

# Performance Based Contracts in Non-Revenue Water Reduction Programs

March 2017

## Session 5: NRW Practices Rating Tool



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## Presentation Outline

### *NRW Management Practices Rating Tool*

1. Introduction
2. Purpose
3. Structure
4. Use
5. Results
6. Discussion



## 1. Background / Introduction

- Water utilities can use metric benchmarking and / or process benchmarking. Using both, in a coordinated way - is more useful than either alone
- This tool evolved from an IWA Utility Efficiency Practices Rating Tool – covered many utility efficiency aspects
- IWA Water Loss Specialists Group drafted a simple spreadsheet version focusing just on NRW – never published
- Under an IDB Project, an expanded Rating Tool was developed and used in 12 utilities in 6 countries. Use is now expanding.
- Under a separate effort, USAID developed a similar tool for the Middle East (Arab Countries Water Utilities Assn)



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## 2. Purpose of the Practices Rating Tool

- The purpose of the Tool is to:
  - Document current NRW Management Practices
  - Prepare a quantitative Rating on the completeness and maturity of current NRW Practices – in six Practice Fields
  - Identify strengths and weaknesses of the current practices, and priority areas for improvement
  - Support preparation of an NRW Plan, Program and Budget
  - Identify areas for possible “outsourcing”
  - Monitor progress on improvement of Practices
- The Tool is most effective when used with other tools:
  - IWA Water Balance
  - Historical trends on NRW, Service Quality, OPEX, Tariffs, etc

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### 3. Structure of the Tool

- The Tool groups practices into 6 Practice Fields:
  1. NRW Program Management
  2. Information Systems
  3. Water Balance
  4. Apparent Loss Reduction and Control
  5. Real Loss Reduction and Control
  6. Monitoring and Analysis
- There are twelve practices in each Practice Field
- Specific guidance is provide on how to “score” current Practices (completeness and maturity) on a scale from 0 = No Practice, up to 5 = Excellent Practice

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### 3. Structure of the Tool: Practice Fields

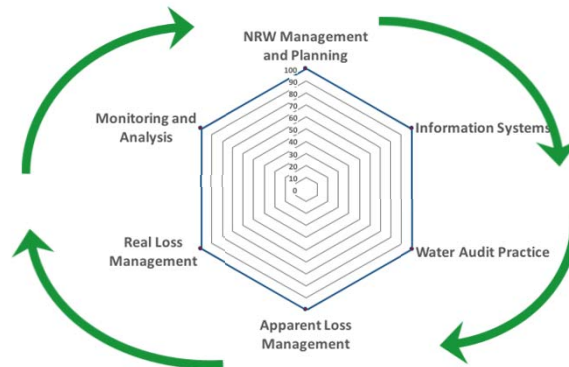
<b>1. NRW Program Management</b>	NRW leadership, organization, planning, budgeting, human and material resources, incentives and use of outside resources
<b>2. Information Systems</b>	Establishing information systems, and keeping them up to date so that NRW planning and programs are based on accurate data
<b>3. Water Balance</b>	Water audit / water balance practices as per IWA terminology and methods, focusing on accuracy and validity
<b>4. Apparent Loss Reduction and Control</b>	Policies and practices on all components of apparent loss reduction and control
<b>5. Real Loss Reduction and Control</b>	Policies and practices on all components of real loss reduction and control
<b>6. Monitoring and Analysis</b>	Practices on use of experiences, program results, and information system data to assess Practices and procedures, and revise strategies, plans, Practices and targets

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### 3. Structure of the Tool

The 6 Practice Fields reflect the annual planning / implementation / evaluation cycle, known as *PDCA – Plan, Do, Check, Act*



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### 3. Structure – Sample Practice Field

Practice Field of **NRW Program Management**: 12 Criteria

1. Top Management Interest / Leadership regarding good NRW management
2. NRW Management Organization
3. *Communication and Coordination among Departments regarding NRW*
4. NRW Program Planning and Budgeting
5. Oversight of NRW Program Plans and Budgets
6. Technical Skill Level and Training of NRW Personnel
7. Technical Resources Available
8. Reporting and Public Information on NRW Progress, Targets, Plans and Budgets
9. Advanced, Ongoing, Staff Training / Capacity Building
10. Use of internal awards and recognition for excellent staff performance
11. Performance based compensation bonus systems for staff
12. Experience in contracting for NRW services

