<u>S13.3-29 検針・請求チーム、顧客サービス・チ</u> <u>ームに係る講義</u>



Distribution management

- Function of Distribution reservoir
- ≻Keep clean water for customers
- Secure water at the disaster
- ≻ For using fire hydrant 170~180L/d/capita



Distribution management

- Where to happen leakage?
- > At the connection between distribution pipe and service pipe
- At a valve beside a water meter Project; NRW reduction of 30% in each pilot area







Improvement of meter reading

- Customers are billed for days
- > New installed meters are
- Uncover reading discrepancies
- > Reading
- Water Sales
- customer complains efficient
- Readings can be accessed
 - (Billings & Customer Care)
- Provides reading
- Communication



Necessary condition of Water meter

- Accurate
- , High ', Wide
- Little of the inside parts and a large capacity of
- Hygienically harmless , Weather
- measurement and checks
- structure, handling
- breakdown, repair, interchangeability, price

Cause	and	measures	for	the	trouble	of the	water	meter
Cause	anu	measures	101	une	uouoic	or the	water	meter

No	The trouble	A cause	Measures
1	The needle of the water meter doesn't work or the movement is slow		
2	The needle of the meter turns in forward and reverse		
3	The movement of the needle is fast		
4	A needle turns in reverse		
5	The indicator on the meter is unclear of rust		
6	The indicator on the water meter is unclear		
			10







<section-header><section-header><image><image><image>

Case	How to save water	Water-saving
		amount
Bathing		90L / d 36L / d
Shower		35L / d
Cooking		80L / d
Face-wash Dentifrice		15L / d 20L / d
Toilet		20L / d
Laundry		45L / d 40L / d
Sweeping/ watering		20L / d

Water meter error

0.101 102 103 104 105 106 107 108 109 Installed Junc 302014 112013 012007 022007 022007 02010 012005 0120	110 1/2008 6.5
Natalled Determine 1 03/2014 11/2013 01/2007 01/2007 02/2017 02/2010 01/2006 <t< td=""><td>1/2008 6.5</td></t<>	1/2008 6.5
Passage Year 0.3 0.7 7.6 7.5 7.4 2.3 8.6 8.5 9.5 Meter DN (mm) 13 14 14 14 14 14 14 14 14 14 14 14 15 15 15 15 15 16 15	6.5
Meter DN (mm) 13 14 15 16 <th16< th=""> 16 16</th16<>	1.0
L'h L L L L L L L L L	13
	L
a 30 10 670.5 361.4 865.1 1011.0 990.9 186.3 526.7 340.8 1153.6	1053.9
858,7 1011,0 981,0 176,5 518,1 330,3 1145,3	1044.7
활 전	1024.7
800 100 600.6 291.8 800.9 973.4 920.4 115.8 459.0 271.8 1084.9	983.9
Initial 500.6 192.1 701.0 867.3 819.9 15.4 359.1 171.6 983.4	883.4
L'h Ave.% % % % % % % % %	%
g 30 -17.7 -1.0 -3.0 -36.0 -100.0 -1.0 -2.0 -14.0 5.0 -17.0	-8.0
표 펄 60 -11.9 0.0 -0.5 -8.0 -100.0 1.0 1.0 -9.0 -1.0 -2.5	0.0
₩ 120 -0.2 0.0 0.0 -1.5 -6.0 1.0 1.3 2.2 -3.3 2.2	2.0
800 0.9 0.0 -0.3 -0.1 6.1 0.5 0.4 -0.1 0.2 1.5	0.5

S13.3-29-2

Calculating formula

 $((865.1 - 858.7) \div 10 \times 100 - 1) \times 100 = -36.0$ $((858.7-840.3) \div 10 \times 100-1) \times 100 = -8.0$ $((840.3 - 800.9) \div 10 \times 100 - 1) \times 100 = -1.5$ $((800.9-701.0) \div 10 \times 100-1) \times 100 = -0.1$

Consideration

1. Billing Q: How to calculate water charge collection rate? A: Q: Solution to reduce non-payment of water charge? À:

Q: Importance of relation between meter reading team and billing team? À:

Q: Water charge is enough to cover the cost?

À:

Q: How to treat low-income payers who are difficult to pay water charge? À:

Consideration

2. PR activity Q: Necessity of PR activity? À:

Q: Necessity of Awareness Meeting? A:

Q: Necessity of School education? A:

Q: Issues of Water Supply Service? À:

Consideration

19

3. Customer Service Q: How to treat customer's complaint? C1: Judging from water consumption, water charge is high. A1: C2: Water pressure is low. A2: C3: Not receiving a billing. A3: C4: Continuing water supply cut? A4: C5: I want to know water quality? A5: C6: I cannot pay water charge because I have no job. A6:

C7: Disconnection due to non-payment of water charge. A7:

Consideration

4. NRW Activity Q: How to calculate NRW ratio? A:

Q: Necessity of NRW Activity? A:

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<u>S13.3-30</u> 漏水探知に係る講義

Preparation for NRW Technical Examination



(1) Revenue Water (RW)

Billed Metered and Billed Unmetered Consumption.

(2) Non-Revenue Water (NRW)

1) Unbilled Metered Consumption and Unbilled Unmetered Consumption

Free water for washing road, park, fire-fighting and washout of pipe lines for public use

2) Unauthorized Consumption

This includes illegal connections and illegal use.

3) Customer Metering Inaccuracies

 $\pm 5\%$ of meter inaccuracy is acceptable. It also includes misreading by meter readers. Excess

consumption more than 32m3/month for flat rate.

4) Real Losses

Leakage on main pipes, service pipes and overflow from tanks, Representative NRW factors are follows;

- Leakage from distribution pipe ۶
- ≻ Illegal connection/use
- ۶ Parasite use from flat-rate customer
- ≻ Excess water use by flat rate customer
- <u>Meter inaccuracy</u>
- ≻ Meter reading error
- Over flow from tank/reservoir

2. What is MNF?

MNF (Minimum night flow) is measured by flow meter, and it is equivalent to leakage volume.



(1) Identification of Lines

> Blue: MNF

Flow rate is reduce during night

> <u>Red: Water Pressure</u> Water pressure increase and is stable during night

(2) Which point is MNF?

MNF volume is always seen at the minimum value during midnight even through the minimum flow records in the daytime.

(3) Check a pattern of MNF graph

It is properly measured the blue line shows lower volume than that of daytime and the red line becomes higher volume than that of daytime

2

SV1

SV2

4

3. Technical Procedure of NRW Reduction



4. Step Test (1) Purpose of step test

1

Step test is conducted to identify leakage volume in each section by closing valves.

(2) Operation of Valve

Manipulation order of valves for step test should start from downstream and valves should be operated slowly in order to avoid braking pipes by strong water shock wave which is called water hammer:

(3) Operation Time

Step test should be done during midnight because customers use least water in the time.

(4) Interval time of closing valves Interval time of closing valves from one to another should be longer than 5 minutes to measure a

stable flow.

(5) How to calculate



- Mark an arrow on the graph above at the point of time was closed the valve.
- ⊳ Draw a horizontal line with a ruler at lowest value of each valve-manipulated point from downstream to upstream.
 - Calculate a difference volume between drawn lines.
- Calculate a per-km flow volume of each section and compare a necessity of leak detection at 5 each section

(1) Understanding of procedure and key words Key words

Per-km Flow Volume (3.0m³/hr/km or more), NRW, Step Test, Acoustic Survey, Listening stick, Installation of Customer Meters, Disconnection of Illegal Connections, Repair of Leakage, Water Leak Detector, Correlator, Monitoring,



Section	Flow on Meter (m ³ /h)	Leakage Volume (m ³ /h)	Length (km)	Converted (m ³ /h/km)	Necessity of Leak Detection (Y/N)
Meter-Hole Lines			4.8		
SV1-End of Pipe			1.2		
SV2-End of Pipe			0.9		
SV3-End of Pipe			0.5		
SV4-SV2			0.3		
SV5-End of Pipe			1.2		
SV6-End of Pipe			0.3		
Flow Meter -SV4			0.4		

<u>S13.3-31</u>漏水探知に係る講義



(1) Revenue Water (RW)

Billed Metered and Billed Unmetered Consumption.

(2) Non-Revenue Water (NRW)

Unbilled Metered Consumption and Unbilled Unmetered Consumption
 Free water for washing road, park, fire-fighting and washout of pipe lines for public use

Unauthorized Consumption

This includes illegal connections and illegal use.

3) Customer Metering Inaccuracies

 \pm 5% of inaccuracy is acceptable, misreading, difference volume from billed unmetered volume.

4) Real losses

Leakage on main pipes, service pipes and overflow from tanks,

2. Estimation or calculation of NRW in DMAs

(1) Estimation of NRW ratio



The NRW Ratio (%) should be calculated or estimated as a preparation for NRW reduction in a DMA.

Flow rate of one day was calculated by an ultrasonic flow meter on the pilot areas. However, in the flow rate of one day is estimated from <u>Monthly Inflow Volume and Monthly Consumptions</u> in the DMA.

If there is no meter at the inlet point of a DMA, instead of measuring flow for a month, average flow of one day can be applied by measuring flow for a week or longer by an <u>Ultrasonic Flow Meter</u>.

(2) How to identify leaks

Leakage detection is to narrow down a point from wide area.



1) Leakage control Zone

The size of a DMA is large, DMA is divided into several <u>Leakage Control Zone (LCZ)</u> by installing valves for conducing leak detection quickly and effectively.



2) Step Test

If valves are installed on a main pipes, a serious leakage section with high possibility is identified from checking the change of the flow by closing valves in order. This method is called <u>Step Test</u>.



When the valves are opened after the completion of the step test, the valves must be opened slowly and gently with releasing the inside air from the end of the taps. This is for avoiding braking the pipe

2

4

or losing a part of the joint by the Strong Air Pressure in the pipe.

3) Where are leaks?

Most of leaks have been found on Service Pipe by a leak detection at the pilot areas.

Whole service pipes are not exactly known at the outside the city center, the reason is the length of service pipes is long and most parts are buried under grass or across another person's property. It causes delays in finding leaks and <u>llegal Connections</u>

It is very difficult to detect leaks and identify illegal connections on service pipes by reason for line goes under difficulties, therefore <u>Tracing Service Lines</u> is a very effective way for both.



4) Identification of Leakage Line

Unknown parts of long service pipes which are branched in a section of a DMA can be identified by measuring the flow volume by an ultrasonic flow meter or a <u>Standard Water Meter</u> (20mm~25mm). In this time, eliminate the <u>Castomer Usage</u> by closing the stopcock during the flow measurement to create a same situation with midnight.



Flow rate of every minute of a service pipe should be measured for at least <u>5 minutes</u> by a standard water meter.

In case water flows too much into a service pipe during checking the flow rate of the suspicious line, the <u>Section of Service Lines</u> can be narrowed down by measuring a flow with the standard water meter at shorter dividable points.



5) Flowchart of NRW activities







2) Metal Pipe Locator Locate a route and depth of metallic pipe.





