Annex 1: Participants in Preparation of Monitoring Sheets and Photos

Photos of Preparation of Monitoring Sheet

	**Day 1**: 20th June 2018 Information sharing and discussion about project progress (Attendance: NRW Management Team members and Action Team Members)
	**Day 2**: 27th June 2018 Preparation of Draft Project Monitoring Sheets (Attendance: Project Manager, Deputy Project Manager, NRW Management Team members and FCTWB Management)

Appendix 4

Federal Capital Territory Administration
Federal Capital Territory Water Board

Japan International Cooperation Agency

The Federal Capital Territory Reduction of Non-Revenue Water Project

8th Joint Coordinating Committee Meeting

Results of Project Monitoring

(Period: August 2017 – June 2018)

and Revision of PDM & PO

Engr. M. K. Rabiu, HOU NRW, FCTWB

28th June 2018

Contents

1. Outline of the Project

Project Name

The Federal Capital Territory Reduction of Non-Revenue Water Project

Project Period

Phase-1: October 2014 to December 2016

Phase-2: January 2017 to September 2018

Project Areas

Federal Capital Territory (FCT)

Pilot Areas: Gudu, Jabi and Garki I

Nigerian Counterparts

Federal Capital Territory Administration (FCTA)

Federal Capital Territory Water Board (FCTWB)

2. Overall Goal, Project Purpose and Three Outputs

Overall Goal	Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.
▲	
Project Purpose	**Capacity of FCTWB for NRW reduction is strengthened.**
▲	
Output-1	Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.
Output-2	Methods/operational procedures for effective NRW reduction are established though pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.
Output-3	A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

3. Progress of Inputs

Inputs from Nigeria

Project Personnel

- Project Director, Project Manager, Deputy Project Manager, Technical Managers, NRW Management Team, NRW Action Team.

Land, Building and Facilities

- Office spaces and necessary facilities at FCTWB

Local Cost

- Operation and maintenance of the provided equipment, and also administrative and operational costs for local traveling, demurrage and communication of telemetric device have been provided.
  These costs have been paid temporarily by the Japanese side because of delay in release of the Counterpart Fund, which were refunded.

3. Progress of Inputs

Inputs from Japan

JICA Experts :

- A Chief Advisor and members for nine areas of expertise

Equipment :

- Installation of zonal meters, data loggers, telemetric monitoring system procured from Japan for water distribution management
- Installation of solar powering systems for the above equipment

Facilities

- No input during this monitoring period

Training

- No input during this monitoring period

4. Progress of Activity for Output-1

Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.

No	Activity	Current Monitoring (as at June 2018)
1-1	Install bulk meters to water treatment plants 1 and 2	Completed.
1-2	Measure/estimate water production of water treatment plants 1, 2, 3, and 4	Completed in February 2018.
1-3	Tally the above water production data/estimation	Completed in February 2018.
1-4	Calculate the water consumption based on the billing data	Completed. However, customers' zonal coding is still ongoing as a fundamental condition for water distribution management. Periodic billed consumption has been not recorded because of non regular meter reading and billing. Constant power supply, adequate provision for consumables and SOP are necessary.

4. Progress of Activity for Output-1

Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.

No	Activity	Current Monitoring (as at June 2018)
1-5	Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4	Completed in February 2018.
1-6	Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system	Completed in August 2017. After completion, loggers' failure were observed at Tank 2 and Tank Kubwa due to power instability and lightning, but they were replaced or fixed. Solar panel for zonal meter located at roof-top of Tank 5 was stolen in February 2018.
1-7	Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	Progress: 85%, Behind: 0.0 months The Activity will be completed after the completion of customers' zonal coding stated in Activity 1-4, before July 2018.

5. Progress of Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Current Monitoring (as at June 2018)
2-1	Review existing NRW reduction operations at each pilot Area Office	Completed.
2-2	Conduct capacity assessment of organization and the relevant staff	Progress: 65%, Behind: 10.0 months Assessment was done partially after the completion of pilot projects, and will be completed after NRW monitoring in pilot Area offices in July and August 2018.
2-3	Identify and select a Pilot Metering Area (PMA) for each Pilot Area Office based on the selection criteria of PMA	Completed.
2-4	Prepare/update distribution network drawings for each PMA	Completed.
2-5	Install water flow meters to each PMA and measure in/outflows monthly	Completed. However, a mechanical PMA meter in Jabi PMA is not functioning, and data from an ultrasonic PMA meter is not transferred to portable logger in Garki I PMA.

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5. Progress of Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Current Monitoring (as at June 2018)
2-6	Zone each PMA into Sub Metering Areas (SMA)	Completed.
2-7	Isolate a SMA by installing valves	Completed in October 2017.
2-8	Update the distribution network drawings for each SMA	Completed in October 2017.
2-9	Measure an initial level of NRW of each SMA	Completed in October 2017.
2-10	Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA	Completed in October 2017.
2-11	Develop a NRW reduction operation plan of each SMA, including reduction target for review by Head of Distribution Department	Completed in October 2017.

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5. Progress of Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Current Monitoring (as at June 2018)
2-12	Review and approve NRW reduction operation plan of each SMA	Completed in October 2017.
2-13	Implement NRW reduction operations at each SMA	Completed in October 2017.
2-14	Monitor the progress of the NRW reduction operations of each SMA	Completed in October 2017.
2-15	Measure level of NRW of each SMA at the end of the respective operations	Completed in October 2017.
2-16	Prepare a report on pilot projects, covering Activity 2-1~2-15	Completed in October 2017.
2-17	Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers & meter readers), incl. audio visual materials	Completed in October 2017.

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6. Progress of Activity for Output-3

A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

No	Activity	Current Monitoring (as at June 2018)
3-1	Establish a Working Group for NRW reduction planning	Completed in October 2017.
3-2	Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB	Completed in October 2017.
3-3	Conduct hydraulic and water pressure distribution analyses of the pipeline networks	Completed in October 2017.
3-4	Develop outlines of the medium-term strategic plan and its annual NRW reduction plan (approval by the Director)	Completed in October 2017.
3-5	Develop the first medium-term strategic plan (2019-2023) for approval by FCTA	Progress: 95%, Behind: 3.0 months Working Group and Advisory Group members have been involved in documentation and check/comments. To be completed by the end of June 2018.

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6. Progress of Activity for Output-3

A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

No	Activity	Current Monitoring (as at June 2018)
3-6	Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA	Progress: 80%, Behind: 1.0 months Working Group, particularly NRW Unit has been involved in documentation based on the first medium-term strategic plan (2019-2023). To be completed by the end of July 2018.
3-7	Develop a planning manual for NRW reduction	Progress: 80%, Behind: 0.0 months JICA Expert Team and NRW Unit have been involved in preparation. To be completed by the end of July 2018.
3-8	Review existing plans, activities and implementing structure, etc. related to water distribution management	Completed in October 2017.
3-9	Establish framework of water distribution management	Progress: 85%, Behind: 8.5 months The Activity will be completed after the completion of customers' zonal coding stated in Activity 1-4, before July 2018.

Photos of Activities

Level of NRW of both the service area of FCTWB and water distribution areas is monitored regularly.

Technical Meeting on Interference along Trunk Main with FCDA

Meeting on Billing System Function

Capacity Assessment (Test) after Pilot Project

Lecture on Hydraulic Analysis

Discussion on Medium-term Strategic Plan by Working Group

Comments on Medium-term Strategic Plan by Advisory Group

Annex2-455

7. Achievement of Three Outputs

No	Indicator	Current Monitoring (as at June 2018)
Output-1: Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.		
1a	Record of NRW ratio is kept by NRW Unit.	NRW ratio was estimated because of data deficiency at bulk meters and recorded. Periodic billed consumption has been not calculated easily because of non monthly meter reading and billing cycle.
1b	NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting.	NRW ratio was estimated because of data deficiency at bulk meters and reported.
1c	NRW ratio of the service area of FCTWB is reported to Management of FCTWB.	NRW ratio was estimated because of data deficiency at bulk meters and reported.
1d	Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	Water flow has been recorded by zonal meters although data deficiency. Billed consumption have been not calculated due to delay in customers' zonal coding.

7. Achievement of Three Outputs

No	Indicator	Current Monitoring (as at June 2018)
Output-2: Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.		
2a	Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations.	Not successful in SMA-2 of Garki I due to difficulty in identifying the installed pipeline, however the Project concluded indicator was generally achieved in all three PMAs. Pilot project spent the period between Nov. 2014 and Dec. 2016 intermittently and the follow up between Mar. and Oct. 2017. See the next slide.
2b	Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	Technical manuals were reviewed and updated in May 2018. Approval process is ongoing.

7. Achievement of Three Outputs

Results of Pilot Project

	Before (%)	After (%)	Reduction Point	Target (%)	status
Gudu					
SMA-1	52.0	12.1	39.9	31.2	OK
SMA-2	53.9	29.9	24.0	32.3	OK
PMA	53.3	20.4	32.9	32.0	OK
Jabi					
SMA-2	45.6	21.1	24.5	27.4	OK
SMA-3	87.6	42.6	45.0	52.6	OK
PMA	70.0	30.9	39.1	42.0	OK
Garki I					
SMA-1	85.1	45.2	39.9	51.1	OK
SMA-2	74.8	49.3	25.5	44.9	Non
SMA-3	70.0	27.4	42.6	42.0	OK
PMA	74.8	34.7	40.1	44.9	OK

7. Achievement of Three Outputs

No	Indicator	Current Monitoring (as at June 2018)
Output-3: A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.		
3a	Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval.	Not yet. To be submitted in early July 2018, after JCC's approval of the draft medium-term strategic plan.
3b	An annual NRW reduction plan (2019) is incorporated in FCWTB's annual recurrent and capital plan (2019) for submission to FCTA for review and approval.	Not yet. The incorporation can be done after FCTA's approval of the draft medium-term strategic plan and when FCWTB's annual recurrent and capital plan (2019) is prepared probably in October 2019 which is after the termination of the Project. So, FCTWB highlighted the need to modify this indicator.
3c	A planning manual for NRW reduction is approved by the Director of FCTWB.	Not yet. To be approved by the end of August 2018.
3d	Framework of water distribution management is established.	Ongoing but delayed due to delay in Activity 1-7 and 3-9.

8. Achievement of Project Purpose

Capacity of FCTWB for NRW reduction is strengthened.

No	Indicator	Current Monitoring (as at June 2018)
a	The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project.	Not yet. To be approved by the end of August 2018.
b	Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level.	Capacity development have been done in Phase-2 of the Project. Follow up to be completed by the end of August 2018.
c	NRW ratio of each PMA is monitored.	Partially monitored. Inflow data has been read in Gudu, but not in Jabi and Garki I due to malfunctioning of a mechanical PMA meter in Jabi and data transfer failure from an ultrasonic PMA meter to portable data logger in Garki I.

9. Remarkable/Considerable Issues

(1) Personnel Reassignment of the FCTWB's Project Members

(2) Delay in Release of 2018 Counterpart Fund

(3) Preparation for FCTWB Autonomy

(4) Administrative Complication with respect to Commerce Operations

(5) Project Vehicle

9. Remarkable/Considerable Issues

(1) Personnel Reassignment of the FCTWB's Project Members
FCTWB needs to consider his/her experiences in the Project and assure transfer of information, knowledge and lessons learned in the Project activities to his/her successor and other members.

(2) Delay in Release of 2018 Counterpart Fund
Though national budget for 2018 was approved in the middle of June 2018, FCT budget for 2018 is still in the process of the approval. Accordingly, 2018 Counterpart Fund has not yet been released. The Nigerian side needs to keep in touch with JICA Expert Team on the status of FCT budget approval and release of the Counterpart Fund.

9. Remarkable/Considerable Issues

(3) Preparation for FCTWB Autonomy
As of September 2017, JICA Expert Team suggested establishing a preparatory committee, listing up and scheduling preparatory activities in expectation for autonomy.
Following enactment of enabling law for autonomous FCTWB in December 2017, JICA Expert Team assisted FCTWB in financial data collection, calculation of unit cost, price and profitable tariff, then financial analysis including profit-loss statement and cash flow until 2023 in accordance with the medium-term strategic plan for NRW reduction.
In preparation for full transition of FCTWB to an autonomous body, FCTWB should utilize these deliverables to advance step by step as scheduled.

9. Remarkable/Considerable Issues

(4) Administrative Complication with respect to Commerce Operations
Mixture of customer categories, meter types, reading divisions and water tariff, and irregular billing cycle and also lagged billing reflection of payment record, etc. have caused inefficiency in commerce operations affecting NRW reduction, which leads to financial losses of FCTWB and customer dissatisfaction. JICA Expert Team suggests FCTWB to solve the issues in consideration of streamlining, simplification and uniform management among relevant Units.
In preparation for full transition of FCTWB to an autonomous body as well as implementation of NRW reduction according to the medium-term strategic plan and annual plans, these issues should be seriously discussed among governing Board and management FCWTB based on lesson learnt from the Project.

9. Remarkable/Considerable Issues

(5) Project Vehicle
As a result of condition check of the project vehicle damaged by the traffic accident in Lokoja in March 2017, FCTWB concluded impossibility of repair and will purchase a new vehicle by using Counterpart Fund. Process of procurement is ongoing.
All project vehicles for NRW reduction should be used strictly for implementation of the medium-term strategic plan for NRW reduction.

10. Problems

(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)

(2) Customers' Zonal and PMA Coding (Output-1)

(3) Irregular Billing Cycle (Output-1)

(4) Monitoring of NRW Ratio and/or related Data in Zone and PMA

10. Problems

(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)

Data acquisition has been not always available due to non-full flow of water at bulk flow meters since the previous monitoring, which results in difficulty in calculating/monitoring system input volume as well as NRW ratio of the whole water supply system.

Cause

FCTWB and FCDA identified interference along trunk mains by water flow from new water treatment plants (Phases 3&4) to water flow from old plants (Phases 1&2) at the upstream point of bulk flow meters as a cause of non-full flow of water and also overflow from water treatment plants (Phases 3&4).

Actions

FCDA started relocation works of the junction from the upstream point to the downstream point in June 2018, and will complete it by the end of July 2018.

10. Problems

(4) Monitoring of NRW Ratio and/or related Data in Zone and PMA

a) System input volume to Zone 5 is not measurable.
b) System input volume to Jabi and Garki I PMAs are not measurable/recordable.
c) Prepaid meter payment record in Gudu PMA has not been submitted regularly.

Cause

a) Solar panel for zonal meter located at roof-top of Tank 5 was stolen in Feb. 2018.
b) A mechanical PMA meter in Jabi is not functioning, and data from an ultrasonic PMA meter seems to have not been transferred to portable logger in Garki I.
c) Existing prepaid meter software cannot create data sheets.

Actions

a) The solar system should be recovered by utilizing spare panels by the end of July 2018, and those spare panels will be restocked later.
b) A PMA mechanical meter should be replaced, and data transfer failure from an ultrasonic PMA meter to data logger should be solved by the end of July 2018.
c) Prepaid meter payment record should be submitted regularly by utilizing an alternative data source.

11. PDM&PO Revision

As a result of this monitoring, the Project Team confirmed the following process and suggests revision of PDM (PDM_4 to PDM_5) as below, as well as Plan of Operation (PO_4 to PO_5).

(1) FCTA's Approval Process of the Medium-term Strategic Plan for NRW Reduction

The draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval as the indicator "3a" for Output-3, and then the approval shall be done by the end of the Project as the indicator "a" for Project Purpose. For this approval process, the Nigerian side confirmed that governing board of FCTWB authorized by FCTA takes responsibility of the approval.

11. PDM&PO Revision

(2) Incorporation of Annual NRW Reduction Plan (2019) to FCTWB's Annual Recurrent and Capital Budget Plan (2019)

FCTWB prepares annual recurrent and capital budget plan in October in recent years, so annual NRW reduction plan (2019) is not likely to be incorporated to annual recurrent and capital budget plan (2019) by September 2018, the end of the Project. The Nigerian side requested to modify the indicator 3b for Output-3 as below, as a revision of the present PDM_4.

Before modification (PDM_4): "3b. An annual NRW reduction plan (2019) is incorporated in FCWTB's annual recurrent and capital plan (2019) for submission to FCTA for review and approval."

After modification (PDM_5): "3b. An annual NRW reduction plan (2019) is incorporated in FCWTB's annual recurrent budget plan (2019) or committed on its incorporation by the General Manager of FCTWB for submission to FCTA for review and approval."

12. Preparation by Nigerian side toward after completion of the Project

- Follow up for incorporation of the annual NRW reduction plan (2019) to FCTWB's annual recurrent budget plan (2019)
- Follow up for modification of FCTWB's budget templates
- Standing imprest either monthly or quarterly basis for routine activities
- Set up staffing, office and equipment storage
- Monitoring of NRW ratio and related data (the whole system, zones and PMAs)
- Preparatory survey on zones
- Regular reporting to Management and governing Board of FCTWB

Preparation of Draft Project Monitoring Sheets by Project Team

Thank you very much for your attention.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDM45

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to September 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Direct Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT — **Pilot Area Offices:** Jabi, Garki I and Gudu

Version 45
Dated 28 Jun. 2018

Monitoring: 27 Jun. 2018

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.	a. NRW reduction operations are carried out according to the medium-term strategic plan for NRW reduction (2019-2023) .	a. Report of NRW reduction activities and monitoring by NRW Unit (NRW ratio, records of leakage detection, repair, disconnection of illegal connections, etc.)		Not yet.	
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project. b. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. c. NRW ratio of each PMA is monitored.	a. Date of approval of the plan b. Results of joint assessment based on the criteria set by the Project c. Record of NRW ratio kept by NRW Unit	A. Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-term strategic plan are not discontinued or delayed	Indicator a: Not yet. Indicator b: Follow-up capacity development have been done in Phase-2 of the Project. Indicator c: Partialy monitored.	
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.	1a. Record of NRW ratio is kept by NRW Unit. 1b. NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting. 1c. NRW ratio of the service area of FCTWB is reported to Management of FCTWB. 1d. Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	1a. Record of NRW ratio 1b&1c. Material for meetings submitted by NRW Unit 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers	Indicator 1a&1b&1c: NRW ratio was estimated because of data deficiency at bulk meters and recorded/reported. Indicator 1d: Water flow has been recorded by zonal meters although data deficiency.	
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	2a. Record of NRW ratio kept by NRW Unit 2b. Date of approval of the manuals		Indicator 2a: Not successful in SMA-2 of Garki I due to difficulty in identifying the installed pipeline, but indicator was generally achieved in all three PMAs. Indicator 2b: Reviewed and updated. Approval process is ongoing.	
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval. 3b. An annual NRW reduction plan (2019) is committed by the governing Board of FCTWB, to be incorporated in FCWTB's annual recurrent and capital budget plan (2019) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the Director General Manager of FCTWB. 3d. Framework of water distribution management is established.	3a&3b. Date of official letter submitting draft strategic plan and annual recurrent and capital plan 3b. Date of commitment incorporating annual NRW reduction plan in annual recurrent and capital budget plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management		Indicator 3a&3b&3c: Not yet. Indicator 3d: Ongoing but delayed due to delay in Activity 1-7 and 3-9.	

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above; they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption	
	The Nigerian Side	The Japanese Side		
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure/estimate water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data/estimation 1-4 Calculate the water consumption based on the billing data 1-5 Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: Director General Manager of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manager / Coordination 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring Design 12. Remote Monitoring Device Installation / Training 13. Financial Analysis / Organization 14. Other experts mutually agreed upon as necessary	A. Natural disaster / political / instability / economic crisis that affect the Project activities do not occur.	
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities (to be financed by Counterpart Fund)** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers for flow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs (to be financed by Counterpart Fund)** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system for selected zonal meters 9. Solar powering systems for zonal meters 10. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for bulk meters for water treatment plants and zonal meters **Training of the Nigerian Project Personnel** 1. Eighteen persons mutually agreed upon will be trained in Japan. 2. GIS training in Nigeria	**Pre-Conditions** A. Furnished offices for Japanese Experts are secured at the Headquarters and each Pilot Area Office of FCTWB. B. Project Personnel is assigned with the finalized list.	
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2019-2023) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction 3-8 Review existing plans, activities and implementing structure, etc. related to water distribution management 3-9 Establish framework of water distribution management				**Issues & Countermeasures** **(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)** Issue: Data acquisition is not always available due to non-full flow of water at bulk flow meters. The Nigerian side identified interference along trunk mains by water flow as a cause of non-full flow of water and also overflow from plants. Countermeasures: FCDA started relocation works of the injection point in June 2018, and will complete it by the end of July 2018. **(2) Customers' Zonal and PMA Coding (Output-1)** Issue: Customers' zonal and PMA coding is still ongoing and FCTWB has faced in difficulty in identifying their locations. Some customers lack address information in billing system database, so coding has slowed down. Countermeasures: Customers' address information should clarified one by one and efficiently, then coding should be completed by the second week of July 2018. **(3) Irregular Billing Cycle (Output-1)** Issue: Meter reading and billing has not been done in regular intervals. The inability is attributed to operational challenges such as dearth of billing paper and non-constant power supply which are caused by funding problem. Countermeasures: The issue is escalated properly to not only management of FCTWB but also governing Board and FCTA to address importance, and to obtain their understanding and necessary funding. **(4) Monitoring of NRW Ratio and/or related Data in Zone and PMA** Issue: a) System input volume to Zone 5 is not measurable because of solar panel stolen. b) System input volume to PMAs in Jabi and Garki I are not measurable or recordable because of meter or data transfer failure. c) Prepaid meter payment record in Gudu PMA has not been submitted regularly from Metering Unit to NRW Unit. Countermeasures: a) Solar system should be recovered by the end of July 2018. b) The meter in Jabi PMA should be replaced, and data transfer failure in Garki PMA should be solved by the end of July 2018. c) Prepaid meter payment record in Gudu PMA should be submitted regularly by utilizing an alternative data sources.

Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow; (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio; and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDMs

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to September 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Dicrect Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT Pilot Area Offices: Jabi, Garki I and Gudu

Version 6
Dated 23 Jun. 2018

Monitoring 27 Jun. 2018

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.	a. NRW reduction operations are carried out according to the medium-term strategic plan for NRW reduction (2019-2023) .	a. Report of NRW reduction activities and monitoring by NRW Unit (NRW ratio, records of leakage detection, repair, disconnection of illegal connections, etc.)		Not yet.	
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project. b. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. c. NRW ratio of each PMA is monitored.	a. Date of approval of the plan b. Results of joint assessment based on the criteria set by the Project c. Record of NRW ratio kept by NRW Unit	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed	Indicator a: Not yet. Indicator b: Follow-up capacity development have been done in Phase-2 of the Project. Indicator c:Partially monitored.	
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.	1a. Record of NRW ratio is kept by NRW Unit. 1b. NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting. 1c. NRW ratio of the service area of FCTWB is reported to Management of FCTWB . 1d. Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	1a. Record of NRW ratio 1b&1c. Material for meetings submitted by NRW Unit 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers	Indicator 1a&1b&1c: NRW ratio was estimated because of data deficiency at bulk meters and recorded/reported. Indicator 1d: Water flow has been recorded by zonal meters although data deficiency.	
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	2a. Record of NRW ratio kept by NRW Unit 2b. Date of approval of the manuals		Indicator 2a: Not successful in SMA-2 of Garki I due to difficulty in identifying the installed pipeline, but indicator was generally achieved in all three PMAs. Indicator 2b: Reviewed and updated. Approval process is ongoing.	
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval. 3b. An annual NRW reduction plan (2019) is committed by the governing Board of FCTWB, to be incorporated in FCWTB's annual recurrent and capital budget plan (2019) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the General Manager of FCTWB. 3d. Framework of water distribution management is established	3a. Date of official letter submitting draft strategic plan 3b. Date of commitment incorporating annual NRW reduction plan in annual recurrent and capital budget plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management		Indicator 3a&3b&3c: Not yet. Indicator 3d: Ongoing but delayed due to delay in Activity 1-7 and 3-9.	

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above; they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption
	The Nigerian Side	The Japanese Side	A. Natural disaster / political / instability / economic crisis that affect the Project activities do not occur.
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure/estimate water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data/estimation 1-4 Calculate the water consumption based on the billing data 1-5 Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: General Manager of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manager1 / Coordination 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring Design 12. Remote Monitoring Device Installation / Training 13. Financial Analysis / Organization 14. Other experts mutually agreed upon as necessary	**Pre-Conditions** A. Furnished offices for Japanese Experts are secured at the Headquarters and each Pilot Area Office of FCTWB. B. Project Personnel is assigned with the finalized list.
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities (to be financed by Counterpart Fund)** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers for flow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs (to be financed by Counterpart Fund)** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system for selected zonal meters 9. Solar powering systems for zonal meters 10. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for bulk meters for water treatment plants and zonal meters **Training of the Nigerian Project Personnel** 1. Eighteen persons mutually agreed upon will be trained in Japan. 2. GIS training in Nigeria	
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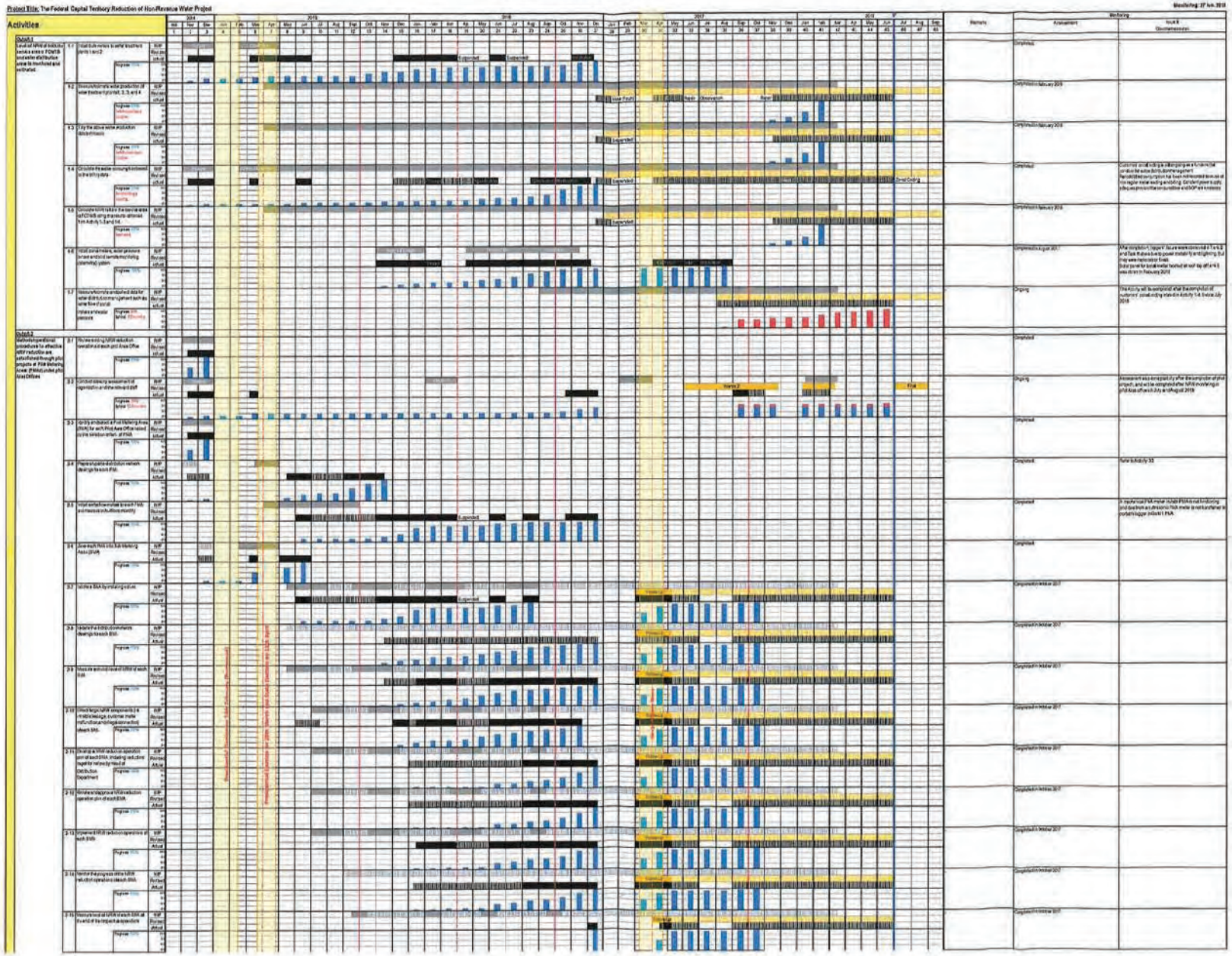
Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow; (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio; and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team

Project Monitoring Sheet II (Plan of Operations)

Plan of Schedule and Actual Work Period

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project



PM Form 3-3 Project Monitoring Sheet II
PO5
Version: 5
Dated: 28 Jan. 2018
Monitoring: 27 Jun. 2018

Project Monitoring Sheet II (Plan of Operations)

Plan of Schedule and Actual Work Period

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project

Output	No.	Activities	Achievement	Issue & Countermeasures
	2-16	Prepare a report on pilot projects covering Activity 2-1 to 2-15	Completed in August 2017	
	2-17	Develop manuals for NRW reduction for Area Offices managers and field operators (ie. technical officers & meter readers), incl. audio visual materials	Completed in July 2018	
Output 3: A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1 & 2	3-1	Establish a Working Group for NRW reduction planning	Completed	
	3-2	Review existing plans, implementation structure, etc. related to NRW reduction in FCTWB	Completed	
	3-3	Conduct hydraulic analysis of the pipeline network	Completed in November 2017	
	3-4	Develop outline of the medium-term strategic plan and its annual NRW reduction plan (approval by the Director)	Completed in December 2017	
	3-5	Develop the first medium-term strategic plan (2019-2023) for approval by FCTA	Ongoing	Working Group and Advisory Group members have been involved in documentation and check/comments. To be completed by the end of June 2018
	3-6	Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA	Ongoing	Working Group, particularly NRW Unit has been involved in documentation based on the first medium-term strategic plan (2019-2023). To be completed by the end of July 2018
	3-7	Develop a planning manual for NRW reduction	Ongoing	JICA Expert Team and NRW Unit have been involved in preparation. To be completed by the end of July 2018
	3-8	Review existing plans, activities and implementing structure, etc. related to water distribution management	Completed in October 2017	
	3-9	Establish framework of water distribution management	Ongoing	The activity will be completed after the completion of customers' proof testing stated in Activity 3-4, before July 2018
Duration / Phasing			54 months	6 months will be extended after amendment of RD and revision of PDM Ver. 3

Inputs (the Japanese side)

JICA Expert

Equipment

Project Monitoring Sheet II (Plan of Operations)

Plan of Schedule and Actual Work Period

PM Form 2-3 Project Monitoring Sheet II

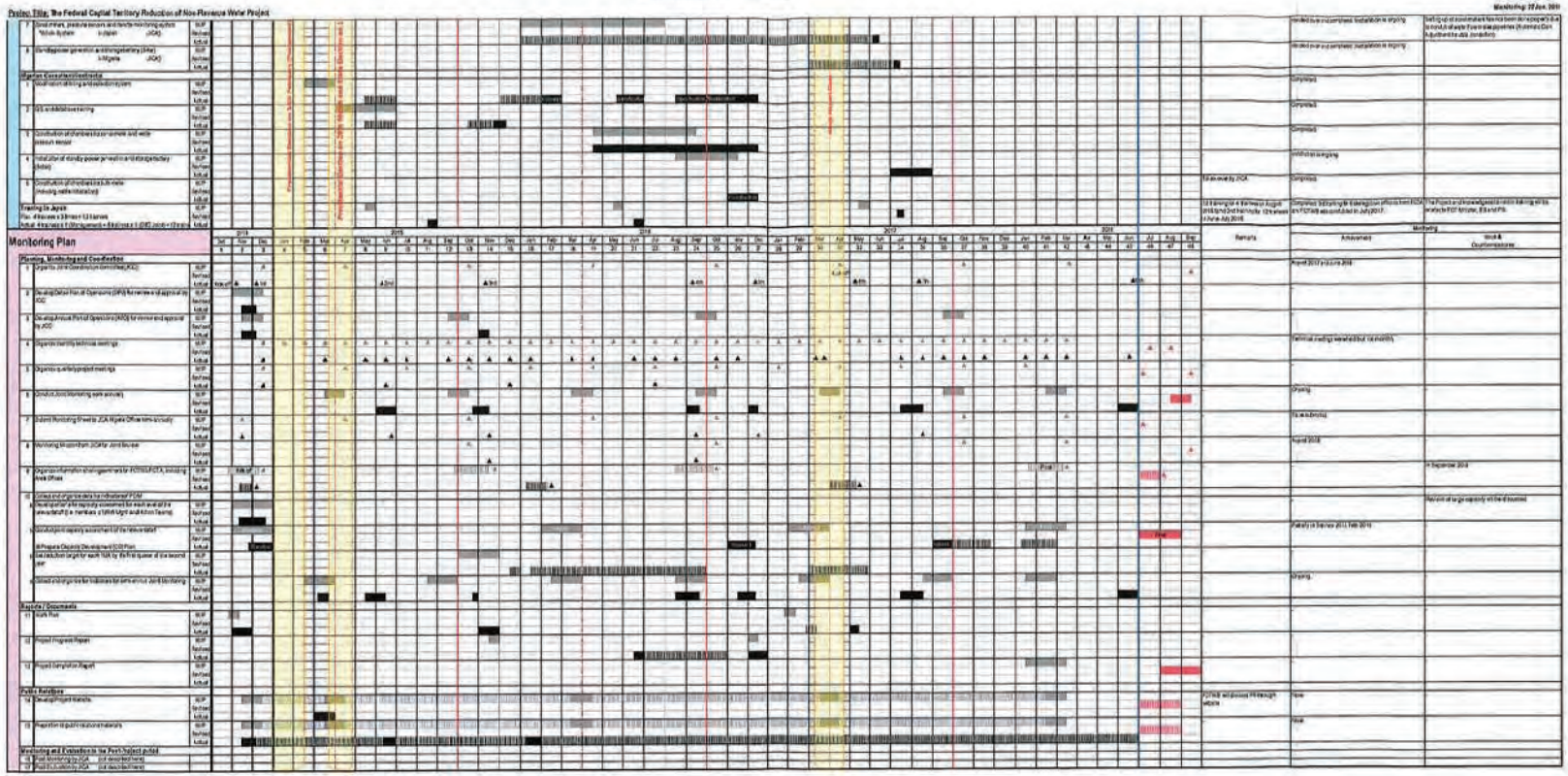
PO5

Version: 1

Dated: 24 Jun, 2011

Monitoring: 22 Jun, 2011

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project



Appendix 6

Federal Capital Territory Administration

ABUJA
The Heart of Nigeria

Federal Capital Territory Water Board

Japan International Cooperation Agency

JICA

The Federal Capital Territory Reduction of Non-Revenue Water Project

THE MEDIUM-TERM STRATEGIC PLAN FOR NRW REDUCTION (2019-2023)

SUMMARY
(Draft)

June 2018

By: Project Team

Annex2-467

Table of Content

1. Introduction to NRW Reduction

1.1 Background

The Federal Capital Territory Water Board (FCTWB) was established in October 1989, saddled with the responsibility of supplying potable water to inhabitants of the Federal Capital Territory (FCT). In carrying out this responsibility, the FCTWB has been facing challenges of operation and maintenance of facilities as well as large proportion of non-revenue water (NRW). The FCTWB could not effectively mitigate NRW because of limited experience, insufficient knowledge and unskilled personnel on planning and execution of NRW reduction.

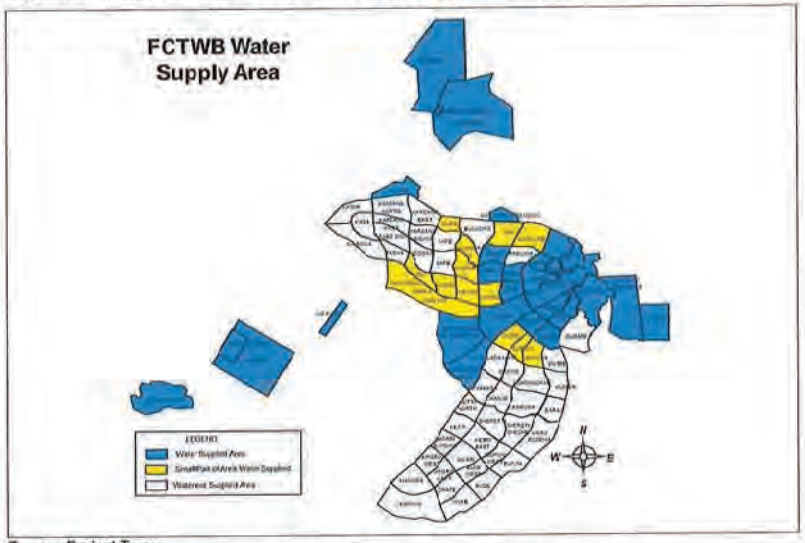
Based on the above, in order to strengthen NRW reduction capacity of the FCTWB and ameliorate issues of NRW, the Federal Capital Territory Administration (FCTA) and the FCTWB has implemented "the Federal Capital Territory Reduction of Non-Revenue Water Project" (the Project), the technical cooperation in collaboration with Japan International Cooperation Agency (JICA).

1.2 Water Supply Facility

The FCTWB's urban water supply system for the Federal Capital City (FCC) relies on two water sources: Lower Usuma Dam (Capacity: 100 million m^3) and Gurara Dam (Capacity: 850 million m^3). The current system consists of Lower Usuma Dam Water Treatment Plants (Design Production: 240,000 m^3/day from Phase 1&2 and 480,000 m^3/day from Phase 3&4) including service reservoirs (24,000 to 45,000 m^3), transmission mains (44 km), distribution mains (535 km) and network pipelines which supplies water to about 47,000 customers (connections) in FCC Phase 1 development area, and a part of FCC Phase 2 area and some satellite towns.

1.3 Water Supply Area

Figure 1-1 shows current FCTWB's water supply areas by District.



Source: Project Team

Figure 1-1 FCTWB's Water Supply Area by District

1.4 Water Supply Situation

Table 1-1 shows water supply situation by Area Office and District.

Table 1-1 Water Supply Situation by Area Office and District

	Area Office	District or Suburb served	Water Supply Situation
1	Abaji	Abaji Town	Hand pumps and motorized boreholes.
2	Asokoro	Asokoro District	Improved supply (gravity and pump)
3	Bwari	Bwari Town	Intermittent by rationing (booster pumping from LUD)
4	Gwagwalada	Gwagwalada Town	Regular with network challenges
5	Garki I	Area 1,2,3,8,11 & 10	Regular
6	Garki II	Garki II, Central Area	Regular
7	Gudu	Gudu District/Games Village	Regular
8	Gwarimpa	Gwarimpa District	Regular
9	Jabi	Utako District, Life Camp & Idu/Karmo, Kado Estate, Katampe and Katampe Extension.	Regular
10	Karu/Nyanya	Karu & Nyanya Towns	Intermittent by rationing
11	Kubwa I	Kubwa I Town	Regular
12	Kubwa II	Kubwa II Town	Regular
13	Maitama	Maitama District	Regular with challenges
14	Wuse I	Wuse I District	Regular with high rises issue and network challenges in parts of zone 3 & 6
15	Wuye	Wuye District	Regular
16	Wuse II	Wuse II District	Regular with challenges in A3 (low pressure)

Source: Project Team

1.5 Current NRW Situation

The Project estimated NRW ratio of urban water supply system for the FCC at 48.3% for the year 2014-2017 as follows:

- System Input Volume: 113.38 million m^3 per year
- RW: 58.63 million m^3 per year
- NRW: 54.75 million m^3 per year (113.38 million - 58.63 million) m^3 per year
- NRW Ratio: 54.75 / 113.38 = 48.3%

Remarks: A considerable number of return bills exist in the billing system of FCTWB, which make analysis inaccurate. "Return (or duplicated) bills" mean the bills which are supposed to be eliminated or deactivated from billing system but have remained. If FCTWB eliminates these bills from billing system, NRW ratio gets higher than this.

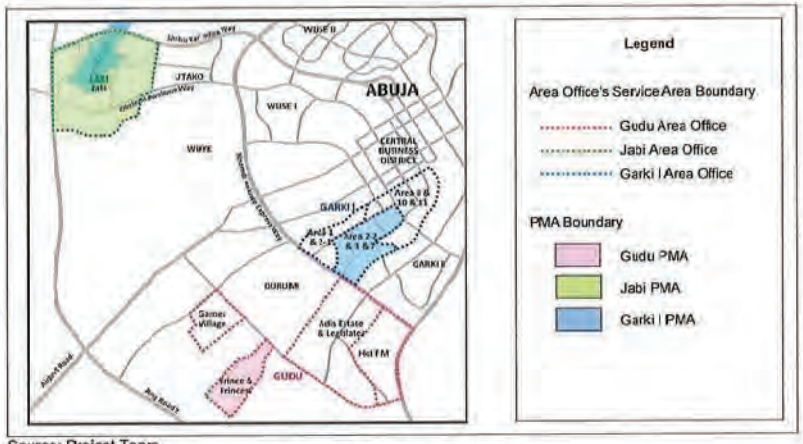
NRW ratios varies from 45.6% to 87.6% in Pilot Metering Areas (PMA) before NRW reduction operations.

2. Assessment of the Pilot Projects

2.1 Overview of the Pilot Projects

The Project implemented the pilot projects on NRW reduction to prepare this strategic plan together with relevant Area Offices in three PMAs, which are defined as District-Metered Areas (DMA).

Figure 2-1 shows location of PMAs and Table 2-1 shows their features.



Source: Project Team

Figure 2-1 Location of PMAs

Table 2-1 Features of PMAs

Pilot Area Office	No. of Customer in PMA	Max. Pipe Dia. (mm)	Total Distance of Pipes (m)	Number of In/out-flow (Places)	Predominant Type of Water Meters in PMA (% of the total installed water meters)
Gudu	784	DN200	14,150	1 / 0	Prepaid (83.0%)
Jabi	604	DN300	23,781	1 / 2	Convertional (96.5%)
Garki I	452	DN450	11,858	1 / 2	AMR (57.7%)
Total	**2,001**	-	**49,789**	-	-

Source: Project Team

2.2 Result of the Pilot Projects

Table 2-2 shows results of NRW reduction operations. NRW ratio after NRW reduction operations apart from SMA-2 of Garki I were achieved successfully.

