requested the support of JICA through the project to assist for pressure control in Kigali water network by installing PRVs.

## **2. Reservoir survey**

This activity is about to survey all WASAC Kigali water reservoir and implement corrective activities such as floater valve replacement / installation of new one.

## **3. Procurement of on-site test meters**

This activities related to the procurement of additional potable test meter. This activity will accelerate the on-site meter testing to ensure NRW reduction and improve the customer satisfaction.

After the presentation of the proposal additional activates by WASA, JICA recognized the importance of these activities and committed to support and finance them.

### ➤ **Remarks by MININFRA**

MININFRA representative, Mr. **MPIMBAZIMANA** Venuste appreciated the continuous support of JICA countrywide in all sectors especially in water sector, he thank WASAC team also and committed ministry support for the successful implementation of the project and the WASAC mandate.

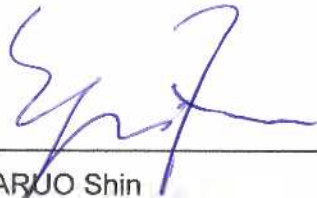
### ➤ **Closing remarks by CEO WASAC**

Eng. Aime MUZOLA closed the meeting by acknowledge the progress of the project and invited all stakeholders to continue to work hand by hand for the implementation of remaining activities, he recommended WASAC engineers to take advantage on Japanese expertise. Finally, He thanked all the participants for the fruitful meeting and suggested to continue put our efforts together to overcome challenges and ensured that with support of JICA. WASAC is confident to meet the target of 2024 to provide clean water for all Rwandan.

MINUTES OF MEETING  
OF  
THE 5<sup>th</sup> STEERING COMMITTEE MEETING  
FOR  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK

HELD AT  
2000 Hotel

Kigali, 4<sup>th</sup> February, 2020




Mr. MARUO Shin  
Chief Representative  
JICA Rwanda Office  
Japan



Eng. Aimé MUZOLA  
Chairman of Steering Committee &  
Chief Executive Officer, WASAC  
The Republic of Rwanda



Mr. OTANI Shigeo  
Chief Advisor  
JICA Expert Team  
Japan



Mr. Méthode RUTAGUNGIRA  
Project Director &  
Director of UWSS, WASAC  
The Republic of Rwanda

For monitoring, discussion on issues, challenges, solutions and way forward of the Project for Strengthening Non-Revenue Water Control In Kigali City Water Network (hereinafter referred to as "the Project"), the 5<sup>th</sup> meeting of Steering Committee (hereinafter referred to as "SC") was held on 4<sup>th</sup> February 2020.

As a result of the discussions, both sides came to understanding concerning the matters referred to the followings;

**1. Procurement and Installation of Equipment for the Monitoring System under Output 4 (Isolation of four Branches)**

JICA Expert explained the general feature of the monitoring system and pointed out following matters to be attention for the monitoring system construction.

1) Flow meters installed by SUSWAS project

JICA Expert raised a concern that flow meters installed by SUSWAS project located on the crossing point of the boundary between Kacyiru-Remara and Remera-Gikondo to isolate each branch are not working well or removed for road expansion works.

WASAC responded that functional recovery of those flow meters shall be made by WASAC before Monitoring System is installed in the Project. WASAC will contact with supplier of those meter as soon as possible to recover un-performing ones and reinstall them to the removed locations due to road works.

2) Transfer of Customer Registration by Isolation of Branches

JICA Expert explained that transfer of customer registration between branches is required for make accurate calculation of billing volume and branch-in-charge into consistent manner so as for isolation of Branches in Kigali City, and urge WASAC to proceed for transfer.

WASAC assured that the transferences process through customer list finalization and Customers Management System (hereinafter referred to as "CMS") data update will be completed before Monitoring System is installed in the Project.

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## **2. Extension of the Project Period**

- 1) Rescheduling of Equipment Procurement and Installation for the Monitoring System in Output 4

JICA reported the revised timeline of the equipment procurement and installation of the monitoring system in Output 4 as attached (3. Implementation schedule concerning the equipment procurement and installation of monitoring system), based on the amendment of the contract which had been concluded between JICA and Japanese supplier on 15<sup>th</sup> January 2020. The completion of installment of the monitoring system to WASAC is scheduled in September, 2020. WASAC asked the reasons behind the rescheduling of the procurement and installation works, and JICA responded that explanation would be given after confirmation with concerned departments of JICA.

- 2) Proposal of Project Period regarding Output 4

On-The-Job Training (hereinafter referred to as "OJT") for NRW calculation using the data of the monitoring system will be conducted for three months from September, 2020 to the end of November 2020. Therefore, JICA proposed to extend the Project period for five months from the end of July 2020 to the end of December 2020 including one month buffer period. SC approved this proposal by JICA.

## **3. Progress of the other activities of the Project**

SC members were informed about the progress, issues and their countermeasures of the Project. And following action are confirmed to implement for the sustainability of the NRW reduction of the Project.

- 1) Pressure Reducing Valve (hereinafter referred to as "PRV") and Float Valve (hereinafter referred to as "FV") Installation as urgent tasks.

As the urgent task to prevent NRW, 12 sets of PRVs and 10 sets of FVs have been procured by JICA side. Installation will be started soon by WASAC with assistance of the Project.

\*

2) On-site Test Meter procurement

26 sets of on-site test meters will be delivered on 6<sup>th</sup> February 2020. Training for efficient utilization of on-site meter will be carried out after delivery.

3) Reservoir Survey

About 120 remaining reservoirs excluding the reservoirs which have been surveyed as urgent task in Kigali City should be surveyed to clarify the current situation and measures to be taken to reduce NRW. The Project team will take action for survey.

4) Preparation of Work Manual of NRW reduction

The manual preparation work has been suspended from May 2019. WASAC agreed to restart to complete it immediately.

Attachments

1. Invitation to the 5th SC
2. Agenda of the 5th SC
3. Implementation schedule concerning the equipment procurement and installment of monitoring system
4. Proposal of Rescheduled Plan Concerning Output 4 by JICA
5. List of Attendants

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Kigali, 20 JAN 2020  
N° 11.07.024 / 48 / 20 / DUWSS-CEO / Jb

To: Chief Representative  
JICA- RWANDA

Dear Sir,

**RE: Invitation to the fifth steering committee (SC) meeting of the project for Strengthening Non-Revenue Water control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

The Steering Committee (SC) meeting is scheduled on **Tuesday 04<sup>th</sup> Feb 2020 from 09:00 am at 2000 Hotel.**

The purpose of the meeting is to confirm the progress and discuss the new work plan for the installation of the monitoring system.

The agenda of the meeting is hereby enclosed.

I thank you for your usual support.

Yours sincerely,

Eng. Aimé MUZOLA  
Chief Executive Officer



CC:

- Hon. Minister of Infrastructure
- Permanent Secretary - MININFRA

**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the 5<sup>th</sup> Steering Committee (SC)**

Venue: 2000 Hotel, 7<sup>th</sup> floor, Conference Room

Date: 4<sup>th</sup> February, 2020

Time	Subject	Person
8:30	Registration	
9:00	Introduction of Participants	
9:05	Remarks by CEO WASAC	CEO WASAC
9:10	Remarks by JICA Rwanda Representative	JICA Representative
9:15	Progress of the Project Output 4	JICA Expert
9:30	Proposal of Project Extension	JICA Rwanda Office
9:40	Discussion on Project Extension Period	WASAC, JICA
10:00	Progress of the Other Project Activities	JICA Expert
10:20	Discussion on Project Progress	WASAC, JICA
10:35	Closing Remarks by WASAC CEO	CEO WASAC
10:40	Remarks by MININFRA	MININFRA



Attachment 3 Implementation schedule concerning the equipment procurement and installment of monitoring system

Schedule of Project For Strengthening Non-Revenue Water Control in Kigali City Water Network

December 5th, 2019

Item	Remarks	Scope	Deadline	2019	2020	2021
<b>A Procurement Work</b>						
1-1	Electromagnetic Flowmeter	E+H	2020/2/26			
1-2	Ultrasonic Flowmeter	E+H	2020/2/26			
1-3	Mechanical Flowmeter	E+H (Sensus)	2020/2/26			
1-4	Pulse Reader	E+H (Sensus)	2020/2/26			
<b>B Designing, Manufacturing and Delivery Work</b>						
<b>1 Approval of Revised Specification</b>						
JICA HQ						
<b>2 Approval of Additional Works</b>						
JICA HQ						
Items from Japan						
4	Approval Drawings	Nihon Kanzei etc	2019/11/30			
5	Manufacturings	Nihon Kanzei etc	2020/2/12			
6	Inspection before shipment (Tokyo)	Nihon Kanzei etc	2020/2/19			
7	Delivery	Takaroka	2020/2/26			
8	Items from Abroad					
9	Approval Drawings	E-H, Saint Gobain	2019/10/18			
10	Manufacturings	E-H, Saint Gobain	2020/2/12			
11	Delivery	E+H, Saint Gobain	2020/2/19			
12	Inspection at WASAC warehouse	J, T	2020/2/26			
<b>3 Construction Work</b>						
3-1	Approval Drawings (construction)	Takeoka	2020/2/26			
<b>D Site Preparation Work</b>						
1	Kick-off Meeting & Site Survey	W, J, T	2019/10/14			
2	New Manhole Construction	WM12, 16, 17	2019/12/31			
3	Case Box for Flowmeter Preparation	WM7	2019/12/31			
4	VAT exemption application	W, J	2019/12/31			
<b>E Site Construction Work</b>						
1-1	Conduit pipe and cable preparation	Plural	2020/1/31			
1-2	Civil Work (Digging trench for cable)	W, J	2020/2/28			
1-3	Civil Work (Conduit pipe & Cable laying)	W, J	2020/4/7			
1-4	Pipe Support Breaking & Repairing Work	W, J	2020/4/30			
2	Installation Work	Plural	2020/6/5			
3	Commissioning Work	E-H	2020/6/5			
4	Final Acceptance Test	T, J	2020/6/12			
<b>Installation of the Monitoring System</b>						
OJT on NRW Rate Calculation						

W: WASAC, J: JICA, T: TAKAOKA

# Proposal of Project Extension

JICA Rwanda  
2020.02.04

## Extension period (Proposal from JICA)

- Proposal: 5 months extension  
(from **end of July 2020** to **end of December 2020**)