Indirect Mode (No cable) Direct Mode (Cable)

2

3) Non-metallic Pipe Locator





Makes shock waves into a pipe







2) Water Pressure Logger Measuring a water pressure at inlet of DMA.





Calculate a velocity from time difference between going and returning of ultrasonic



Configuration of data collection is handled by PC

(3) Detecting Equipment 1) Listening Stick Checking sound at water meter or valve





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Connect a tip of stick to a water meter and listen sound. Do not hold a stick.

2) Electric Listening Stick

Checking a leak sound through a headphones





Sound is amplified by 3 level switches. It is effective equipment for sound check on non-metallic pipe.

3) Water Leak Detector





Sensor moves in every direction at suspicious point. Detect the

loudest point.

(4) Confirmation Equipment 1) Residual Chlorine Meter Checking a residual chlorine



Measure a density of residual chlorine whether water is drinking water or not.

2) Leak Noise Correlator

Leak point can be detected by inputting pipe information.



- > Leak sound reaches to both sides.
- > Leak point must be between two sensors.
- 4. Maintenance of Equipment

Maintenance of equipment is very important to use in good condition for long time.

1) Types of maintenance

There are two ways of maintenance for the equipment. One is a **Dairy Check Test** whether the equipment can work smoothly and properly before using them. The other one is a *Thorough Check* $\underline{\textit{Test}}$ as a periodical check for the accuracy of the performance and, it should be done at least every 6 months.

2) Importance of Record

List of all components should be checked to avoid loss of any component. Inventory Record must include the information of "Who", "When" use them and when batteries have installed for the management of equipment.

3) Keeping of Equipment

Detach the Batteries when the equipment is not used for a long time. The batteries may leak and cause damage to the equipment after being stored inside for long.

4) Weakness of Equipment

Most of the Equipment has electric parts and is not <u>Waterproofs</u>. Do not give a strong shock to them. Especially the sensor of the water leak detector may break because the element plate is made of Ceramic.

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5. Estimation of Lekage Volume

Please try to calculate a change of volume in each section from the graph of Step Test in a next sheet. Exercise for Calculation of Step Test





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Procedure of Calculation

> Mark an arrow at the time to close the valve on the graph above.

> Draw a horizontal line at the operated point from downstream with a rural.

Calculate a difference volume between drawn lines.6. Make a plan of leak detection in DMA by your plan.

(1) MNF in DMA: 50m3/h

- (2) Distribution Length: 10km
- (3) LCZ (Leakage Control; Zone): DMA can be divided into A and B-LCZ
- (4) Main Pipe: 200 mm, CIP
- (5) 5 valves and 3 air valves in each LCZ.
- (6) Average water Pressure : 0.25MPa
- (7) Service pipe is long and in the settlement.(8) About 70% of route of main pipes are unknown.

Key Points

Does leak detection need to do in this DMA? Why do you think so? What kind of technique and equipment do you need in this DMA ? Why do you think so?

Reference: Procedure of leak detection in DMA.

<u>S13.3-32 ワークショップ(プロジェクト進捗、</u> 課題提起、チャレンジ事項に係る発表)

THE PROJECT FOR IMPROVEMENT OF NON-REVENUE WATER REDUCTION CAPACITY FOR SOLOMON WATER

WORKSHOP

 Venue:
 Board Room, Solomon Water, Honiara

 Date:
 Tuesday, 4th August 2015 at 11:00 am

AGENDA

- 1 Welcome and introduction by Project Manager
- 2 Brief Explanation of the Project - History and Background of the Project - Project Design Matrix (PDM) - Project Implementation and Management - Collaboration between Two-Year Plan and JICA Project
- Project Progress, Issues and Challenges - Achievement - Delay in PRV-related Procurement
 - Acceleration of DMA Creation - Organizational Reform for DMA Monitoring and Maintenance
- 4 Terminal Evaluation

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- 5 Question and answer session
- 6 Closing remarks by Project Director

Handout

- Presentation Material on Brief Explanation of the Project
- PDMs
- Definition of Terms
- Project Implementing Structure and Member List
- Overall Implementing Flow under TYP and the Project
- Scope of Responsibilities, Contribution and Cooperation between TYP and the Project
- Presentation Material on Project Progress, Issues and Challenges
- Current Achievement, Progress and Issues
- Location Map of DMAs
- Honiara Water Supply System in Operation and Proposed DMAs (July 2015)
- SW Organizational Chart (Present and Proposed)



Summary of Previous JCC Meetings and Discussions Meeting Date Topics Presentation by JICA Expert Team on the Project Progress and Action Plan Presentation by SW on the Solomon Water Development Plan 2013-2015 (the Two-Year Plan) 1st JCC 24 Apr 2013 Suggestion for revision of the PDM and PO, including determination of indicator for the project purpose and changes in the project activities due to introduction of the Two-Year Plan. SW, JICA Solomon Islands Office and JICA Expert Team discussed the 15 Aug. 2013 suggested changes in the PDM and PO. - Agreement of the Amendment of Minute of the 1st JCC for revision of 2nd JCC 27 Nov PDM, and acceptance of PDM, Presentation by NRW Action Team members on creation of DMAs and 2013 acceptance of the creation of DMAs acceptance or the creation of DMAS Other than the above topics, participants made some comments and responded on the recently-opened Customer Care Center, Risk Management Plan of SW, and financial benefit of NRW reduction, etc. - Agreement of revision of PDM2, and acceptance of PDM3 Presentation by NRW Action Team members on project progress of the 3rd JCC 19 Mar 2015 Participants made some comments and contributions to issues and challenges on procurement, illegal connections and DIMA Management 30 Mar Commitment of procurement and its schedule by SW 2015

Framework of the Project









Collaboration between Two-Year Plan and JICA Project



Programme Logic of Two-Year Plan

Project Design (1)

Overall Goal

SW's service levels are improved and SW's revenue is increased.

Project Purpose

SW is assisted to achieve its target of reducing the NRW ratio in Honiara to 30% by 2015.

Outputs

- 1. Planning process of SW for NRW reduction is systematized.
- 2. The procedure for NRW reduction is established through the pilot areas and LCZs.
- 3. NRW reduction is implemented in accordance with the procedure in pilot areas and/or LCZs.
- Water meter reading and billing process management are improved.

Project Design (2)

Solomon Islands side

Inputs

- Personnel: 25 members (NRW Management Team: 5, NRW Action Team: 20)
 Project office and facilities for the project implementation, including office
- furniture, electricity and communication equipment
- Pipes, fittings and other materials for NRW reduction measures such as repair and meter installation
- Installation of flow meters and customer meters, and repair works Japanese side

- Expert: 8 experts

- Equipment: bulk flow meters, sluice valves for isolation, ultrasonic flow meters, data loggers, leakage detection equipment, GPSs, office automation equipment, customer meters, pickup trucks, an excavator and etc.
- **Training in Japan**: 3 times for 12 trainees in total (April and October 2013, and June 2014), and also group trainings

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Terminal Evaluation Mission

Purpose:

- to confirm the project progress during the period of this Project, based on the current PDM (PDM₃);
- (2) to identify issues that affect the process of implementation, including implementation arrangement, project management, and other external factors;
- (3) to undertake qualitative assessment of the performance to date, by five criteria (<u>Relevance, Effectiveness, Efficiency, Impact</u> and Sustainability) proposed by the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD-DAC);
- (4) to make recommendations on the project regarding the measures to be taken for the remaining and post-project period; and
- (5) to draw lessons learned from the implementation of this Project.

Mission Members:

Mr. Yoshiki Omura, Team Leader, JICA HQs Ms. Momoko Otsuka, Survey Planning, JICA HQs Mr. Makoto Tanaka, Assessment & Analysis, ICONS Inc.

Schedule: 13th to 26th August 2015

Date	Tentative Schedule	Member
13 th Aug. (Thu)	Individual Interview to NRW Management Team	Mr. Tanaka
14 th Aug. (Fri)	Individual Interview to NRW Management Team Individual Interview to DFAT	Ditto
17 th Aug (Mon)	Group Interview to NRW Action Team (Output 2&3) Meeting with Joint Evaluator	Ditto
18 th Aug (Tue)	Group Interview to NRW Action Team (Output 4)	Ditto
20 th August (Thu)	Interview (if necessary)	
21 st Aug (Fri)	Courtesy Visit to SW's GM Meeting with main Counterparts	All three members
22 nd Aug (Sat)	Site Visit	Ditto
24 th Aug (Mon)	Meeting with main Counterparts	Ditto
25 th Aug (Tue)	Meeting with main Counterparts (if necessary)	Ditto
26 th Aug (Wed)	4th JCC Meeting and Signing to M/M	Ditto

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PROJECT PROGRESS: 15 pilot projects and DMAs, AND Issues and Challenges.

Date: 4th of August 2015 Venue: Solomon Water Conference Room

		Reduction Point of	NRW-Ra	tio	
No	Area No	Area Name	NRW I	Reduction	
INO	Area No	Area Name	Before	After	Point
1	No.9	White River- Namo Ruka	86.5	32.2	54-3
2	No.10	Independence Valley	57.7	9.9	47-9
3	No.3	Lenggakiki	62.0	33.2	28.8
		After additional Countermeasures		14.7	47.3
4	No.5	Mbokonavera-1	53.1	14.7	38.5
5	No.14	Tuvaruhu-1	65.4	41.4	24.0
		After additional Countermeasures		11.0	54-4
6	No.15	Tuvaruhu-2	67.2	20.5	46.7
7	No.6	Vavaea Ridge	63.1	27.2	35.8
8	No.4	Mbokona	50.2	19.2	31.0
9	No.8	Mbaranamba	23.2	3.5	19.7
10	No.2	Mbua Valley	50.9	6.8	44.1
n	No.11	Bahai Kukum	58.6	16.2	42.4
12	No.7	Panatina Valley	37-9	6.7	31.2
13	No.12	Naha 2	51.7	15.6	36.1
14	No.13	Naha 3	60.9	25.8	35.1
15	No.1	FFA Kola Road	47.1	14.9	32.2
16	No.6	Tasahe A&B (DMA)	86.0	44-5	41.5
		After Pressure Control		Not-yet	Not-yet
17	No.17	West Kolaa Ridge A (DMA)	60.4	49.7	10.7
		After additional Countermeasures		20.3	40.1

Contents

- Project Progress , Issue and Challenges
 - Achievements
 - Findings
 - Delay in PRV Related Procurement
 - Acceleration of DMA creation
 - Organisational Reform for DMA Monitoring and Maintenance

Schedule of Project Activities

A set data a	2015							
Activities	Mar	Apr	May	Jun	Jul	Aug Sep		Oct
Output 1								
- Strategic implementation planning								
- Approval of the Plan								
Output 2&3								
- Manuals			10.1					
- Tasahe A&B								
- NRW reduction activities								
- Pressure control								
- West Kola Ridge A								
- NRW reduction activities								
- Procurement by SW								
- PRVs and bulk flow meters								
- Fittings								
- Chambers and installation	1.1							
- Procurement by JICA								
- Ultrasonic flow meter (additional)								

Output 1 – Planning process of SW for NRW Reduction is Systemized

- Indicator 1-1: Annual Budget for NRW is secured in the pilot project areas and LCZs.
 - Total Cost incurred by NRW in the 15 Pilot Areas is **SBD2.23 Million**.
 - Equate to SBD 148,800 per pilot area, or
 - SBD 152,500 per 100 household
 - SBD 100,400 per km of pipe (total pipe length of pilot area approx. 22km)
 - If converted to whole Honiara City (total pipe length approx. 178km), the total estimated cost is SBD 17.87 M in today's value.