Table 2-2 NRW Ratio (%) and Reduction Points in PMAs

Area Office	PMA/ SMA	Before NRW Reduction Operations (%)	After NRW Reduction Operations (%)	Percentage-Reduction Point	Target after Reduction (%)	Achievement
Gudu	SMA-1	52.0	12.1	39.9	31.2	OK
	SMA-2	53.9	29.9	24.0	32.3	OK
	PMA	53.3	20.4	32.9	32.0	OK
Jabi	SMA-2	45.6	21.1	24.5	27.4	OK
	SMA-3	87.6	42.6	45.0	52.6	OK
	PMA	70.0	30.9	39.1	42.0	OK
Garki I	SMA-1	85.1	45.2	39.9	51.1	OK
	SMA-2	74.8	49.3	25.5	44.9	Non
	SMA-3	70.0	27.4	42.6	42.0	OK
	PMA	74.8	34.7	40.1	44.9	OK

Source: Project Team

Annex2-469

2.3 Causes of NRW and their Patterns by Features of the Pilot Projects

As a result of the pilot projects, causes of NRW and their patterns by features are summarised as follows:

(1) Gudu PMA

In the area like Gudu PMA in Phase 2 development area where prepaid meters were installed by private developers, the following components contribute to NRW:

- Billed unmetered consumption (excess use by flat-rate customers)
- Unauthorized consumption (illegal bypassing/connections), and
- Physical losses (surface/underground leaks) on network pipelines and service pipes

(2) Jabi PMA

In the area like Jabi PMA in Phase 2 development area where conventional meters are common, the following components contribute to NRW:

- Unauthorized consumption (illegal bypassing/connections)
- Customer metering inaccuracies and data handling errors
- Physical losses (surface/underground leaks) on network pipelines and service pipes

(3) Garki I PMA

In the area like Garki I PMA in Phase 1 development area where Automatic Meter Reading (AMR) meters were introduced and a number of major consumers exist, the following components contribute to NRW:

- Billed unmetered consumption (excess use by flat-rate customers)
- Unauthorized consumption (illegal bypassing/connections), and
- Physical losses (surface/underground leaks) on network pipelines and service pipes

2.4 Cost Effectiveness of the Pilot Project

Cost incurred for three pilot projects and envisaged increased revenue were sorted out as shown in Table 2-3. The Project applies the following conditions to cost-benefit analysis:

After initial NRW reduction operations, the improved NRW ratio will be maintained through routine monitoring and maintenance activities. Monitoring and maintenance activities for three years are assumed as same as the initial cost spent in the NRW reduction operations.

Even though FCTWB spends a certain amount of expenses for NRW reduction operations, FCTWB increase billed water in return for NRW reduction operations. Therefore, it is desirable that FCTWB positively takes NRW reduction operations. However, it is essential that FCTWB seeks to apply the activities apart from the NRW reduction operations taken in the pilot project in the light of delay or no release of the Nigerian budget to implement NRW reduction operations.

Table 2-3 Cost Effectiveness of the Pilot Project

PMA	1) Initial Cost incurred for the Pilot Project (K. NGN)	2) Initial & Recurrent Cost for NRW Reduction Operation* (K.NGN)	3) Estimated Revenue Increase for three years (K. NGN)	3) Cost Effectiveness (Dimensionless) 3) / 2)
Gudu	40,949	81,898	100,576	1.2
Jabi	47,498	94,996	274,317	2.9
Garki-I	48,937	97,874	112,426	1.1

Source: Project Team

* Recurrent cost for NRW reduction required to maintain conditions well for three years is estimated as 100% of the initial cost spent in the Pilot projects.

Furthermore, Table 2-4 shows direct benefit by NRW reduction operation for three years in terms of recurrence of NRW. Elimination of illegal connection and leakage is efficient

operations compared with mitigation of nominal excess use and unbilled unmetered & meter inaccuracy.

Table 2-4 Direct Benefit by NRW Reduction Operation

No.	Items	Main Causes of NRW	Gudu	Jabi	Garki I
(1)	Initial & Recurrent Cost for NRW Reduction Operation* (k. NGN)	Nominal Excess Use	19,164	24,504	46,294
		Unbilled Unmetered & Inaccuracy	1,966	28,499	17,813
		Illegal & Physical Losses	60,686	42,843	33,767
		Total	81,816	95,946	97,874
(2)	Expected Water Sales for three years (k. NGN)	Nominal Excess Use	1,833	6,312	20,796
		Unbilled Unmetered & Inaccuracy	1,833	-28,065	1,686
		Illegal & Physical Losses	96,500	296,064	89,940
		Total	100,266	274,311	112,422
(3)	Direct Benefit (k. NGN) (2) - (1)	Nominal Excess Use	-17,331	-18,292	-25,498
		Unbilled Unmetered & Inaccuracy	-133	-56,564	-16,127
		Illegal & Physical Losses	35,914	253,221	56,173
		Total	18,450	178,365	14,548

Source: Project Team

2.5 Findings and Lessons Learnt

2.5.1 Findings

The following findings were obtained through the overall activities

(1) Lack of Feedback between FCTWB and FCDA

The pilot project observed that as-built drawings of the laid pipeline networks have not been handed over from FCDA to FCTWB properly, and also problems and issues in O&M have not been fed back to FCDA for improvement in services.

(2) As-Built Drawings

Drawings of pipelines are supposed to be managed and stored in Pipeline Unit of FCTWB Headquarters (HQ) and/or Area Offices. However, most of existing drawings are not soft copies but hard copies and are not well organized. Most of drawing copies are only one set in FCTWB.

As far as it goes, FCTWB has maintained the facilities by relying on pipeline information based on individual knowledge or using design drawings which is often different from actual situation of the constructed facilities.

This was one of facts which forced the pilot projects to redo NRW reduction operations.

(3) GIS

During pilot projects, FCTWB shifted own GIS system being free from AGIS security which was an obstacle for smooth GIS operation and data transfer. However, GIS Unit of FCTWB is still an interim unit consisting of one staff plus a casual staff

(4) Inefficient Management of Customer Data

While HQ staff make use of customer data computed from database (billing system), Area Offices manually deal with customer data by using "Customer Notes (List)" transcribed from printed bills by Commerce staff in Area Offices, which is an inefficient procedure and causes data handling errors, then may lead to wrong billing.

This was one of facts which forced the pilot project to redo NRW reduction operations.

(5) Complexity in Customer Category

Customers are categorized variously. These category mixture caused difficulty in data assembling in the pilot project.

(6) Several Types of Customer Meter

Customer meter types are; conventional including flat-rate, AMR and prepaid meters. This mixture makes C&M and financial analysis difficult.

(7) Estimate Billing System

A considerable number of estimate bills caused by no meter reading, which sometimes lead to unexpected billed amount to customers and then their complaints, hamper calculation of revenue water. No meter reading usually results from absence of customer, inaccessibility to customer meter, infrequent meter reading due to non-provision logistics, and probably dereliction of meter reader.

(8) Duplicated / Return Bills

A number of duplicated/return bills exist in billing system of FCTWB, which make analysis inaccurate. "duplicated/return bills" mean the bills which are supposed to be eliminated or deactivated from billing system but have remained, then have resulted in being returned or not delivered. Existence of duplicated/return bills in billing system causes wastefulness and unreliable financial analysis statement, NRW and collection ratio.

(9) Complexity in Water Tariff

Water tariff are, as standard, N80/m^3 or N5,500/month for domestic, N150/m^3 or N45,000/month for commercial, and N150/m^3 or various prices per month for major consumers. This mixture makes financial analysis complicated.

(10) Customer Meter Inaccuracy

Inaccuracy of conventional meter is higher than that of AMR and prepaid meters. After replacement of those meters in the pilot projects, NRW ratio was improved certainly. However, meters will be getting inaccurate gradually without regular maintenance and periodical replacement.

(11) Unauthorized Consumption

Illegal bypassing/connections were found in all the three PMAs, particularly often in Gudu and Garki I PMAs where prepaid or AMR meters were installed. These were caused by non-reading or non-inspection by water board's staff and non-existent regular monitoring in the field.

(12) Leakage

The pilot project observed water leaks on both network pipelines and service pipes up to customer meters, and surface leakage because of low-quality in appurtenant/meter materials, installation and workmanship, and non-standard situations such as service pipes laid from the back side. The pilot project also observed an inflow pipeline over a ditch without a sheath pipe and bursts due to substandard materials and no thrust block.

(13) Quality Failure in Facility and Workmanship

Low quality in construction and plumbing works including materials was observed across the pilot projects, which causes pipe burst and leakage.

2.5.2 Lessons learnt

The following lessons learnt were obtained through implementation of the pilot projects. The

lessons learnt were basis of setting-up the various scenarios.

(1) Delayed or No Release of the Nigerian Budget to implement NRW Reduction Operations

The pilot project suffered from delayed or no release of the Nigerian budget to implement NRW reduction operations such as chamber construction for flow-meters and valves to create PMA (DMA), leak repair by using materials and logistics including fuel. Budget constraint always hampered implementation of the pilot projects.

(2) Area Office's Capability, Logistics and Staff Skills

Budget allocation is limited for the routine services which Area Offices are in charge, and as an organization capacity, Area Offices are not equipped well with personal computer, material stocks, tools and devices, as well as their logistics including vehicles, fuel, electricity and in-house power generation are not enough at all to provide adequate and quality services for O&M and meter reading.

As an individual capacity, staff such as plumbers and water meter readers have attended limited systematic employee training under the human resources development programme of FCTWB. They can learn skills through on-the-job training or apprenticeship from superiors. In addition, most of staff are not good at mathematics, reading drawings, maps and operate personal computer, even basic word-processing and spreadsheet programmes due to their educational background and inadequate training. It was also observed that, although staff are willing to learn and contribute, staff have little responsibility and motivation because of no incentives, poor logistics and working conditions of Area Offices. Consequently, skill development was limited to some staff in each pilot Area Office.

(3) Difficulties in isolating PMAs and SMAs

The pilot projects faced difficulties in isolating PMAs and SMAs due to lack or discrepancy of the existing pipeline information among design drawings and staff's knowledge. The existing GIS pipeline network data has never been updated and doesn't reflect correct information in Garki I, meanwhile FCTWB doesn't have any drawings and GIS data in Gudu and Jabi.

Customer location maps are not available because FCTWB has never positioned customers on drawings or GIS. This also caused difficulties in identifying customers inside PMAs and SMAs.

(4) Meter Reading Divisions and Flat-Rate

Several divisions of FCTWB, such as Area Offices, AMR Unit, Prepaid Unit and nine Units for major consumers in HQ are responsible for meter reading. This kind of segmentation causes inefficiency of the billing.

Flat-rate customers tend to consume water more than the expected as excess use, a part of NRW.

(5) Billed Unmetered Consumption (Nominal Excess Use)

A certain number of flat-rate (unmetered) customers existed and resulted in spending much time on calculation of revenue water in baseline analysis. They tend to consume water more than one which is converted from set tariff as nominal excess use according to measurement in the pilot projects, so installing meters to flat-rate customers contributes to NRW reduction.

(6) Unbilled Unmetered Consumption

The pilot projects observed some unbilled unmetered consumption from major consumers, public institutions because of procedural omission and also from FCTWB offices and its staff quarters. FCTWB needs to install meters, shift them to the billed or unbilled metered

consumers at least by installing meters to measure water consumption.

3. Scenario, Goal and Cost-Effectiveness

3.1 Overall Scenarios

From lessons obtained through the pilot project, it is very difficult for Project Team to determine the particular NRW reduction activity. Project Team therefore, prepared six scenarios such as Scenario-a to Scenario-e for NRW reduction operations in order flexibly to cope with influence due to various conditions such as budget disbursement, appointment of trained appropriate staff, progress of database for the existing pipelines in future. Figure 3-1 shows criteria for selecting scenario of NRW Reduction Activity as aspects of financial, human resources, etc. are changed.

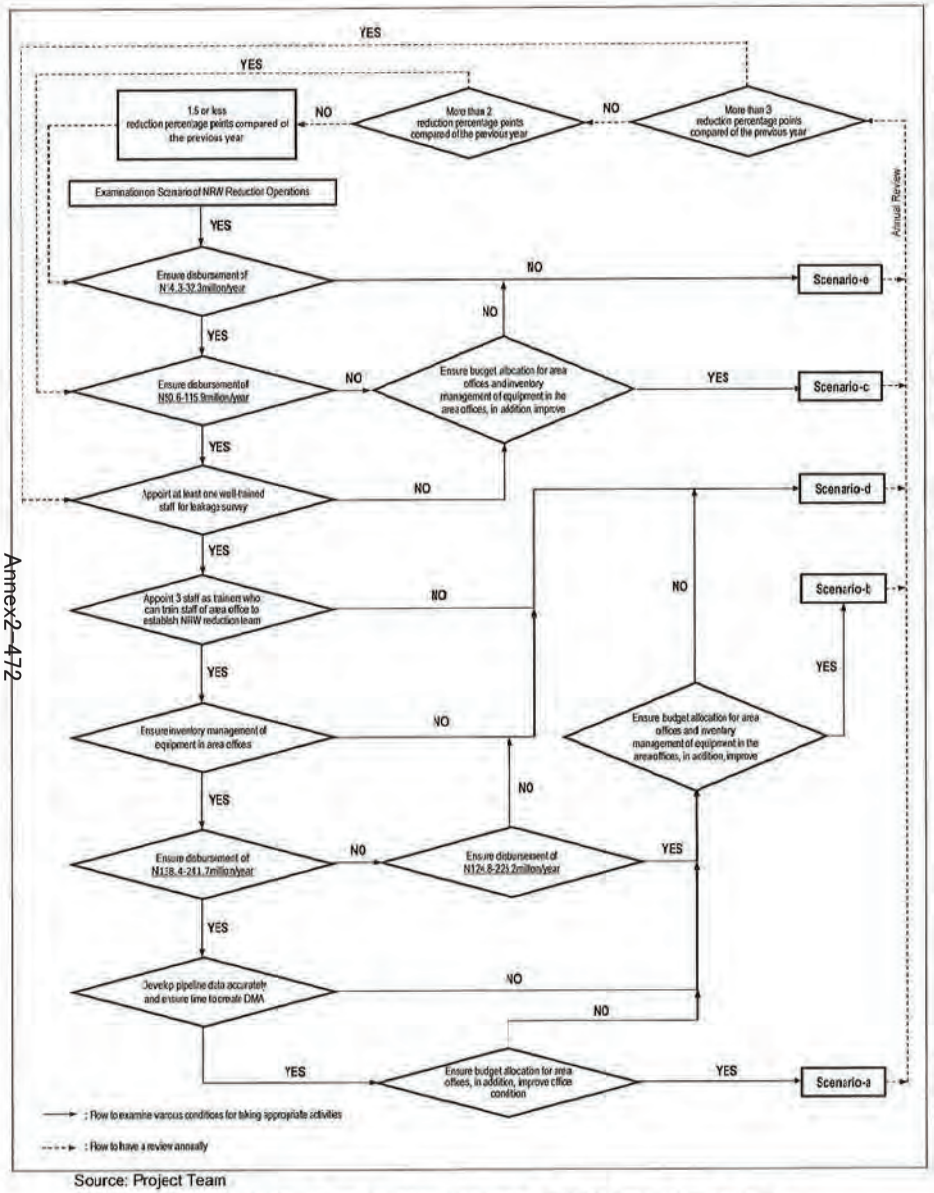
Especially, Project Team set condition for the criteria in terms of the following five aspects:

- Budget release
- Appointment of well-trained staff for leakage survey
- Appointment of trainers required for Area Office's staff
- Inventory management of equipment in Area Office
- Development of pipeline data

Table 3-1 summaries main activities and procurement of equipment of all the scenarios as well as target NRW ratio. The target NRW ratio shown in Table 3-1 indicates percentage unless scenario is changed the year 2019 through 2023. Therefore, target NRW ratio should be reviewed and setup in the annual action plan based on the first six-month activities of the previous year.

Even if FCTWB does not achieve targeted NRW ratio for the year of 2023, the common objective of NRW reduction operation among five scenarios is to achieve the following activities which are significant for FCTWB to learn status of NRW ratio.

- Data collection of monthly billed consumption
- Data collection of monthly System Input Volume (SIV)
- Monthly IWA water balance analysis



Source: Project Team

Figure 3-1 Criteria for selecting Scenario of NRW Reduction Activity

Table 3-1 Features of Scenarios for NRW Reduction Operations

Items	Scenario				
	a	b	c	d	e
1. Target					
1.1 Target Year	2023	2023	2023	2023	2023
1.2 Baseline NRW Ratio (%)	48.3	48.3	48.3	48.3	48.3
1.3 Target NRW Ratio in 2023 (%)	31.9	32.4	36.9	35.1	42.8
1.4 Reduction Approach	DMA	Zone	Zone	Zone	Zone
2. Main Body for NRW Reduction Operations					
2.1 Main Body for Operations (Supervision)	HQ's NRW Unit	HQ' NRW Unit	HQ's NRW Unit	HQ's NRW Unit	HQ's NRW Unit
2.2 Main Body for Operations (Field Actions)	Area Offices	Area Offices	Area Offices	HQ's NRW Unit	HQ's NRW Unit
3. NRW Reduction Operations					
(1) Network Drawings and Data	X	X	X	X	X
(2) Customer Enumeration					
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X
(3) DMA Design, Creation and Prioritization	X	-	-	-	-
(4) Zonal Prioritization	-	-	-	X	X
(5) Field Inspection	X	-	-	-	-
(6) Isolation by installing Flow Meters and Valves	X	-	-	-	-
(7) Step Test in DMA	X	-	-	-	-
(8) Zonal Measurement	-	-	-	X	X
(9) Leakage Detection					
a) by Area Office (DMA)	X		-	-	-
b) by Area Office (Zone)	-	X	-		-
c) by NRW Unit (Zone)	-	-	-	X	X
(10) Patrol of Surface Leaks	-	-	X	-	-
(11) Repair of Leaks and Recording					
a) for (9)-a)	X	-	-	-	-
b) for (9)-b)	-	X	X	-	-
c) for (10)	-	-	X	-	-
d) for (9)-d)	-	-	-	X	X
(12) Identification of Illegal Connection and Inaccuracy Meters					
a) Illegal Connection (Area Office)	X	X	X	-	-
b) Illegal Connection (NRW Unit)	-	-	-	X	X
c) Inaccuracy Meters	X	X	X	X	-
d) Labo Test of Meter Inaccuracy for Meter Standardization	X	X	X	X	-
(13) Measures against Illegal Connection and Meter Inaccuracy					
a) Illegal Connection (Area Office)	X	X	X	-	-
b) Illegal Connection (NRW Unit)	-	-	-	X	X
c) Meter Inaccuracy	X	X	X	X	X
(14) Data Collection of Monthly Billed Consumption					
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X
(15) Data Collection of Monthly SIV					
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X
c) Bulk Meters	X	X	X	X	X
(16) Monthly Water Balance Analysis	X	X	X	X	X
(17) Measurement of 1-week SIV (DMA)	X	-	-	-	-
(18) Installing Water Meters	X	X	X	X	-
(19) Survey on Trunk, Distribution Mains and Reservoirs	X	X	X	X	X
(20) Preparation for Pipe Replacement Plan	X	X	X	X	X
4. Procurement of Equipment					

Items	Scenario				
	a	b	c	d	e
4.1 Flow Meters and Valves for Isolation	X	-	-	-	-
4.2 Leak Detection Equipment	X	X	-	-	-
4.3 Water Meters	X	X	X	X	-
5. Place where equipment is stocked					
5.1 Existing Equipment	3 Pilot A.O.	3 Pilot A.O.	NRW Unit	NRW Unit	NRW Unit
5.2 Newly-procured Equipment	A.O.	A.O.	-	-	-

Source: Project Team

3.2 Scenarios

(1) Scenario-a

1) Summary of Scenario

FCTWB will establish the NRW reduction team in each Area Office. The team will create DMA and take NRW reduction operations like the Pilot Project targeting on NRW ratio of 31.9% for the year 2023.

2) Pre-condition

The following are pre-condition to take NRW reduction operations based on Scenario-a.

- Develop data on the existing water supply pipelines accurately ensure time to create DMA.
- Appoint staff who were involved in The Federal Capital Territory Reduction of Non-Revenue Water Project in FCTWB HQ.
- Appoint three staff as trainers who are able to train staff of Area Offices to establish NRW reduction team in Area Office.
- Appoint well- trained staff for installation of flow meters and leakage survey.
- Ensure enough budget of about N883million for five years for allowance and equipment such as flow meters, isolation valves, leak detectors, customer water meters, meter boxes, fuel, pipes, their fittings, etc.
- Ensure adequate budget allocation for Area Offices.
- Ensure inventory management of equipment such as leak detectors, flow-meters, etc. in Area Offices.
- Improve Area Offices' condition.
- Ensure vehicle and PC.

3) External Factors

NRW reduction operations may suspend for a certain period due to circumstance of cash disbursement in transition period for FCTWB's autonomy.

In addition, NRW reduction operations may not be carried out due to objections of some of the FCTWB's board members who are concerned with budgetary fund for NRW reduction operations.

4) Challenges in Future

FCTWB must consider the following actions as soon as possible in order to maintain NRW reduction operations.

- Procure leakage survey equipment and accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition.

(2) Scenario-b:

1) Summary of Scenario

FCTWB will establish the NRW reduction team in each Area Office. The team will NOT create DMA, but will take NRW reduction operations such as leakage survey, illegal connection survey and water meter survey by zone targeting on NRW ratio of 32.4% for the year 2023.

2) Pre-condition

The following are pre-condition to take NRW reduction operations based on Scenario-b.

- Appoint staff who were involved in The Federal Capital Territory Reduction of Non-Revenue Water Project in FCTWB HQ.
- Appoint three staff as trainers who are able to train staff of Area Offices to establish NRW reduction team in Area Office.
- Appoint well- trained staff for leakage survey
- Ensure enough budget of about N805million for five years for allowance and procurement of equipment such as leak detectors, customer water meters, meter boxes, fuel, pipes, their fittings, etc.
- Ensure adequate budget allocation for Area Offices.
- Ensure inventory management of equipment such as leak detectors, flow-meters, etc. in Area Offices.
- Improve Area Offices' condition.
- Ensure vehicle and PC.

3) External Factors

NRW reduction operations may suspend for a certain period due to circumstance of cash disbursement in transition period for FCTWB's autonomy.

In addition, NRW reduction operations may not be carried out due to objections of some of the FCTWB's board members who are concerned with budgetary fund for NRW reduction operations.

4) Challenges in Future

FCTWB must consider the following actions as soon as possible in order to maintain NRW reduction operations.

- Procure leakage survey equipment and accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition.

(3) Scenario-c:

1) Summary of Scenario

FCTWB will establish the NRW reduction team in each Area Office. The team will NOT create DMA, but will take NRW reduction operations such as water meter survey, monitoring for surface leakage and illegal connection by zone targeting on NRW ratio of 36.9% for the year 2023.

2) Pre-condition

The following are pre-condition to take NRW reduction operations based on Scenario-c.