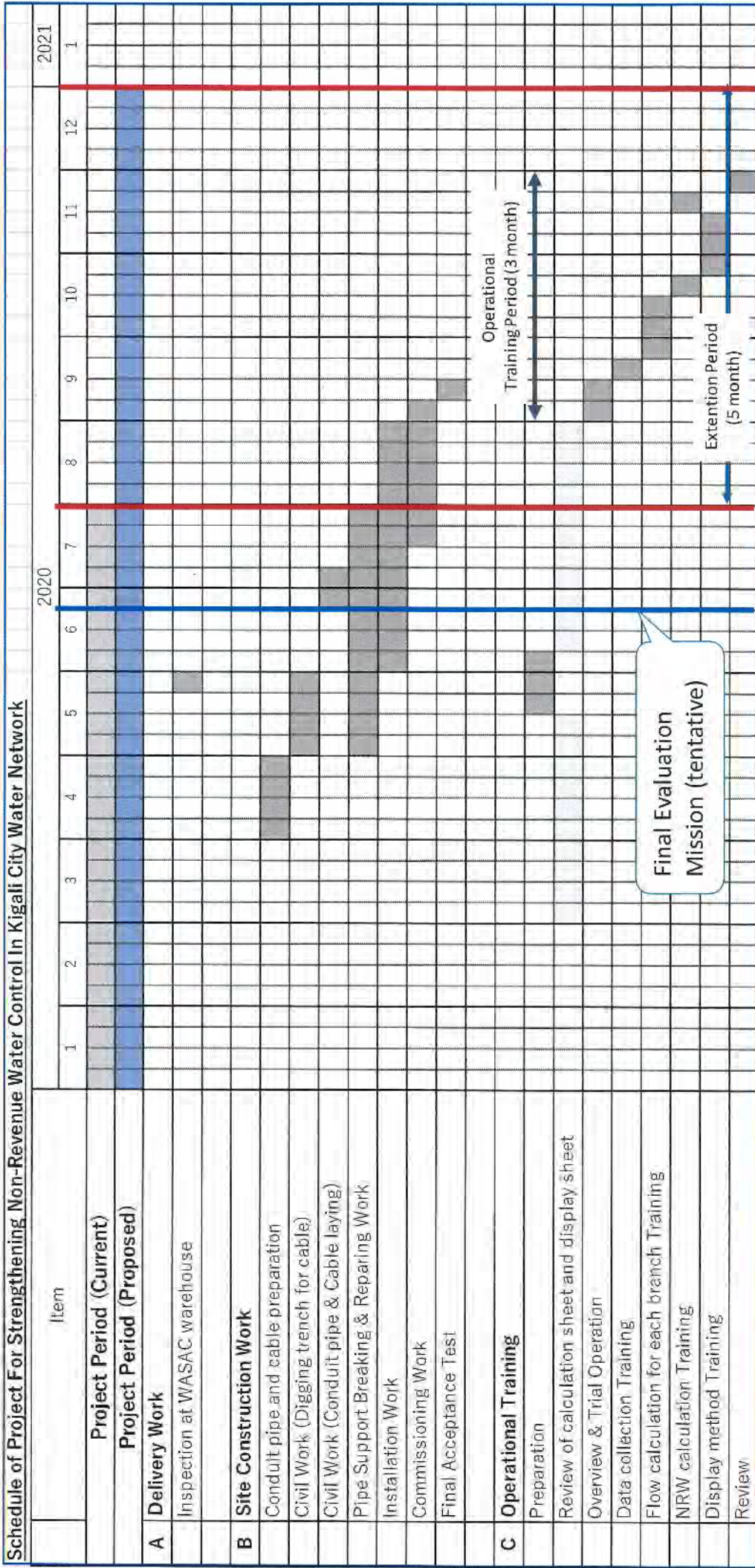
<Schedule>

- Installment:  
Done by September 2020
- Training on the system:  
September to November 2020 (3 months)
- Buffer:  
1 months (To mitigate the risk of the delay of installment)



# Schedule

Schedule of Project For Strengthening Non-Revenue Water Control In Kigali City Water Network



*[Handwritten signature]*

**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : the 5th steering committee meeting

Place : Leopold Hotel

Date : 4th February 2020

Name	Position
Masanobu MAYUSUMI	Position: JICA expert Mobile: 0788 824190 E-mail: mayusumi.masanobu@gmail.com
BATHIGE J. B	Position: NRW Manager Mobile: 0788307401 E-mail: bathige@wasac.rw
MWITUKYE James	Position: Director Commercial Service Mobile: +250788305361 E-mail: jmuritukye@wasac.rw
MUTAGUNGIRA Nestor	Position: Director of Urban Water & Sewerage Services Mobile: 0788403181 E-mail: mmutagungira@wasac.rw
Mano Shin	Position: Chief Representative, JICA Rwanda Office Mobile: 0788305523 E-mail: Mano.Shin@jica.go.jp
Virgile KWIZERA	Position: WATSAN Program Officer Mobile: 0784865730 E-mail: VirgileKWIZERA-RW@jica.go.jp
SARANDA Catherine	Position: Head of Nyarugenge Branch Mobile: 0782031897 E-mail: csaranda@wasac.rw
MWITOMBE Desire	Position: Zoning and Mapping service officer Mobile: 0733402552 E-mail: dmwitunge@wasac.rw
Vedaste ITANGISHAKA	Position: Assistant NRW project / WASAC - JICA Mobile: 0788537229 E-mail: shakavedaste@yahoo.fr
RUTEMBEZA J.M.V	Position: Ag WBO NYARUGENGE E-mail: rutpeace@gmail.com

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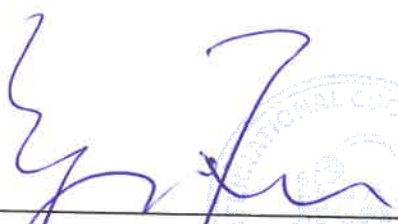
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Alexandre BIMENYIMANA	Position: Head of IT Business Application Mobile: 0788408394	E-mail: abimenyimana@waka.co.rw
Ekwendro Mery Ruseno	Position: Mobile: 0788952002	E-mail: gmerty@yahoo.fr
Aime Myola	Position: CEO Mobile: 0788534399	E-mail: amuyola@waka.co.rw
SHIGEO OTANI	Position: JICA Expert Mobile: 0781449355	E-mail: otani@kyowa.co.jp
	Position: Mobile:	E-mail:
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**MINUTES OF MEETING  
OF  
THE 6<sup>th</sup> STEERING COMMITTEE MEETING  
FOR  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK**



**HELD AT  
WASAC Board room**

Kigali, 3/ May, 2021



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Mr. MARUO Shin  
Chief Representative  
JICA Rwanda Office




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Eng. Alfred D. BYIGERO  
Chairman of Steering Committee &  
Chief Executive Officer, WASAC  
The Republic of Rwanda



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Mr. OTANI Shigeo  
Chief Advisor  
JICA Expert Team  
Japan



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Mr. Méthode RUTAGUNGIRA  
Project Director &  
Director of UWSS, WASAC  
The Republic of Rwanda

For monitoring, discussion on issues, challenges, solutions and way forward of the PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK (hereinafter referred to as "the Project"), the 6<sup>th</sup> meeting of Steering Committee (hereinafter referred to as "SC") was held on 27<sup>th</sup> April 2021.

As a result of the discussions, all parties came to agree on concerning matters referred the following;

### **1. Progress of the activities of the Project**

SC members generally understood the progress, issues and its countermeasures of the Project based on the result of joint management team monitoring of 26<sup>th</sup> March, 2021. Project activities will be implemented continuously until the end of the Project.

Following issues are pointed out and its countermeasures were proposed.

1) Output 1;

✓ 1.4 Necessity of inventory surveys in order to identify facilities improvement

The number of facilities to be surveyed is huge, while the resources are limited.

The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all Water Treatment Plants (hereinafter referred to as "WTPs"). As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.

✓ 1.6 Necessity for organizational and institutional changes identification

The organizational gaps have been identified through the implementation of the 5Year Strategic Plan (hereinafter referred to as "5YSP").

It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient. WASAC management recognized the importance of the organizational change and the re-structuring process is on-going.

✓ 1.8 WASAC secures budget in accordance with the priorities of Activity

Annual budget does not yet cover most of NRW reduction activities. CAPEX required for the NRW reduction seems to be huge compare to current available budget. WASAC should think about other sources of funds to support NRW reduction activities

(OPEX and CAPEX).

✓ 1.12 Revision of New Connection Policy and a Standard Enforcement Policy.

The New Connection Policy was formulated in January 2019. Later, it was observed the need to revised it again in order to ensure customers procured material are good quality. Because it has been confirmed that most of leaks are coming from service pipes (poor quality).

The gap between the policy and its implementation is still also a problem.

As countermeasure, WASAC should review the new connection policy and the enforcement of its implementation.

2) Output 2;

✓ 2.9 Training programs are developed and training courses are planned.

The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage despite completion of the NRW Reduction Procedure Manual (hereinafter referred to as "Manual") used for the training.

As countermeasure, it is needed to finalize, validate and disseminate the Manual. Manual shall be shared with the Human Resource department in order to be incorporated into WASAC's internal training program.

3) Output 3

✓ 3.13 Pilot project effect (Kadobogo and Ruyenzi)

Planned pilot activities in the pilot area were completed, although some equipment (Bulk meter, 2PRVs) was defected. The replacement took time because of limited maintenance budget from the Project and WASAC.

For the sustainability of NRW reduction, it should be continued to monitor the Pilot area (reading index, calculation of the NRW). WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the Project.

✓ 3.14 Reviews the results of Activities

In Pilot area (Ruyenzi), the NRW target ratio (25%) could not be achieved, due to poor quality water pipes and high pressure.

As countermeasure, it is necessary to replace small-diameter High Density



Polyethylene pipes which has high leakage is being conducted in the framework of JICA COVID-19 support. Preparation of BoQ for tender of material procurement is in process under the Project.

#### 4) Output 4

✓ 4.3 Procurement and installation of the Equipment for isolation of 4 branches Activity has been delayed due to Covid-19 restriction measures, but equipment procurement has been almost completed and the installation works have been commenced. The remaining works are to complete following tasks:

- To complete the transfer of customer registrations as the branch-to-branch boundary is moved.
- To replace default meters installed in SUSWAS project at an early time.
- To train WASAC team to properly operate the installed NRW monitoring system

## 2. COVID-19 Response supported by JICA

The SC committee members were informed of the progress of COVID -19 response activities that have been implementing within the framework of the NRW project as shown below.

- 1) Procurement of materials and equipment for Reduction of Intermittent Water Supply
- 2) Emergency water supply to people with limited access to clean water

In terms of 1), procurement of materials of "pipe and fittings for network repair" and "service pipes" and procurement of equipment of "FV & PRV" are in process and these will be delivered to WASAC before December by JICA, and WASAC will use and install them properly.

In terms of 2), water has been delivered through the support by the Project to 23 satellite public taps installed and procured by JICA. The delivery started in November, and has been meeting expectations of the beneficiaries. However, according to the initial mutual agreement among JICA and WASAC, the period of support was agreed for 6 month time, lasting until the end of May, 2021. Since the COVID-19 pandemic is still affecting Rwanda, WASAC according to the Appendix 4 requested JICA to continue support until the water tanker procured by JICA will be available.

JICA agreed to continue its support in accordance with the plan of WASAC to reduce the

number of remote public tap sites and frequency of water delivery gradually (Appendix 4). JICA agreed to continue the support until the water tanker's delivery or until the end of September, 2021 whichever comes first. JICA informed that the water tanker would be delivered to Kigali by August, 2021. JICA requested WASAC to make necessary arrangement for the proper water tanker operation and maintenance including but not limited to deploy of driver(s) and securing of budget for fuel, and WASAC agreed.

### **3. Approval of work plan for remaining activities and Revision of PO**

Based on the discussion in terms of the remaining activities of PDM and COVID-19 response to be implemented in the project period, JICA expert proposed the revised timeline as attached (refer to Appendix 5), and the SC members accepted this new schedule. It was also approved to change the PO as shown in Appendix 6.

Appendix:

1. Invitation letter to the 6<sup>th</sup> SC
2. Agenda of the 6<sup>th</sup> SC
3. Project Monitoring Sheet ver.8
4. Emergency Water Supply Plan
5. Implementation schedule of remaining work in the Project
6. Draft of the Revised PO
7. Presentation document: Progress of the Project
8. Presentation document: COVID-19 Response
9. List of Attendants



Kigali, 22 APR 2021  
N° 11.07.024/1962/21/DUWSS-CEO/jb

To: Chief Representative  
JICA- RWANDA

Dear Sir,

**RE: Invitation to the sixth Steering Committee (SC) meeting of the project for Strengthening Non-Revenue Water control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

The Steering Committee (SC) meeting is scheduled on Tuesday, 27<sup>th</sup> April 2021 from **08:30 at WASAC board room**

The purpose of the meeting is to confirm the progress and approve the new work plan for the installation of the monitoring system.