Indicator 1-2: The strategic Implementation (rolling-out) plan for NRW reduction of approved by management of SW

• Based on the result of the 15 pilot project, the preparation of rolling-out plan has commenced.

Increase in Revenue Water Volume as a result of NRW Reduction Activities in 15 Pilot Areas

- Total Revenue Water before NRW Reduction Activities is 1420.6 m3/day
- Total Revenue Water after NRW Reduction Activities has increased to 2,845.4 m3/day
- Daily increase of Revenue Water as a result of the Project is 1,424.8 m3/day
- Converting to Monetary Value
 - Honiara's unit water supply price (not tariff price) is SBD 16.89/m3
 - The total annual revenue by the NRW Reduction is SBD $8.78\ {\rm M}$
 - Annual Benefit by the NRW reduction is SBD 6.55 M (Total annual Revenue – Total cost incurred)

Output 2- The procedure for NRW reduction is established through the pilot areas and LCZs

- Indicator 2-1: A manual for NRW reduction measures is prepared
 - This manual will consist of 3 components; NRW Reduction Measures; Leakage Detection Techniques; and Update of Database.
 - Manual will be prepared to include forms that are already in use during Phase 4 (Apr 2015-Oct 2015)



S13.3-32-4



Project Design Matrix (PDM₃)

Project Title: T	The Project for I	mprovement of Non-Revenue Water Reduction	Capacity for Solomon Islands Water Authority in Solomon Islands
Target Area: H	Ioniara City	Target Group: SW Staff	Project Period: November 2012 to October 2015 (3 years)

Version 14 Date: 19 March 2015

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Narrative Summary	Objective	y Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal SW's service levels are im roved and SW's revenue is increased.	 The NRW ratio in Honiara City is reduced to 20%* by Ratio of o crational revenue-to-expenditure is sustained 	2018. d at greater than 100%.	SW Annual Operation Report SW Annual Operation Report SW Annual Operation Report	
Project Purpose SW is assisted to achieve its tar et of reducin the NRW ratio in Honiara to 30%* b 2015.	 The NRW ratio is reduced b / 30** points in each pilot Re ardin the ilot ro ect areas, selected DMAs, and reduction measures are less than 30%, the NRW reduc area and/or zone, so that effectiveness of the NRW ret 	project area, selected DMAs and/or LCZs. or LCZs where the NRW ratio before the implementation of NRW tion measures are implemented in accordance with features of each fuction measures are validated.	1. Project Reports	
Outputs 1-1. Annual budget for NRW reduction is systematized. 2. The procedure for NRW reduction is established through the pilot areas and LCZs. 2-1. A manual for NRW reduction measures is prepared. 3. NRW reduction is implemented in accordance with the procedure in pilot areas and/or LCZs. 3-1. The number of pipe repairs is increased in the pilot provide the pilot areas and/or LCZs. 4. Water meter readin and billin rocess 4-1. Standard o eratin rocedures (SOP) and training matures areas and the pilot areas and the pilot areas and the pilot areas and the pilot areas and pilot areas and/or LCZs.		ot project areas and LCZs. W reduction is approved by management of SW. egal connections is increased in the pilot project areas and LCZs. ent of malfunctioning customer meters is increased in the pilot project areas ject areas and LCZs. erials are formulated.	 1-1. Annual Budget Plans 1-2. Strategic implementation (rolling-out) plan for NRW reduction 2-1. Project Reports 2-2. Project Reports 2-3. Project Reports 3-1. Project Reports 4-1. Project Reports 	Budgetary and human resources necessary for stable water supply are continuously allocated by SW. SW staff trained by the Project continue to work in their respective positions. Natural disasters do not give a profound effect to the project activities.
 Activities 1-1. Establish the NRW Mana ement Team in SW. 1-2. Review the current NRW reduction activities do 1-3. Assist in h draulic anal sis includin identificat 1-4. Select ilot ro ect areas and DMAs. 1-5. Formulate an annual action la no NRW reduction attivitie 1-6. Monitor the ro ress of NRW reduction activities 1-7. Anal ze cost-effectiveness of NRW reduction attiviti 1-7. Anal ze cost-effectiveness of NRW reduction attiviti 1-7. Anal ze cost-effectiveness of NRW reduction at 1-8. Pre are strate ic in lementation rollin -out 2-1. Establish the NRW Action Team in SW. 2-2. Check existin flow meters and re lace the mall 2-3. Conduct trainin on NRW reduction for the NR 3-1. Provide assistance in the definition and creation 3-2. Provide assistance in the definition of LCZ within 3-3. U date existin water distribution of LCZ within 3-4. Install necessar valves for isolation of the ilot the NRW ratio before in lementation of LC is areas and DMAs throu h the OT. 3-6. Im lement NRW reduction measures such as le meter installation and o timization of water restriation after im lementation of the ilot 3-9. Convene the worksho sto share the ex eriences 3-10. Provide acti develo ment and trainin usin activities. 4-1. Formulate the work schedule and staff assi nme 4-2. Conduct trainin on water meter readin and re for water meter readers 4-3. Promote PR activities on water conservation and 4-4. Monitor the water meter readin and bilin activities. 	ne b SW. ion of roblems in the existin network. tion in the ilot ro ect areas and LCZs. es in the ilot ro ect areas and LCZs. etivities lan for NRW reduction in the whole Honiara City. unctionin meters with new ones at all the water sources. W Action Team. of discrete DMA's and their boundaries. the DMAs. in s b usin GIS in the ilot ro ect areas and DMAs. ro ect areas and DMAs, install flow meters, and measure ot ro ect. al connections and meter-related losses) in the pilot project alization of users, leaka e detection, leakage repair, water soure in the ilot ro ect areas and DMAs, and measure the ects . efft. endes in, installation and network operation. s, outcomes and etc. of the ilot ro ects. the DMA's and LCZ's as the basis for NRW reduction nt lan for water meter readers ortin methods for anomalies and illegal connections d savin , and water tariff for the customers. vities.	Inputs Solomon Islands Side 1. Personnel - Project Director - Project Manager - NRW Management Team (5 members) - NRW Management Team (6 members) - Status - NRW Action Team (19 members) - Customer Services Sub-Team (6 members) Leakage Detection Sub-Team (3 members) Leakage Detection Sub-Team (3 members) 2. Creation of discrete DMAs 3. Provision of the project offices and facilities necessary for the project implementation 4. Expenses for implementing pilot projects in Honiara City: - Provide habor to implement the project including PR resources. - Provide babor to implement the project including PR resources. - Provide management support to facilitate successful implementatio the pilot project 5. Administrative and operational expenses - Electricity, water, communication, etc. - Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel - Others as necessary Japanese Side 1. Expert 1. Eader / Water Supply Planning, Operation and Management	Japanese Side (continued) 2. Training of counterpart personnel in Japan 3. Provision of machinery and equipment <equipment by="" expert="" jica="" team=""> <ultrasonic (type)="" <ul="" <ultrasonic="" counter="" flow="" meter=""> Water leak detector (Leak noise correlator) Water leak detector (Acoustic type) Metal locator Distance meter Hammer drill Drill bits Boring bar Generator Sluice valves (To isolate pilot areas) Test meter Handy Terminals (Data recorder of meter reading) GPSs Personal computers Plotter Printer Multifunction copier Equipment by JICA offices> Small-size excavator Plata loggers Custor meters And loggers Custore meters </ultrasonic></equipment>	Precondition

Note: Pilot Project includes NRW reduction activities not only in Pilot Area but also in DMAs.

* Indicators are based on SW's Two-year plan (2013-2015) target.

** The target figure is set temporarily based on the result of only one pilot project. Therefore, the figure might be changed in next JCC based on the progress of the pilot project.

Project Design Matrix (PDM₂)

Project Title: The Project for Improvement of Non-Revenue Water Reduction Capacity for Solomon Islands Water Authority in Solomon Islands Target Area: Honiara City Target Group: SW Staff Project Period: November 2012 to October 2015 (3 years) Version 13("PDM2, PO2Rev.13.xlsx") Date: 30 July 2013