- Appoint three staff as trainers who are able to train staff of Area Offices to establish NRW reduction team in Area Office.
- Appoint staff who were involved in the Project in FCTWB HQ.
- Ensure enough budget of about N326million for five years for allowance and equipment such as customer water meters, meter boxes, fuel, pipes, their fittings, etc.

- Ensure adequate budget allocation for Area Offices.
- Ensure inventory management of equipment such as leak detectors, flow-meters, etc. in Area Offices.
- Improve Area Offices' condition.
- Ensure vehicle and PC.

3) External Factors

NRW reduction operations may suspend for a certain period due to circumstance of cash disbursement in transition period for FCTWB's autonomy.
In addition, NRW reduction operations may not be carried out due to objections of some of the FCTWB's board members who are concerned with budgetary fund for NRW reduction operations.

4) Challenges in Future

FCTWB must consider the following actions as soon as possible in order to maintain NRW reduction operations.

- Procure leakage survey equipment and accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition.

(4) Scenario-d:

1) Summary of Scenario

Only FCTWB HQ will take NRW reduction operations such as leakage survey, illegal connection survey and water meter survey systematically by zone but NOT create DMA. FCTWB will target on NRW ratio of 35.1% for the year 2023. Area Offices patrol for detect surface leakage and illegal connection.

2) Pre-condition

The following are pre-condition to take NRW reduction operations based on Scenario-d.

- Appoint staff who were involved in the Project in FCTWB HQ.
- Appoint well- trained staff for leakage survey
- Ensure enough budget of about N223million for five years for allowance and equipment such as customer water meters, meter boxes, fuel, pipes, their fittings, etc.
- Ensure vehicle and PC.

3) External Factors

NRW reduction operations may suspend for a certain period due to circumstance of cash disbursement in transition period for FCTWB's autonomy.

In addition, NRW reduction operations may not be carried out due to objections of some of the FCTWB's board members who are concerned with budgetary fund for NRW reduction operations.

4) Challenges in Future

FCTWB must consider the following actions as soon as possible in order to maintain NRW reduction operations.

- Procure accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition.

(5) Scenario-e:

1) Summary of Scenario

FCTWB HQ will focus on developing fundamental information of the existing water supply pipelines and customer enumeration required for future NRW reduction operations. HQ will also conduct leakage detection and measures against illegal connections for NRW reduction as much as possible. FCTWB will target on NRW ratio of 42.8% for the year 2023.

2) Pre-condition

The following are pre-condition to take NRW reduction operations based on Scenario-e.

- Appoint staff who were involved in the Project in FCTWB HQ.
- Ensure enough budget of about N124million for five years for allowance and fuel and equipment such as pipes, their fittings, etc.
- Ensure vehicle and PC.

3) External Factors

NRW reduction operations, particularly leakage detection and countermeasures against illegal connection, may suspend for a certain period due to circumstance of cash disbursement in transition period for FCTWB's autonomy.

In addition, NRW reduction operations may not be carried out due to objections of some of the FCTWB's board members who are concerned with budgetary fund for NRW reduction operations.

4) Challenges in Future

FCTWB must consider the following actions as soon as possible in order to maintain NRW reduction operations.

- Procure accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition.

In addition, staff who were trained through the pilot project have no an opportunity to take major activities for NRW reduction for the time being unless FCTWB applies other scenario. This may result in loss of staff's skill on NRW reduction operations.

3.3 Cost-Effectiveness by Scenario

Overall cost-effectiveness for five years was worked out in Table 3-2. Scenario-d indicates the highest cost-effectiveness at 18.9.

Table 3-2 Cost-Effectiveness by Scenario

Items		Scenario				
		a	b	c	d	e
Cost (mil. NGN)	i.	883.2	804.5	326.9	222.7	123.5
Revenue yielded (mil. NGN)	ii.	4,822.60	4,752.60	3,636.90	4,198.40	1,698.80
Direct benefit (mil. NGN)	iii=ii.-i.	3,939.40	3,948.10	3,310.00	3,975.70	1,575.30
Cost-Effectiveness	iv. = ii./ i.	5.5	5.9	11.1	18.9	13.8

Source: Project Team

3.4 Financial Consideration based on the Scenarios

The Financial statements of the five scenarios such as "Profit and Loss" and "Cash Flow" were examined and summarized scenario-wisely in this section.

(1) Conditions

Table 3-3 presents various conditions set out for the study.

Table 3-3 Conditions for preparing Financial Statement

Items	Conditions
1. Baseline of NRW ratio	48.3%
2. Incremental O&M expenditures	Scenario-wise
3. Capital investment expenditures	
1) Construction works in 2019 for the switch over of the water supplied by LUD-WTP Phase-3&4	NGN673Mil.
2) Procurement in connection with the scenarios	Scenario-wise
4. Depreciation	
1) Procurement of above 3-2)	10 years
2) Other assets including the construction of switch-over and Phase-3&4	20 years
5. Price escalation	Not applied
6. Tariff: weighted average between the domestic and commercial customers	NGN90/m³
7. Collection ratio of water tariff against bills raised	31.3%
8. Allocation and remittance to FCTA	Not applied

Source: Project Team

(2) Profit and Loss (P/L) Statement

Table 3-4 shows the summary of the P/L statement for the year 2023. With-project cases (five scenarios) will obviously make a larger profit than without-project case (no scenario).

Table 3-4 Summary of P/L Statement of the Year 2023 by Scenario (Million Naira)

Account Items	No Scenario	Scenarios				
		a	b	c	d	e
1.Revenues	7,829	10,306	10,239	9,547	9,824	8,668
2.Expenditures	2,799	2,895	2,886	2,844	2,824	2,815
3.P/L = 1-2	5,030	7,411	7,353	6,703	7,000	5,853

Source: Project Team

(3) Cash Flow (C/F) Statement

The C/F Statement refers to cash-inflows and cash-outflows in a given period categorizing such activities as operational, investment and financial. The difference between the cash-inflows and the cash-outflows comes out to "net cash flow" at the end. Table 3-5 presents the C/F Statement for the year 2023.

With-project cases (five scenarios) will apparently generate the net C/F more than without-project case (no scenario). Moreover, the net C/F will surely soar if reducing the number of un-paid customers.

Table 3-5 Summary of C/F Statement of Year 2023 by Scenario (Million Naira)

Activities	No Scenario	Scenarios				
		a	b	c	d	e
1.Operational	714.5	1,451.3	1,434.6	1,220.4	1,325.0	965.1
2.Investment	0	-100.0	-91.0	-18.9	-38.4	-20.5
3.Financial	0	0	0	0	0	0
4. Net C/F = 1+2+3	714.5	1,351.3	1,343.6	1,201.5	1,286.6	944.7

Source: Project Team

4. NRW Reduction Operations Plan

Overall NRW reduction operations from Scenario-a to Scenario-e are shown in Table 3-1. All the NRW reduction operations contains 20 operations. Scenario-a consists of most operations among five scenarios, while Scenario-e consists of least ones.

5. Scenario that FCTWB selected and the Background

In order to carry out NRW reduction operations, considering the following reasons, the Management of FCTWB selected "Scenario-d" which states that, "Only FCTWB HQ will take NRW reduction operations such as systematic leakage survey, illegal connection survey, and installation of water meters but NOT create DMAs. FCTWB will target on NRW ratio of 35.1% for the year 2023'.

- Practical goal of NRW ratio
- Insufficient data of the existing water supply facilities
- Vulnerable structure and limited discretion in budget use of Area Offices
- Insufficient number of skilled staff of Area Offices
- Expected accommodation of disbursement due to approved autonomy of FCTWB and appointment of board members
- Making the most use of skills and know-how which were obtained through the Project as much as possible so that FCTWB's capacity on NRW reduction especially at individual level is sustained

6. Implementing Schedule and Budget Allocation

In the past three years, FCTWB made a budget of 40million to 50million yearly, but suffered from delayed or no release of the budget to implement the pilot projects as scheduled. From the current condition of release, Budget for the year 2018 has not been approved and released as of April 2018. It is most likely that approval and release of budget for the year 2019 will be delayed. Therefore, the Project Team allocated a budget up to about 35million apart from Scenario-a, b and c which requires huge initial investment for the first year in accordance with FCTWB's prospect. Table 6-1 shows budget allocation for five years. The budget was estimated based on the cost to be incurred for NRW reduction operation of each scenario and the cost (about 7.5millions) of training for five years as human resource development.

Table 6-1 Implementing Schedule and Budget Allocation

Scenario	Total Cost (mil. NGN)	2019	2020	2021	2022	2023
Scenario-a	883.3	241.7	185.4	178.1	139.7	138.4
	100%	27%	21%	20%	16%	16%
Scenario-b	804.5	225.2	169.0	161.7	123.8	124.8
	100%	28%	21%	20%	15%	16%
Scenario-c	326.9	115.8	59.3	50.7	50.7	50.5
	100%	35%	18%	16%	16%	15%
Scenario-d	222.7	34.1	34.6	50.7	51.4	52.0
	100%	15%	16%	23%	23%	23%
Scenario-e	123.5	14.2	14.7	30.9	31.5	32.2
	100%	12%	12%	25%	26%	26%

Source: Project Team

7. Staffing Plan

Number of staff is calculated as following conditions:

- National Holiday: Total 13 days
- Annual Leave: 30 days include Saturday and Sunday (Eight non-working days): 22 days
- Working days per week: 5 days per week x 52 weeks = 260 working days
- Working days per year: 260 days -13 days - 22 days = 225 working days per year

Table 7-1 Necessary No. of Staff by Scenario

Unit	2019					2020					2021					2022					2023				
HQs	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
NRW reduction	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9
GIS	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Distribution	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2
Billing	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Commerce	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0
HQs Sub-total	13	11	11	19	16	12	10	10	18	15	12	10	10	18	15	12	10	10	18	15	12	10	10	18	15
Area Offices																									
Distribution	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Commerce	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1
Area Office Sub-total	8	8	7	7	7	8	8	7	7	7	8	8	7	7	7	8	8	7	7	7	8	8	7	7	7
Total	21	19	18	25	23	20	18	17	25	22	20	18	17	25	22	20	18	17	25	22	20	18	17	25	22

Source: Project Team

8. Human Resource Development (HRD) Plan on NRW Reduction

8.1 Necessity of HRD on NRW Reduction

Human resource management is recruiting, hiring and managing employees. Project Team focused on human resource development in terms of staff's individual capacity in NRW reduction.

At present, there is no systematic HRD plan for NRW reduction in FCTWB, but It is necessary to create systematic HRD plan and deepen staff's understanding of NRW, so that NRW ratio will be decreased in FCTWB's service area.

The purpose of the plan is to deepen understanding of NRW among staff of FCTWB and to contribute to NRW reduction.

8.2 Training Curriculum on NRW Reduction

The HRD plan consists of the following seven curriculums:

1) Training Curriculum 1: Basic and Common Knowledge about NRW
2) Training Curriculum 2: Management of Pipelines
3) Training Curriculum 3: Management of Data
4) Training Curriculum 4: Leakage and Illegal Connection Survey
5) Training Curriculum 5: Streamlining of billing system and examination on unifying water meters
6) Training Curriculum 6: Plumbing for repair and or replacing pipelines
7) Training Curriculum 7: Basic operation of personal computer, graphing by using excel

Table 8-1 shows the training curriculums on HRD of FCTWB in 2019 and 2020.

Table 8-1 Training Schedule (Tentative)

Curriculums	2019				2020			
	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4
Curriculum 1: Basic and Common Knowledge about NRW								
➢ Meaning of NRW Reduction	■	■		■	■			
➢ Outline of Water Balance analysis	■	■		■	■			
➢ Outline of NRW Reduction Operation	■	■		■	■			
Curriculum 2: Management of Pipelines								
➢ Outline of GIS		■	■	■	■			
➢ Outline of Water Balance analysis		■	■	■	■			
➢ Outline of NRW Reduction Operation		■	■	■	■			
Curriculum 3: Management of Data								
➢ Meter Reading				■	■	■		
➢ Meter Test				■	■	■		
Curriculum 4: Leakage and Illegal Connection Survey								
➢ Kinds of Illegal Survey Equipment					■		■	■
➢ Leakage Survey Methods					■		■	■
➢ Illegal Connection Survey					■		■	■
Curriculum 5: Streamlining of billing system and examination on unifying water meters								
➢ Examination on unifying water meters						■	■	■
➢ Streamlining of Meter reading & billing						■	■	■
➢ Development of customer data						■	■	■
Curriculum 6: Plumbing for repair and or replacing pipelines								
➢ Repair jointing for large scale and small scale						■	■	■
➢ Laying pipelines						■	■	■
➢ Install valves, flow-meters, saddle, etc.						■	■	■
Curriculum 7: Basic operation of personal computer, graphing by using excel								
➢ PC operation						■	■	■
➢ Calculation by using Excel						■	■	■
➢ Drawing graph by using Excel						■	■	■

Source: Project Team

9. Recommendation

Generally, FCTWB has a number of challenges to not only implement NRW reduction in the long term but also become an autonomous body pursuing revenue.

9.1 Distribution

(1) Improvement in As-Built Drawings and Drawing Management

FCTWB has operated and maintained facilities, while FCDA has been in charge of development.

It is important for FCTWB to review and improve procedures of drawing collection from FCDA and feedback issues in O&M to FCDA.

(2) Calibration of Customer Meters

Even though water meters are replaced with new ones and or installed newly, meters will be inaccurate gradually without regular maintenance and periodical replacement, for example every eight years, regardless of meter types. Conventional meters available in local markets vary in quality, so FCTWB needs to establish a simplified meter laboratory for meter-accuracy

test by using reference meters, and also prepare a fact-finding report for guideline on meter standardization in the future.

9.2 Commerce

(1) Improvement in Update of Customer Database

Management of customer data including meter-reading data and payment records has not been unified timely among HQ and Area Offices.

FCTWB HQ should unify database of customers' information among HQ and Area Offices, update, improve it and well-manage customer data.

(2) Streamlining of Customer Category

Customers are categorized as domestic, commercial (un-coced), major consumer (co-operate body, mini-hotel / restaurant, major consumer, petrol station / plaza, private school / clinic), institution (embassy / high commission, ministry, liaison office, religion), public tap / convenience & kiosk, and lifting point (bulk selling. This mixture caused difficulty in data assembling in the pilot project.

FCTWB should lessen a number of categories for simplified customer management.

(3) Simplification and Quality Assurance of Customer Meter

The strategic plan includes an operation to review customer meter types by meter laboratory using reference meters so that FCTWB brings the future metering policy, standardization and licensing in view.

(4) Elimination of Estimating Billing System

In order to bill the amount accurately, FCTWB should give responsibilities of reading to Area Offices close to customers, then HQ' Units should specialise supervision of them.

The strategic plan includes an operation to eliminate flat-rate customers by installing or replacing meters, but FCTWB should prevent reoccurrence thoroughly.

To reduce estimating bills, FCTWB should discuss enhancement in staff's performance of duties with awareness-rising, adequate logistics, thorough monitoring of reading regardless of meter types, review of reading frequency (i.e. once a month to once in two months), meter installation and replacement of malfunctioning maters, and meter reposition to outside property or empowering FCTWB for reading accessibility or illegal connection check.

(5) Duplicated / Return Bills

In order to ensure correct billing and avoid complain from customers, FCTWB should deactivate or eliminate duplicated/return bills promptly, and establish proper addressing, procedures and management of billing information to prevent reoccurrence.

(6) Simplification and Revision of Water Tariff

To simplify financial analysis, FCTWB should review water tariff for simplification on the occasion of autonomy as well as revision (reduction) in tariff as a result of financial analysis.

(7) Elimination of Unauthorized Consumption

Regardless of meter types and customer categories, technical staff and meter readers need to inspect water meters, surroundings and monitor consumption data routinely to track irregularities. FCTWB should pay attention to possible illegal connections on service pipes extended to public taps located in informal settlements, so-called "villages".

9.3 Finance

The following management of the FCTWB is not functioned effectively; this caused us a great deal of difficulty for the financial study. Regardless to say, a quick and timely provision of the data and

information to the managerial officers is also an important role. The enhancement of the functions is duly taken account as well as the regular financial activities of the Department.

(1) Fixed Asset Management

Every fixed asset must be booked and managed properly in the following manners envisaging a regular maintenance and future renewal.

- Entry: acquisition date and price, specification, place located, department responsible, etc.
- Disposal: sale, disuse and retirement, etc.
- Inventory check: periodically once a year visa-vis the fixed assets book

(2) Water Cost Management

A cost center has to be functionalized to learn the actual water cost of FCTWB; the unit cost, Naira/m^3, should be calculated at least once a year. The data in chronological order will suggest a lot of managerial information through analysis on why increased or decreased and setting a water tariff as well.

9.4 Administration

(1) Improvement in ICT System and Intranet

FCTWB have no well-established system using information and communication technology as well as an intranet and or internet with security protection, so FCTWB should develop them for smooth information sharing and communication.

(2) Improvement in Office Environment

HQs' office is composed of small rooms which are not suitable for a water utility office, and also Area Offices use ordinary flat house, prefabricated house or container. FCTWB should improve office environment as electric power is stabilized for doing with daily work efficiently.

(3) Human Resource Development

FCTWB should prepare comprehensive training programme based on assessment for each level of staff in accordance with business plan and the strategic plan.

The Federal Capital Territory Reduction of NRW Project

Medium-Term Strategic Plan (2019 – 2023)

Draft

June, 2018

Engr. M. K. Rabiu
HoU NRW, FCTWB

Contents

Introduction

- - Preparation of Medium-Term Strategic Plan for Reduction on NRW for the year (2019-2023) is the output 3 of the pilot project.

- The results of outputs 1 & 2 of the pilot project were used to prepare the Medium-Term strategic plan with the primary aim of upscaling lessons learnt to the other service areas of the Board.

- Non-revenue water ratios in Garki, Gudu and Jabi pilot areas ranges from 45.6% - 87.6% before and 20.4% - 34.7% after counter measures respectively.

- Cost of Non-Revenue Water Reduction, Estimated NRW ratio of 48.3% amongst others were used for the plan.

- Based on the Mid-term strategic plan, FCT water Board will target Non-Revenue Water Ratio of 35.1% for the year 2013 on implementation of Scenario d provisions.

Introduction

- **Non-Revenue water is define as** : "water which is being produced and lost before reaching customers.

Modified IWA's Water Balance Sheet

System Input Volume (SIV)	Authorized Consumption	Billed Authorized Consumption	a. Billed Metered Consumption	Revenue Water
			b. Billed Unmetered Consumption	
			b. Billed Unmetered Consumption (Excess Use)	Non-Revenue Water (NRW)
		Unbilled Authorized Consumption	c. Unbilled Metered Consumption	
			d. Unbilled Unmetered Consumption	
	Water Losses	Commercial (Apparent) Losses	e. Unauthorized Consumption	
			f. Customer Metering Inaccuracies and Data Handling Errors	
		Physical (Real) Losses	g. Leakage on Transmission and/or Distribution Mains	
			h. Leakage and Overflows at Utility's Storage Tanks	
			i. Leakage on Service Connections up to Point of Customer Use	

Introduction

Impacts of NRW Reduction

- Reduction of Operation and Maintenance cost
- Increase in Revenue Generation
- Contribution to Water Conservation
- Improvement in Efficiency and Financial Sustainability of Utility Organization
- Increase in Water Supply Coverage
- Improvement in Customer Satisfaction

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Introduction

Water Distribution Zones

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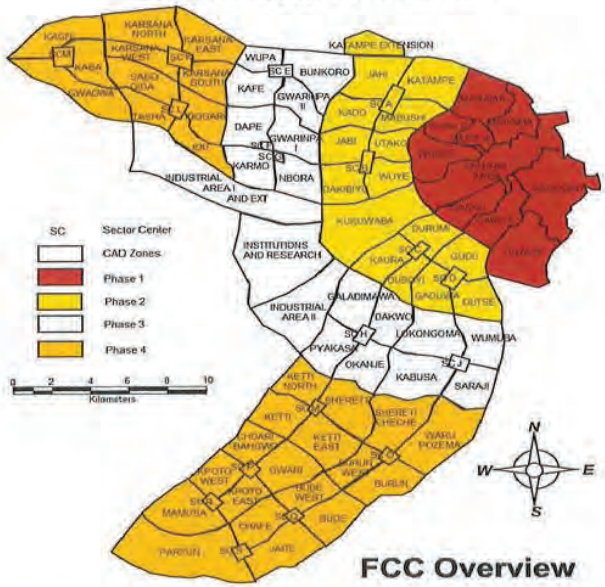
Introduction

Water Supply Areas/Zones



FCC Overview

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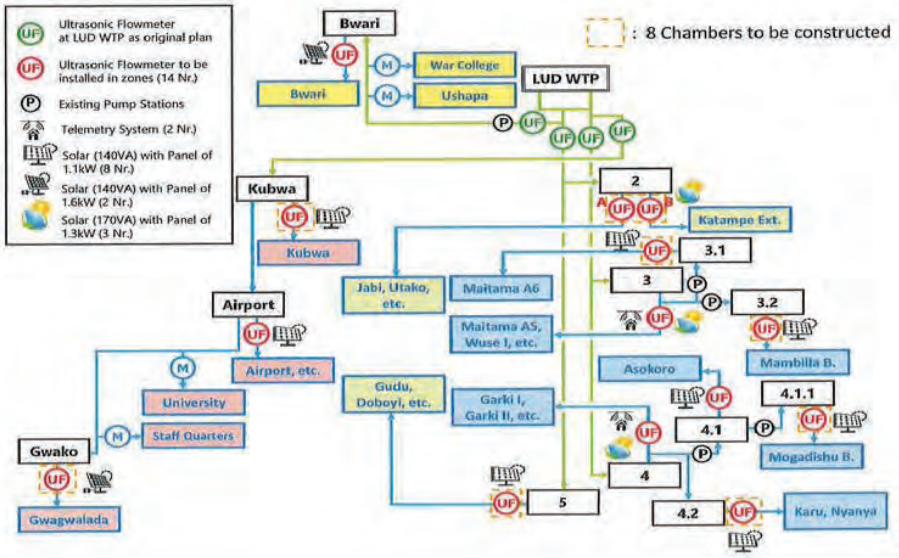
Introduction