The agenda of the meeting is hereby enclosed.

I thank you for your usual support.

Yours sincerely,

  
Eng. Alfred BYIGERO  
Chief Executive Officer



CC:

- Hon. Minister of Infrastructure – MININFRA
- Permanent Secretary –MININFRA





Kigali, **22 APR 2021**  
N° 11.07.024/19.6.6/21/DUWSS-CEO/jb

**To: Permanent Secretary / MININFRA  
KIGALI**

Dear Madam,

**RE: Invitation to the sixth Steering Committee (SC) meeting of the project for  
Strengthening Non-Revenue Water control in Kigali city water network**

Reference is made to the Record of discussion signed on March 30<sup>th</sup>, 2016 between WASAC and JICA concerning the Project for strengthening Non-Revenue Water Control in Kigali City water network in its paragraph II.3 and annex indicating the project outputs, work plan and all stakeholders involved in its implementation.

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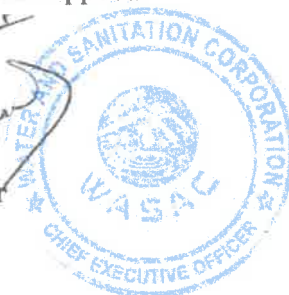
It is in this context that we would like to request you to nominate one official from MININFRA to attend this meeting

The agenda of the meeting is hereby enclosed.

I thank you for your usual support.

Yours sincerely,

  
**Eng. Alfred BYIGERO**  
Chief Executive Officer



CC:

- Hon. Minister of Infrastructure – MININFRA

*“Dignifying Life”*

**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the 6<sup>th</sup> Steering Committee (SC)**

Venue: **WASAC HQ board room**

Date: **27<sup>th</sup> April, 2021**

Time	Activity	Responsible
8:30	Registration	
9:00	Introduction of Participants	
9:05	Remarks by CEO WASAC	CEO WASAC
9:10	Remarks by JICA Rwanda Representative	JICA Representative
9:15	Progress of the Project	Project Director /JICA Expert
10:00	Progress and Challenges on the COVIT-19 Response	Head of LDPM
10:30	Presentation and Approval of work plan for remaining activities, Revision of PO	JICA Expert
10:40	Discussion	All
11:00	Closing remarks by MININFRA	MININFRA representative




## Appendix 3. Project Monitoring Sheet Ver.8

TO CR of JICA RWANDA OFFICE

### PROJECT MONITORING SHEET

**Project Title: Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network**

**Version of the Sheet : Ver. 8 (Term: July, 2017 – March, 2021: 2nd Phase)**

**Name: Shigeo OTANI**

**Title: Chief Advisor/ Non-Revenue Management**

**Submission Date: March 26, 2021**

#### I. Summary

##### 1 Progress

##### 1-1 Progress of Inputs

##### 1-1-1 Japan Side

##### (1) List and Assignment Terms of Japanese Experts

##### a. Working in Rwanda

Table 1 Assignment Term in Rwanda (Phase 2) Working in Japan

	Field in Charge	Name	Duration		MM
			From	To	
1	Chief Adviser/Non-Revenue Water management	Shigeo OTANI	2017/8/5	2017/10/16	2.43
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/9/18	1.50
			2018/10/20	2018/11/29	1.37
			2019/1/15	2019/3/9	1.80
			2019/4/15	2019/6/2	1.63
			2019/7/15	2019/11/24	4.43
			2020/1/21	2020/2/15	1.06
2	Adviser/Non-Revenue Water Management	Hiroyuki HIGUCHI	2017/8/5	2017/9/17	1.47
			2018/5/24	2018/7/12	1.27
3	NRW Reduction Plan 1 (1)	Chiaki SUZUKI/ Hiroyuki YAMAGUCHI Toru TOYODA	2017/8/5	2017/9/23	1.67
			2018/1/16	2018/3/1	1.50
			2018/5/9	2018/7/7	1.77
			2018/10/12	2018/12/27	2.57
4	NRW Reduction Plan 1 (2)	Hiroyasu YODA	2017/11/8	2017/12/22	1.50
			2018/3/18	2018/5/16	2.00
			2018/8/5	2018/10/3	2.00
			2019/2/18	2019/4/6	1.60
5	NRW Reduction Plan 2 (2)	Nobuyuki TSUTSUI	2017/8/5	2017/9/3	1.00
			2019/10/11	2019/11/30	1.70
			2021/3/6	2021/3/30	0.83
6	Leak Detection	Junichi TAKAHASHI	2017/12/3	2018/2/15	2.50
7	Pipe Repairing and Service Connection (1)	Tokiya MOMOZONO	2018/2/5	2018/4/5	2.00
8	ICT	Shigeo OTANI	2021/3/6	2021/3/30	0.83
Total MM					42.43

Note: Man Month (MM)

Item	Output	Equipment	Description	Qty.	Procured by	Procurement Status	Handover Status	Date of Handover
14		Intermittent Water	Service pipe	1 Unit	KEC	Not yet	Not yet	-
15			PRV, FV	1 Unit	KEC	Not yet	Not yet	-
16	4	Equipment for hydraulic isolation of 4 Branches and development of the monitoring systems	Flange Adapter, Dismantling joint.	1 Unit	JICA	Completed	Completed	-
17			Valve and pipes	1 Unit	JICA	Completed	Completed	-
18			Electro-magnetic flow meter, water pressure gauge, data logger,	1 Unit	JICA	Completed	Completed	-
			Server	1 Unit	JICA	Not yet	Not yet	
19			Monitoring systems (facility)	1 Unit	JICA	Not yet	Not yet	-
20	-	Equipment for project operation	Vehicle (minibus)	1 Unit	JICA	Completed	Not yet	-
			Vehicle (pickup)	1 Unit	JICA	Completed	Not yet	-
			Multifunctional photocopier	1 set	KEC	Completed	Not yet	-

Note: KEC (Kyowa Engineering Consultants c. co.jp)

### (3) List of Facilities Provided for the Project

Table 4 List of Equipment

#### Facilities to be Provided

Lot	Item	Contents	Unit	Quantity	Executor	Status	Handing over to WASAC
Lot 1	Chambers for Pilot Areas	3 chambers for Pilot Area 1 1 chamber for Pilot Area 2	set	1	Consultant	May. 2017, Sept, 2018 Completed	Completed
Lot 2	Chambers for Monitoring System		set	23	Consultant	Feb. 2019 Completed	Completed
Lot 3	Monitoring System		set	1	Consultant	In progress	Not yet

#### 1-1-2 Rwanda Side

##### (1) Counterpart

Table 5 Responsible persons for output activities

Output	Name	NRW section lower organization
Output 1	Jean Berchmas BAHIGE	Manager of NRW, UWSS
Output 2	Celestin MWAMBUTSA	Head of water distribution services, WOS, UWSS
Output 3	Désiré NTAMUTURANO	Head of leak detection and pressure management, NRW, UWSS
Output 4	Jean Paul KAYITARE	Head of zoning and mapping services, NRW, UWSS

##### (2) Facilities

- Office space for Japanese experts at WASAC Head Office, office furniture
- Training room with the capacity of about 20 persons

### (3) Steering Committee (SC)

The results of holding SC meetings and future plans and agenda are as shown in the table below.

Table.7 The held time of the SC meeting and the agenda

Time	Holding time	Theme contents
1st	April 3, 2017	<ul style="list-style-type: none"><li>• Discussion of the work plan (WP1), approval</li><li>• Confirmation of the Rwandan side burden matter</li></ul>
2nd	October 12, 2017	<ul style="list-style-type: none"><li>• Progress confirmation of the project</li><li>• Common knowledge of the NRW reduction 5YSP</li><li>• Approval of the second work plan</li><li>• About the enforcement of the project evaluation</li></ul>
3rd	August 28, 2018. At the time of Project Monitoring by JICA	<ul style="list-style-type: none"><li>• Result of Joint Monitoring</li><li>• Procurement and Installation Plan of the Equipment for Monitoring System</li><li>• Monitoring result of the JICA Monitoring Survey Mission</li></ul>
4th	May 22, 2019	<ul style="list-style-type: none"><li>• Progress of the Project</li><li>• Rescheduling of Equipment Procurement and Installation of Output 4</li><li>• Additional Activities</li><li>• Revised Work Plan for Phase 2</li></ul>
5th	February 4, 2020	<ul style="list-style-type: none"><li>• Progress and problems in the procurement and installation of equipment in the Output 4 activities</li><li>• Extension of the Project period</li><li>• Progress of other project activities</li></ul>
6th	April 27, 2021	<ul style="list-style-type: none"><li>• Revision of the Plan of Operation after resumption of the work in Rwanda</li></ul>
7th	At the time of project completion, scheduled in Oct 2021	<ul style="list-style-type: none"><li>• Project evaluation</li></ul>

### (4) Weekly Meeting

As a rule, PIM meetings are held basically at the end of every week and the activities for the week are reported, the activities scheduled for the following week are confirmed and pending issues, matters of concern, requests, etc., are discussed. The meetings are also utilized as a venue for training through seminars and workshops on matters proposed by the experts, etc. Meetings have been held 101 times as of the end of March 2021 (including thirty times in Phase 1).

### (5) Project Progress Report (Part 6)

Project Progress Report (Part 6) was submitted to JICA and WASAC in January 2021.



the seminar on May 29, 2017.

**1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.**

The implementation of the activities for identifying reservoirs that required urgent repair for overflow, one of the causes of water leakage, and repairing equipment in the facilities of the reservoirs, was proposed at the 4th SC. The functional survey of the 36 existing distribution reservoirs at the 26 sites in Kigali selected by the branch offices of WASAC was conducted in July and August 2019. The survey revealed that the distribution reservoirs at nine sites are in the greatest need of urgent repair. To prevent overflow from the identified reservoirs, float valves (FVs) were procured and installed in the reservoirs.

In the above-mentioned work, a discrepancy was found between the number of distribution reservoirs at 158 sites in Kigali in the GIS list of WASAC and the number of the existing reservoirs. It was also revealed that the reservoirs had not been named systematically and the structures and functional state of facilities of each reservoir were not known. In addition, the survey found overflow water leakage due to the absence or defect of FVs at many reservoirs. Based on these observations, it was decided to conduct an inventory survey to elucidate the functional state of the distribution reservoirs as an activity for Output 1. The results of the survey were to be used as the basic data for the implementation of 5YSP activities in the future.

The first survey of the distribution reservoirs was conducted between May and August 2020. The branch offices selected 55 reservoir sites where they found problems among the 158 sites in Kigali for the survey. Engineers were hired for the survey. The staff of the NRW Control Services, GIS Team, and branch offices of WASAC also participated in the survey. The same survey was conducted for the second time at 61 sites in September and October.

Based on the results of the surveys mentioned above, the list of the reservoirs in Kigali was updated. WASAC will create a database of the updated list for sharing and use the list as baseline data for the preparation of the plan for a 5YSP activity, functional improvement of the distribution reservoirs in Kigali. The reservoirs requiring the installation or replacement of FVs have been identified and the BOQ for the required equipment have been prepared.

The number of facilities to be surveyed is huge and the resources are limited. The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.

**1-5 Based on the results of Activity 1-3 and 1-4, management team prepares a draft of 5YSP.**

The Final Draft of the 5YSP was completed in September 2017, and was approved at the 2nd SC which was held on October 12, 2017.

After responding to the comments received, the final approval of the WASAC Board of Directors was obtained on April 27. Implementation of the plan has been delayed by 1-year relative to the schedule, and will be commenced in fiscal year 2018/2019.

**1-10 The management team holds seminars and presents 5YSP (Activity 1-8) for WASAC and other concerned parties.**

5YSP was shared with the relevant persons in MININFRA and WASAC at the SC meeting on October 12, 2017.