Narrative Summary	Objectivel	v Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal				1
SW's service levels are im roved and SW's revenue is increased.	 The NRW ratio in Honiara City is reduced to 20%* by Ratio of o erational revenue-to-expenditure is sustained 	2018. d at greater than 100%.	SW Annual Operation Report SW Annual Operation Report SW Annual Operation Report	
Project Purpose SW is assisted to achieve its tar et of reducin the NRW ratio in Honiara to 30%* b 2015.	1. The NRW ratio is reduced b / 30** points in each pilot	project area, selected DMAs and/or LCZs.	1. Project Reports	
Outputs				1
 Planning process of SW for NRW reduction is systematized. 	 Annual budget for NRW reduction is secured in the pil The strategic implementation (rolling-out) plan for NR 	ot project areas and LCZs. W reduction is approved by management of SW.	1-1. Annual Budget Plans1-2. Strategic implementation (rolling-out) plan for NRW reduction	Budgetary and human resources necessary for stable water supply are continuously allocated by SW.
 The procedure for NRW reduction is established through the pilot areas and LCZs. 	 A manual for NRW reduction measures is prepared. The number of authorizations and disconnections of ill The number of new service connections and replaceme and LCZs. 	egal connections is increased in the pilot project areas and LCZs. nt of malfunctioning customer meters is increased in the pilot project areas	2-1. Project Reports2-2. Project Reports2-3. Project Reports	SW staff trained by the Project continue to work in their respective positions. Natural disasters do not give a profound effect to the project activities.
 NRW reduction is implemented in accordance with the procedure in pilot areas and/or LCZs. 	3-1. The number of pipe repairs is increased in the pilot pro	ject areas and LCZs.	3-1. Project Reports	
 Water meter readin and billin rocess management are improved. 	4-1. Standard o eratin rocedures (SOP) and training mat	erials are formulated.	4-1. Project Reports	
Activities		Inputs		Precondition
 Establish the NRW Mana ement Team in SW. Review the current NRW reduction activities de 1-3 Assist in h draulic anal sis includin identificat 1-4 Select ilot ro ect areas and DMAs. Formulate an annual action I an on NRW reduci 1-6 Monitor the ro ress of NRW reduction activitit 1-7. Anal ze cost-effectiveness of NRW reduction a 1-8. Pre are strate ic im lementation rollin -out Establish the NRW Action Team in SW. Check existin flow meters and re lace the mall Conduct trainin on NRW reduction for the NR Provide assistance in the definition and creation Provide assistance in the creation of LCZ within U date existin water distribution network draw Install necessar valves for isolation of the ilot the NRW ratio before im lementation of the il Identif the causes of NRW water leaka e, ille areas and DMAs throu h the OJT. In lement NRW reduction measures such as le meter installation and timization of water res NRW ratio after im lementation of the il tor Provide acie acit develo ment and trainin usin activities. Formulate the works bedule and staff assi mme Conduct trainin on water meter readin and tilin acit Formulate the work schedule and staff assi mme And Monitor the water meter readin and billin acit Re ort the monitorin results, such as anomalie: 	ne b SW. ion of roblems in the existin network. ion in the ilot ro ect areas and LCZs. so in the ilot ro ect areas and LCZs. stivities an for NRW reduction in the whole Honiara City. unctionin meters with new ones at all the water sources. W Action Team. of discrete DMA's and their boundaries. the DMAs. in s b usin GIS in the ilot ro ect areas and DMAs. ro ect areas and DMAs, install flow meters, and measure to ro ect. al connections and meter-related losses) in the pilot project alization of users, leaka e detection, leakage repair, water sure in the ilot ro ect areas and DMAs, and measure the ects . eft. m desi n, installation and network operation. t, outcomes and etc. of the ilot ro ects. the DMA's and LCZ's as the basis for NRW reduction and Infor water meter readers ortin methods for anomalies and illegal connections I savin , and water tariff for the customers. vities.	Solomon Islands Side 1. Personnel - Project Director - Project Manager - NRW Management Team (5 members) - NRW Management Team (9 members) Technical Sub-Team (8 members) Customer Services Sub-Team (6 members) Clastic Control (2 members) Leakage Detection Sub-Team (6 members) 2. Creation of discrete DMAs 3. Provision of the project offices and facilities necessary for the project implementation 4. Expenses for implementing pilot projects in Honiara City: - Provide labor to implement the project including PR resources. - Provide labor to implement the project including PR resources. - Provide management support to facilitate successful implementation the pilot project 5. Administrative and operational expenses - Electricity, water, communication, etc. - Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel - Others as necessary Japanese Side 1. Expert - Leader / Water Supply Planning, Operation and Management - Deputy Leader / NRW Reduction Measures -1 - NRW Reduction Measures -2 - Leader Water Services & Public Relations - Coordimator - Coordinator </td <td>Japanese Side (continued) 2. Training of counterpart personnel in Japan 3. Provision of machinery and equipment <equipment by="" expert="" jica="" team=""> Ultrasonic flow meter Data logger Water leak detector (Leak noise correlator) Water leak detector (Acoustic type) Non-metal pipe locator Distance meter Hammer drill Drill bits Boring bar Generator Cacoustic rods Residual chlorine analyzer Sluice valves (To isolate pilot areas) Of Test meter Handy Terminals (Data recorder of meter reading) GPSs Personal computers Pinter Multifunction copier Multifunction copier Multifunction copier Multifunction copier Scausevator Dist-size excavator Dist-size excavator Catouster solutions Catouster solutions Catouster solutions Dista of Test meter Dister Dis</equipment></td> <td></td>	Japanese Side (continued) 2. Training of counterpart personnel in Japan 3. Provision of machinery and equipment <equipment by="" expert="" jica="" team=""> Ultrasonic flow meter Data logger Water leak detector (Leak noise correlator) Water leak detector (Acoustic type) Non-metal pipe locator Distance meter Hammer drill Drill bits Boring bar Generator Cacoustic rods Residual chlorine analyzer Sluice valves (To isolate pilot areas) Of Test meter Handy Terminals (Data recorder of meter reading) GPSs Personal computers Pinter Multifunction copier Multifunction copier Multifunction copier Multifunction copier Scausevator Dist-size excavator Dist-size excavator Catouster solutions Catouster solutions Catouster solutions Dista of Test meter Dister Dis</equipment>	

Note: Pilot Project includes NRW reduction activities not only in Pilot Area but also in DMAs.

* Indicators are based on SW's Two-year plan (2013-2015) target.

** The target figure is set temporarily based on the result of only one pilot project. Therefore, the figure might be changed in next JCC based on the progress of the pilot project.

Project Design Matrix (PDM₁)

Project Title: The Project for Improvement of Non-Revenue Water Reduction Capacity for Solomon Islands Water Authority in Solomon Islands Target Area: Honiara City Target Group: SW Staff Project Period: November 2012 to October 2015 (3 years)

Version 1 (Inception Report) Date: -- November 2012

Narrative Summary	Objectivel	y Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal				
SIWA's service levels are im roved and SIWA' revenue is increased	 Water su 1 hours become longer The NRW ratio in Honiara City is reduced to XX % b Ratio of current ex ense to current income becomes n 	y 2018. hore than 100% by 2018	SIWA Annual Report SIWA Annual Report SIWA Annual Report	
Project Purpose				1
Non-revenue water NRW ratio in Honiara Cit is reduced.	1. The NRW ratio is reduced to XX % in each pilot proj	ect area and the NRW ratio in Honiara City is reduced to XX $\%$	1. Project Report	
Outputs				1
 The planning process for NRW reduction is systematized. 	1-1. Annual budget for NRW reduction is secured in the pi1-2. The strategic implementation (rolling-out) plan for NR	ilot project areas. RW reduction is approved by the executive board of SIWA.	 Annual Budget Plans Strategic implementation (rolling-out) plan for NRW reduction 	The SIWA staff capacitated by the Project Budgetary and human resources necessary for stable water sumply are continuously
2. The implementation procedure of NRW	2-1. A manual for NRW reduction measures is revised.		2-1. Project Reports	allocated by SIWA.
reduction is established through the pilot project	c 2-2. The number of pipe repairs is increased in the pilot pr	oject areas.	2-2. Project Reports	The SIWA staff capacitated by the Project
5 1 1 5	2-3. The number of authorizations and disconnections of il	legal connections is increased in the pilot project areas.	2-3. Project Reports	continues working for their respective
	2-4. The number of new service connections and replacem	ent of malfunctioning customer meters is increased in the pilot project areas.	2-4. Project Reports	positions.
3. Billing process management is improved.	3-1. Standard of procedures (SOP) and training materials a	re formulated.	3-1. Project Reports	Natural disasters do not give a profound effect to the project activities.
Activities		Inputs		Precondition
1-1. Establish the NRW Mana ement Team in SIW	A	Solomon Islands Side	Japanese Side (continued)	
1-2. Review the current NRW reduction activities d	lone b SIWA			
1-3. Conduct h draulic anal sis of distribution netw	vork and water balance audit	1. Personnel	1. Expert	
1-4. Select ilot ro ectareas		- Project Director	- Chief Advisor / Water Supply Planning and Management	
1-6. Monitor the ro ress of NRW reduction activit	ties in the ilot ro ect areas	- Project Manager - Counterpart personnel	- INKW Reduction Management - Leakage Detection Technology	
1-7. Anal ze cost and benefit of NRW reduction me	easures		- GIS	
1-8. Pre are the strate ic im lementation rollin -o	ut lan for NRW reduction in the whole Honiara City	 Provision of the project offices and facilities necessary for the project implementation 	- Customer Services / PR - Others as necessary	
2-1. Establish the NRW Action Team in SIWA				
2-2. Check the flow meters and re-lace the malfunc	ctionin meters with new ones at all the water sources	3. Expenses for implementing pilot projects in Honiara City	 Training of counterpart personnel in Japan and/or the Third 	
2-3. Conduct training on NKW reduction for the NF 2-4. U date the water distribution network drawing	s b usin GIS at the ilot ro ect areas	valves ad meter, etc.	Countries	
 Identif the causes of NRW water leak e ille areas throu h the OJT. Im lement NRW reduction measures in the illot to ects. Bre are re orts of the ilot ro ect results inclu 2-9. U date the manuals on i e installation, leaka 2-10. Convene the worksho s to share the ex erience. 	e al connection, meter-related losses) in the pilot projec ot ro ect areas and measure the NRW ratio after the idin the costs and benefits e detection, et es, outcomes, etc. of the ilot rojects	 Administrative and operational expense: Electricity, water, communication, etc. Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel Others as necessary 	Leakage detection equipment Water flow meters Customer meters Valves Handheld data-input device GPS portable terminals Office equipment	
 3-1. Formulate the work schedule and staff assi nm 3-2. Conduct trainin on water meter-readin and reformeter readers. 3-3. Promote PR activities on water conservation ar 3-4. Monitor the meter readin activities and bill de 3-5. Re ort the monitorin results, such as anomalia 	ent lan for meter readers e ortin methods for anomalies and illegal connection nd tariff for the customers liveries es and ille al connections, to the responsible section:		 Others as necessary Local expenses for the project activities Teaching materials for training and workshops Others 	

Definition of Terms

Non-Revenue Water (NRW)

The following Table shows the IWA standard international water balance and terminology. NRW is composed of unbilled authorized consumption, apparent and real losses.

Table: IWA Standard International Water Balance and Terminology

fuble finite line international finite bullate and ferminations												
		rized aption	Billed Authorized	Billed metered consumption	Revenue							
Water Production			Consumption	Billed unmetered consumption	Water							
	e l	Autho	Unbilled Authorized	Unbilled metered consumption								
	System Input Volur	10	Consumption	Unbilled unmetered consumption								
				Unauthorized consumption (incl. illegal connections)	Non							
			Apparent Losses	Metering inaccuracies	Revenue Water							
		Water Losses	Water		Leakage on transmission and/or distribution networks	(NRW)						
							- 1		- 1	- 1		Real Losses
				Leakage on service connections to customer meters								
	Trea	atment	Losses (Backwash, etc.) and	d Evaporation								

Source: IWA

District Metered Area (DMA)

"District Metered Area (DMA)" is defined as a discrete area of a distribution system permanently created by isolation or the complete disconnection of pipe work in which the quantities of water inflow and outflow the area are metered (see the following Figure). The water flow is analyzed to quantify the level of NRW. In this way, it is possible to determine more precisely where and when it is most beneficial to undertake NRW reduction activities.

Leakage Control Zone (LCZ)

"Leakage Control Zone (LCZ)" introduced specially in Solomon Water is defined as a discrete zone of a distribution system tentatively created for implementation of countermeasures such as Active Leakage Control against leakage (rather NRW) (see the following Figure). The discrete zones can be created by isolation or the complete disconnection of pipe work in which the rate of water inflow and outflow the area are metered temporarily.

The Project assumes each DMA consists of a number of LCZs, but that may be not always the case because of DMA size or configuration of network.

Pressure Control Zone (PCZ)

One of important factors in lowering and subsequently maintaining a low level of NRW in a water network is "Pressure Control". The division of network into DMAs facilitates the creation of a permanent pressure control system, thus enabling pressure reduction in DMAs which reduces the level of background leakage, the flow rate of individual bursts and the rate of the annual burst frequency. Solomon Water has already set up seven zones in six DMAs as "Pressure Control Zones (PCZs)" in which Pressure Reducing Valves (PRVs) are installed and other remaining zones as "Non Pressure Control Zones (Non-PCZs)" in 22 DMAs in Honiara City. Their locations are shown in the following Table. The following Figure shows a conceptual location drawing of a bulk flow meter, DMA flow meter, PRV in DMAs and or LCZs.