Location of Bulk and Zonal Meters



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Water Supply Facilities

Category	Facilities	Capacity	Remarks
Water Source	Lower Usuma Dam	100 Million m^3	
	Guraura	840 Million m^3	
Treatment Plant	Phase 1 & 2	240,000m^3/day	Constructed in 1987 & 2000
	Phase 3 & 4	480,000m^3/day	Constructed in 2014
	Final Stage	-	Proposed
Service Reservoir	No. 1 (under construction)	40,000m^3	Supply to the north of Phase 3
	No. 2	45,000m^3	Supply to the north of Phase 2
	No. 3	24,000m^3	Supply to the north of Phase 1
	No. 4	24,000m^3	Supply to the south of Phase 1, the south of Phase 2 (partially) and suburbs
	No. 5	40,000m^3	Supply to the south of Phase 2
	No. 6 (under construction)	40,000m^3	Supply to the south of Phase 3
	No. 7 (propose)	-	Supply to the north of Phase 4
	No. 8 (propose)	-	Supply to the south of Phase 4
	No. 9 (propose)	-	Supply to the south of Phase 4
	No. 10 (propose)	-	Supply to the south of Phase 4
Trunk Main and Distribution Main	Phase 1&2 system (partially under development in Phase 2)	T. Main: 44km D. Main: 296km 2nd D. Main: 339km	Secondary distribution mains under development partially in Phase 2.
	Phase 3 system	-	Partially developed. Under development by Greater Abuja Water Supply Project
	Phase 4 system	-	Partially developed. Under development by Greater Abuja Water Supply Project

Water Supply Situation

	Area Office	District or Suburb served	Water Supply Situation
1	Abaji	Abaji Town	Hand pumps and motorized boreholes.
2	Asokoro	Asokoro District	Improved supply (gravity and pump)
3	Bwari	Bwari Town	Intermittent by rationing (booster pumping from LUD)
4	Gwagwalada	Gwagwalada Town	Regular with network challenges
5	Garki I	Area 1,2,3,8,11 & 10	Regular
6	Garki II	Garki II, Central Area	Regular
7	Gudu	Gudu District/Games Village	Regular
8	Gwarimpa	Gwarimpa District	Regular
9	Jabi	Utako Districts, Life Camp & Idu/Karmo, Kado Estate, Katampe and katampe Extension.	Regular
10	Karu/Nyanya	Karu & Nyanya Towns	Intermittent by rationing
11	Kubwa I	Kubwa I Town	Regular
12	Kubwa II	Kubwa II Town	Regular
13	Maitama	Maitama District and part of Central Area	Regular with challenges
14	Wuse I	Wuse I District	Regular with network challenges in parts of zone 3 & 6
15	Wuye	Wuye District	Regular
16	Wuse II	Wuse II District	Regular with challenges in A8

Current NRW Situation in the FCT

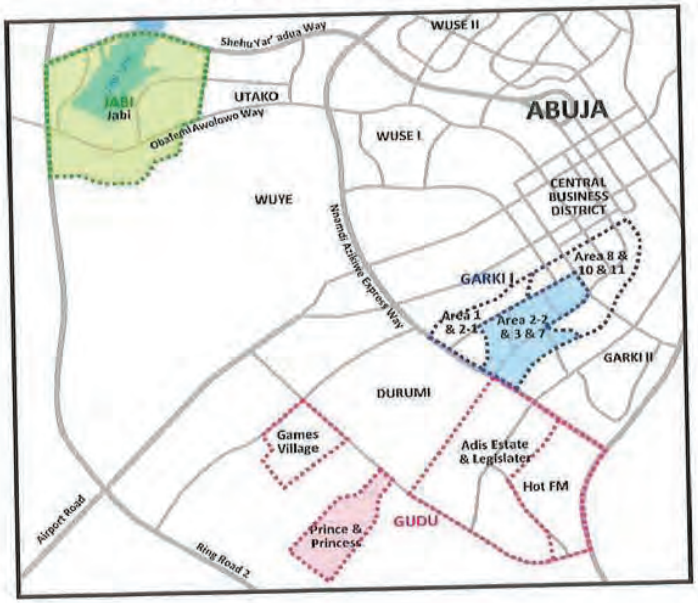
-System Input Volume: 113.38 million m^3 per year

-Revenue Water:58.63 million m^3 per year

-Non-Revenue Water:54.75 million m^3per year

-Estimated Non-Revenue Water Ratio:48.3%

Overview of the Pilot Projects



Features of The PMAs

Pilot Area Office	No. of Customer in PMA	Max. Pipe Dia. (mm)	Total Distance of Pipes (m)	Number of In/out-flow (Places)	Predominant Type of Water Meters in PMA (% of the total installed water meters)
Gudu	784	DN200	14,150	1 / 0	Prepaid (83.0%)
Jabi	604	DN300	23,781	1 / 2	Conventional (96.5%)
Garki I	452	DN450	11,858	1 / 2	AMR (57.7%)
Total	**2,001**	-	**49,789**	-	-

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Procedures of Pilot Project

Distribution Aspects

- Preparation of Drawing
- Design of PMA/SMAs (Pilot Metering Area / Sub-Metering Areas)
- Creation of PMA/SMA (Flow Meter & Isolation Valves)
- Baseline Analysis of NRW in PMA/SMA (Before)
  - 24hrs & Min. Night Flow Measurement, Step Test and Leakage Detection, Illegal Connection Survey
- NRW Reduction Operations/Countermeasures
  - Repair of Leaks, Disconnection/Legalization of Illegal Users
- Post Analysis of NRW in PMA/SMA (After)
  - 24hrs & Min. Night Flow Measurement

Commerce Aspects

- Customer Database
- Customer Listing and Customer Survey
- Baseline Analysis of NRW in PMA/SMA (Before)
  - Meter Reading, Meter Error Test and Illegal Connection Survey
- NRW Reduction Operations/Countermeasures
  - Replacement of Faulty Meters, Meter Installation to Flat-Rate Customers, Disconnection/Legalization of Illegal Users
- Post Analysis of NRW in PMA/SMA (After)
  - Meter Reading

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Results of the Pilot Project

NRW Ratio (%) in the PMAs

Area Office	PMA/ SMA	Before NRW Reduction Operations (%)	After NRW Reduction Operations (%)	Percentage-Reduction Point	Target after Reduction (%)	Achievement
Gudu	SMA-1	52.0	12.1	39.9	31.2	OK
	SMA-2	53.9	29.9	24.0	32.3	OK
	PMA	53.3	20.4	32.9	32.0	OK
Jabi	SMA-2	45.6	21.1	24.5	27.4	OK
	SMA-3	87.6	42.6	45.0	52.6	OK
	PMA	70.0	30.9	39.1	42.0	OK
Garki I	SMA-1	85.1	45.2	39.9	51.1	OK
	SMA-2	74.8	49.3	25.5	44.9	Non
	SMA-3	70.0	27.4	42.6	42.0	OK
	PMA	74.8	34.7	40.1	44.9	OK

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Causes of NRW in PMAs

The following contribute to NRW:

- Billed unmetered consumption (excess use by flat-rate customers)
- Unauthorized consumption (illegal bypassing/connections), and
- Physical losses (surface/underground leaks) on network pipelines and service pipes

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Cost Effectiveness of the Pilot Project

PMA	1) Initial Cost incurred for the Pilot Project (K. NGN)	2) Initial & Recurrent Cost for NRW Reduction Operation* (K.NGN)	3) Estimated Revenue Increase for three years (K. NGN)	3) Cost Effectiveness (Dimensionless) 3) / 2)
Gudu	40,949	81,898	1000,576	1.2
Jabi	47,498	94,996	274317	2.9
Garki-I	48,937	97,874	112,426	1.1

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Challenges

-Discrepancies between As-built drawings and what is actually on ground

-Difficulty in data assembling due to Complexity in Customer Category

-Data handling errors, which lead to inaccurate billing

-Existence of many customer meter types

-Existence of estimated bills

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Challenges

--Existence of duplicated/return bills.

-Illegal bypassing/connections

-Water meter inaccuracy

-Many surface leakages occur in both distribution and service pipes

-Late Release of counterpart fund

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Goal of NRW Reduction Operation and Review of Verifiable Indicators for Achievement

- Goal of NRW Ratio: 48.3% (Baseline) to 35.1% at the end of 2023
- Verifiable indicator: Report of annual operations with IWA Water Balance Analysis

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Features of Scenarios for NRW Reduction Operations

Items	Scenario				
	a	b	c	d	e
1. Target					
1.1 Target Year	2023	2023	2023	2023	2023
1.2 Baseline NRW Ratio (%)	48.3	48.3	48.3	48.3	48.3
1.3 Target NRW Ratio in 2023 (%)	31.9	32.4	36.9	35.1	42.8
1.4 Reduction Approach	DMA	Zone	Zone	Zone	Zone
2. Main Body for NRW Reduction Operations					
2.1 Main Body for Operations (Supervision)	HQ's NRW Unit	HQ' NRW Unit	HQ's NRW Unit	HQ's NRW Unit	HQ's NRW Unit
2.2 Main Body for Operations (Field Actions)	Area Offices	Area Offices	Area Offices	HQ's NRW Unit	HQ's NRW Unit
3. NRW Reduction Operations					
(1) Network Drawings and Data	X	X	X	X	X
(2) Customer Enumeration	X	X	X	X	X
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X
(3) DMA Design, Creation and Prioritization	X	-	-	-	-
(4) Zonal Prioritization	-	-	-	X	X
(5) Field Inspection	X	-	-	-	-
(6) Isolation by installing Flow Meters and Valves	X	-	-	-	-
(7) Step Test in DMA	X	-	-	-	-
(8) Zonal Measurement	-	-	-	X	X

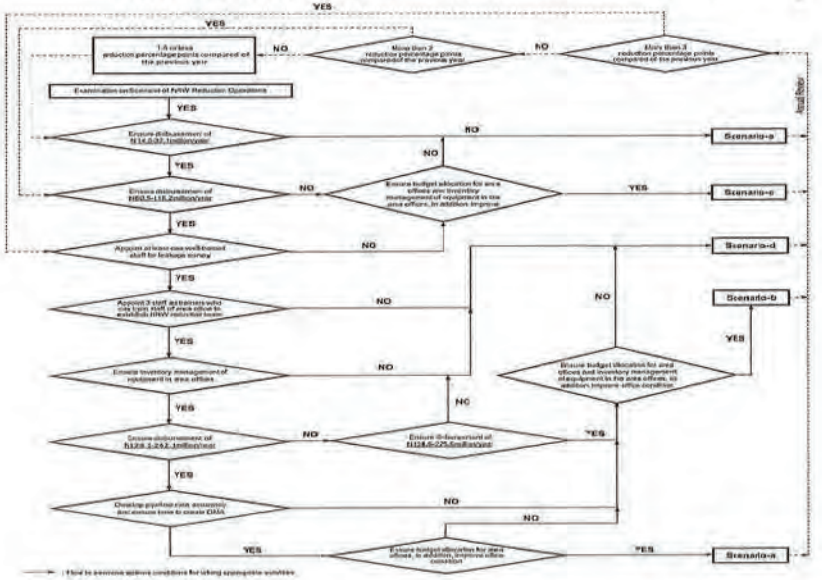
Features of Scenarios for NRW Reduction Operations

(9) Leakage Detection					
a) by Area Office (DMA)	X		-	-	-
b) by Area Office (Zone)	-	X	-		-
c) by NRW Unit (Zone)	-	-	-	X	X
(10) Patrol of Surface Leaks	-	-	X	-	-
(11) Repair of Leaks and Recording	X	X	X	X	X
a) for (9)-a)	X	-	-	-	-
b) for (9)-b)	-	X	X	-	-
c) for (10)	-	-	X	-	-
d) for (9)-d)	-	-	-	X	X
(12) Identification of Illegal Connection and Inaccuracy Meters	X	X	X	X	X
a) Illegal Connection (Area Office)	X	X	X	-	-
b) Illegal Connection (NRW Unit)	-	-	-	X	X
c) Inaccuracy Meters	X	X	X	X	-
d) Labo Test of Meter Inaccuracy for Meter Standardization	X	X	X	X	-
(13) Measures against Illegal Connection and Meter Inaccuracy	X	X	X	X	X
a) Illegal Connection (Area Office)	X	X	X	-	-
b) Illegal Connection (NRW Unit)	-	-	-	X	X
c) Meter Inaccuracy	X	X	X	X	X
(14) Data Collection of Monthly Billed Consumption					
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X

Features of Scenarios for NRW Reduction Operations

(15) Data Collection of Monthly SIV					
a) DMA	X	-	-	-	-
b) Zone	X	X	X	X	X
c) Bulk Meters	X	X	X	X	X
(16) Monthly Water Balance Analysis	X	X	X	X	X
(17) Measurement of 1-week SIV (DMA)	X	-	-	-	-
(18) Installing Water Meters	X	X	X	X	-
(19) Survey on Trunk, Distribution Mains and Reservoirs	X	X	X	X	X
(20) Preparation for Pipe Replacement Plan	X	X	X	X	X
4. Procurement of Equipment					
4.1 Flow Meters and Valves for Isolation	X	-	-	-	-
4.2 Leak Detection Equipment	X	X	-	-	-
4.3 Water Meters	X	X	X	X	-
5. Place where equipment is stocked					
5.1 Existing Equipment	3 Pilot A.O.	3 Pilot A.O.	NRW Unit	NRW Unit	NRW Unit
5.2 Newly-procured Equipment	A.O.	A.O.	-	-	-

Criteria for selecting Scenario of NRW Reduction Activity



Criteria for selecting Scenario of NRW Reduction Activity

- Early release of budget
- -Availability of well-trained staff for leakage survey
- -Availability of trainers for analysis of NRW Ratio for Area Office's staff
- -Availability of standard storage facility for equipment in Area Office
- -Ensure availability of accurate existing pipeline information for creation of DMA.

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Cost-Effectiveness by Scenario

Items		Scenario				
		a	b	c	d	e
Cost (mil. NGN)	i.	882.2	804.5	326.9	222.7	123.5
Revenue yielded (mil. NGN)	ii.	4,822.6	4,752.6	3,636.9	4,198.4	1,698.8
Direct benefit (mil. NGN)	iii=ii.-i.	3,939.40	3,948.10	3,310.00	3,975.70	1,575.30
Cost-Effectiveness	iv. = ii./ i.	5.5	5.9	11.1	18.9	13.8

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Implementation Schedule and Budget allocation

Scenario	Total Cost (mil. NGN)	2019	2020	2021	2022	2023
Scenario-a	883.3	241.7	185.4	178.1	139.7	138.4
	100%	27%	21%	20%	16%	16%
Scenario-b	804.5	225.2	169.0	161.7	123.8	124.8
	100%	28%	21%	20%	15%	16%
Scenario-c	326.9	115.8	59.3	50.7	50.7	50.5
	100%	35%	18%	16%	16%	15%
Scenario-d	222.7	34.1	34.6	50.7	51.4	52.0
	100%	15%	16%	23%	23%	23%
Scenario-e	123.5	14.2	14.7	30.9	31.5	31.2
	100%	12%	12%	25%	26%	26%

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Conditions for Preparing Financial Statement

- Baseline of NRW ratio:48.3%
- On the basis of 5 Scenarios of NRW strategies
- Depreciation period/costs of WTP 3&4 and ongoing projects
- Investment (NGN673Mil) and depreciation costs of the Switch-over construction works that connect WTP III & IV to remote distribution pipes (increase of distribution: 150,000 m3/day)
- No allocation/remittance to FCTA (autonomous basis)
- Tariff: weighted average between the domestic and commercial customers (N90/m^3)
- Tariff collection ratio: 31.3%
- Price escalation: Not applied

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Profit and Loss (P/L) Statement of the Year 2023 by Scenario (Million Naira)

Account Items	No Scenario	Scenarios				
		a	b	c	d	e
Revenues	7,829	10,306	10,239	9,547	9,824	8,668
Expenditures	2,799	2,895	2,886	2,844	2,824	2,815
P/L	5,030	7,411	7,353	6,703	7,000	5,853

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Cash Flow Statement of Year 2023 by Scenario (Million Naira)

Activities	No Scenario	Scenarios				
		a	b	c	d	e
Operational	714.5	1,451.3	1,434.6	1,220.4	1,325.0	965.1
Investment	0	- 100.0	- 91.0	- 18.9	- 38.4	- 20.5
Financial	0	0	0	0	0	0
Net C/F	714.5	1,331.3	1,343.6	1,201.5	1,286.6	944.7

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Annex2-485

Workflow of NRW Reduction Operation

(1) Network Drawings and Data

(2) Customer Enumeration

(3) DMA Design, Creation, Prioritization

(3)-1 DMA Design, Creation and Prioritization

(3)-2 DMA Prioritization in NRW Reduction

(4) Zonal Prioritization

(5) Field Inspection

(6) Isolation by installing Flow-meters and Valves

(7) Step-Test in DMA

(8) Zonal Measurement

(9) Leakage Detection

(10) Patrol of Surface Leaks

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Workflow of NRW Reduction Operation

(11) Repair of Leaks and Recording

(12) Identification of Illegal Connections and Meter Inaccuracy

(12)-1 Identification of Illegal Connection

(12)-2 Identification of Meter Inaccuracy

(13) Measures against Illegal Connection and Inaccuracy Meters

(13)-1 Measures against Illegal Connections

(13)-2 Measures against Meter Inaccuracy

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Workflow of NRW Reduction Operation

(14)Data Collection of Monthly Billed Consumption

(15)Data Collection of Monthly SIV

(16)Monthly Water Balance Analysis

(17)Measurement of One-week SIV

(18)Installing Water Meters

(19)Survey on Trunk, Distribution Mains and Reservoirs

(20) Preparation for Pipe Replacement Plan

Selected Scenario by The Board

FCT Water Board selected Scenario d, considering **availability of limited number trained staff for leakage survey**, possibility of having enough budget of **N223million for five years** for allowance and equipment such as customer water meters, meter boxes, fuel, pipes, their fittings, etc.

The selected Scenario provides that only FCTWB HQ will take NRW reduction operations such **as leakage survey, illegal connection survey and water meter survey systematically by zone** but NOT create DMA. FCTWB will target on NRW ratio of **35.1% for the year 2023**

It should be noted that, implementation of NRW reduction operations may change from one scenario to the other for a certain period due to favourable circumstance of cash disbursement and move to higher scenario

Selected Scenario by The Board

FCT Water Board should consider the following actions in order to maintain NRW reduction operations:

- Procure accurate water meters.
- Ensure budget to develop meter laboratory.
- Need some technical assistance for developing meter laboratory.
- Calibrate test meters.
- Need design of leakage training yard considering local condition

Staffing Plan

Required Number of Staff by Scenario

Unit	2019					2020					2021					2022					2023				
HQs	a	b	c	d	e	a	b	c	d	e	a	b	c	c	e	a	b	c	d	e	a	b	c	d	e
NRW reduction	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9	4	3	3	11	9
GIS	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Distribution	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2
Billing	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Commerce	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0
HQs Sub-total	**13**	**11**	**11**	**19**	**16**	**12**	**10**	**10**	**18**	**15**	**12**	**10**	**10**	**18**	**15**	**12**	**10**	**10**	**18**	**15**	**12**	**10**	**10**	**18**	**15**
Area Offices																									
Distribution	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Commerce	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1	2	2	1	1	1
Area Office Sub-total	**8**	**8**	**7**	**7**	**7**	**8**	**8**	**7**	**7**	**7**	**8**	**8**	**7**	**7**	**7**	**8**	**8**	**7**	**7**	**7**	**8**	**8**	**7**	**7**	**7**
Total	**21**	**19**	**18**	**26**	**23**	**20**	**18**	**17**	**25**	**22**	**20**	**18**	**17**	**25**	**22**	**20**	**18**	**17**	**25**	**22**	**20**	**18**	**17**	**25**	**22**

Human Resource Development (HRD) Plan on NRW Reduction

Training Curriculum on NRW Reduction

- Training Curriculum 1: Basic and Common Knowledge about NRW
- Training Curriculum 2: Management of Pipelines
- Training Curriculum 3: Management of Data
- Training Curriculum 4: Leakage and Illegal Connection Survey
- Training Curriculum 5: Streamlining of billing system and examination on unifying water meters
- Training Curriculum 6: Plumbing for repair and or replacing pipelines
- Training Curriculum 7: Basic operation of personal computer, graphing by using excel

Training Schedule (Tentative)

Curriculums	2019 1/4	2019 2/4	2019 3/4	2019 4/4	2020 1/4	2020 2/4	2020 3/4	2020 4/4
Curriculum 1: Basic and Common Knowledge about NRW								
➢ Meaning of NRW Reduction								
➢ Outline of Water Balance analysis								
➢ Outline of NRW Reduction Operation								
Curriculum 2: Management of Pipelines								
➢ Outline of GIS								
➢ Outline of Water Balance analysis								
➢ Outline of NRW Reduction Operation								
Curriculum 3: Management of Data								
➢ Meter Reading								
➢ Meter Test								
Curriculum 4: Leakage and Illegal Connection Survey								
➢ Kinds of Illegal Survey Equipment								
➢ Leakage Survey Methods								
➢ Illegal Connection Survey								
Curriculum 5: Streamlining of billing system and examination on unifying water meters								
➢ Examination on unifying water meters								
➢ Streamlining of Meter reading & billing								
➢ Development of customer data								
Curriculum 6: Plumbing for repair and or replacing pipelines								
➢ Repair jointing for large scale and small scale								
➢ Laying pipelines								
➢ Install valves, flow-meters, saddle, etc.								
Curriculum 7: Basic operation of personal computer, graphing by using excel								
➢ PC operation								
➢ Calculation by using Excel								
➢ Drawing graph by using Excel								

Recommendation

Distribution

- ✓ Improvement in As-Built Drawings and Drawing Management
- ✓ Calibration of Customer Meters

Commerce

- ✓ Improvement in Update of Customer Database
- ✓ Streamlining of Customer Category
- ✓ Simplification and Quality Assurance of Customer Meter
- ✓ Elimination of Estimating Billing System
- ✓ Duplicated / Return Bills
- ✓ Simplification and Revision of Water Tariff
- ✓ Elimination of Unauthorized Consumption

Recommendation

Finance

- ✓ Fixed asset management
- ✓ Water cost management

Administration

- ✓ Improvement in ICT System and Intranet
- ✓ Improvement in Office Environment
- ✓ Human Resource Development

MINUTES OF MEETING
ON
THE CLOSING JOINT COORDINATING COMMITTEE
FOR
THE FEDERAL CAPITAL TERRITORY
REDUCTION OF NON-REVENUE WATER PROJECT

HELD AT
THE OFFICE OF DIRECTOR, ECONOMIC PLANNING RESEARCH AND STATISTICS,
FEDERAL CAPITAL TERRITORY ADMINISTRATION

5th September 2018

Mr. Abubakar Sani Pai
Project Director,
Director, Economic Planning, Research and Statistics Department,
Federal Capital Territory Administration (FCTA),
Federal Republic of Nigeria

Mr. Akinori Miyoshi
Chief Advisor,
The Federal Capital Territory Reduction of Non-Revenue Water Project,
Japan International Cooperation Agency (JICA) Expert Team

Engr. A. A. Nahuche
Project Manager,
General Manager
Federal Capital Territory Water Board (FCTWB),
Federal Republic of Nigeria

Mr. Katsutoshi Komori
Chief Representative,
JICA Nigeria Office

Attached Document

For wrapping up the Project and discussion on results, outstanding issues and solutions before the termination of the Federal Capital Territory Reduction of Non-Revenue Water Project (hereinafter referred to as "the Project"), the closing meeting of Joint Coordinating Committee (hereinafter referred to as "JCC") was held on 5th September 2018.