The Project Manager and JICA expert had visited all WASAC branches between April and July 2018 and explained 5YSP to the staff members of the branches to make all of them understand it. The recording format for the monthly 5YSP activity report required for the explanation was finalized.

An in-house workshop was held in WASAC on July 19, 2018, to identify activities required for achieving the goal of the first year of the Non-Revenue Water Reduction 5YSP from the progress of and the problems found in the implementation of the plan.

**1-11 The management team facilitates implementation and the monitoring of the 5YSP.**

Monitoring team (5 persons) were officially appointed by CEO on September 3, 2018.

Monitoring is carried out every quarter in accordance with the reports (monthly reports) from the branches. Monitoring started in July 2018. The contents of the reports are evaluated and a workshop on the reports is held every quarter.

The NRW Section, DUWSS, WASAC, prepared the quarterly monitoring report for fiscal year (FY) 2019/2020 4Q and submitted it to the Monitoring Team on September 25th, 2020. With the submission of the report, the activities in the second year of the project, FY 2019/2020, was completed. A workshop on the report was held on October 8th, 2020. The participants in the workshop evaluated the implemented NRW-reduction activities and discussed the ways to promote 5YSP in the future.

**1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and monitoring of standard compliancy of pipes with the existing pipe standards.**

Initially, this activity was planned to be done by the Project. However due to the emergency to comply with RURA, this document was done by Commercial Directorate of WASAC (Connection Policy, Jan, 2019).

The reports on new connections in the 5YSP monthly reports confirmed whether the new connections had been established in accordance with the guidelines. But WASAC has not been able to provide guidance on strict compliance with the guidelines. And, it was observed the need to revised again the new connection policy in order to ensure customers procured material are good quality. Because it has

**2-7 In-room training and OJT on meter reading, billing, and customer services for the pilot project are conducted.**

Done.

**2-8 Training materials on NRW are reviewed and updated.**

The team has compiled the manual based on the various training materials used in the Output 2 activities and adding the methods of activities practiced in the Output 3 pilot project to those materials. The manual shall be used in the formulation of training programs.

**2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are planned.**

The Directorate of Support Services (SSD) is responsible for the training programs in WASAC. The training programs in the Project should be incorporated into the training scheme of the entire WASAC to disseminate the NRW control technology to all staff members of WASAC. The cooperation between the NRW Control Services and SSD shall be strengthened for the technology dissemination.

The training is to be planned for the eleven subjects mentioned below that have been recognized as activities with high short-term effects in the Pilot Project and recognized as important subjects in the Pilot Project activities.

Table 10 Training Courses on NRW Reduction Activities

Item	Subject
1	Introduction to NRW Reduction Activities
2	High-Pressure Control
3	Water Distribution Control
4	Leakage Surveys and Repair
5	Replacement of Water Supply and Distribution Pipes
6	Management of Distribution Reservoirs
7	Control of Volume of Water Distribution
8	Maintenance of Charge Collection Data and Customer Meters
9	Monitoring of NRW Rates
10	Preparation for NRW Reduction Activities
11	Handling of Survey Equipment

The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage despite completion of the manual. As countermeasure, finalize the manual validation and dissemination. Share the manual with the HR in order to be incorporated into WASAC's internal training program.

**3-8 The action team conducts measures for reducing surface leakage (visible leakage).**

Area 1: In process as daily routine work of Branch office

Area2: Large quantity of the existing leakage was measured. Visible leakages were found at 16 places in March, 14 places in July and August.

**3-9 The action team measures NRW after conducting Activity 3-8 and examines their effectiveness.**

Done.

**3-10 The action team conducts measures for reducing underground leakage (invisible leakage).**

Area 1: Done.

Area2: Step test was conducted during May to July 2019.

**3-11 The action team measures NRW after conducting Activity 3-10 and examines their effectiveness.**

Area 1: Done

Aria 2: Qmnf measurement was conducted during June to September 2019.

**3-12 The Action team conducts measures for reducing high water pressure.**

Area 1: PRVs are set at PM2 and PM3 in October, 2018. Manholes were constructed with concrete block. PRV at PM1 was set in September 2019.

Aria 2: Based on topographic and network conditions, PRVs were installed. Two in RY1 in Sept., one in RY2 in Oct., 2018. Additionally, one each in RY1 and RY3. Ball valve in RY1.

**3-13 The action team measures NRW after conducting Activity 3-12 and examines their effectiveness.**

Area 1: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.

Aria 2: The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. NRW rate before and after PRV adjustment was compared in A2 (Small DMA). Also, Qmnf before and after setting PRV was compared. Qmnf was measured.

Planned pilot activities in the pilot area were completed, although some equipment (Bulk meter, 2PRVs) was defected. The replacement took time because of limited maintenance budget from the Project and WASAC.

For the sustainability of NRW reduction it should be continued to monitor the Pilot area (reading index, calculation of the NRW, progress). WASAC should ensure the availability of necessary budget for the

project activities shall be reflected in the 5YSP.

**3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.**

The action team invited the heads of Kacyiru and Nyarugenge Branches that were responsible for the water services in Pilot Areas 1 and 2, respectively, to a seminar held on February 14, 2020.

When the completion report has been finalized after the second review by the C/P, the action team shall hold a workshop on the report for all WASAC staff.

**3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.**

It was decided to set up the manual preparation team of the pilot project inside WASAC and prepare the manuals in coordination with this team. The manual preparation meetings were regularly held after the kickoff meeting held on January 29<sup>th</sup>, 2019.

The Pilot Project Completion Report and the NRW-reduction Manual have already been prepared. WASAC shall hold an in-house workshop to disseminate the report and manual in WASAC.

**【Activities of Output 4】 :**

**4 branches in Kigali establish the system to measure NRW rates accurately.**

**4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.**

Done.

**4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flowmeters and pressure gauges are determined by field survey.**

Done.

**4-3 Chambers are constructed as appropriate.**

Done.

**4.4 Electromagnetic flow meters and pressure gauges to be procured and installed**

JICA will be responsible for the procurement and installation of the monitoring equipment. JICA will employ a contractor for the procurement and installation. In accordance with the original plan of holding the tender for the procurement and installation of the equipment in Kigali, JICA announced the invitation to the tender on May 26, 2017. The tender failed in October 2017 after all bidders had been disqualified because their financial states and/or the technical specifications of the equipment in their bid proposals did not meet the tender requirements. Therefore, JICA decided to hold another tender for a blanket

### **1-3 Achievement of Output**

#### **(1) Output1 Planning capacity of NRW reduction of WASAC is enhanced.**

**Indicator 1-1: 5 YSP is reviewed and updated, taking into account of the results of the Pilot Project.**

The Project updated or added/modified some indicators in the 5YSP after reviewing the monitoring results of the pilot project.

The Project held a review workshop inviting primary members including managers to look back and update the 5YSP in July 2019. The participants evaluated the achievements of the pilot project according to monitoring indicators as well as discussed necessary additional further actions. The workshop concluded some updates of implementation and monitoring plans with new indicators.

Primary indicators updated/added are as follows:

- Number of PRV installed
- Number of customer meters replaced
- Number of customer inspections conducted
- Number of customer meters inspected their accuracy

WASAC plans to review and update the plan continuously with official approval of the WASAC's board.

**Indicator 1-2: All the project achievements are shared by WASAC and other concerned parties by holding seminars.**

- Sharing information within WASAC:

All the progresses and challenges the Project encountered are being shared through various workshops, seminars, management meetings, and SC meetings.

- Sharing information with concerned parties:

MINIFRA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been well shared.

The Project will hold a final seminar to present all the achievements of the Project by the end of the Project period.

#### **Overall assessment:**

The Project has achieved the Output 1 as of the Terminal evaluation.

It can be evaluated that the cycle of Plan-Do-Check-Action, PDCA cycle, has been well applied in WASAC's job place.

## Pilot Area 2:

PRV has been contributing to NRW reduction up to the certain level; however, it is difficult to reach the target figure. Considering the geographical condition of the target area, following measures are additionally required; 1) necessary to conduct pressure control more segmentally by altitude basis; and 2) necessary to reinstall water service pipes and to redesign water distribution network.

This nonattainment situation should be also analyzed from the viewpoint of the level set as the target figures. Firstly, the Project set the target figures at rather challenging level. Secondly, NRW rate reduction can be attained by not only excellent manpower but also material inputs including infrastructure and equipment. NRW reduction requires approaches from both sides. Moreover, thirdly, the target area is located at quite challenging geographical condition for NRW reduction with huge difference of elevation. Considering such feature of NRW reduction at this target area, the Project has faced difficulties in terms of reaching the target figure.

### **Indicator 3-2: Action team members share experiences at workshops regarding implementation of the pilot projects.**

In the same manner as the indicator 1-2, the Action team members shared experiences and lessons through workshops and a variety of meetings.

### **Indicator 3-3: The action team prepares a completion report of the pilot project.**

The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will review and finalize them through workshops.

## **Overall Assessment:**

The Project has almost achieved the Output 3 as of the Terminal evaluation.

The aim of this Output is to enhance capacity to cope with expected and unexpected events at working fields, employing the technical knowledge and skills obtained in the Output 2.

Through implementation of the pilot project, WASAC developed their technical capacity on NRW reduction. Actual experiences at working fields directly contributed to enhancing their technical proficiency. Followings are the major technical items which the counterparts enhanced: formulation of DMA; conducting tests of customer meters, planning and conducting leak detection survey including step test and Qmin measurement; management and control water pressure; planning of replacement of aged and substandard pipe, making customer mapping.

In addition, the cost benefit analysis of countermeasures to NRW reduction was conducted in the framework of this Output, and concluded their countermeasures economically viable.

installation, meter replacement, leakage survey, and others. Their plans comprise a part of the annual action plan of entire WASAC.

**Indicator 3: The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction**

The indicator 3 has not been achieved, or in other words, the achievement status is moderate at this moment. This indicator contains two different issues, firstly, recognition of the effects of NRW reduction by WASAC management strata, and secondly, budget approval.

The management strata of WASAC fully recognized the effectiveness of NRW reduction measures through the pilot project and already extended the same countermeasures such as installation of PRV and float valve, FV, balk meter assessment, customer analysis, customer inspection, on site meter testing, customer meter replacement outside of the pilot project area.

On the other hand, budget allocation for branches on NRW reduction has been facing immense challenges. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.

**Overall assessment:**

The Project purpose has been almost achieved.

Towards the Project purpose “enhancement of WASAC’s capacity to conduct NRW reduction measures”, the Project took approaches from four (4) aspects, 1) planning aspect, 2) technical aspect, 3) applied technical aspect, and 4) establishment of NRW rate measuring system. As the achievement status of the Output 1 shows, WASAC has been steadily implementing and monitoring NRW works in accordance with the 5 YSP by PDCA cycle. In 2) technical aspect, WASAC’s staffs acquired knowledge and skills through a series of trainings in the Output 2. Capacity to cope with actual situations/challenges at working field is also enhanced through the pilot project, as 3) applied technical capacity, the Output 3. Only 4) as the Output 4: establishment of NRW rate measuring system is still remained.

On the other hand, looking at fulfillment status of the indicators, it has to be pointed out that actual budget allocation is not matched with annual action plan. Since WASAC itself cannot increase its organization’s revenue without raising water tariff as an independent corporation status, this insufficient situation is not attributed to WASAC; however, this deviation of NRW action plan is strongly influential on WASAC’s NRW reduction efforts on the basis of the acquired technical skills by the Project.