Table: Pressure Control Zones or Non Pressure Control Zones in Honiara City							
No	DMA	PCZ / Non PCZ	Number of Zones where PRV is installed	No	DMA	PCZ / Number of Non PCZ PRV is instal	
1	White River A	Non-PCZ		15	Lower West Kolaa A	Non-PCZ	
2	White River B	Non-PCZ		16	Lower West Kolaa B	Non-PCZ	
3	Rove A	Non-PCZ		17	West Kolaa Ridge A	Non-PCZ	
4	Rove B	Non-PCZ		18	West Kolaa Ridge B & C and Naha Height	Non-PCZ	
5	Rove C	Non-PCZ		19	Tanuli & Mbua Valley	PCZ	1
6	Tasahe A and B	PCZ	2	20	Kombibatu	Non-PCZ	
7	Tasahe C	Non-PCZ		21	Trecce House, Bura Height and Naha Valley	Non-PCZ	
8	8 Ngossi PCZ 1		22	Kombito-Borderline, Jakson Ridge and Bura Valley	Non-PCZ		
9	Mbokona	PCZ	1	23	Kombito Trunk Main	Non-PCZ	
10	Lenggakiki	Non-PCZ		24	Panatina Ridge East	Non-PCZ	
11	Vavaea Rigde	PCZ	1	25	Panatina Ridge West	Non-PCZ	
12	Skyline	Non-PCZ		26	Panatina Industrial	Non-PCZ	
13	Bokonavera	PCZ	1	27	Burns Creek	Non-PCZ	
14	Tuvaruhu	Non-PCZ		28	Lungga and Airport	Non-PCZ	
Total		Number of	DMAs with PCZs				6
		Number of	DMAs with Non-I	PCZs -			22
		Number of	Zones where PRV	is insta	lled		7



Figure: Spatial Relationship among DMA, LCZ and PCZ/Non-PCZ (Example)



Project Implementation Structure

Member List of NRW Management Team

Name	Position in the Project	Job Title in SW	Nationality
Mr. Ian Godden	Project Director	General Manager	New Zealander
Mr. Ray Andresen	Project Manager	Operations& Technical Manager	Solomon Islander
Mr. Nemani Waganivalu	Program Manager	Program Manager	Fijian
Ms. Debbie Johnsen	Finance & Administration Manager	Finance & Administration Manager	Australian
Ms. Tima Kofana	Human Resources Manager	Human Resources Manager	Fijian/ Solomon Islander
Mr. Carlos James Saliga	Service Delivery& Communications Manager*	Acting Service Delivery& Communications Manager	Solomon Islander

time use an use served partner y a commitment of damaged response in rate documer, and carnes some so of Public Relation in the Project is an acting Service Delvery & Communication Manager. Member List of NRW Action Team

Name	Position in the Project	Job Title in SW	Division
Technical Sub-Team			
Mr. Benjamin BILLY	Action Team Leader 1 / Sub-Team Leader (NRW Taskforce Leader)	Network Operations Team Leader	Operations & Technical
Mr. Austin ATA	Deputy Sub-Team Leader (Customer Connections)	Service Coordinator	Service Delivery & Communications
Mr. Moses RAMO	(Customer Connections)	New Connections Works Officer	Service Delivery & Communications
Mr. Silas TALOSUI	Deputy Sub-Team Leader (Network Maintenance & Repair)	Network Maintenance Team Leader	Operations & Technical
Mr. Mathias BERA	Pipe Repair (Network Pipe Maintenance & Repair)	Technical Assistant for Network Operations	Operations & Technical
Mr. Layten JACOB	Deputy Sub-Team Leader (Procurement)	Procurement Coordinator	Finance & Administration
Mr. Frank DAUKALIA	Meter Repair/Replacement (Pipe Materials Management & Procurement)	Technical Assistant for Network Operations	Operations & Technical
Mr. Chris MERIKO	Deputy Sub-Team Leader (Water Resources & Treatment)	Source Treatment & Plant Team Leader	Operations & Technical
Customer Service Sub-	Team		T
Mr. Carlos James Saliga*	Action Team Leader 2 / Sub-Team Leader(Customer Care & Communications Manager)	Acting Service Delivery & Communications Manager	Service Delivery & Communications
Ms. Beverly SAOHU	Deputy Sub-Team Leader (Customer Care)	Customer Care Team Leader	Service Delivery & Communications
Mr. Carlos SALIGA	Deputy Sub-Team Leader (Community Relations & Media)	Communications & Public Relations Team	Service Delivery & Communications

Name	Position in the Project	Job Title in SW	Division
Ms. Sophia TANGO	(Community Relations & Media Assistant)	Communications & Public Relations Assistant	Service Delivery & Communications
Ms. Daisy MENAGA	Deputy Sub-Team Leader (Meter Reading)	Meter Reading Team Leader	Finance & Administration
Ms. Mary TAFOA	Deputy Sub-Team Leader (Billing)	Billing Team Leader	Finance & Administration
Mr. Lawrence IROI	(Chief Accountant)	Accountant	Finance & Administration
Ms. Rosta Tinarai**	Deputy Sub-Team Leader (Debt Collection)	Debt Collection Team Leader	Finance & Administration
Ms. Mary Pidoke**	Customer Care Officer	Customer Care Officer	Service Delivery & Communications
GIS Sub-Team			
Mr. Gavin BARE	Sub-Team Leader (GIS Technician)	GIS Technician for Network Operations	Operations & Technical
Mr. Japhliet ROUHANA	(IT Administration)	IT Technician	Finance & Administration
Leakage Detection Sub	-Team		
Mr. Eric UNGA	Sub-Team Leader (Leakage)	Provincial & Leakage Operations Team Leader	Operations & Technical
Mr. Matthew MAFE	Plumber	Plumber for Provincial & Leakage Operations	Operations & Technical
Mr. David AKOEASI	Plumber	Plumber for Provincial & Leakage Operations	Operations & Technical
Consultant			
Ms Marista KAPINI	In-house Consultant	In-house Consultant	-

-

 Ms. Marinsta KAPI'NN
 In-house Consultant
 In-house Consultant

 ⁴M. Filten Maranefar resigned as the Service Delivery & Communication Manager in December 2014. Now Mr. Carlos James
 Salars is the acting Manager.

 ** Two persons were the member of trainces of the 3⁴⁴ Training in Japan and involved in the Project as Counterpart since April 2014.
 2014.

Member List of JICA Expert Team

IName	Expertise
Mr. Taketoshi	Leader /Water Supply Planning, Operation and Management
FUJIYAMA	
Mr. Akinori MIYOSHI	Deputy Leader / NRW Reduction Measures -1
Mr. Masatoshi SENO	NRW Reduction Measures -2
Mr. Akihiko OKAZAKI	Leakage Detection Technology
Mr. Masakazu ASAI	GIS
Mr. Yoshiharu WADA	Customer Services & Public Relations
(Mr. Kenji	* Mr. Wada has replaced Mr. Kasamatsu since April 2013.
KASAMATSU)	
Mr. Akiko SAKAMOTO	Coordinator (Support Member)
Mr. Kazutoshi MASUDA	GIS Advisor (Support Member)
(Mr. Norio ISHIJIMA)	* Mr. Masuda has replaced Mr. Ishijima since June 2014.

Overall Implementing Flow under TYP and JICA NRW Reduction Project

* This workflow was prepared from the standpoint of JICA NRW Reduction Project



Scope of Responsibilities, Contribution and Cooperation between JICA Project and the Two Year Plan

Activities in the Project			Activities for 1 st Output in the Two Year Plan
1-3 Assist in hydraulic analysis including identification of problems in the existing network.			2.1 Developing operations and technical support
		•	2.1.1 System Monitoring
1-4 Select pilot project areas and DMAs.		•	- Review, procure and install SCADA/Telemetry
		\ ·	- Recruit and train technicians
1-6 Monitor the progress of NRW reduction activities in the pilot project areas and DMAs/LCZs.	· · / / /	Ч.	2.1.2 Hydraulic Modelling of the Network
		•	 Procure modelling software
1-7 Analyze cost-effectiveness of NRW reduction activities.	· /// \	· ·	- Establish modelling unit, recruit and train modellers
		<u>۱</u>	 Develop a calibrated network model
1-8 Prepare strategic implementation (rolling-out) plan for NRW reduction in the whole Honiara City.	· \\\	(\cdot)	2.2 Reducing NRW
	I N	١Ŀ	2.2.2 Pressure Management
2-3 Conduct training on NRW reduction for the NRW Action Team.	1 x 11	\♥.	 Procure, install PRVs and meters in chambers
		×.	 Customer awareness campaign
3-1 Provide assistance in the definition and creation of discrete DMA's and their boundaries.	$ \cdot\rangle$	\ <u>}</u>	 Set up selected high priority supply zones as DMAs
3-2 Provide assistance in the creation of LCZ within the DMAs.	· \]	N٠	 Procure, install GSM data loggers in DMAs
		Λ	 NRW task force role expanded to include management of pressure zone
3-3 Update existing water distribution network drawings by using GIS in the pilot project areas and DMAs.		_ } .	 Geospatial referencing of all registered connections/meters
		VR:	 Establish MapInfo GIS link to customer billing
3-4 Install necessary valves for isolation of the pilot project areas and DMAs, install flow meters, and measure		X Y.	 Ongoing monitoring of DMAs
the NRW ratio before implementation of the pilot project.	./	M:	2.2.3 Increasing Rate of Progress of NRW Reduction
3-5 Identify the causes of NRW (water leakage, illegal connections and meter-related losses) in the pilot project		N.	 Specs for materials identified and made available for installation
areas and DMAs through the OJT.	·	₩	- Train supervisors
3-6 Implement NRW reduction measures such as legalization of users, leakage detection, leakage repair, water		7	 Detailed in the field audit of illegal connections
meter installation and optimization of water pressure in the pilot project areas and DMAs, and measure the			 Disconnection of illegal connections
NRW ratio after implementation of pilot project.		P .	 Fit meters to flat rate connections
		1.	 Procure materials for leak repair and main replacement
3-7 Prepare reports of results including cost and benefit.		1.	 Recruit additional staff for leak repair, meter and billing teams
3-8 Provide advice for the improvement of pipe system design, installation and network operation.	· //	· ·	- Vehicle and plant
3-9 Convene the workshops to share the experiences, outcomes and etc. of the pilot projects.	· //	- P -	2.3 Improving the capacity of the network
3-10 Provide capacity development and training using the DMA's and LCZ's as the basis for NRW reduction	·///	· ·	- Review and select appropriate design standard
activities.	· //	1	- Thal relocation of first 200 customer meters
		L.	- Improve capacity of SW repair team
3-11 Prepare a manual for NRW reduction. (not mentioned in PDM ₂)		L.	Prepare prioritized main upgrade programme
4-3 Promote PR activities on water conservation and saving, and water tariff for the customer	· 	¥	Rolling upgrade of distribution system
4-4 Monitor the water meter reading and billing activities	1.1		2.4 Improving the connectivity and reliability of water supply
	• 1		Transmission, reservoir, borehole replacement/maintenance and generator

31st July 2015

The Project for Improvement of Non-Revenue Water Reduction Capacity for Solomon Islands Water Authority in Solomon Islands

Current Achievement, Progress and Issues

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1. Project Outline

- Project Title: The Project for Improvement of Non-Revenue Water Reduction Capacity for Solomon Islands Water Authority in Solomon Islands
- Counterpart: Solomon Islands Water Authority (Solomon Water)
- Relevant Organization: MMERE, Australian DFAT
- Project Period (R/D: 27th July 2012): November 2012 to October 2015 (3 years)
- Relevant Cooperation: JICA Grant Aid Project (The Project for Improvement of Water Supply System in Honiara and Auki), Solomon Water's Two-year Plan assisted by DFAT

2. Project Design

- (1) Overall Goal: SW's service levels are improved and SW's revenue is increased.
- (2) Project Purpose: SW is assisted to achieve its target of reducing the NRW ratio in Honiara to 30% by 2015.