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### 3. Structure of the Tool – Sample Rating

For **Communication and Coordination among Departments regarding NRW** – Guidance on how to score from 0 (None), 1(Poor), ... 5(Excellent)

0 (None)	Communication between departments (planning, commercial, water production, water distribution, finance) is non-existent.
1 (Poor)	Communication between departments is very infrequent: for example, only in writing during the annual planning process
2 (Deficient)	Communication between departments is loosely structured but infrequent - semi annually or quarterly. There is no coordination of NRW related activity
3 (Adequate)	Communication between departments is well structured but infrequent - quarterly. There is some coordination of NRW related activity
4 (Good)	Communication between departments is well structured and fairly frequent - monthly. The various "functions" meet quarterly or monthly, and coordinate activity on NRW
5 (Excellent)	Communication between departments is well structured and frequent. The various "functions" meet monthly, coordinate activity on NRW and informally exchange information and ideas frequently

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### 3. Structure of the Tool – Practices

Non-Revenue Water Practices Assessment Rating Fields and Criteria

Practices Field	Program Management	Information Systems	Water Balance Practice	Apparent Loss Reduction and Control	Real Loss Reduction and Control	Monitoring and Analysis
<b>Description of Practices Field</b>	Rates utility practices on NRW Program leadership, organization, planning, budgeting, human and material resources, incentives and use of public resources	Rates utility practices on establishing information systems, and keeping them up to date so that NRW planning and programs are based on accurate information	Rates utility practices on water audit / water balance as per IWA terminology and methods, focusing on accuracy and validity	Rates utility practices and activities on all components of apparent loss reduction and control	Rates utility practices and activities on all components of real loss reduction and control	Rates utility practices on use of experience, program results, and information system data to assess plans and procedures, and revise strategies, plans and targets
<b>Criteria for Basic NRW Practitioner</b>	1 Top Management Interest / Leadership regarding good NRW management	Information Systems Plan	Water Audit / Water Balance Procedures	Planned Customer Database Verification / Update	Leak repair capabilities	Regular Water Balance Update
	2 NRW Management Organization	General NRW Information System (Key Indicators and Trends)	Estimation of system input (master metering) - including imports and exports	Written guidelines on customer meter class and meter sizing	Leak Repair Time - distribution pipes	Assessment of NRW plans and activities for effectiveness and cost efficiency, for planning
	3 Communication and Coordination among Departments regarding NRW	Water Source / Supply Information System	Estimation of billed metered consumption (customer metering)	Written guidelines on meter replacement, based on financial analysis	Leak Repair Time - service connections	(Large) customer consumption monitoring
	4 NRW Program Planning and Budgeting	Billing and Customer Information System	Investigation and analysis of customer metering inaccuracies	Customer meter reading control and efficiency improvement	Use of Pressure Management	Billing accuracy and efficiency investigation and improvement
	5 Oversight of Plans and Budgets	Water Distribution Network Maps and Data Systems (GIS or other)	Estimation of billed unmetered consumption	Use of customer meter workshop for meter testing	Active leakage control program based on financial considerations	Monitoring of areas and delinquent accounts
	6 Technical Skill Level and Training of NRW Personnel	Maintenance Management System	Estimation of unbilled authorized consumption	Reduction of the number of unattended connections, especially large users (gov't, etc)	Use of District Meter Areas (DMAs), Zones or Sectors	Pressure Monitoring and Control
	7 Technical Resources Available	Program on Data Validity Improvement	Estimation of unauthorized consumption	Program to reduce unknown or unauthorized use: unauthorized connections, meter tampering, bypasses	Pipe Rehabilitation / Replacement Policies and Implementation, based on financial considerations	Customer reporting feedback system / call center, with response rate monitoring
	8 Reporting and Public Information on NRW Progress, Targets, Plans and Budgets	Information Systems Integration / Compatibility	Estimation of data handling errors	Public education on water use, cost of water supply, and consequences of unauthorized use	Information / Promotion to the public and local authorities on the importance of prompt reporting of leaks	Regular NRW Monitoring Reports
<b>Criteria for Advanced NRW Assessor</b>	9 Advanced Ongoing Staff Training / Capacity Building	Database on pipe material, age and condition, break rate	Use of uncertainty analysis to examine expected range of water audit results, by category	Program for residents of slum areas with unauthorized connections to "legitimate" their connections	Analysis of pipe material, burst frequency, age etc for planning rehabilitation and / or replacement	Monitoring and quality control on the team and their efforts on reducing unreported and / or unauthorized water use
	10 Use of internal awards and recognition for excellent staff performance	Database on meter type, size, class, and age	Use of leak / burst records for leakage component analysis	Use of disconnection policy for non-payment	Efforts to reduce or eliminate storage tank overflow or leakage	Quality control on crews or contractors which conduct leak detection, repairs, rehabilitation or replacement works
	11 Performance-based compensation bonus systems for staff	Database on DMA configuration and performance	Night flow testing and analysis to estimate leakage	Assessment of different type or class of water meters for both large and small customers	Regular maintenance of valves, air valves, PVAL, hydrants and mains flushing	Zone or DMA performance analysis
	12 Experience in contracting for NRW services	Water Network Hydraulic Model	Water balance refinement using a comparison of top-down and bottom up audit methods	Use of AMI / AMR Systems (perhaps for large customers only)	Use of flow / pressure / noise sensors to detect leakage	Use of SCADA for real time monitoring and operational optimization