In conclusion, although the Project has challenges on budgetary aspects, the Project activities successfully led to capacity enhancement of WASAC. Subtracting the indicators’ moderate achievement



- Concept Note preparation for decision of branch boundary.
- Survey and adjustment to decide to points to be construct the chambers.
- DMA formation of Pilot Area 1 and Area 2 (installation of valves, adjustment of tertiary pipe)
- Preparation of 5YSP for NRW reduction.
- Joint visit JICA-WASAC of WASAC's upcountry branches.
- Training in Japan
- Training in the third Country

**1-9 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

None

## **2. Delay of Work Schedule and/or Problems**

In view of the delay of the Project caused by COVID-19, it was decided to extend the project to December 2021 ~~in~~ <sup>from</sup> December 2020.

## **II. Project Monitoring Sheet I & II**

As attached.

AS

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**Project Monitoring Sheet I (Revision of Project Design Matrix)**

**Project Title:** Project for Strengthening Non-Revenue Water (NRW) Control in Kigali City Water Network

**Version 5**

**Implementing Agency:** WASAC

**Dated March 26, 2021**

**Target Group:** WASAC staff engaged in Non-Revenue Water reduction

**Period of Project:** 2021/2021

**Project Site:** 6 Branches in Kigali city (Kacyiru, Nyamirambo, Gikondo, Nyarugamba, Torera and Kanombe)

**Model Site:**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement
<b>Overall Goal</b> WASAC conducts NRW reduction measures as planned for Kigali city.	NRW rate of Kigali city (year 2022/23 : 25 %)	Annual report of WASAC	The Government policy on NRW remains as highly prioritized.	Indicators of PDM for Overall Goal was decided with 25%. Achievement in 2020/2021 was 40.3%. NRW rate 15.3% has to be reduced to achieved the target. It is a challenge to reach the target figure by the time of the goal setting 2022/2023. Achievement of the Overall goal is heavily dependent on securing of budget of WASAC.
<b>Project Purpose</b> WASAC's capacity is enhanced to conduct NRW reduction measures as planned for Kigali city.	<ol style="list-style-type: none"> <li>5-year Strategic Action Plan for NRW reduction is approved by the Minister of Infrastructure.</li> <li>Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC</li> <li>The management at WASAC recognizes the effects of NRW reduction, and approves the budget of each branch for implementing annual action plan for NRW water reduction</li> </ol>	<ol style="list-style-type: none"> <li>5-year Strategic Action Plan for NRW reduction approved by the Minister of Infrastructure.</li> <li>Annual action plan of WASAC.</li> <li>Budget of WASAC.</li> </ol>	<p>The non-revenue water section at WASAC is not subject to large scale reorganization.</p> <p>WASAC staff do not resign after training by the Project.</p> <p>Large scale natural disaster does not occur.</p>	<p>SYSP was approved by the Board of Directors of April 27, 2019. The MININFRA is aware.</p> <p>The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area. Though in the future more specific actions for NRW reduction is needed. NRW reduction Branches annual budgets should be incorporated in the company NRW reduction budget.</p> <p>The budget of NRW reduction activity was decided in WASAC Action Plan. On the other hand, that budget is not fully allocated at an implementation level for branches on NRW reduction. In the case of the year 2019/20, although WASAC headquarter approved annual action plans, the actually allocated budget for NRW reduction works was lower than the planned budget. The difference created discrepancy between the plan and the actual activities.</p>
<b>Outputs</b>				
1 Planning capacity of NRW reduction of WASAC is enhanced.	<ol style="list-style-type: none"> <li>1-1 5 year Strategic Action plan is reviewed and updated, taking into account of the results of the Pilot Project.</li> <li>1-2 All the project achievements are shared by WASAC and other concerned parties by holding seminars.</li> </ol>	<ol style="list-style-type: none"> <li>1-1 Records of the project</li> <li>1-2 Records of the project</li> </ol>		<p>SYSP is being updated considering the result of its implementation for past 2 years, findings from the pilot project and dissemination from the MP studies. The final draft of the revised version is expected in the beginning of May and will follow the normal approval process.</p> <p>All the progresses and challenges the Project encountered are being shared through various workshops, seminars, project management meetings, and SG meetings.</p> <p>MININFRA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been shared.</p> <p>The Project will hold a final seminar to present all the achievements of the Project by the end of the Project period.</p>
2 Basic knowledge, skills and technique on NRW control are acquired by WASAC.	<ol style="list-style-type: none"> <li>2-1 More than 300 number of trainees receive training.</li> <li>2-2 WASAC human resource development plan includes training programs prepared by the project.</li> </ol>	<ol style="list-style-type: none"> <li>2-1 Records of the project.</li> <li>2-2 Records of the project</li> </ol>		<p>596 cumulative number of trainees were received training (60 numbers of the staff).</p> <p>The manual containing training courses is ready and in validation process by the technical and commercial directorate.</p> <p>Finalize the manual validation and dissemination and share the manual with HR in order to be incorporated into WASAC's internal training program.</p>
3 WASAC learned how to conduct NRW reduction measures through the implementation of the Pilot Project.	<ol style="list-style-type: none"> <li>3-1 NRW rates are reduced at each pilot area as follows: Pilot Area 1: from 37% to 20% and Pilot Area 2: from 68% to 25%.</li> <li>3-2 Action team members share experiences at workshops regarding implementation of the pilot projects.</li> <li>3-3 The action team prepares a completion report of the pilot project.</li> </ol>	<ol style="list-style-type: none"> <li>3-1 Records of the project</li> <li>3-2 Records of the project</li> <li>3-3 Survey plans for locations outside the pilot project</li> </ol>		<p>Result of NRW rate were not to reach the target figures. Q3 of 2019/2020 (in March 2020) Pilot Area 1: 25% Pilot Area 2: 56%</p> <p>In the same manner as the indicator 1-2, the Action team members share experiences and lessons through workshops and a variety of meetings.</p> <p>The draft completion reports of the pilot project were already presented to WASAC from the JICA experts in October 2019 for the Pilot Area 1 and in February 2020 for the Pilot Area 2. WASAC will review and finalize them through workshops</p>
4 4 branches in Kigali establish the system to measure NRW rates accurately.	4-1 NRW rate of each branch is periodically monitored and reported in PIP (Performance Improvement Plan) every month.	4-1 Records of the project		<p>The system to measure NRW rate has not been installed yet due to delay in equipment procurement. Though equipment procurement and their installation works have been suspended under COVID-19 situation, the works resumed from February 2021.</p> <p>In order for the Project's system to function completely, repairing works of BUSWAS system by WASAC is indispensable, also re-registration works of customers whose residential location lie in boarder area of the targeted branches.</p> <p>CUT for NRW rate calculation and reporting by using data obtained from monitoring system is also planned after the equipment installation.</p>



Output 3: WASAC Items to conduct NRW reduction measures through the implementation of the Pilot Project.

Item	Plan	Actual	Program 4 - Expansion of Construction of Chukhar												Achievements	Issues	Countermeasures			
			1	2	3	4	5	6	7	8	9	10	11	12						
<b>A. Preparation</b>																				
3.1	An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2. The action team consists of the current NRW PM, the current NRW PM, and other members of the team.	Actual																Member of the team was identified in August 2017.	None	None
3.2	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.3	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.4	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
<b>B. Activity of Pilot Area 1 Rehabilitation</b>																				
3.5	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.6	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.7	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.8	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.9	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.10	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.11	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.12	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
<b>C. Activity of Pilot Area 2 Rehabilitation</b>																				
3.5	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.6	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.7	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.8	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.9	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.10	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.11	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None
3.12	The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2. The action team identifies the current NRW reduction measures at Pilot Area 1 and Area 2.	Actual																None	None	None

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### Appendix 5. Implementation Schedule for Remaining Work in the Project

Project Phase	Phase 2																
	2020			2021												2021	
	Month	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Dec	Jan
<b>【Activities in PDM】</b>	<b>Main Activity</b>																
<b>【Output 1】</b>	Enhancement of Planning capacity of NRW reduction of WASAC												<b>End of the Project</b>				
1.4 Inventory Survey (Reservoir)																	
1.6 Organizational and Institutional Change																	
1.8 Securing of the Budget in accordance with the priority of Activities																	
1.12 Revised NEW Connection Policy and a Standard Enforcement Policy																	
<b>【Output 2】</b>	Acquisition of Basic knowledge, skills and technique on NRW control by WASAC																
2.9 Development training programs/ Planning training courses																	
<b>【Output 3】</b>	Learning how to conduct NRW reduction measures through the implementation of the Pilot Project																
3.13, 14 Pilot Project																	
<b>【Output 4】</b>	Establishment of the system to measure NRW rates accurately in 4 branches in Kigali (Monitoring System)																
4.3 Procurement of the Equipment																	
4.3 Installation of the Equipment																	
4.3 Commissioning and Training																	
4.5 Measurement of system input to each Branch																	
4.6 Calculation and reporting of NRW rate for each Branch																	
<b>【COVID-19 Measure Support】</b>																	
1. Emergency Water Supply																	
2. Reduction of Intermittent Water Supply																	
2.1 Pipe and fittings for network repair																	
2.2 Service pipe (Ruyenzi)																	
2.3 Float Valve (FV) and Pressure reduction valve (PRV)																	
A Joint Monitoring																	
Monitoring mission from JAPAN																	
B Steering Committee (SC)																	
D Outputs																	
Monitoring Sheet																	
Report																	