(3) Outputs:

- 1) Planning process of SW for NRW reduction is systematized.
- 2) The procedure for NRW reduction is established through the pilot areas and LCZs.
- 3) NRW reduction is implemented in accordance with the procedure in pilot areas and/or LCZs.

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4) Water meter reading and billing process management are improved.

1) Inputs from Japanese side

- Expert: 8 experts
 - Equipment: bulk flow meters, sluice valves for isolation, ultrasonic flow meters, data loggers, leakage detection equipment, GPSs, office automation equipment, customer meters, pickup trucks, an excavator and etc.
- Training in Japan : 3 times for 12 trainees in total (April and October 2013, and June 2014)
 Inputs from Solomon Islands side
 - Personnel: 25 members (NRW Management Team: 5, NRW Action Team: 20)
- Project office and facilities for the project implementation, including office furniture, electricity and communication equipment
- Pipes, fittings and other materials for NRW reduction measures such as repair and meter installation
- Installation of flow meters and customer meters, and repair works

3. Current Achievement, Progress and Issues

(1) Achievement of Project Purpose

<u>Project Purpose</u>: SW is assisted to achieve its target of reducing the NRW ratio in Honiara to 30% by 2015.

Indicator 1: The NRW ratio is reduced by 30 points in each pilot project area, selected DMAs and/or LCZs.

Indicator 2: Regarding the pilot project areas, selected DMAs, and/or LCZs where the NRW ratio before the implementation of NRW reduction measures are less than 30%, the NRW reduction measures are implemented in accordance with features of each area and/or zone, so that effectiveness of the NRW reduction measures are validated.

Status of the Achievement in the Pilot Areas

After the selection of 15 pilot areas and prioritization in March 2013, the Project commenced the pilot project in the following month, April and completed all projects by September 2014 (see *Table 1*).

The Project achieved the conditions stipulated by Indicator 1 in all pilot areas except for "No 8:Mbaranamba". In "No.3:Lenggakiki" and "No.5:Tuvaruhu-1", the Project could not achieve the reduction target of 30 points initially during implementing the NRW reduction activities, therefore the Project had to take additional countermeasures leading to successful results.

Although NRW ratio before the activities was less than 30% for "No.8:Mbaranamba", the Project was able to achieve conditions stipulated by Indicator 2.

Table 1
 Reduction Point of NRW Ratio before/after NRW Reduction Activities in Pilot Areas

N		NRW Ratio (%)		atio (%)	Deduction Daint	
NO	Area No Area Name		Before	After	Reduction Point	
1	No.9	White River- Namo Ruka	86.5	32.2	54.3	
2	No.10	Independence Valley	57.7	9.9	47.9	
3	No.3	Lenggakiki	62.0	33.2	28.8	
		After additional countermeasures		14.7	47.3	
4	No.5	Mbokonavera-1	53.1	14.7	38.5	
5	No.14	Tuvaruhu-1	65.4	41.4	24.0	
		After additional countermeasures		11.0	54.4	
6	No.15	Tuvaruhu-2	67.2	20.5	46.7	
7	No.6	Vavaea Ridge	63.1	27.2	35.8	
8	No.4	Mbokona	50.2	19.2	31.0	
9	No.8	Mbaranamba	23.2	3.5	19.7	
10	No.2	Mbua Valley	50.9	6.8	44.1	
11	No.11	Bahai Kukum	58.6	16.2	42.4	
12	No.7	Panatina Valley	37.9	6.7	31.2	
13	No.12	Naha 2	51.7	15.6	36.1	
14	No.13	Naha 3	60.9	25.8	35.1	
15	No.1	FFA Kola Road	47.1	14.9	32.2	

Status of the Achievement in the selected DMAs and/or LCZs

After demarcation of 28 DMAs and the prioritization in September 2014, the Project commenced NRW reduction activities in DMAs in December 2014. As of the end of February 2015, the activities are ongoing in two selected DMAs (see *Tuble 2*).

However, procurement and installation of pressure reducing valves (PRV) and fittings for pressure control, and also construction of chambers are behind schedule. Solomon Water has made efforts to come back on track and procure important items necessary for the completion of all activities within the scheduled period of the Project; while the JICA Expert Team continues to provide support to them wherever possible.

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Table 2	Reduction Point of	9 NKW Kano I	pejore/ajter	NKW Reduction	Activities in DMAs

N	DMAN	DMAN	NRW Ratio (%)		
NO	DIMA NO.	DMA Name	Before	After	Reduction Point
1	No.6	Tasahe A&B	86.0	44.5	41.5
		After pressure control		XX	XX
2	No.17	West Kola Ridge A	60.4	49.7	10.7
		After additional countermeasures		20.3	40.1

(2) Achievement of Outputs

[Output 1]: Planning process of SW for NRW reduction is systematized.

Indicator 1-1: Annual budget for NRW reduction is secured in the pilot project areas and LCZs.

With the secured budget, the NRW reduction activities in the 15 pilot areas were completed. The activities in two selected DMAs are in progress and to be completed with the budget for 2015 of 3

		Area Area Name Before After ^{'1} Increased R.W. (m ³ /day)		ter (m³/day)	Estimated Daily	Estimated Annual	Estimated Annual
No	Area No			Increased R.W. (m ³ /year)	Increased Revenue (SBD/year)		
			[1]	[2]	[3]=[2]-[1]	[4]=[3]x365	Estimated Annual Increased Revenue (SBD)year) [5]-[4]s; Unit Price 1,160,420, 471,192, 1,722,739, 422,513, 354,882 327,806, 1,160,099, 2,37,419, 199,285, 808,054, 855,280, 179,870, 2,15,455, 2,97,216, 425,690,
1	No.9	White River-Namo Ruka	47.0	235.2	188.2	68,717.4	1,160,420.3
2	No.10	Independence Valley	67.5	144.0	76.5	27,903.0	471,192.6
3	No.3	Lenggakiki	224.9	504.5	279.6	102,077.1	1,723,759.0
4	No.5	Mbokonavera-1	83.7	152.5	68.8	25,079.5	423,513.1
5	No.14	Tuvaruhu-1	36.6	94.2	57.6	21,015.3	354,882.5
6	No.15	Tuvaruhu-2	37.4	90.6	53.2	19,412.0	327,806.7
7	No.6	Vavaea Ridge	185.6	365.5	179.9	65,678.3	1,109,099.5
8	No.4	Mbokona	61.8	100.3	38.5	14,059.5	237,419.8
9	No.8	Mbaranamba	122.5	153.9	31.4	11,445.9	193,285.1
10	No.2	Mbua Valley	146.2	277.3	131.1	47,850.0	808,034.4
11	No.11	Bahai Kukum	135.2	273.6	138.4	50,529.3	853,280.2
12	No.7	Panatina Valley	58.0	87.1	29.1	10,651.5	179,870.0
13	No.12	Naha 2	46.8	81.8	35	12,758.7	215,453.6
14	No.13	Naha 3	53.6	101.9	48.3	17,600.5	297,216.0
15	No.1	FFA Kola Road	113.8	183.0	69.2	25,267.7	426,690.1
Tota			1,420.6	2,845.4	1,424.8	520,045.7	8,781,923.5

 Table 4
 Increase in Revenue Water and Revenue by NRW Reduction Activities in Pilot Areas

*1 In order to make before-after conditions consistent each other, these are calculated by the formula "(System input volume after NRW measures) + (System input volume before NRW measures) + (Volume of actual revenue water after NRW measures)"

Indicator 1-2: The strategic implementation (rolling-out) plan for NRW reduction is approved by management of SW.

Based on the results of the pilot projects, the project team commenced preparation of the strategic implementation (rolling-out) plan at the end of Phase-3 of the Project corresponding to the first quarter of 2015, which will be drafted and approved in Phase-4.

[Output 2]: The procedure for NRW reduction is established through the pilot areas and LCZs.

Indicator 2-1: A manual for NRW reduction measures is prepared.

A manual for NRW reduction consists of three components: NRW reduction measures, leakage detection techniques and database update. Forms for record and analysis have been used, improved and updated in consideration for user-friendliness through the Project. The manual will be prepared with the above forms in the Phase-4.

Indicator 2-2: The number of authorizations and disconnections of illegal connections is increased in the pilot project areas and LCZs.

140 illegal connections including parasite users were identified which account for 9.6% of the total number of household. Out of 140, 38 connections were legalized (authorized) and 102 connections were disconnected. This means that only 27.1% became valid customers while 72.9% were disconnected (see *Table 5*).

While the monthly number of legalizations (authorizations) of illegal connections as a result of a

Solomon Water, which allocates SBD4.62 million for the NRW-related activities.

Actual cost incurred for the NRW reduction activities in the 15 pilot areas is shown in *Tuble 3*. Total initial cost is about SBD2.23 million, which equates to cost per pilot area to be about SBD148,800, cost per 100 household to be SBD152,500, and cost per km of pipeline to be SBD100,400. Based on these actual values, Solomon Water is supposed to secure budget for NRW reduction in the future. Total existing pipeline length in the whole Honiara City is about 178 km, so grand total of the initial cost for NRW reduction in the whole city is estimated at about SBD1787 million based on today's value.

By applying Honiara's unit water supply price of SBD16.89/m³ based on actual values and data in 2014, annual benefit by the NRW reduction is SBD6.55 million in the 15 pilot areas, which is the difference between the estimated annual revenue SBD8.78 million to be generated by NRW reduction (see *Table 4*) and the initial cost of SBD2.23 million. If the activities are scaled up to the whole Honiara City, the annual benefit by the NRW reduction is estimated at SBD52.46 million by using per-kilometer benefit of the pilot projects.

In consideration of intermittent water supply in most of Honiara, the Project regards the effect of NRW reduction as increase in revenue water only.