1. Remarks and Presentation

On behalf of Mr. Abubakar Sani Pai, Project Director of the Project, Mr. Babagawa Adam, Deputy Director of Economic Planning, Research and Statistics Department, Federal Capital Territory Administration (FCTA) gave an apology for the absence and late arrival of the Project Director and started the JCC meeting.

Mr. Katsutoshi Komori, Chief Representative of JICA Nigeria Office expressed his appreciation to all stakeholders for their contribution to the Project. He emphasized the achievement of Non-Revenue Water (hereinafter referred to as "NRW") reduction in the Pilot projects as the biggest impact of the Project as well as indispensability of NRW reduction for financially stable management of FCTWB. He also showed his strong expectation that FCTWB will continue and expand NRW reduction operations based on the Medium-term Strategic Plan in the process of authorization. Lastly, he stated JICA would like to continue to support FCTWB to become an ideal autonomous organization in many things having been addressed, and then expressed his great thanks again.

Engr. M. Kabir Rabiu, Head of NRW Reduction Unit of FCTWB made a presentation about the result of the Project, achievement and backlog, and emphasized outstanding issues to be solved before the termination of the Project (*refer to Appendix 3).

As observations from JICA Headquarters Mission Team (*refer to Appendix 4), Mr. Hiroki Ishimaru, Project Officer congratulated achievement of outputs and emphasized increase in water supply by solving interference at outlet of water treatment plants, ongoing knowledge sharing of NRW reduction in other Area Office of FCTWB and necessity of regularization, and then presented expected goals toward the prospective cooperation. Mr. Yoshiki Omura, Senior Advisor presented history of water supply service coverage of Japan and emphasized limited rehabilitation in the past years particularly on broken vacuum pump, a component of pulsator in the water treatment plant (Phase-1&2) then gave technical advices. Mr. Wataru Takashima, Project Formulation Advisor gave advice on fundamentals for water supply business through autonomy.

At the end of the discussions, Engr. A. A. Nahuche, the Project Manager of the Project gave closing remarks. He emphasized FCTWB has shown feasible growth and staff have become more knowledgeable and capable through project activities since the commencement of the Project. He expressed his gratitude to JICA for commitment from onset to round off and

stated FCTWB will never be mediocre because of this great Project.

2. Main Points Discussed

As a result of discussions, all JCC members confirmed the matters mentioned below:

2-1. Approval of the Medium-Term Strategic Plan for NRW Reduction (2019-2023) and incorporation of Annual NRW Reduction Plan to FCTWB's Recurrent and Capital Budget Plan

The governing board of FCTWB has approved the Medium-Term Strategic Plan for NRW Reduction (2019-2023). The Nigerian side will immediately submit official documents testifying the approval to the Japanese side (*refer to Appendix 5).

2-2. Utilization and Information Sharing of the Result of Project

Mr. Masanori Sakamoto, Representative of JICA Nigeria Office encouraged that the strategic plan is taken seriously as the great improvement will be gotten in the water sector if the same knowledge obtained from the Project is extended to other areas.

Mr. Sani Pai, Project Director suggested that agencies such as FCTA, FCTWB, Federal Capital Development Agency (FCDA) and others should harmonize especially to enable information sharing.

The Nigerian side accepted these comments and suggestions, and confirmed other organizations including the Federal Ministry of Water Resources (FMWR), state water agencies, development partners will be invited to project seminar.

Mr. Kenneth Ogbonna, FMWR added that JICA should support other states and carry out similar projects to empower the Nigerian water sector.

2-3. Budgeting of the Medium-Term Strategic Plan for NRW Reduction (2019-2023)

Mr. Sani Pai, Project Director suggested that all cost for the strategic plan be added to the recurrent budget plan to avoid delay in carrying out operations in the strategic plan. Mr. Babagawa Adam commended that the recent budget consisting of the recurrent and capital budget are charged in the same place and it should be mainstreamed as part of FCTWB activities so as to incorporate all aspect of the strategic plan in the new budget template. The template should be changed now and presented to the Treasury of FCTA for approval so that when 2019 Budget is sent with the new addition, there

won't be any delay with approving the budget template. There is a need to separate the recurrent expenditure from the capital Expenditure to enable FCTWB to access the fund and charge it appropriately.

FCTWB accepted these comments and suggestions for preparation of 2019 Budget.

2-4. Outstanding Issues

Based on the presentation about the result of the Project, achievement, backlog, the Nigerian side with support from JICA Experts will deal with outstanding issues as below:

(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)

FCDA/FCTWB completed relocation works of the junction from the upstream point to the downstream point in August 2018, and FCTWB observed no longer overflow from water treatment plants 3&4 as a significant result.

However, non-full flow of water still seems to remain along Tank 2&5 and Kubwa/Airport/Gwako at least, so FCTWB will monitor the flow of bulk/zonal meters and take necessary measures with support from JICA Experts (possible by the end of the Project). Also, FCDA/FCTWB will construct another chamber and relocate an ultrasonic flow meter (sensor) according to the plan.

(2) Customers' Zonal/PMA Coding (Output-1)

Customers' zonal/PMA coding have been almost done but still not yet completed, and also a database problem and system bug were observed. FCTWB has almost done zonal/PMA coding, but FCTWB will solve the database problem, system bug and then hasten completion of zonal/ PMA coding by the 14th of September 2018.

(3) Irregular Billing Cycle (Output-1)

From the fact that bills were issued at 6 times in the past 12 months, meter reading and billing has not been done in regular intervals, which causes difficulty in calculation/monitoring of billed water consumption.

The inability of regular billing is attributed to operational challenges such as dearth of billing paper and non-constant power supply which are caused by funding problem.

The issue should be escalated properly to not only management of FCTWB but also governing Board and FCTA to address importance of regular billing for improvement in calculation of billed water consumption, and to obtain their understanding and necessary funding.

(4) Monitoring of NRW Ratio and/or related Data (Output-2)

System input volume to Jabi PMA is not measurable, because a mechanical PMA meter in Jabi is not functioning.

FCTWB will replace the malfunctioning PMA mechanical meter by new one by the 14th of September 2018. Then, FCTWB will read and monitor system input volume to Jabi PMA.

(5) The Final Capacity Assessment (Output-2)

The final assessment will be done by JICA Experts before the completion of the Project

(6) Project Vehicle

FCTWB concluded impossibility of repair of a damaged project vehicle and will purchase a new vehicle by using Counterpart Fund or FCTWB fund. Process of procurement is ongoing. All project vehicles for NRW reduction should be used strictly for implementation of the strategic plan.

(7) Seminar

The both side confirmed that one-day project seminar will be held in the third week of October 2018.

END

Appendix

Appendix 1: Programme/Agenda
Appendix 2: Attendance List
Appendix 3: Presentation: Result of the Project, Achievement and Backlog
Appendix 4: Presentation: Observations from JICA Headquarters Mission Team
Appendix 5: Notice of Approval: The Medium-term Strategic Plan for Non-Revenue Water Reduction (2019-2023) and its Incorporation into FCTWB Budget Expenditure

Federal Capital Territory Administration (FCTA)
Federal Capital Territory Water Board (FCTWB)
assisted by
Japan International Cooperation Agency (JICA)

THE FEDERAL CAPITAL TERRITORY REDUCTION OF NON-REVENUE WATER PROJECT

PROGRAMME/AGENDA FOR

CLOSING JOINT COORDINATING COMMITTEE MEETING

Venue: Conference Room, EPRS, FCT Administration, Abuja
Date: 10:00, Wednesday, 5th September 2018

10:00	Opening Prayer
10:00 - 10:05	Introduction of JCC Members
10:05 - 10:15	Welcome Remarks by Project Director, Mr. Sani Pai (Director, EPRS, FCTA)
10:15 - 10:25	Address by Chief Representative, Mr. Katsutoshi Komori (JICA Nigeria Office)
10:25 - 11:10	Presentation of the Result of the Project, Achievement and Backlog by Engr. M. Kabir Rabiu (Head of NRW Reduction Unit, FCTWB)
11:10 - 11:40	Questions, Answers and Discussions
11:40 - 12:00	Observation (JICA Headquarters' Mission)
12:00 - 12:20	Way forward
12:20 - 12:30	Closing Remarks by Project Manager, Engr. A. A. Nahuche (General Manager, FCTWB)
12:30	Closing Prayer

Appendix 2

FEDERAL CAPITAL TERRITORY REDUCTION OF NON-REVENUE WATER PROJECT

CLOSING JOINT COORDIANTING COMMITTEE (JCC) MEETING

HELD ON 5TH SEPTEMBER 2018 AT FCTA/EPRS CONFERENCE ROOM

ATTENDANCE LIST

S/N	NAME	ORAGANIZATION	POSITION
1	Katsutoshi Komori	JICA Nigeria	Chief Representative
2	Yoshiki Omura	JICA HQ	Senior Advisor
3	Wataru Takashima	JICA Kenya Office	Project Formulation Advisor
4	Hiroki Ishimaru	JICA HQ	Program Officer
5	Masanori Sakamoto	JICA Nigeria	Representative
6	Abubakar Sani Pai	EPRS	Director
7	Babagawa Adam	EPRS	Deputy Director
8	Ahmed Kabiru	EPRS	CSO
9	Aliyu A. Nahuche	FCT Water Board	General Manager
10	Rabiu M.K	FCT Water Board	Head NRW Reduction Unit
11	Phoebe Ocheja	FCT Water Board	HOD/ Admin and Supply
12	Okobi O. Y	FCT Water Board	HOD/ Quality Control
13	Segun Kayode	FCT Water Board	Public Relation Officer
14	Usuman A. Aliyu	FCT Water Board	Deputy Director Distribution
15	Abolade Lawal	FCT Water Board	Technical Manager
16	Dele Olatunji	FCT Water Board	Head MLR
17	Abbas Ahmed	FCT Water Board	Head Public Relations
18	Adeyemi A. Taiwo	FCT Water Board	HOD/ Commerce
19	Akujobi Obianuju	FCT Water Board	Ag (HIA)
20	Yusuf Mohammed	FCT Water Board	P.A
21	Eze Obiageli	FCT Water Board	PRO
22	Chuks Uddi	FCDA	A.D
23	Gambo Y.L	FCDA/DES	C.E
24	Sunday Oruche	FCDA/DES	Asst. Director
25	S. T Udo	FCDA/DES	ACE(W&S)
26	Ogbonna Kenneth	FMWR	ACH
27	Sadiq Ibrahim	FMWR	SGL
28	Ademoroti Isaiah	FMWR	Deputy Director
29	Akinori Miyoshi	JICA Expert Team	Chief Advisor
30	Taketoshi Fujiyama	JICA Expert Team	Deputy Chief Advisor
31	Otobo Deborah	JICA Expert Team	Admin/Sec

Appendix 3

Federal Capital Territory Administration
Federal Capital Territory Water Board

Japan International Cooperation Agency

The Federal Capital Territory Reduction of Non-Revenue Water Project

Closing Joint Coordinating Committee Meeting

Results of the Project, Achievement and Backlog

Engr. M. K. Rabiu, HOU NRW Reduction, FCTWB

5th September 2018

Contents

1. Outline of the Project

Project Name

The Federal Capital Territory Reduction of Non-Revenue Water Project

Project Period

Phase-1: October 2014 to December 2016

Phase-2: January 2017 to September 2018

Project Areas

Federal Capital Territory (FCT)

Pilot Areas: Gudu, Jabi and Garki I

Nigerian Counterparts

Federal Capital Territory Administration (FCTA)

Federal Capital Territory Water Board (FCTWB)

2. Overall Goal, Project Purpose and Three Outputs

Overall Goal	Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.
▲	
Project Purpose	**Capacity of FCTWB for NRW reduction is strengthened.**
▲	
Output-1	Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.
Output-2	Methods/operational procedures for effective NRW reduction are established though pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.
Output-3	A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

3. Inputs

Inputs from Nigeria

Project Personnel

- Project Director, Project Manager, Deputy Project Manager, Technical Managers, NRW Management Team, NRW Action Team.

Land, Building and Facilities

- Office spaces and necessary facilities at FCTWB

Local Cost

- Operation and maintenance of the provided equipment, and also administrative and operational costs for local traveling, demurrage and communication of telemetric device have been provided.
- However, the Project suffered from non or late release of Counterpart Fund.

3. Inputs

Inputs from Japan

JICA Experts :

- A Chief Advisor and members for nine areas of expertise

Equipment :

- Bulk and zonal meters, data loggers, telemetric monitoring system procured from Japan
- Solar powering systems for the above equipment
- NRW reduction-related equipment such as leak detectors,
- Flow meters, valves and water meters, etc.

Facilities

- Chambers for bulk and zonal meters
- Update of billing system , etc.

Training

- Training on GIS software
- 3 trainings in Japan for 18 officials

3. Inputs

GIS Training on Software in Abuja

1st Training in Japan (Lecture on Business Plan)

1st Training in Japan (Lecture on Mapping System)

2nd Training in Japan (Leakage Detection Survey)

2nd Training in Japan (Meter Reading by using Handheld Device)

3rd Training in Japan (Meter Laboratory)

4. Activity for Output-1

Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.

No	Activity	Status (as at the End of August 2018)
1-1	Install bulk meters to water treatment plants 1 and 2	Completed.
1-2	Measure/estimate water production of water treatment plants 1, 2, 3, and 4	Completed. FCDA completed relocation works of the junction along trunk mains at outlet of water treatment plants in August 2018. However, the interference challenge (non-full flow of water) at outlet of water treatment plants still remain, and relocation of ultrasonic flowmeter has not yet been done.
1-3	Tally the above water production data/estimation	Completed.
1-4	Calculate the water consumption based on the billing data	Completed. However, customers' zonal/PMA coding is still ongoing as a fundamental condition for water distribution management. Periodic billed consumption has been not recorded because of non regular meter reading and billing. Constant power supply, adequate provision for consumables and SOP are necessary.

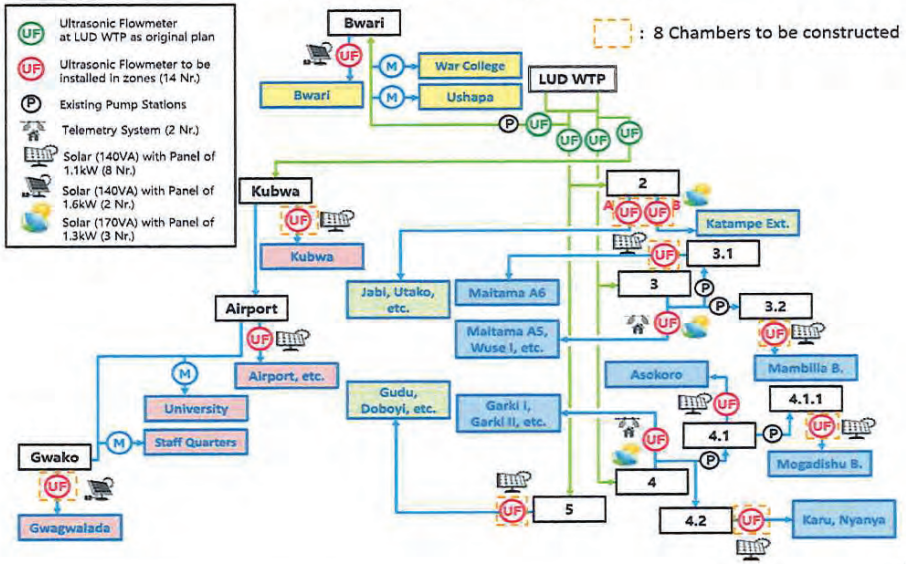
4. Activity for Output-1

Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.

No	Activity	Status (as at the End of August 2018)
1-5	Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4	Completed.
1-6	Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system	Completed.
1-7	Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	Not completed. The Activity will be done after the customers' zonal/PMA coding stated in Activity 1-4, before the completion of the Project.

4. Activity for Output-1

Location of Bulk and Zonal Meters



4. Activity for Output-1

Chamber Construction for Bulk Meters (Activity 1-1)

Chamber Construction for Bulk Meters (Activity 1-1)

Bulk Flowmeter Chamber and Fence (Bwari)

Discussion about Modification of Billing System (Activity 1-4)

Chamber Construction for Zonal Meters (Activity 1-6)

Chamber Construction for Zonal Meters (Activity 1-6)

4. Activity for Output-1

Sensor Cable Installation

Data Logger for Bulk Flowmeters

Installation of Zonal Meter's Main Unit (Ultrasonic Flowmeter)

Flowmeter Sensors

Solar Panels for Zonal Meter

Telemetry System (Monitoring PC)

5. Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Status (as at the End of August 2018)
2-1	Review existing NRW reduction operations at each pilot Area Office	Completed.
2-2	Conduct capacity assessment of organization and the relevant staff	Not completed. Initial and interim assessments were done, and the final assessment will be done before the completion of the Project.
2-3	Identify and select a Pilot Metering Area (PMA) for each Pilot Area Office based on the selection criteria of PMA	Completed.
2-4	Prepare/update distribution network drawings for each PMA	Completed.
2-5	Install water flow meters to each PMA and measure in/outflows monthly	Completed. However, a mechanical PMA meter in Jabi PMA is not functioning, and data from an ultrasonic PMA meter is not transferred to portable logger in Garki I PMA. Only data transfer failure was solved in the end of August 2018.

5. Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Status (as at the End of August 2018)
2-6	Zone each PMA into Sub Metering Areas (SMA)	Completed.
2-7	Isolate a SMA by installing valves	Completed.
2-8	Update the distribution network drawings for each SMA	Completed.
2-9	Measure an initial level of NRW of each SMA	Completed.
2-10	Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA	Completed.
2-11	Develop a NRW reduction operation plan of each SMA, including reduction target for review by Head of Distribution Department	Completed.

5. Activity for Output-2

Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.

No	Activity	Status (as at the End of August 2018)
2-12	Review and approve NRW reduction operation plan of each SMA	Completed.
2-13	Implement NRW reduction operations at each SMA	Completed.
2-14	Monitor the progress of the NRW reduction operations of each SMA	Completed.
2-15	Measure level of NRW of each SMA at the end of the respective operations	Completed.
2-16	Prepare a report on pilot projects, covering Activity 2-1~2-15	Completed.
2-17	Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers & meter readers), incl. audio visual materials	Completed.

Location Map of Pilot Metering Areas (PMAs)

5. Activity for Output-2

Preparation of Network Drawings
(Activity 2-4)

Physical Verification of Pipeline
(Activity 2-7)

Installation of Isolating Valve
(Activity 2-7)

24hrs Flow Measurement
(Activity 2-9)

Minimum Night Flow Survey and
Step Test (Activity 2-9)

Leakage Detection Acoustic Survey
(Activity 2-10)

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5. Activity for Output-2

Different Types of Customer Meters
(AMR, several conventional meters)

Demonstration of Meter Error Test
(Activity 2-9)

Data Analysis of Meter Error Test
(Activity 2-9)

Explanation of Meter Error Test to
Area Offices by HQs (Activity 2-9)

24hrs Customer Consumption
Survey (Activity 2-9)

Illegal Connection Survey
(Activity 2-10)

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Annex2-500

5. Status of Activity for Output-2

Door-to-Door Acoustic Survey in
Gudu

Service Pipes to Villages in Jabi

Illegal Bypass in Gudu

Training on Correlator

24hrs Flow Measurement in Jabi

Re-check of Customer List in Garki I

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6. Activity for Output-3

A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

No	Activity	Status (as at the End of August 2018)
3-1	Establish a Working Group for NRW reduction planning	Completed.
3-2	Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB	Completed.
3-3	Conduct hydraulic and water pressure distribution analyses of the pipeline networks	Completed.
3-4	Develop outlines of the medium-term strategic plan and its annual NRW reduction plan (approval by the Director)	Completed.
3-5	Develop the first medium-term strategic plan (2019-2023) for approval by FCTA	Completed.