Regent: — The Project Incrementation  
- - - WASAC implementation

Schedule of Major Japanese Inputs	Month	2016												2017												2018												2019												2020												2021												2022																																																																																																																																																																																																																																	
		Year 1			Year 2			Year 3			Year 4			Year 5			Year 6			Year 7			Year 8			Year 9			Year 10			Year 11			Year 12			Year 13			Year 14			Year 15			Year 16			Year 17			Year 18			Year 19			Year 20			Year 21			Year 22			Year 23			Year 24			Year 25			Year 26			Year 27			Year 28			Year 29			Year 30			Year 31			Year 32			Year 33			Year 34			Year 35			Year 36			Year 37			Year 38			Year 39			Year 40			Year 41			Year 42			Year 43			Year 44			Year 45			Year 46			Year 47			Year 48			Year 49			Year 50			Year 51			Year 52			Year 53			Year 54			Year 55			Year 56			Year 57			Year 58			Year 59			Year 60			Year 61			Year 62			Year 63			Year 64			Year 65			Year 66			Year 67			Year 68			Year 69			Year 70			Year 71			Year 72			Year 73			Year 74			Year 75			Year 76			Year 77			Year 78			Year 79			Year 80			Year 81			Year 82			Year 83			Year 84			Year 85			Year 86			Year 87			Year 88			Year 89			Year 90			Year 91			Year 92			Year 93			Year 94			Year 95			Year 96			Year 97			Year 98			Year 99			Year 100
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1. Planning capacity of NRW reduction of WASAC is enhanced.																																																																																																																																																																																																																																																																																																											
1-1 A management team is organized to prepare 5-year Strategic Plan (SYSP) for NRW reduction.																																																																																																																																																																																																																																																																																																											
1-2 The management team assesses NRW reduction measures currently conducted by WASAC for Kigali city and other secondary cities (14 branches outside Kigali city) and identifies problems.																																																																																																																																																																																																																																																																																																											
1-3 Based on the problems identified by Activity 1-2, the management team proposes methods and procedures to conduct NRW reduction measures by WASAC in the future.																																																																																																																																																																																																																																																																																																											
1-4 The management team undertakes inventory surveys in order to identify facilities improvement necessary to conduct methods and procedures proposed by Activity 1-3.																																																																																																																																																																																																																																																																																																											
1-5 Based on the results of Activity 1-3 and 1-4, the management team prepares draft of the SYSP.																																																																																																																																																																																																																																																																																																											
1-6 The management team identifies organizational and institutional changes necessary to conduct methods and procedures proposed by Activity 1-3 and presents a report.																																																																																																																																																																																																																																																																																																											
1-7 The management team prioritizes and schedules the conducts of specific actions of SYSP.																																																																																																																																																																																																																																																																																																											
1-8 WASAC secures budget in accordance with the priorities of Activity 1-7 for the next fiscal year.																																																																																																																																																																																																																																																																																																											
1-9 The management team prepares the SYSP on NRW reduction that summarizes the achievements from Activities 1-1 to 1-7.																																																																																																																																																																																																																																																																																																											
1-10 The management team holds seminars and presents SYSP for NRW reduction (Activity 1-8) for WASAC and other concerned parties.																																																																																																																																																																																																																																																																																																											
1-11 The management team facilitates implementation and the monitoring of the SYSP.																																																																																																																																																																																																																																																																																																											
1-12 The management team drafts the revised New Connection Policy and a Standard Enforcement Policy. In addition, the management team will facilitate training and membership of expert committees of areas with the existing one.																																																																																																																																																																																																																																																																																																											
1-13 The management team reviews SYSP for NRW reduction, updates it as necessary, and secures the budget for the next fiscal year.																																																																																																																																																																																																																																																																																																											
1-14 Seminars are organized to present all the achievements of the project for WASAC and other concerned parties.																																																																																																																																																																																																																																																																																																											
2. Basic knowledge, skills and techniques on NRW control are acquired by WASAC.																																																																																																																																																																																																																																																																																																											
2-1 Training materials on NRW control are prepared.																																																																																																																																																																																																																																																																																																											
2-2 Training on NRW management is conducted for the management team and WASAC management as necessary.																																																																																																																																																																																																																																																																																																											
2-3 OJT is conducted on the updating of GIS data, using available GIS data base.																																																																																																																																																																																																																																																																																																											
2-4 OJT is conducted on hydraulic analysis and pressure management, using available hydraulic models.																																																																																																																																																																																																																																																																																																											
2-5 In-room training and OJT on leak detection for the pilot project are conducted with approved equipment.																																																																																																																																																																																																																																																																																																											
2-6 In-room training and OJT on repairing leaking pipes and installing service connection for the pilot project are conducted.																																																																																																																																																																																																																																																																																																											
2-7 In-room training and OJT on meter reading, billing, customer services for the pilot project are conducted.																																																																																																																																																																																																																																																																																																											
2-8 Training materials on NRW are reviewed and updated.																																																																																																																																																																																																																																																																																																											
2-9 Based on feedback of Activities from 2-5 to 2-8, training programs are developed and training courses are initiated.																																																																																																																																																																																																																																																																																																											
3. WASAC is empowered to implement NRW reduction measures through the implementation of the Pilot Project.																																																																																																																																																																																																																																																																																																											
3-1 An action team is organized to conduct NRW reduction measures at Pilot Area 1 and Area 2.																																																																																																																																																																																																																																																																																																											
3-2 The action team grasps the current situation of Pilot Area 1 and Area 2 through reviewing available maps, customer ledgers, surveys, and other available data.																																																																																																																																																																																																																																																																																																											
3-3 The action team plans and schedules the implementation of the pilot project for Pilot Area 1 and Area 2.																																																																																																																																																																																																																																																																																																											
3-4 The action team hydraulically isolates Pilot Area 1 and Area 2, and installs flow meters and pressure gauges at the brach of the Pilot Area 1 and Area 2.																																																																																																																																																																																																																																																																																																											
3-5 The action team establishes the baseline NRW rate of Pilot Area 1.																																																																																																																																																																																																																																																																																																											
3-6 The action team conducts measures for reducing "Apparent Losses" indicated by the water balance of International Water Association (IWA) for Pilot Area 1.																																																																																																																																																																																																																																																																																																											
3-7 The action team measures NRW after conducting Activity 3-5 and examines the effectiveness.																																																																																																																																																																																																																																																																																																											
3-8 The action team conducts measures for reducing surface leakage (visible leakage).																																																																																																																																																																																																																																																																																																											
3-9 The action team measures NRW after conducting Activity 3-8 and examines the effectiveness.																																																																																																																																																																																																																																																																																																											
3-10 The action team conducts measures for reducing underground leakage (invisible leakage).																																																																																																																																																																																																																																																																																																											
3-11 The action team measures NRW after conducting Activity 3-10 and examines the effectiveness.																																																																																																																																																																																																																																																																																																											
3-12 The action team conducts measures for reducing high water pressure.																																																																																																																																																																																																																																																																																																											
3-13 The action team measures NRW after conducting Activity 3-12 and examines the effectiveness.																																																																																																																																																																																																																																																																																																											
3-14 The action team reviews the results from Activities 3-5 to 3-13, and undertakes cost-benefit analysis of NRW for each Activity of 3-5, 3-8, 3-10 and 3-12.																																																																																																																																																																																																																																																																																																											
3-15 The action team summarizes activities and results from Activities 3-1 to 3-14, prepares the completion report on the pilot project for Pilot Area 1, and submits it to the management team.																																																																																																																																																																																																																																																																																																											
3-16 The action team holds a workshop and presents the completion report of the pilot project prepared by Activity 3-15 to WASAC and other concerned parties.																																																																																																																																																																																																																																																																																																											
3-17 Action team conducts activities from Activities 3-5 to 3-13 at Pilot Area 2.																																																																																																																																																																																																																																																																																																											
3-18 Action team prepares manuals on methods and use of survey equipment learned through the implementation of the pilot project, and holds seminars in order to share them with WASAC and other concerned parties.																																																																																																																																																																																																																																																																																																											
3-19 Action team disseminates the manual and use of survey equipment to the activity of whole branches.																																																																																																																																																																																																																																																																																																											
4. 4 branches in Kigali establish the system to measure NRW rates accurately.																																																																																																																																																																																																																																																																																																											
4-1 Isolation plan of 4 branches prepared by WASAC will be reviewed and revised as necessary.																																																																																																																																																																																																																																																																																																											
4-2 Based on the isolation plan prepared by Activity 4-1, exact locations for the installation of electromagnetic flow meters and pressure gauges are determined by field surveys.																																																																																																																																																																																																																																																																																																											
4-3 Electromagnetic flow meters and pressure gauges are procured and installed for isolating 4 branches.																																																																																																																																																																																																																																																																																																											
4-4 Chambers are constructed as appropriate.																																																																																																																																																																																																																																																																																																											
4-5 System input to each of 4 branches to be measured.																																																																																																																																																																																																																																																																																																											
4-6 Based on the results of Activity 4-5, NRW rates for each branch are calculated and reported.																																																																																																																																																																																																																																																																																																											
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**The Project for  
Strengthening Non-Revenue Water Control  
In Kigali City Water Network**

**6th Steering Committee Meeting**

**Progress of the Project**

**April 27, 2021**

**【Project Period】**

- 1. Original : August 2016 to July 2019**
- 2. Amendment : Nov. 2018, June 2020 and Dec. 2020**
- 3. Final Project Period: August 2016 to December 2021**





# 1. Overall Goal

**WASAC conducts NRW reduction measures as planned for Kigali city.**

**Indicator**

**NRW rate of Kigali city (year 2022/23 : 25 %)**

## Overall Goal of the Project

### Present Situation of NRW Rate

year	5 Year Strategic Business Plan		SYSP NRW Rate		
		Target	Year	Proposed	Actual
2015/16	Year 1	38%	-		31.3 (35.5)
2016/17	Year 2	32%	-	(38.3)	37.8 (38.3)
2017/18	Year 3	28%	-	(38.0)	36.3 (38.0)
Present	2018/19	Year 4	Year 1	32.1 (35.0)	36.9 (38.8)
	2019/20	Year 5	Year 2	32.3 (34.4)	40.3 (41.2)
	2020/21		Year 3	(30.0)	
	2021/22		Year 4	(28.0)	
	Target	2022/23		Year 5	25.0 (25.0)

**Reduction  
15.3%**

Note: NRW Rate Kigali city (20 Branches)

## Project purpose : Indicator 1

- **5-year Strategic Plan for NRW reduction is approved by the Minister of Infrastructure.**

### Achievement

- **5YSP was approved by the Board of Directors of April 27, 2018.**
- **The MININFRA is aware.**

## Project purpose : Indicator 2

- **Annual action plan regarding NRW reduction of each branch is reflected in annual action plan of WASAC**

### Achievement

- **The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside piloted area.**
- **Though in the future more specific actions for NRW reduction is needed. NRW reduction branches annual budgets should be incorporated in the company NRW reduction budget.**



## Indicator 1-1

- 5YSP is reviewed and updated taking into account of the results of the Pilot Project.

### Achievement

- 5YSP is being updated considering the result of it's implementation for the past 2 years, findings from the pilot project and observations from the MP studies .
- The final draft of the revised version is expected in the beginning of May and will follow the normal approval process

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## Indicator 1-2

- All the project achievements are shared by holding seminars.

### Achievement

- Sharing information within WASAC:

All the progresses and challenges the Project encountered are being shared though various workshops, seminars, project management meetings, and SC meetings.

- Sharing information with concerned parties:

MINIFRA as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been well shared.

- The Project will hold a final seminar to present all the achievements of the Project by the end of the Project period.

## Output 3

Acquisition of the knowledge through the Pilot Projects

### Indicator 3-1

- **NRW Rate Reduction (Target)**
  - Area 1 : Baseline 37% Target 20%,
  - Area 2 : Baseline 68% Target 25%

### Achievement

- **Result of NRW rate were not to reach the target figures.**  
**Q3 of 2019/20 (in March 2020 )**
  - Area 1 : 25%, Area 2 : 56 %

### In Kadobogo (Pilot Area 1) ;

- **The target NRW rate (%) was achieved in the Q3 of 2018/2019, but afterward rate raised up to 25%, because of malfunction of the PRVs.**
- **Attention must be paid to maintenance of the PRVs in order to maintain the NRW rate achieved.**

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## Lessons Learned from the Pilot Project

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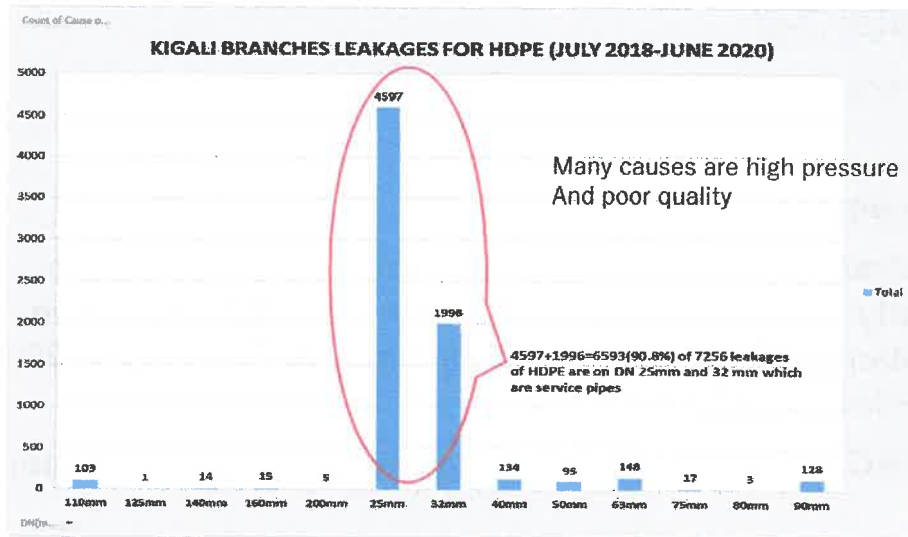
### 1) Effective Measures to be Taken for NRW Reduction

- ✓ Most of the NRW volume are water leakage.
- ✓ The biggest causes of the leakage are **high water pressure** and **sub-standard service/distribution pipes of small diameter**.
- ✓ It was proved through Pilot Projects that the activity such as **high water pressure reduction**, **replacement of aged and sub-standard pipe**, and **leakage repair** are effective for the NRW reduction.