	Tuble 5 Initial Con for twee Reduction Activities in Pulot Areas												
No	Area No	Area Name	Pipeline Length (m)	Total No. of Household	Personnel Cost (SBD)	Consumable Cost (SBD)	Material & Equipment (SBD)	Total Initial Cost (SBD)					
			[1]	[2]	[3]	[4]	[5]	[6]=[3]+[4]+[5]					
1	No.9	White River-Namo Ruka	1,063.23	83	74,710	2,306	22,673	99,689					
2	No.10	Independence Valley	2,184.45	91	78,825	2,207	32,889	113,921					
3	No.3	Lenggakiki	2,481.38	161	55,087	971	59,810	115,868					
4	No.5	Mbokonavera-1	1,104.12	76	48,515	269	32,138	80,922					
5	No.14	Tuvaruhu-1	1,205.88	47	43,084	884	32,769	76,737					
6	No.15	Tuvaruhu-2	1,371.31	62	45,669	942	43,438	90,049					
7	No.6	Vavaca Ridge	1,298.15	163	56,752	4,081	104,816	165,649					
8	No.4	Mbokona	1,418.66	110	91,461	7,417	146,267	245,145					
9	No.8	Mbaranamba	1,512.29	100	39,498	5,959	38,764	84,221					
10	No.2	Mbua Valley	1,989.95	122	125,706	6,701	175,856	308,263					
11	No.11	Bahai Kukum	1,691.80	182	95,068	6,349	180,944	282,361					
12	No.7	Panatina Valley	885.12	60	82,801	6,033	41,097	129,931					
13	No.12	Naha 2	785.93	57	92,066	6,289	32,058	130,413					
14	No.13	Naha 3	959.63	67	100,337	6,495	24,927	131,759					
15	No.1	FFA Kola Road	2,275.52	82	101,699	4,831	69,906	176,436					
Tota	Total		22,227.42	1,463	1,131,278	61,734	1,018,264	2,231,364					

Table 3 Initial Cost for NRW Reduction Activities in Pilot Are

campaign by Solomon Water prior to the Project was about 10 in whole of Honiara as of November 2011, the monthly number of disconnections of illegal connections was about 20 according to information gathered from Solomon Water in an interview. Assuming this figure is regarded as the baseline in the whole Honiara, the baseline in the 15 pilot areas should then be estimated at 3.5 for legalization (authorization) and 6.5 for disconnection respectively as a result of conversion by proportion to the pipeline length as well as pilot project period (2.6 month per area). Therefore, the total number of legalizations (authorizations) and disconnections of illegal connections was increased from 10 (3.5+6.5) to 140 (38+102) for the 15 pilot areas as a result of the NRW reduction activities. The baseline figure however is only reference.

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	T	able 5 Number of	Author	ization	s and Disconn	ection	s of Illegal Co	nnect	ions
No	Area No	Area Name	Total Household	Illegal Connection ¹¹	Percentage of Illegal Connection in Total Household	Legalization (Authorization)	Percentage of Legalization in Illegal Connection	Disconnection	Percentage of Disconnection in Illegal Connection
			[1]	[2]	[3]=[2]/[1]x100	[4]	[5]=[4]/[2] x100	[6]	[7]=[6]/[2] x10
1	No.9	White River-Namo Ruka	83	28	33.7%	6	21.4%	22	78.6%
2	No.10	Independence Valley	91	7	7.7%	1	14.3%	6	85.7%
3	No.3	Lenggakiki	161	35	21.7%	1	2.9%	34	97.1%
4	No.5	Mbokonavera-1	76	2	2.6%	0	0.0%	2	100.0%
5	No.14	Tuvaruhu-1	48	6	12.5%	3	50.0%	3	50.0%
6	No.15	Tuvaruhu-2	62	11	17.7%	3	27.3%	8	72.7%
7	No.6	Vavaca Ridge	163	0	0.0%	0	0.0%	0	0.0%
8	No.4	Mbokona	110	10	9.1%	5	50.0%	5	50.0%
9	No.8	Mbaranamba	100	2	2.0%	2	100.0%	0	0.0%
10	No.2	Mbua Valley	122	13	10.7%	7	53.8%	6	46.2%
11	No.11	Bahai Kukum	182	14	7.7%	8	57.1%	6	42.9%
12	No.7	Panatina Valley	60	0	0.0%	0	0.0%	0	0.0%
13	No.12	Naha 2	57	2	3.5%	0	0.0%	2	100.0%
14	No.13	Naha 3	67	10	14.9%	2	20.0%	8	80.0%
15	No.1	FFA Kola Road	82	0	0.0%	0	0.0%	0	0.0%
Tota	1		1,464	140	9.6%	38	27.1%	102	72.9%

<u>Indicator 2-3</u>: The number of new service connections and replacement of malfunctioning customer meters is increased in the pilot project areas and LCZs.

In the 15 pilot areas, there are 268 households that were found to be un-connected or in other words they do not have water connections from Solomon Water system (no including illegal connections), which account for 18.3% of the total number of household. Generally, un-connection households rely on springs, rain water, water purchased from private water tanker and from metered customers. As a result of NRW reduction activities, 31 households proceeded to become connected or re-connected and account for 11.6% of the total un-connection households (see *Table 6*). *Table 7* also shows a notable decrease of valid customers before and after the NRW reduction activities. Before, the total number of valid customers is 72.1% of the total households. However, after the activities, only 70.8% of the total

number of households are valid customers of Solomon Water. Refer to section 3. (4) 3) for the reason of decrease in customers.

Table 6 Number of New Service Connections and Re-connections

No	Arca No	Area Name	Total Household Un- connection ¹¹ Percentage of Un-connection in (before) N Co [1] [2] [3]=[2]/[1]x100 N		New/Re- Connection [4]	Percentage of New/Re-connection in Un-connection [5]=[4]/[2] x100	
1	No.9	White River- Namo Ruka	83	11	13.3%	2	18.2%
2	No.10	Independence Valley	91	16	17.6%	3	18.8%
3	No.3	Lenggakiki	161	11	6.8%	6	54.5%
4	No.5	Mbokonavera-1	76	10	13.2%	0	0.0%
5	No.14	Tuvaruhu-1	48	4	8.3%	3	75.0%
6	No.15	Tuvaruhu-2	62	10	16.1%	1	10.0%
7	No.6	Vavaca Ridge	163	69	42.3%	8	11.6%
8	No.4	Mbokona	110	12	10.9%	6	50.0%
9	No.8	Mbaranamba	100	20	20.0%	0	0.0%
10	No.2	Mbua Valley	122	16	13.1%	1	6.3%
11	No.11	Bahai Kukum	182	53	29.1%	1	1.9%
12	No.7	Panatina Valley	60	9	15.0%	0	0.0%
13	No.12	Naha 2	57	13	22.8%	0	0.0%
14	No.13	Naha 3	67	2	3.0%	0	0.0%
15	No.1	FFA Kola Road	82	12	14.6%	0	0.0%
Total			1,464	268	18.3%	31	11.6%

*1 Illegal connections and illegal parasite users are not included

Table 7 Number of Customers before/after NRW Reduction Activities

No	Area	Arca Name	Total Household	Customer (before)	Percentage of Customer in Household (before)	Customer (after)	Percentage of Customer in Household (after)
	No		[1]	[2]	[3]-[2]/[1] x100	[4]	[5]-[4]/[1] x100
1	No.9	White River- Namo Ruka	83	44	53.0%	52	62.7%
2	No.10	Independence Valley	91	68	74.7%	72	79.1%
3	No.3	Lenggakiki	161	115	71.4°6	120	74.5%
4	No.5	Mbokonavera-1	76	64	84.2%	64	84.2%
5	No.14	Tuvaruhu-1	48	38	79.2%	28	58.3%
6	No.15	Tuvaruhu-2	62	41	66.1%	32	51.6%
7	No.6	Vavaca Ridge	163	94	57.7%	93	57.1%
8	No.4	Mbokona	110	88	80.0%	86	78.2%
9	No.8	Mbaranamba	100	78	78.0%	80	80.0%
10	No.2	Mbua Valley	122	93	76.2%	100	82.0%
11	No.11	Bahai Kukum	182	115	63.2%	97	53.3%
12	No.7	Panatina Valley	60	51	85.0%	50	83.3%
13	No.12	Naha 2	57	42	73.7%	42	73.7%
14	No.13	Naha 3	67	55	82.1%	56	83.6%
15	No.1	FFA Kola Road	82	70	85.4%	64	78.0%
Total			1.464	1.056	72.1%	1.036	70.8%

The project also installed 378 customer meters to new or unmetered or reconnected customers in the 15 pilot areas. In addition 596 meters were also replaced with new ones. This amount to 974 meters out of the 1,000 meters procured by JICA which can be said to be effectively used in the 15 pilot areas (see *Table 8*). Meanwhile, the Two-year Plan also procured about 3,000 meters. In DMAs, both the

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Leakage ratio is 27.7 (see *Table 10*).

Table 9 Number of Leak Point an	d Pine	• Renair

					<u> </u>	
Nø	Area No	Area Name	Pipe Length (m) [1]	No. of Leak Point [2]	No. of Pipe Repair [3]	Per-km Leak Point [4]=[2]/[1] x1,000m
1	No.9	White River- Namo Ruka	1,063.23	13	13	12
2	No.10	Independence Valley	2,184.45	12	12	5
3	No.3	Lenggakiki	2,481.38	31	31	12
4	No.5	Mbokonavera-1	1,104.12	13	13	12
5	No.14	Tuvaruhu-1	1,205.88	9	9	7
6	No.15	Tuvaruhu-2	1,371.31	9	9	7
7	No.6	Vavaca Ridge	1,298.15	11	11	8
8	No.4	Mbokona	1,418.66	25	25	18
9	No.8	Mbaranamba	1,512.29	12	12	8
10	No.2	Mbua Valley	1,989.95	18	18	9
11	No.11	Bahai Kukum	1,691.80	18	18	11
12	No.7	Panatina Valley	885.12	3	3	3
13	No.12	Naha 2	785.93	2	2	3
14	No.13	Naha 3	959.63	10	10	10
15	No.1	FFA Kola Road	2,275.52	5	5	2
Tota			22,227.42	191	191	9

	Table 10 Reduction Point of Leakage Ratio before/after NRW Reduction Activities												
No	Area No	Area Name	Leakage Ratio (%, before) [1]	Leakage Ratio (%, after) [2]	Reduction Point [3]=[1]-[2]								
1	No.9	White River- Namo Ruka	49.2	30.7	18.5								
2	No.10	Independence Valley	15.7	8.6	7.1								
3	No.3	Lenggakiki	52.1	14.3	37.8								
4	No.5	Mbokonavera-1	50.1	10.6	39.5								
5	No.14	Tuvaruhu-1	59.4	11.0	48.4								
6	No.15	Tuvaruhu-2	52.8	19.4	33.4								
7	No.6	Vavaca Ridge	60.7	24.7	36.0								
8	No.4	Mbokona	44.7	19.0	25.7								
9	No.8	Mbaranamba	21.3	3.3	18.0								
10	No.2	Mbua Valley	39.7	6.7	33.0								
11	No.11	Bahai Kukum	42.7	16.2	26.5								
12	No.7	Panatina Valley	24.8	6.1	18.7								
13	No.12	Naha 2	42.5	14.9	27.6								
14	No.13	Naha 3	42.1	25.8	16.3								
15	No.1	FFT Kola Road	44.5	14.9	29.6								
Aver	age		42.8	15.1	27.7								

[Output 4]: Water meter reading and billing process management are improved.