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6. Activity for Output-3

A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

No	Activity	Status (as at the End of August 2018)
3-6	Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA	Not completed. The plan was drafted and will be completed soon.
3-7	Develop a planning manual for NRW reduction	Completed.
3-8	Review existing plans, activities and implementing structure, etc. related to water distribution management	Completed.
3-9	Establish framework of water distribution management	Not completed. The Activity will be done after the customers' zonal/PMA coding stated in Activity 1-4, before the completion of the Project.

6. Activity for Output-3

A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.

Lecture on Hydraulic Analysis

Discussion on Medium-term Strategic Plan by Working Group

Comments on Medium-term Strategic Plan by Advisory Group

7. Achievement of Three Outputs

No	Indicator	Status (as at the End of August 2018)
Output-1: Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.		
1a	Record of NRW ratio is kept by NRW Unit.	NRW ratio was estimated because of data deficiency at bulk meters and recorded. Periodic billed consumption has been not calculated easily because of non monthly meter reading and billing cycle.
1b	NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting.	NRW ratio was estimated because of data deficiency at bulk meters and reported.
1c	NRW ratio of the service area of FCTWB is reported to Management of FCTWB.	NRW ratio was estimated because of data deficiency at bulk meters and reported.
1d	Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	Water flow has been recorded by zonal meters although data deficiency. Billed consumption have been not calculated due to delay in customers' zonal/PMA coding.

7. Achievement of Three Outputs

No	Indicator	Status (as at the End of August 2018)
Output-2: Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices.		
2a	Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations.	Not successful in SMA-2 of Garki I due to difficulty in identifying the installed pipeline, however the Project concluded indicator was generally achieved in all three PMAs. Pilot project spent the period between Nov. 2014 and Dec. 2016 intermittently and the follow up between Mar. and Oct. 2017. See the next slide.
2b	Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	Technical manuals were approved in the middle of August 2018.

7. Achievement of Three Outputs

Results of Pilot Project

	Before (%)	After (%)	Reduction Point	Target (%)	Status	Initial Cost + Recurrent Cost (million/3yrs)	Estimated Revenue Increase (million/3yrs)
Gudu							
SMA-1	52.0	12.1	39.9	31.2	OK		
SMA-2	53.9	29.9	24.0	32.3	OK		
PMA	**53.3**	**20.4**	**32.9**	**32.0**	**OK**	**N81.9**	**N100.6**
Jabi							
SMA-2	45.6	21.1	24.5	27.4	OK		
SMA-3	87.6	42.6	45.0	52.6	OK		
PMA	**70.0**	**30.9**	**39.1**	**42.0**	**OK**	**N95.0**	**N274.3**
Garki I							
SMA-1	85.1	45.2	39.9	51.1	OK		
SMA-2	74.8	49.3	25.5	44.9	Non		
SMA-3	70.0	27.4	42.6	42.0	OK		
PMA	**74.8**	**34.7**	**40.1**	**44.9**	**OK**	**N97.9**	**N112.4**

7. Achievement of Three Outputs

No	Indicator	Status (as at the End of August 2018)
Output-3: A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2.		
3a	Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval.	Draft medium-term strategic plan for NRW reduction (2019-2023) was submitted by FCTWB to the governing Board of FCTWB on behalf of FCTA for review and approval in the end of July 2018.
3b	An annual NRW reduction plan (2019) is committed by the governing Board of FCTWB, to be incorporated in FCWTB's annual recurrent and capital budget plan (2019) for submission to FCTA for review and approval.	Not yet. Official request letter for the commitment was submitted by FCTWB to the governing Board of FCTWB in the end of July 2018. The incorporation will be committed by the governing Board of FCTWB on behalf of FCTA before the completion of the Project.
3c	A planning manual for NRW reduction is approved by the General Manager of FCTWB.	A planning manual was approved in the middle of August 2018.
3d	Framework of water distribution management is established.	Not yet. Ongoing and delayed due to delay in Activity 1-7 and 3-9.

8. Achievement of Project Purpose

Capacity of FCTWB for NRW reduction is strengthened.

No	Indicator	Status (as at the End of August 2018)
a	The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project.	Not yet. The medium-term strategic plan will be approved by the governing Board of FCTWB on behalf of FCTA before the completion of the Project.
b	Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level.	Relevant staff's capacity for NRW reduction have been become equipped with skills and knowledge necessary for NRW reduction. The final assessment and follow up if necessary will be done before the completion of the Project.
c	NRW ratio of each PMA is monitored.	Partially monitored. Inflow data has been read in Gudu, but not in Jabi and Garki I due to malfunctioning of a mechanical PMA meter in Jabi and data transfer failure from an ultrasonic PMA meter to portable data logger in Garki I. Only data transfer failure in Garki I was solved in the end of August 2018.

9. Backlogs and necessary Actions

(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)
(2) Customers' Zonal/PMA Coding (Output-1)
(3) Irregular Billing Cycle (Output-1)
(4) Monitoring of NRW Ratio and/or related Data
(5) The Final Capacity Assessment
(6) Approval of the medium-term strategic plan and commitment of incorporation of an annual plan (2019) into recurrent/capital budget plan
(7) Project Vehicle
(8) Seminar

9. Backlogs and necessary Actions

(1) Data Acquisition by Bulk and Zonal Flow Meters (Output-1)

Data acquisition has been not always available due to non-full flow of water at bulk flow meters since the previous monitoring, which results in difficulty in calculating/monitoring system input volume as well as NRW ratio of the whole water supply system.

Cause

FCTWB and FCDA identified interference along trunk mains by water flow from new water treatment plants (Phases 3&4) to water flow from old plants (Phases 1&2) at the upstream point of bulk flow meters as a cause of non-full flow of water and also overflow from water treatment plants (Phases 3&4).

Actions

FCDA/FCTWB completed relocation works of the junction from the upstream point to the downstream point in August 2018, and FCTWB observed no longer overflow from water treatment plants 3&4 as a

9. Backlogs and necessary Actions

significant result.

However, non-full flow of water still seems to remain along Tank 2&5 and Kubwa/Airport/Gwako at least, so FCTWB will monitor the flow of bulk/zonal meters and take necessary measures with support from JICA Experts (possible by the end of the Project). Also, FCDA/FCTWB will construct another chamber and relocate an ultrasonic flow meter (sensor) according to the plan.

9. Backlogs and necessary Actions

(2) Customers' Zonal/PMA Coding (Output-1)

Customers' zonal/PMA coding have been almost done but still not yet completed, as a fundamental condition for water distribution management and NRW monitoring, and FCTWB has faced in difficulty in identifying their locations.

Cause

Some customers lack address information in billing system database, and also system bug was observed.

Actions

FCTWB has almost done zonal/PMA coding, but FCTWB will solve the system bug and hasten completion of zonal/ PMA coding by the 14th of September 2018.

9. Backlogs and necessary Actions

(3) Irregular Billing Cycle (Output-1)

From the fact that bills were issued at 6 times in the past 12 months, meter reading and billing has not been done in regular intervals, which causes difficulty in calculation/monitoring of billed water consumption.

Cause

The inability of regular billing is attributed to operational challenges such as dearth of billing paper and non-constant power supply which are caused by funding problem.

Actions

The issue should be escalated properly to not only management of FCTWB but also governing Board and FCTA to address importance of regular billing for improvement in calculation of billed water consumption, and to obtain their understanding and necessary funding.

9. Backlogs and necessary Actions

(4) Monitoring of NRW Ratio and/or related Data

System input volume to Jabi PMA is not measurable.

Cause

A mechanical PMA meter in Jabi is not functioning.

Actions

FCTWB will replace the malfunctioning PMA mechanical meter by new one by the 14th of September 2018. Then, FCTWB will read and monitor system input volume to Jabi PMA.

(5) The Final Capacity Assessment

The final assessment and follow up if necessary will be done before the completion of the Project.

9. Backlogs and necessary Actions

(6) Approval of the medium-term strategic plan and commitment of incorporation of an annual plan (2019) into recurrent/capital budget plan.

These will be approved or committed by the governing Board of FCTWB on behalf of FCTA before the completion of the Project.

(7) Project Vehicle

FCTWB concluded impossibility of repair of a damaged project vehicle and will purchase a new vehicle by using Counterpart Fund. Process of procurement is ongoing. All project vehicles for NRW reduction should be used strictly for implementation of the medium-term strategic plan for NRW reduction.

(8) Seminar

One day in the third week of October 2018. (for example, 18th)

10. Preparation by Nigerian side toward after completion of the Project

- Follow up for incorporation of the annual NRW reduction plan (2019) to FCTWB's annual recurrent and capital budget plan (2019)
- Follow up for modification of FCTWB's budget templates
- Standing imprest either monthly or quarterly basis for routine activities
- Set up staffing, office and equipment storage
- Monitoring of NRW ratio and related data (the whole system, zones and PMAs)
- Preparatory survey on zones
- Regular reporting to Management and governing Board of FCTWB

Kick off the Project on 6th November 2014

FCTWB welcomed Dr. Shinichi Kitaoka, JICA President on 16th June 2016

Certificate Awarding Ceremony in JICA Yokohama on 1st July 2016

FCTWB welcomed Mr. Yukio Okamoto, JICA Special Advisor on 13th April 2018

Thank you very much.

Observations from JICA Headquarters

5 September, 2018
Abuja

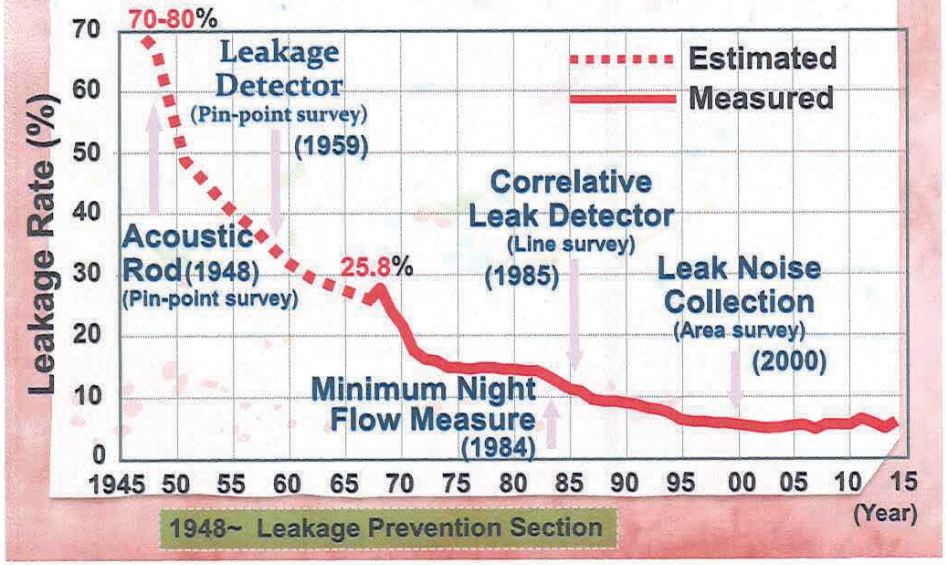
First of all…,

- Congratulation for achieving all Outputs!

1. Monitoring and estimating NRW rate
2. Establishing methods for effective reduction of NRW through pilot activities
3. Strategic plan is almost approved

History of Prevention Works

~Leakage Rate History of Yokohama~



1948~ Leakage Prevention Section

Contents

Findings and Recommendations

(1) Increasing Water Supply (Output-1)

(2) Knowledge Sharing in FCTWB (Output-2&3)

(3) Expected Goals toward the Prospective Cooperation

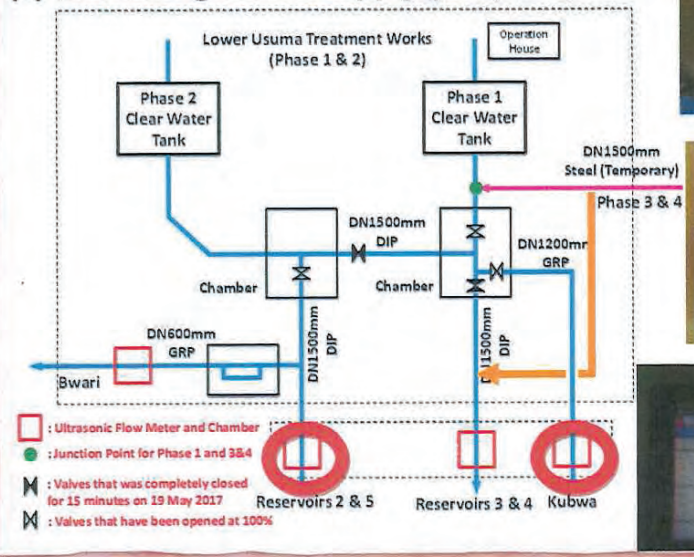
(1) Increasing Water Supply (Output-1)

※ m3 / hour

WTP	Phase 1	Phase 2	Phase 3	Phase 4
Designed Capacity	5,000	5,000	10,000	10,000
	Total 30,000			
Intake (*Water Right)	61,200? (= Gurara 43,200 + Lower Usuma 18,000)			
Raw Water Transmission	3,500	No Meter	?	?
Clear Water Transmission	N/A	N/A	2,000	1,500
	Total 13,123 (Estimate)			

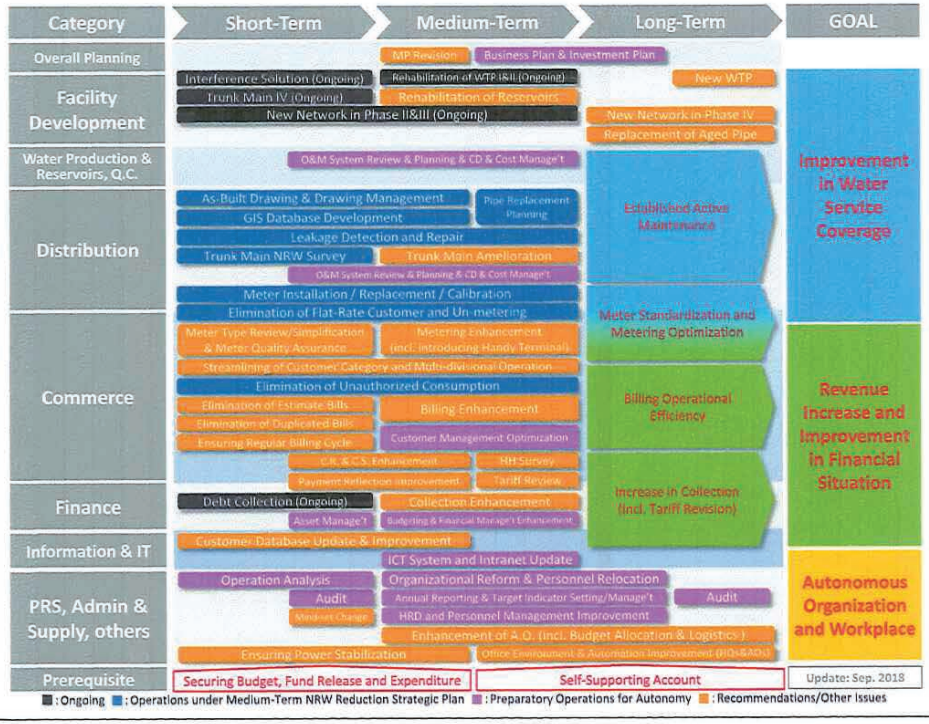
Distribution Network	Phase 1 (Loops-3&4)	Phase 2 (Loops-2&5)	Phase 3 (Loops-1&6)	Phase 4 (Loops-7~10)
Distribution	N/A?	N/A?	-	-
Supply (*Revenue Water)	N/A?	N/A?	-	-
Water Demand	Total 15,000 (2018) ~ 28,423 (2020)			

(1) Increasing Water Supply (Output-1)



(2) Knowledge Sharing in FCTWB (Output-2&3)

- FCTWB officers keep and utilize knowledge and information regarding NRW reduction activities in the organization even though project counterpart members are changed.
- We suggest FCTWB is going to establish regular internal meetings (general assembly etc.) for sharing knowledge and information.



(3) Expected Goals toward the Prospective Cooperation

- Implementation of medium-term strategic plan and annual plan for NRW reduction; the first step is to install 2,000 mechanical customer-meters.
- Commencement of improving FCTWB services (water quantity and quality); the vital issue is the rehabilitation of WTP phase1-2 (*Pulsater*, coagulation and sedimentation basin)

Contents

JICA Mission's Comments

The FCTWB NRW Reduction Project

Final JCC Meeting
5 September 2018
Abuja, Nigeria

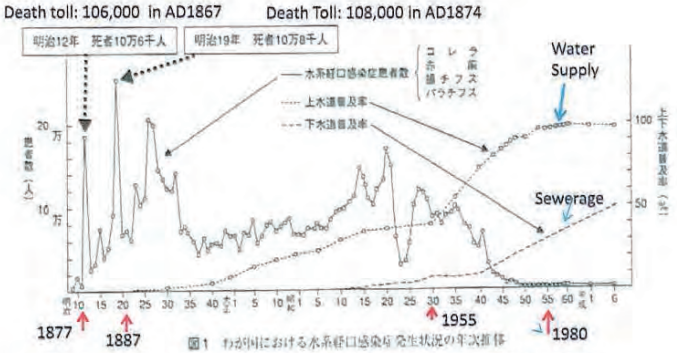
Omura Yoshiki

Autonomy of FCTWB

- More room to maneuver by itself

- New responsibilities:
  - Financial soundness
  - Higher service level
  - Service coverage

Service Coverage (1877-1994)



Death Toll of Water-borne Diseases vs Service Coverage of Water/Sewerage Services

Annex2-508

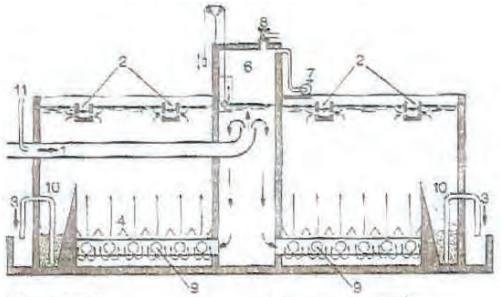
Lower Usuma Dam Water Treatment Plants #1 and #2

What I am concerned with since 2014?

Pulsators are not functioning because of vacuum pumps are out of order.

Pulsators

Pulsation: Degremont technology



Annex2-509

What is a problem if vacuum pump is out of order?

- **Turbid matters (soil suspended in water)** can not form flocs.
- **Settling** is not done.
- Turbidity remains high and loaded to Rapid sand filters.
- Turbid matters remaining on sand have to be removed by **frequent** backwashing.
- More clear water is used for backwashing than designed.

Please complete rehabilitation works as soon as possible.

Contents

1. Findings and Recommendations
2. Last Message from JICA Senior Advisor
3. Water Supply Business through "Autonomy"
   by Wataru Takashima,
   Regional Project Formulation Advisor, JICA Kenya

(1) Water Supply Business

- …is the one which could never be abandoned.

→ Once you start this business, you will never abandon it for good.

(2) Business through "Autonomy"

- When you can do everything through "Autonomy," this means you must do everything by yourselves.
- You have to deal with pressures from customers and cost problems.
- Efficient management for customers is required.

Thank you very much for your attention !
Na Gode!
Imeela!
Eshe gon!

Appendix 5

FEDERAL CAPITAL TERRITORY WATER BOARD

P.M.B. 164, Garki-Abuja F.C.T. Tel: 09-2341559 Email: fctwb@alpha.linkserve.com

FCT/WB/11/S.304/3 **5th September, 2018**

The Chief Advisor,
NRW Reduction, Project
FCT Water Board

NOTICE OF APPROVAL: THE MEDIUM-TERM STRATEGIC PLAN FOR NON-REVENUE WATER REDUCTION (2019 – 2023) AND ITS INCORPORATION IN TO FCT WATER BOARD BUDGET EXPENDITURE

This is to acknowledge the receipt of request for approval of Medium-Term Strategic plan and its incorporation in to FCT Water Board's Capital and Recurrent Budget Expenditure, Reference No. FCT/WB/S.82361 dated 30th July, 2018.

The FCT Water Board Governing Board has approved the Medium-Term Strategic plan for NRW reduction (2019 – 2023) and its incorporation in to the FCT Water Board's Capital and Recurrent Budget Expenditure.

While appreciating the Technical Cooperation for development of FCT Water Board, please accept the assurances of our warm regards.