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## Indicator 3-2

- Implementation experiences are shared at workshops

### Achievement

- The Action team members share experiences and lessons through workshops and a variety of meetings

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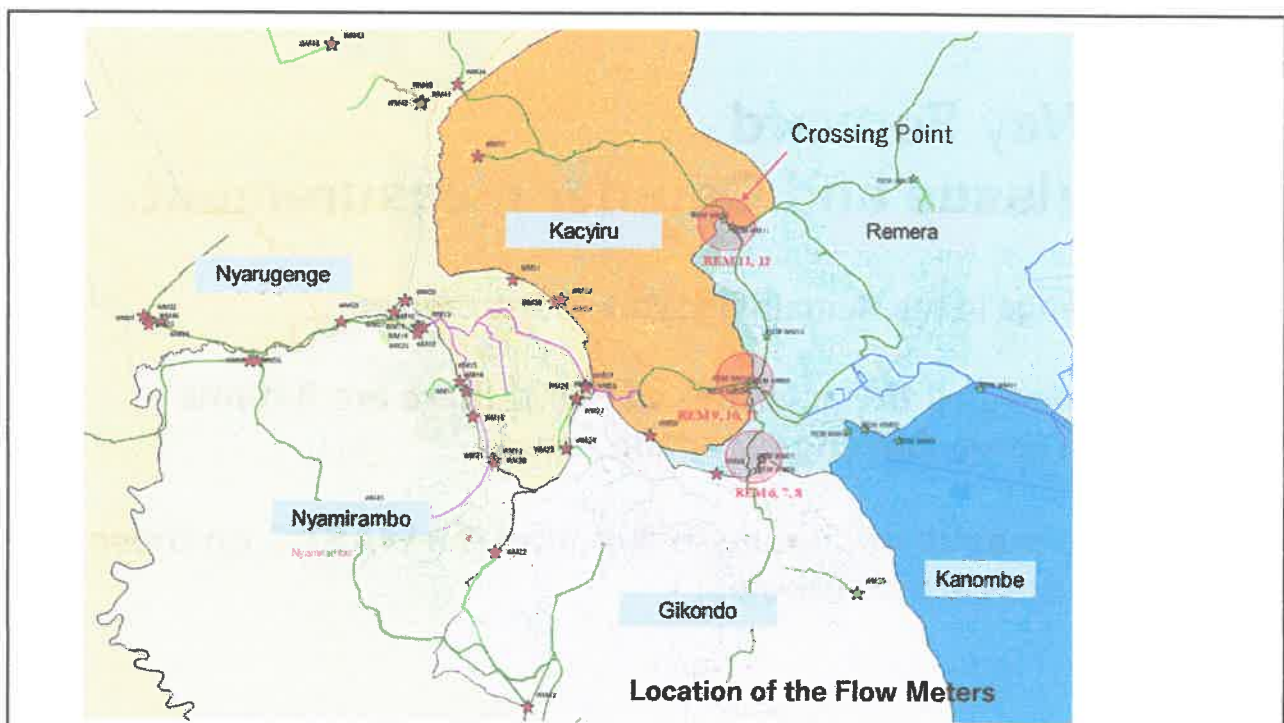
## Indicator 4-1

- NRW rate of each branches is periodically monitored every month

### Achievement

- The system to measure NRW rate has not been installed yet due to delay in equipment procurement.
- Though equipment procurement and their installation works have been suspended under COVID-19 situation, the works resumed from February 2021.

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## 1. Output 1, 1.4

No.	Activity	Achievements	Issue	Countermeasures
1.4	Inventory surveys in order to identify facilities improvement necessary	Inventory survey was done for all Kigali distribution reservoirs and the bulk meter survey was done for all most all WTPS.	The number of facilities to be surveyed is huge and the resources are limited.	The priority was done to distribution reservoirs in Kigali and bulk meters assessment in almost all WTPs. As way forward, the survey method will be incorporated into NRW reduction manual. Dissemination will be done for all branches and WTPs in order to conduct the survey by themselves. Upcountry reservoirs survey and bulk meter assessment will be performed by WASAC.

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## 2. Output 1, 1.6

No.	Activity	Achievements	Issue	Countermeasures
1.6	Identifies organizational and institutional changes necessary.	The organizational gaps have been identified through the implementation of the 5 YSP.	It is necessary to consider organizational reform to promote the implementation of 5YSP. For example, the review WASAC structure to be more responsive and efficient.	WASAC management recognized the importance of the organizational change and the re-structuring process is on-going.

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## 5. Output 2, 2.9

No.	Activity	Achievements	Issue	Countermeasures
2.9	Training programs are developed and training courses are planned.	The manual containing training course is ready and in validation process by the technical and commercial directorate.	The expected final result is that the training program formulated by this project will be incorporated into WASAC's human resource development plan, but it has not yet reached that stage because of the delay of completing the manual .	Finalize the manual validation and dissemination Share the manual with the HR in order to be incorporated into WASAC's internal training program.

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## 6. Output 3, 3.13

No.	Activity	Achievements	Issue	Countermeasures
3.13	The action team measures NRW rate in the pilot area after pressure control ( PRVs installation )	The proof measurement of the PRV effect was performed. Qmnf in stage adjustment of PRV pressure was measured. Also, Qmnf before and after setting PRV was compared.	Planned pilot activities in the pilot area were completed, although some equipment (Bulk meter, 2 PRVs) were defected. The replacement took time because of limited maintenance budget from the project and WASAC.	The project staff and branch staff should continue to monitor the Pilot area (reading index, calculation of the NRW, monitor the progress). For the sustainability of NRW reduction, WASAC should ensure the availability of necessary budget for the continuation of routine maintenance activities using lesson learned from the project.

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**The Project for  
Strengthening Non-Revenue Water Control  
In Kigali City Water Network**

**Steering Committee Meeting  
COVID-19 Infection Prevention  
Measures**

**April 27, 2021**

**COVID-19 SUPPORT FROM JICA**

1. Procurement of materials and equipment for the Reduction of intermittent water supply
2. Emergency water supply to people with limited access to clean Water

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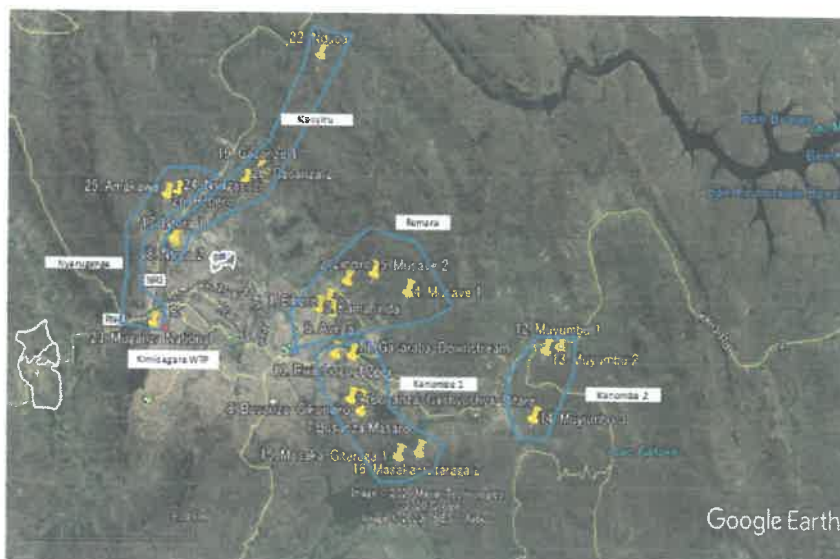
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## Emergency water supply to people with limited access to clean Water

### Monthly Payment for Water Tanker (USD)

Month	Water Tanker Owner 1	Water Tanker Owner 2	Total
Nov.2020	2,682	1,200	3,882
Dec.2020	22,918	11,272	34,190
Jan.2021	15,231	8,273	23,504
Feb.2021	20,358	11,104	31,462
Marc.2021	18,382	9,617	27,999

### Public Tap (PT) Location Map



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## Points for attention

- Water distribution activities by water tanker have started from November 2020, and this activity meets expectation of residents.
- However, the original purpose of the activity was to support COVID-19 infection prevention measures to People who have limited access to clean water.
- Therefore, the amount of water distribution by tankers should be gradually reduced, taking into account the improvement of water supply conditions by WASAC network and the calming down of COVID-19.

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**PROJECT FOR  
STRENGTHENING NON-REVENUE WATER CONTROL IN  
KIGALI CITY WATER NETWORK**

**Attendance List**

Title : SIEGING COMMITTEE  
Place : WASAC Headquarter  
Date : 27th April 2023

Name	Position
BAHIGE A. Berhman	Position: NEW Manager Mobile: 0788307401 E-mail: Bahige@wasac.rw
BESIRE NTAMUKURANO	Position: Head of Leak Detection & Pressure Mgmt. Mobile: 078874664 E-mail: ntamukurano@wasac.rw
MWIJUKYE James	Position: Director Commercial Services Mobile: 425078830361 E-mail: jmwijukye@wasac.rw
RUTHAGUNGIRA Rutshock	Position: Director of Urban Water & Sewerage Services Mobile: 0788403181 E-mail: rutshock@wasac.rw
SAMSON HATEGEKIMANA	Position: Manager corporate planning & strategy Mobile: 078848323 E-mail: shategekimana@wasac.rw
VENUSTE NYIMBA AZIMANA	Position: Urban Water Supply Senior Engineer Mobile: 0788550872 E-mail: venuste@wasac.rw
Shin HARUO	Position: Client Representative Mobile: 0788305523 E-mail: HaruoShin@jica.go.jp
Eng. Alfred D. BUCERO	Position: (GD) Mobile: 0788303910 E-mail: cec@wasac.rw
KWIZERA Virgile	Position: WATJAN Program Officer Mobile: 0788486830 E-mail: Virgile Kwizera - RWB jica.go.jp

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MINUTES OF MEETING  
OF  
THE 7<sup>th</sup> STEERING COMMITTEE MEETING  
FOR  
PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL  
IN KIGALI CITY WATER NETWORK

HELD AT  
Hotel Karisimbi

Kigali, 25 November, 2021

 Mr. MARUO Shin Chief Representative JICA Rwanda Office		 Ms. Gisèle UMUHUMUZA Chairman of Steering Committee & Acting Chief Executive Officer, WASAC The Republic of Rwanda	
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 Mr. OTANI Shigeo Chief Advisor JICA Expert Team Japan	 Mr. Méthode RUTAGUNGIRA Project Director & Director of UWSS, WASAC The Republic of Rwanda
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For the purpose mentioned below, the PROJECT FOR STRENGTHENING NON-REVENUE WATER CONTROL IN KIGALI CITY WATER NETWORK (hereinafter referred to as "the Project"), the 7<sup>th</sup> meeting of Steering Committee (hereinafter referred to as "SC") meeting was held on 25<sup>th</sup> November 2021.

The "Terminal evaluation" of the project was conducted by JICA in August 2020 remotely between Japan and Rwanda under COVID-19 pandemic situation. The evaluation results were agreed between JICA and WASAC on 5<sup>th</sup> August 2020, and the project period was extended to December 2021.

The biggest cause of the delay of Output 4 "Isolation of 4 branches" was due to the impact of COVID-19 pandemic. However, the activity resumed in March 2021, and the construction of the monitoring system was completed but leaving some outstanding matters. Thereafter, training on NRW rate calculation using the monitoring system has been carried out and completed

The purpose of this SC meeting is to take this opportunity to confirm the achievement of the Project and to clarify the responsibilities that WASAC shall take in the future.