Indicator 4-1: Standard operating procedures (SOP) and training materials are formulated.

Draft of SOP on customer meter reading and billing system was prepared temporarily in April 2013, and will be completed with training materials based on knowledge and issues obtained through routine works.

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remaining 26 meters procured by JICA and the meters procured by the Two-year Plan will be used.

The monthly number of new service connections and replacement of malfunctioning customer meters by Solomon Water before the Project was about 30 in the whole Honiara according to interview to Solomon Water. This figure also includes connections without meter in occasions when SW is out of its stock of meters. Assuming this figure is regarded as the baseline in the whole Honiara, the baseline in the 15 pilot areas is estimated at 10 as a result of conversion by proportion of the pipeline length as well as the pilot project period (2.6 month per area). Therefore, the number of new service connections and replacement of malfunctioning customer meters was increased from 10 to 974 in the 15 pilot areas as a result of the NRW reduction activities. The baseline figure however is only reference.

		Table 8 Number	of New Ins	tallation an	nd Replacem	ent of Custome	er Meter
No	Arca No	Area Name	Total Household	Meter New Installation	Meter Replacement	Replacement & New Installation	Percentage of Replace't & New Installation in Total Household
			[1]	[2]	[3]	[4]=[2]+[3]	[5]-[4]/[1]x100
1	No.9	White River- Namo Ruka	83	37	12	49	59.0%
2	No.10	Independence Valley	91	37	35	72	79.1%
3	No.3	Lenggakiki	161	29	89	118	73.3%
4	No.5	Mbokonavera-1	76	30	32	62	81.6%
5	No.14	Tuvaruhu-1	48	16	11	27	56.3%
6	No.15	Tuvaruhu-2	62	16	16	32	51.6%
7	No.6	Vavaca Ridge	163	36	57	93	57.1%
8	No.4	Mbokona	110	45	28	73	66.4%
9	No.8	Mbaranamba	100	11	39	50	50.0%
10	No.2	Mbua Valley	122	34	58	92	75.4%
11	No.11	Bahai Kukum	182	44	53	97	53.3%
12	No.7	Panatina Valley	60	15	35	50	83.3%
13	No.12	Naha 2	57	6	36	42	73.7%
14	No.13	Naha 3	67	9	46	55	82.1%
15	No.1	FFA Kola Road	82	13	49	62	75.6%
Total			1,464	378	596	974	66.5%

[Output 3]: NRW reduction is implemented in accordance with the procedure in pilot areas and/or LCZs.

Indicator 3-1: The number of pipe repairs is increased in the pilot project areas and LCZs.

There were 191 leak points detected in the 15 pilot areas, which were repaired as a part of the NRW reduction measures (see *Table 9*).

The monthly number of pipe repairs by Solomon Water before the Project was 46 in the whole Honiara as of December 2012. Assuming this figure is regarded as the baseline in the whole Honiara, the baseline in the 15 pilot areas is estimated at 15 as a result of conversion by proportion of pipeline length as well as pilot project period (2.6 month per area). Therefore, the number of pipe repairs was increased from 15 to 191 in the 15 pilot areas as a result of the NRW reduction activities. The baseline figure however is only reference.

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(3) Expected Achievement of Project Purpose

As a matter of concern, described section 3. (1) "Status of the Achievement in the selected DMAs and/or LCZs", procurement and installation of pressure reducing valves (PRV) and fittings for pressure control, and also construction of chambers are behind schedule. However, the Project will achieve project purpose in accordance with the following schedule of project activities (see *Table 11*).

	Table 11	Sched	ule of Pro	oject Acti	vities				
				20	15				
Activities	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
Output 1									
- Strategic implementation planning									
- Approval of the Plan									
Output 2&3									
- Manuals									
- Tasahe A&B									
- NRW reduction activities									
- Pressure control									
- West Kola Ridge A									
- NRW reduction activities									
- Procurement by SW									
- PRVs and bulk flow meters									
- Fittings									
- Chambers and installation									
- Procurement by JICA									
Ultraconic flow meter (additional)									

(4) Issues and Challenges

1) Legalization of Illegal Connections

As shown in *Table 5*, the number of legalization of illegal connections is 38 and accounts for 27.1% of the total 140 illegal connections identified in the 15 pilot areas. Behind the illegal connections is the fact that water users are not satisfied with high water tariff and its frequent increase, besides they are not adequately aware of beneficiary-pay principle. To win over customers through legalization as a solution to illegal connections, it is essential for Solomon Water to carry on awareness activities to obtain water user's understanding of water tariff and beneficiary-pay principle, with development of an appropriate water tariff structure and an attempt to improve water supply facilities and services.

2) New Service Connections and Re-connections

As shown in *Tuble 6*, the number of new connection and re-connection of un-connection household (excluding illegal connections and parasite users) is 31 and accounts for 11.6% of the total 268 un-connection household found in the 15 pilot areas. To attract new customers, it is essential for Solomon Water to carry on awareness activities to obtain water user's understanding of water tariff

and beneficiary-pay principle, with development of an appropriate water tariff structure and an attempt to improve water supply facilities and services.

3) Decrease in Customers

In the 15 pilot areas, legalization of illegal connections, and new connection and re-connection of un-connected households contributed positively and to added 69 to the number of the valid customers. While this is happening. Solomon Water disconnected 28 metered customers as part of its ongoing disconnection activities, representing 4.1% of all un-metered customers before the pilot projects as well as 61 un-metered customers representing 16.4% of all un-metered customers before the pilot projects also in the pilot areas. This massive disconnection is not part of the pilot projects but Solomon Water's routine works against unpaid arears. This means 89 customers in total representing 8.4% of all customers before the pilot projects were removed from the valid customer list in spite of the 69 customers increase by the pilot projects. Consequently there are 20 customers less after the NRW reduction activities compared to before (see *Table 7* and *Table 12*). One of the reasons behind the unpaid arears is the customer's complaints quarks turff.

Although NRW reduction activities can contribute to not only reduction of NRW in quantity but also increase in customers and thus revenue, maintaining or increasing further customers is an issue. To avoid losing customers, it is essential for Solomon Water to carry on awareness activities to obtain water user's understanding of water tariff and beneficiary-pay principle, with development of an appropriate water tariff structure and an attempt to improve water supply facilities and services.

4) Leakage Detection and Effective Use of Equipment

In most cases leakages in the 15 pilot areas have been detected steadily by visual check combined with step test method, because of difficulty in application of detection equipment in places such as village community and hilly terrain, and also where pipeline routes are unclear or covered deeply with weed. As shown in *Table 9* and *Table 10*, repair of pipes and fittings where leakages were detected have a remarkable effect on NRW reduction. However, some detection equipment have not been always utilized adequately in the field, and their practical use will be limited even in ongoing activities in two DMAs. This means Solomon Water will not be able to reach the expected capacity for effective leakage detection with the equipment for the Project, so the Project will provide further assistance and training of detection equipment to be utilized more effectively.

As shown in *Table 10*, a certain volume of leakage, which may include unidentified illegal water usage, still remains in some pilot areas even after the NRW reduction activities. It is a challenge to develop further and update database of pipelines for easier maintenance and more effective leak detection.

5) NRW Reduction in DMAs and DMA Management

In the future, Solomon Water will implement NRW reduction to 28 DMAs including two ongoing 11

	Table 12 Change in the Number of Customers before/after NRW Reduction Activities														
No	Area No	Area Name	Meterod Customer (before)	Un-metered (D/L) Oustemer (before)	Total Customer (before)		Conversion from Un-metered (D.L) Metered	Legalization	NewRe- Connection	Discontition of Metered Customer	Disconnection of Un-metared (D/L) Outstaner		Metered Customer (after)	Un-metered (D.U.) Oustemer (sflar)	Total Customer (after)
			[1]	[2]	[3]=[1]+[2]		[4]	[5]	[6]	[7]	[8]	J	[9]= [1]+[4]+[5]+[6]•[7]	[10]= [2]-[4]-[8]	[11]=[9]+[10]
1	No.9	White River-Namo Faka	13	31	44		29	6	2	0	0		50	2	52
2	No.10	Independence Valley	35	33	68		33	1	3	0	0		72	0	72
3	No.3	Lenggakiki	93	22	115		22	1	6	2	0		120	0	120
4	No.5	Mbokonavera-1	34	30	64		30	0	0	0	0		64	0	64
5	No.14	Tavaruhu-1	18	20	38		10	3	3	6	10		28	0	28
6	No.15	Tovaruhu-2	19	22	-41		12	3	1	3	10		32	0	32
2	No.6	Vavaca Ridge	57	37	94		28	0	8	0	9		93	0	93
8	No.4	Mbekona	45	43	\$8	I	34	5	6	4	9		86	0	86
9	No.8	Mbaranamba	69	9	78		9	2	0	0	0		80	0	80
10	No.2	Mbus Valley	67	26	93		26	2	1	1	0		100	0	100
11	No.11	Bahai Kukum	61	54	115		35	8	1	8	19		97	0	97
12	No.7	Panatina Valley	36	15	51		15	0	0	1	0		50	0	50
13	No.12	Naha 2	36	6	42		6	9	0	0	0		42	0	-42
14	No.13	Naha 3	48	7	55		7	2	0	1	0		56	0	56
15	No.1	FFA Kola Road	53	17	70		13	0	0	2	4		64	0	64
Total			684	372	1,056		349	38	31	28 (1.1%a ^{*2}	61 (16.49%) ^{*3}		1,034	2 (0.7%)	1,036
1			(outo hy	(Prim 74y	(100.0)	i -	(data) iy		(4.1%) * (16.4%) *		4		02.07.0	(0.2.79	(100.00)
								69 (8.4%a) ^{*4}		99) ⁵⁴					

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2. Support to the second state of the secon

DMAs targeted by the Project. However, Solomon Water does not have a clear vision and concrete framework of DMA Management (Monitoring & Maintenance) in order to maintain the reduced NRW ratio after NRW reduction activities, so this fact makes sustainability of DMA Management doubtful. The reason is that the present organizational structure of Solomon Water is still not robust in terms of the following points:

- Concentration in command channel on NRW reduction activities
- Non-existence of the dedicated section for periodical monitoring in DMAs after NRW reduction
- Inadequacy of the team for illegal connections on a regular basis
- Inadequacy of the dedicated staff for hydraulic analysis

In consideration of them, some of the management of Solomon Water had dealt with organizational reform for sustainable NRW reduction and DMA Management in the future. However, this effort has been suspended and leadership for introduction of DMA Management is absent in the management of Solomon Water.

The JICA Expert Team will encourage Solomon Water to promote organizational reform so that NRW reduction and DMA Management become more sustainable.





Figure. Diagram of Honiara Water Supply System in Operation and Proposed DMAs (July 2015)

Solomon Water Organizational Chart (Present)



Solomon Water Organizational Chart (Proposed)