Engr. K. A. Ali, FNSE, NPOM, mni
Chairman, FCT Water Board

Engr. A. A. Nahuche
General Manager, FCT Water Board

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: **The Federal Capital Territory Reduction of Non-Revenue Water Project** **Version** 1
Project Period: **October 2014 to March 2018** **Dated** 6 Nov. 2014
Implementing Organization: **Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)**
Dicrect Beneficiaries: **FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices**
Project Site: **FCT** **Pilot Area Offices:** **Jabi, Garki I and Gudu**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Level of Non-Revenue Water (NRW) is reduced at the service area of FCTWB	a: Annual NRW ratio is reduced to X%(*) at the end of the year 2021 Note(*): Target value (X%), which is expected to be determined in the medium-term strategic plan for NRW reduction, shall be tentatively filled when the final draft was approved by the Director of FCTWB, which shall be finalized when the plan is approved by FCTA	a. Record of NRW ratio kept by Distribution Department			
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2018-2022) is approved by FCTA by the end of the Project. b. NRW reduction operations of the first quarter of 2018 specified in the annual plan of the above plan are carried out according to the plan by FCTWB c. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level d. NRW ratio of each PMA in the last quarter of the Project reaches its respective target (**) Note(**): Target for each PMA is expected to be determined by the end of the first quarter of the second year	a. Date of approval of the plan b. Result of monitoring by NRW Management Team c. Results of joint assessment based on the criteria set by the Project d. Record of NRW ratio kept by Distribution Department	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed		
<Outputs>					
1. Level of NRW of the service area of FCWTB is monitored regularly	1a. Record of monthly NRW ratio is kept by Distribution Department from the third quarter of the first year of the Project 1b. Monthly NRW ratio of the service area of FCTWB is reported to its monthly Joint Management Meeting from the third quarter of the first year of the Project 1c. Quarterly NRW ratio of the service area of FCTWB is reported to the Board of Directors of FCTWB from the third quarter of the first year of the Project	1a. Monthly record of NRW ratio. 1b&1c. Material for meetings submitted by the Distribution Department	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers		
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce by the first quarter of the third year of the Project	2a. Record of NRW ratio kept by the Distribution Department 2b. Date of approval of the manuals			
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. By October 2017, draft medium-term strategic plan for NRW reduction (2018-2022) is submitted by FCTWB to FCTA for review and approval 3b. By October 2017, an annual NRW reduction plan (2018) is incorporated in FCWTB's annual recurrent and capital plan (2018) for submission to FCTA for review and approval 3c. A planning manual for NRW reduction is approved by the Director of FCTWB by the end of the Project	3a&3b. Date of official letter submitting draft strategic plan and annual recurrent and capital plan 3c. Date of approval of the manual			

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above: they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Annex 5-13

Activities	Inputs		Important Assumption
	The Nigerian Side	**The Japanese Side**	A Natural disaster/political/ instability/economic crisis that affect the project activities do not occur
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure monthly water production of water treatment plants 1, 2 ,3, and 4 1-3 Tally the above water production data monthly 1-4 Calculate the monthly water consumption based on the billing data 1-5 Calculate monthly NRW ratio of the service area of FCTWB using the data obtained from Activity 1-3 and 1-4	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: Director of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary **Land, Building and Facilities** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each Pilot Area Office, including internet connection and air conditioners 3. Other facilities mutually agreed upon as necessary **Local Costs** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including costs for local travel for the Project Personnel	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Management / Coordinator 8. Other experts mutually agreed upon as necessary **Equipment** 1. Bulk meters for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles(Pick-ups) 6. Other equipment mutually agreed upon as necessary **Training of the Nigerian Project Personnel in Japan** Four persons mutually agreed upon will be trained in Japan annually	**Pre-Conditions** A Furnished offices for Japanese Expert Team are secured at Headquarters and each Pilot Area Office of FCTWB B Project Personnel is assigned with the finalized list
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials			**Issues & Countermesures**
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2018-2022) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction			

Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow: (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio: and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDM2

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to March 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Dicrect Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT **Pilot Area Offices:** Jabi, Garki I and Gudu

Version 2
Dated 12 Nov. 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Level of Non-Revenue Water (NRW) is reduced at the service area of FCTWB	a: Annual NRW ratio is reduced to X%(*) at the end of the year 2021 Note(*): Target value (X%), which is expected to be determined in the medium-term strategic plan for NRW reduction, shall be tentatively filled when the final draft was approved by the Director of FCTWB, which shall be finalized when the plan is approved by FCTA	a. Record of NRW ratio kept by Distribution Department			
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2018-2022) is approved by FCTA by the end of the Project. b. NRW reduction operations of the first quarter of 2018 specified in the annual plan of the above plan are carried out according to the plan by FCTWB. c. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. d. NRW ratio of each PMA in the last quarter of the Project reaches its respective target (**). Note(**): Target for each PMA is expected to be determined by the end of the first quarter of the second year.	a. Date of approval of the plan b. Result of monitoring by NRW Management Team c. Results of joint assessment based on the criteria set by the Project d. Record of NRW ratio kept by Distribution Department	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed		
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored regularly	1a. Record of monthly NRW ratio is kept by Distribution Department from the third quarter of the second year of the Project. 1b. Monthly NRW ratio of the service area of FCTWB is reported to its monthly Joint Management Meeting from the third quarter of the second year of the Project. 1c. Quarterly NRW ratio of the service area of FCTWB is reported to Management of FCTWB from the third quarter of the second year of the Project. 1d. Periodic records of data on water distribution management such as water flow of zonal meters and water pressure are kept by Distribution Department from the first quarter of the third year of the Project.	1a. Monthly record of NRW ratio 1b&1c. Material for meetings submitted by the Distribution Department 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers		
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce by the first quarter of the third year of the Project.	2a. Record of NRW ratio kept by the Distribution Department 2b. Date of approval of the manuals			
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. By October 2017, draft medium-term strategic plan for NRW reduction (2018-2022) is submitted by FCTWB to FCTA for review and approval. 3b. By October 2017, an annual NRW reduction plan (2018) is incorporated in FCWTB's annual recurrent and capital plan (2018) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the Director of FCTWB by the end of the Project. 3d. By November 2016, framework of water distribution management is established.	3a&3b. Date of official letter submitting draft strategic plan and annual recurrent and capital plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management			

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above: they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption	
	The Nigerian Side	**The Japanese Side**		
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure monthly water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data monthly 1-4 Calculate the monthly water consumption based on the billing data 1-5 Calculate monthly NRW ratio of the service area of FCTWB using the data obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: Director of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manage't / Coordinator 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring 12. Other experts mutually agreed upon as necessary		
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers for bulk meters for water treatment plants, flow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system with standby power generating facility for selected zonal meter(s) and/or water pressure sensor(s). 9. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for zonal meters and water pressure sensors **Training of the Nigerian Project Personnel** 1. Four persons mutually agreed upon will be trained in Japan annually 2. GIS training in Nigeria	**Pre-Conditions**	
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2018-2022) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction 3-8 Review existing plans, activities and implementing structure, etc. related to water distribution management 3-9 Establish framework of water distribution management				

Issues & Countermesures

Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow: (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio: and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDM3

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to March 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Dicrect Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT **Pilot Area Offices:** Jabi, Garki I and Gudu

Version 3
Dated 22 Sep. 2016

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Level of Non-Revenue Water (NRW) is reduced at the service area of FCTWB	a: Annual NRW ratio is reduced to X%(*) at the end of the year 2021 Note(*): Target value (X%), which is expected to be determined in the medium-term strategic plan for NRW reduction, shall be tentatively filled when the final draft was approved by the Director of FCTWB, which shall be finalized when the plan is approved by FCTA	a. Record of NRW ratio kept by Distribution Department			
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2018-2022) is approved by FCTA by the end of the Project. b. NRW reduction operations of the first quarter of 2018 specified in the annual plan of the above plan are carried out according to the plan by FCTWB. c. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. d. NRW ratio of each PMA in the last quarter of the Project reaches its respective target (**). Note(**): Target for each PMA is expected to be determined by the end of the first quarter of the second year.	a. Date of approval of the plan b. Result of monitoring by NRW Management Team c. Results of joint assessment based on the criteria set by the Project d. Record of NRW ratio kept by Distribution Department	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed		
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored regularly	1a. Record of monthly NRW ratio is kept by Distribution Department from the third quarter of the second year of the Project. 1b. Monthly NRW ratio of the service area of FCTWB is reported to its monthly Joint Management Meeting from the third quarter of the second year of the Project. 1c. Quarterly NRW ratio of the service area of FCTWB is reported to Management of FCTWB from the third quarter of the second year of the Project. 1d. Periodic records of data on water distribution management such as water flow of zonal meters and water pressure are kept by Distribution Department from the first quarter of the third year of the Project.	1a. Monthly record of NRW ratio 1b&1c. Material for meetings submitted by the Distribution Department 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers		
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce by the first quarter of the third year of the Project.	2a. Record of NRW ratio kept by the Distribution Department 2b. Date of approval of the manuals			
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. By October 2017, draft medium-term strategic plan for NRW reduction (2018-2022) is submitted by FCTWB to FCTA for review and approval. 3b. By October 2017, an annual NRW reduction plan (2018) is incorporated in FCWTB's annual recurrent and capital plan (2018) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the Director of FCTWB by the end of the Project. 3d. By November 2016, framework of water distribution management is established.	3a&3b. Date of official letter submitting draft strategic plan and annual recurrent and capital plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management			

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above: they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption	
	The Nigerian Side	**The Japanese Side**	A. Natural disaster / political / instability / economic crisis that affect the Project activities do not occur.	
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure monthly water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data monthly 1-4 Calculate the monthly water consumption based on the billing data 1-5 Calculate monthly NRW ratio of the service area of FCTWB using the data obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: Director of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manage't / Coordinator 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring 12. Other experts mutually agreed upon as necessary	**Pre-Conditions** A. Furnished offices for Japanese Experts are secured at the Headquarters and each Pilot Area Office of FCTWB. B. Project Personnel is assigned with the finalized list.	
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers forflow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system with standby power generating facility for selected zonal meter(s) and/or water pressure sensor(s). 9. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for bulk meters for water treatment plants, zonal meters and water pressure sensors **Training of the Nigerian Project Personnel** 1. Four persons mutually agreed upon will be trained in Japan annually 2. GIS training in Nigeria		
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2018-2022) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction 3-8 Review existing plans, activities and implementing structure, etc. related to water distribution management 3-9 Establish framework of water distribution management				**Issues & Countermeasures**

Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow: (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio: and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDM4

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to September 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Dicrect Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT **Pilot Area Offices:** Jabi, Garki I and Gudu

Version 4
Dated 24 Aug. 2017

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.	a: NRW reduction operations are carried out according to the medium-term strategic plan for NRW reduction (2019-2023) .	a. Report of NRW reduction activities and monitoring by NRW Unit (NRW ratio, records of leakage detection, repair, disconnection of illegal connections, etc.)			
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project. b. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. c. NRW ratio of each PMA is monitored.	a. Date of approval of the plan b. Results of joint assessment based on the criteria set by the Project c. Record of NRW ratio kept by NRW Unit	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed		
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.	1a. Record of NRW ratio is kept by NRW Unit. 1b. NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting. 1c. NRW ratio of the service area of FCTWB is reported to Management of FCTWB . 1d. Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	1a. Record of NRW ratio 1b&1c. Material for meetings submitted by NRW Unit 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers		
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	2a. Record of NRW ratio kept by NRW Unit 2b. Date of approval of the manuals			
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval. 3b. An annual NRW reduction plan (2019) is incorporated in FCWTB's annual recurrent and capital plan (2019) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the Director of FCTWB. 3d. Framework of water distribution management is established.	3a&3b. Date of official letter submitting draft strategic plan and annual recurrent and capital plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management			

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above: they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption	
	The Nigerian Side	**The Japanese Side**	A. Natural disaster / political / instability / economic crisis that affect the Project activities do not occur.	
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure/estimate water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data/estimation 1-4 Calculate the water consumption based on the billing data 1-5 Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: Director of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manage't / Coordination 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring Design 12. Remote Monitoring Device Installation / Training 13. Financial Analysis / Organization 14. Other experts mutually agreed upon as necessary	**Pre-Conditions** A. Furnished offices for Japanese Experts are secured at the Headquarters and each Pilot Area Office of FCTWB. B. Project Personnel is assigned with the finalized list.	
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities (to be financed by Couterpart Fund)** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers for flow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs (to be financed by Couterpart Fund)** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system for selected zonal meters 9. Solar powering systems for zonal meters 10. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for bulk meters for water treatment plants and zonal meters **Training of the Nigerian Project Personnel** 1. Eighteen persons mutually agreed upon will be trained in Japan. 2. GIS training in Nigeria		**Issues & Countermeasures**
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2019-2023) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction 3-8 Review existing plans, activities and implementing structure, etc. related to water distribution management 3-9 Establish framework of water distribution management				

Note (*3) Selection criteria of PMA are as follows: (i) Safety for night works is secured in measuring minimum night flow: (ii) Distribution network is separated and it is easy to isolate it in measuring NRW ratio: and (iii) NRW ratio is supposedly high.
Note (*4) Working Group for NRW planning would consist of Project Manager (as chair), Deputy Project Manager, Technical Managers, Head of Finance Dept., Head of Production Dept., Head of PRS Unit, and members of NRW Management Team.

Project Monitoring Sheet I (Revision of Project Design Matrix)

PDM5

Project Title: The Federal Capital Territory Reduction of Non-Revenue Water Project
Project Period: October 2014 to September 2018
Implementing Organization: Federal Capital Territory Administration (FCTA) / Federal Capital Territory Water Board (FCTWB)
Dicrect Beneficiaries: FCTWB, relevant staff of FCTWB Headquarters and pilot Area Offices
Project Site: FCT **Pilot Area Offices:** Jabi, Garki I and Gudu

Version 5
Dated 28 Jun. 2018
Monitoring: 27 Jun. 2018

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
<Overall Goal> Non-Revenue Water reduction activities are routinely implemented in the service area of FCTWB.	a: NRW reduction operations are carried out according to the medium-term strategic plan for NRW reduction (2019-2023) .	a. Report of NRW reduction activities and monitoring by NRW Unit (NRW ratio, records of leakage detection, repair, disconnection of illegal connections, etc.)			
<Project Purpose> Capacity of FCTWB for NRW reduction is strengthened	a. The medium-term strategic plan for NRW reduction (2019-2023) is approved by FCTA by the end of the Project. b. Relevant staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) become equipped with skills and knowledge necessary for NRW reduction according to the criteria set by the Project for each level. c. NRW ratio of each PMA is monitored.	a. Date of approval of the plan b. Results of joint assessment based on the criteria set by the Project c. Record of NRW ratio kept by NRW Unit	A. Policy support for NRW reduction is not discontinued Policy support for NRW reduction is not discontinued B. Natural disaster/ political instability/ economic crisis that affect the service area of FCTWB do not occur C. Activities to implement the medium-tem strategic plan are not discontinued or delayed		
<Outputs>					
1. Level of NRW of both the service area of FCWTB and water distribution areas is monitored and estimated.	1a. Record of NRW ratio is kept by NRW Unit. 1b. NRW ratio of the service area of FCTWB is reported to its Joint Management Meeting. 1c. NRW ratio of the service area of FCTWB is reported to Management of FCTWB . 1d. Periodic records of data and estimation on water distribution management such as water flow of zonal meters and water pressure are kept by NRW Unit.	1a. Record of NRW ratio 1b&1c. Material for meetings submitted by NRW Unit 1d. Periodic records of data on water distribution management	A. Staff of FCTWB (i.e. members of NRW Management Team and Pilot NRW Action Teams) trained through the Project do not leave the office in large numbers		
2. Methods/operational procedures for effective NRW reduction are established through pilot projects at Pilot Metering Areas (PMAs) under pilot Area Offices (*1)	2a. Decrease rate of NRW ratio for each Sub Metering Area of a PMA reaches at least 80% of its target at the end of the respective NRW reduction operations. 2b. Technical manuals for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials, are approved by Head of Department (HoD) for Distribution and HoD for Commerce.	2a. Record of NRW ratio kept by NRW Unit 2b. Date of approval of the manuals			
3. A medium-term strategic plan of FCTWB for NRW reduction is developed, utilizing the results of Output 1-2 (*2)	3a. Draft medium-term strategic plan for NRW reduction (2019-2023) is submitted by FCTWB to FCTA for review and approval. 3b. An annual NRW reduction plan (2019) is committed by the governing Board of FCTWB, to be incorporated in FCWTB's annual recurrent and capital budget plan (2019) for submission to FCTA for review and approval. 3c. A planning manual for NRW reduction is approved by the General Manager of FCTWB. 3d. Framework of water distribution management is established.	3a. Date of official letter submitting draft strategic plan 3b. Date of commitment incorporating annual NRW reduction plan in annual recurrent and capital budget plan 3c. Date of approval of the manual 3d. Implementing structure and workflow of water distribution management			

Note (*1): NRW components targeted by Output 2 are (i) invisible leakage; (ii) customer meter malfunction; and (iii) illegal connection
Note (*2): A medium-term strategic plan is a five-year plan, which may include medium-term target, strategies and actions, timeframe, human resource requirement, on-the-job training mechanism, cost-benefit analysis of NRW reduction, etc. It is noted that NRW components addressed by the strategic plan are not limited to the ones mentioned in (*1) above: they shall be discussed and determined in developing the outline of the strategic plan (through Activity 3-4).

Activities	Inputs		Important Assumption	
	The Nigerian Side	**The Japanese Side**	A. Natural disaster / political / instability / economic crisis that affect the Project activities do not occur.	
1-1 Install bulk meters to water treatment plants 1 and 2 1-2 Measure/estimate water production of water treatment plants 1, 2, 3 and 4 1-3 Tally the above water production data/estimation 1-4 Calculate the water consumption based on the billing data 1-5 Calculate NRW ratio of the service area of FCTWB using the results obtained from Activity 1-3 and 1-4 1-6 Install zonal meters, water pressure sensor and pilot remote monitoring (telemetry) system 1-7 Measure/estimate and collect data for water distribution management such as water flow of zonal meters and water pressure	**Project Personnel** 1. Project Director: Director of Economic Planning, Research and Statistic Department, FCTA 2. Project Manager: General Manager of FCTWB 3. Deputy Project Manager: HoD for Administration and Supply/FCTWB 4. Technical Managers (Also Leaders of NRW Management Team): HoD for Distribution and HoD for Commerce /FCTWB 5. Members of NRW Management Team (FCTWB): - Head of Special Project Unit of Distribution Department (as Coordinator) - Relevant Head of Unit (HoU) and officers of the Distribution Department, Commerce Department, and Administration and Supply Department 6. Heads of other relevant Departments and Unit of FCTWB: HoD for Finance, HoD for Production, HoU for Planning Research and Statistics (PRS) 7. Members of NRW Action Team: Area Manager, Assistant Area Manager (Distribution), Assistant Area Manager (Commerce), technical officers (Distribution) and meter readers (Commerce) of each pilot Area Office 8. Other personnel mutually agreed upon as necessary	**Japanese Experts** 1. Chief Advisor / NRW Reduction Planning / Water Distribution Management 1 2. Deputy Chief Advisor / NRW Reduction Planning 3. NRW Reduction Operations Management 4. Leakage Detection Technology 5. Commercial Loss 6. Hydraulic Analysis / GIS 7. Procurement Manage't / Coordination 8. Facility Design / Construction Supervision 9. Equipment Design / Installation 10. Water Distribution Management 2 11. Remote Monitoring Design 12. Remote Monitoring Device Installation / Training 13. Financial Analysis / Organization 14. Other experts mutually agreed upon as necessary	**Pre-Conditions** A. Furnished offices for Japanese Experts are secured at the Headquarters and each Pilot Area Office of FCTWB. B. Project Personnel is assigned with the finalized list.	
2-1 Review existing NRW reduction operations at each pilot Area Office 2-2 Conduct capacity assessment of the relevant staff of each pilot Area Office 2-3 Identify and select a Pilot Metering Area (PMA) for each pilot Area Office based on the selection criteria of PMA(*3) 2-4 Prepare/update distribution network drawings for each PMA 2-5 Install water flow meters to each PMA and measure in/outflows monthly 2-6 Zone each PMA into Sub Metering Areas (SMA) 2-7 Isolate a SMA by installing valves 2-8 Update the distribution network drawings for each SMA 2-9 Measure an initial level of NRW of each SMA 2-10 Detect target NRW components (i.e. invisible leakage, customer meter malfunction, and illegal connection) of each SMA 2-11 Develop a NRW reduction operation plan of each SMA ,including reduction target, for review by Head of Distribution Department 2-12 Review and approve NRW reduction operation plan of each SMA 2-13 Implement the NRW reduction operations at each SMA 2-14 Monitor the progress of the NRW reduction operations of each SMA 2-15 Measure level of NRW of each SMA at the end of the respective operations 2-16 Prepare a report on pilot projects, covering Activity 2-1~2-15 2-17 Develop manuals for NRW reduction for Area Office managers and field operators (i.e. technical officers and meter readers), including audio visual materials	**Land, Building and Facilities (to be financed by Couterpart Fund)** 1. Office building and facilities necessary for the implementation of the Project 2. Office spaces and necessary facilities for the Japanese Experts at the FCTWB Headquarters and each pilot Area Office, including internet connection and air conditioners 3. Chambers for flow meters and valves for the selected PMAs/SMAs. 4. Electric wiring to bulk/zonal meters, loggers and pressure sensors. 5. Other facilities mutually agreed upon as necessary **Local Costs (to be financed by Couterpart Fund)** 1. Cost for installation, operation and maintenance of the provided equipment and cost for pipe repair at PMAs 2. Administration and operational costs, including cost for local travel for the Project Personnel, demurrage at local customs point, licensing cost of radio application and cost for communication of telemetric device for selected zonal meter(s) and water pressure sensor(s) 3. Other costs mutually agreed upon as necessary	**Equipment** 1. Bulk meters and loggers for water treatment plants 2. Water flow meters, valves, and customer meters for SMA 3. Leakage detection equipment for PMA 4. Pipe repair equipment for PMA 5. Vehicles (Pick-ups) 6. Generator for project office 7. Zonal meters, loggers and water pressure sensors 8. Telemetric monitoring system for selected zonal meters 9. Solar powering systems for zonal meters 10. Other equipment mutually agreed upon as necessary **Facilities** 1. Modification of existing billing system 2. Chambers for bulk meters for water treatment plants and zonal meters **Training of the Nigerian Project Personnel** 1. Eighteen persons mutually agreed upon will be trained in Japan. 2. GIS training in Nigeria		**Issues & Countermeasures**
3-1 Establish a Working Group for NRW planning (*4) 3-2 Review existing plans, implementation structure, on-the-job training mechanism, etc. related to NRW reduction at FCTWB 3-3 Conduct hydraulic and water pressure distribution analyses of the pipeline networks 3-4 Develop outlines of the medium-term strategic plan and its annual NRW reduction plan 3-5 Develop the first medium-term strategic plan (2019-2023) for approval by FCTA 3-6 Develop an annual NRW reduction plan based on the strategic plan as an integral part of an annual recurrent and capital plan of FCTWB for approval by FCTA 3-7 Develop a planning manual for NRW reduction 3-8 Review existing plans, activities and implementing structure, etc. related to water distribution management 3-9 Establish framework of water distribution management				

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