SC members understood the achievement of the Project as a result of the discussions, and all parties agreed on concerning matters referred the following;

## 1. Result of the project

### 1.1 Overall Goal.

Although Activity of 5 Year Strategic Plan (hereinafter referred to as "5YSP") has started, in recent years the NRW rate in Kigali City has been on an increasing trend (2.6%/year). Recent projects to increase water production such as Kanzenze, water treatment plant in Nzove, AfDB's construction of distribution facilities, etc. may have affected the increase trend of NRW rate.

On the other hand, NRW reduction measures of large investments such as replacement of distribution and service pipes, high pressure management, and reservoir management are not yet sufficient because of budget constrain. The NRW reduction measures have not caught up with the 5YSP.

NRW rate of Kigali in 2020/2021 was 42.2%. To achieve the 25% NRW target by the end of 2022/23, 17.2% reduction of NRW rate is required in coming two years. Considering the NRW rate for the last 3 years (above 40%), it is not realistic to achieve the set target (25%) of the Overall Goal of the Project in the remaining two years.



Achievement of the Overall goal is heavily dependent on availability of budget of WASAC and assistance from development partners. It can be predicted that the direction of achieving the Overall Goal will continue, but it will take time to achieve the indicator of Overall Goal.

## 1.2 Project purpose

The impact of NRW reduction in the pilot area is recognized and some activities are being replicated outside the pilot area. However, in the future, each branch will need more specific activities based on the results of the survey and implementation plan to reduce NRW.

The budget of NRW reduction activity was decided in WASAC Action Plan. On the other hand, that budget is not fully allocated at an implementation level for branches on NRW reduction. Although WASAC approved annual action plans, the actual allocated budget for NRW reduction works has been lower than the planned budget. The activities of the annual action plan are not backed by the budget and the action plan has not been achieved.

## 1.3 Outputs

### 1) Output: Planning capacity of NRW reduction

5YSP has been updated reflecting the result of its implementation in the past 3 years, findings from the pilot project, and observations from the water supply masterplan for city of Kigali study. All the progresses and challenges the Project encountered was shared through various workshops, seminars, project management meetings, and SC meetings. And, Ministry of Infrastructure (hereinafter referred to as "MINIFRA") as a major stakeholder has participated in SC meetings. Information and lessons of the Project have been well shared. However, the following issues have become apparent in the implementation of the 5YSP.

The organizational gaps have been identified through the implementation of the 5YSP. Therefore, it is necessary to consider organizational structure to promote the implementation of 5YSP.

The New Connection Policy was formulated in January 2019 as a revised version of the Requirements for Water Distribution and House Connection due to the emergency to comply with the regulatory agency (RURA).



Later, it was observed the need to have the new connection policy revised again in order to ensure customers procured material are in good quality. This is because it has been confirmed that most of leaks are coming from poor quality service pipes.

## **2) Output 2: Basic knowledge, skills and technique on NRW control**

The basic knowledge, skills and technique on NRW control have been acquired through the individual trainings and implementation process of the various project activities. However, dissemination and share the manual in order to be incorporated into WASAC's internal training program has not yet been done.

## **3) Output 3: Knowledge through the Pilot Projects**

The action team members have been shared experiences and lessons through workshops and various meetings. Although the reduction of the NRW rate did not reach the initial target in the pilot areas, analysis of cost-benefit showed that there is an economic benefit on measures to reduce NRW.

## **4) Output 4: Establishment of the Monitoring System to measure NRW Rate**

The monitoring system to measure distribution volume of isolated each Branch area in Kigali was completed in September 2021 but leaving some outstanding matters. Thereafter, training to calculate the NRW rate by the data obtained from the monitoring system was carried out and completed.

As the outstanding matters, there are sites that flow meters are not function or no meters are installed.

- Sites for isolation of Kanombe and Remera (meters are not function): (5 locations)
- New crossing points of branch boundaries of the project by AfDB (no meters are installed): (11 locations)

WASAC cannot calculate the NRW in each branch since the flow meters above has not been installed by WASAC. Another issue is that the transfer of customer registrations as the branch-to-branch boundary are to be modified because of the facility to make the real isolation, WASAC must complete the customer re-registrations as soon as possible.

## **2. COVID-19 Response supported by JICA**

The result of COVID -19 response activities that was implementing within the framework

of the NRW project are as shown below.

1) Procurement of materials and equipment for Reduction of Intermittent Water Supply

The procurement of materials and equipment of "pipe and fittings with small diameter for network leakage repair in Kigali city", "service pipes for replacement of existing sub-standard pipes in Ruyenzi" and "Floater Valves for installation for 11 reservoirs in Kigali", which total amount is about 193,000 USD, was completed and handed over to WASAC.

2) Emergency water supply to people with limited access to clean water

Water was supplied to suburban area with severe water shortage in Kigali city, which WASAC supply systems did not cover. Water Tanks were installed by JICA and water supply was entrusted to the private service providers who owned the water tanker. The operation started in November 2020, ended in September 2021 in accordance with the resolution of the 6th SC. The situation of water supply to residents who have difficulty for supplying water was improved through this activity, and residents got the benefits of COVID-19 infection prevention as follows.

Total water supply volume	: 43,233 m <sup>3</sup>
Total cost	259,480 USD
Water unit cost for convey	6.0 USD/m <sup>3</sup>
Number of beneficiaries	: about 5,200 households
Estimated population	about 26,000 peoples

In September 2021, the new water tanker was granted from JICA to WASAC through the master plan study team and operation have already started. The know-how of the water supply operation cultivated in the activity in the NRW project was succeeded to WASAC.

### 3. Way Forward for Achievement of Overall Goal and Project Purpose

#### 3.1 Overall Goal

One of the most important results of the Project is that measures that can be expected to be effective for NRW measures have been clearly laid out. In addition, it was shown that the implementation of these activities is sufficiently beneficial from the viewpoint of cost effectiveness. WASAC should show this fact to the shareholders and the ministry



and should intensify communication with other organizations, to get sufficient funds for selected activities to be regularly implemented.

### 3.2 Project Purpose

Although WASAC approved annual action plans, the actual allocated budget for NRW reduction works has been lower than the requested budget.

Insufficient annual budget doesn't cover most of NRW reduction activities. CAPEX required for the NRW reduction to be huge compare to current available budget. WASAC should seek funding sources outside of WASAC to support NRW reduction activities (OPEX and CAPEX).

### 3.3 Outputs

#### 1) Output 1

1) Necessity for organizational and institutional changes

It is necessary to consider organizational reform to promote the implementation of 5YSP. WASAC management recognized the importance of the organizational change and the re-structuring process is on-going. WASAC propose to have a team in charge of NRW in each branch.

The following increase has been drafted in the 5YSP update report.

- Quick and quality repairs, for Kigali Branch (1 engineer and 2 technicians)
- Inspection and enforcement of water theft, for NRW unit (2 officers and 3 operators)
- Leak detection activity of NRW unit (2 engineers and 3 operators)

2) Revision of New Connection Policy and a Standard Enforcement Policy

WASAC should review the new connection policy and the enforcement of its implementation.

#### 2) Output 2;

The training program formulated by the Project will be incorporated into WASAC's human resource development plan. The core person of the dissemination of the manual on NRW reduction activities have been trained in the Project. Therefore, the training can be conducted mainly by NRW Section staff of Directorate of Urban Water Supply Services.

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The program and manual on NRW, which is the deliverable of this project, shall be included in WASAC's internal training system and used in the annual plan.

### 3) Output 4

WASAC shall install following 16 flow meters as soon as possible to incorporate the measurement data into the monitoring system. At the same time WASAC shall complete customer re-registrations of part of branch boundary to ensure the NRW rate calculation.

- Replacement of existing malfunction meters for isolation of Kanombe and Remera (5 locations)
- Installation of meters at newly increased branch boundary crossing points by the AfDB project (11 locations)

WASAC showed a milestone for installing and/or replacing flow-meters and necessary accessories needed for the 4-branch isolation, as per Appendix 4.

### 3.4 COVID-19 Response supported by JICA

As part of the COVID-19 response activity, JICA has procured items listed on Appendix 5. Both sides agreed that WASAC shall properly use and install these materials and equipment procured for reduction of Intermittent water supply. Utilization of these items will be contributing to the implementation of the 5YSP. WASAC has agreed with JICA to install and utilize the items according to the milestone shown on the table of Appendix 6. WASAC will regularly report to JICA on the progress of the utilization of the items handed over.

### 4. Extension of the Project Period

The present project period is until December 2021. JICA requested and SC agreed to extend the project period to September 2022 to accommodate final inspection and maintenance of all the installed equipment, and tasks above in the term of guarantee.



## BEFORE

Five (5) years and five (5) months from the arrival of the first expert, i.e., till the end of December 2021.

## AFTER AMENDMENT

About Six (6) years and two (2) months from arrival of the first expert on August 15 2016 to September 30 2022.

Although the assignment of JICA expert in Rwanda ended in November 2021 and procurement and installation of equipment related to Output 4 by Takaoka Engineering Co.,Ltd. has almost finished in September 2021, periodical maintenance at 6<sup>th</sup> and 12<sup>th</sup> months after Partial Completion will be conducted by Takaoka Engineering Co.,Ltd. in March and September 2022 respectively. Therefore, to support maintenance works of the monitoring system, JICA request to extend the duration of R/D to September 2022 as above. Takaoka Engineering Co., Ltd. will continuously support WASAC to operate monitoring system in this duration.

The remaining works to be done by Takaoka Engineering Co., Ltd. are as follows;

- Equipment Inspections of manhole 3, 7 and 19 for data measuring and transmission facilities and data receiving and processing server at HQ.  
Inspection of the equipment which is installed in the manholes M4, M19, M22, M23 because there was no water passage at that time of inspection in September 2021.
- Inspection of WM12 in the Kimisagara water treatment plant because of no service code provided by WASAC.
- Correction of equipment defect that occurred after the equipment installation inspection in September 2021.

The above concerns will be re-inspected and proper measures are taken at the above periodical maintenances.

## 5. AOB; Water Utility Regional Partnership (WURP) Activity

Regional partnership between Rwanda, Malawi and Kenya has been promoted in a good relationship, and future continuation is expected. In November 2018, 1<sup>st</sup> regional workshop was held in Rwanda, and the second in September 2019 at Malawi. The memorandum of understanding among the three utilities have not been signed since it has been prepared in July 2019. The document is to be updated and signed by the time of the workshop in February, 2022.

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Appendix:

1. Agenda of the 7<sup>th</sup> SC
2. Presentation document: Achievement of the Project
3. Presentation document: Result on the COVID-19 Response
4. Schedule of complete formation of Monitoring System by installation and replacement of Flowmeters
5. List of Items provided for the COVID-19 response activity
6. Schedule of installation and use of the equipment and materials procured for COVID-19 response
7. List of Attendance

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*“Dignifying Life”*

**Project for Strengthening Non-Revenue Water Control in  
Kigali City Water Network**

**Agenda of the 7<sup>th</sup> Steering Committee (SC)**

Venue: **Hotel Karisimbi**

Date: **25<sup>th</sup> November, 2021**

Time	Activity	Responsible
10:30	Registration	
11:00	Introduction of Participants	
11:05	Remarks by CEO WASAC	CEO WASAC
11:10	Remarks by JICA Rwanda Representative	JICA Representative
11:15	Achievement of the Project and Way Forward	Project Director
11:45	Result on the COVID-19 Response	Head of LDPM
12:00	Discussion	All
12:30	Extension of the project period	JICA Office
12:40	AOB WURP Activity	Project Director
13:00	Closing remarks by MININFRA	MININFRA representative