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### 3. Structure – Spreadsheet: 1 Page per Field



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### 3. Structure – Spreadsheet: Synthesis

Location: <i>Aguas de Quatrobó</i>		Period Covered: <i>2014</i>								
NRW Practices Field	Rating of NRW Practices							Weighted Scoring to 100		
	Basic Score	None	Poor	Deficient	Adequate	Good	Excellent	Score	Weight	Net Score
NRW Management and Planning	4.3							87	100%	87
Information Systems	4.1							81	100%	81
Water Balance Practice	4.4							87	100%	87
Apparent Loss Management	4.5							91	100%	91
Real Loss Management	4.5							90	100%	90
Monitoring and Analysis	4.5							90	100%	90
<b>Overall NRW Practices Rating</b>	<b>4.4</b>							<b>88</b>	<b>100%</b>	<b>88</b>

Prepared by: *Arturo Vegas*

Weighting should only be applied when one or more particular Practice Fields are more important than others. For example, if water production costs are very high, Real Loss management is very important, so a higher weighting for Real Loss Management could be applied. A HIGHER WEIGHT would lower the Net Score for that area. To balance scoring, adjust other weights to arrive at a net weight of 100%

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## 4. How to Use the Tool

- Conduct Collaborative Learning Process
  - Outside “facilitator” leads the Rating process
  - Purpose should be made clear – no one will lose their job
  - Facilitator should have no particular programmatic agenda or bias, or any interest in future sales
  - Gaming (high or low) is non-productive
  - Could be conducted as a series of small meetings – with various utility functions, or conducted in a “Workshop” setting
  - In a large utility could do two ratings with different people from relevant functions and compare results.
- Examine Results in relation to Metric Performance Indicators (numerical outputs or inputs)
- Perform Annual Updates, Track Progress and Adjust

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## 4. How to Use the Tool

### Com + Agua NRW Training Program - Brazil

Has been conducting training for utilities in Brazil for 10 years. Practice Scoring has just been integrated into the technical training, as of March 2017. Sessions recently conducted for staff from EMBASA (Bahia State) and for COMPESA (Pernambuco State)



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## 4. How to Use the Tool

### Com + Agua NRW Training Program Brazil

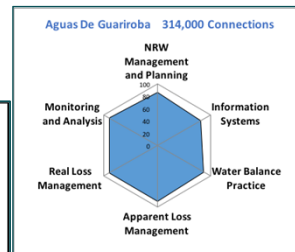
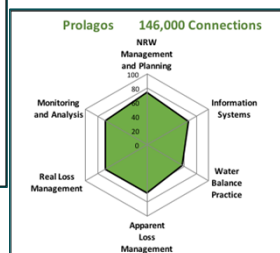
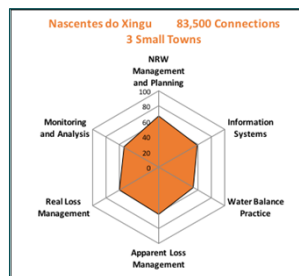
- Course Facilitators introduce the Practices Survey Tool, and innovative projects such as the Sao Luiz NRW PBC in Sao Paulo. Small groups comprising staff from different Business Units within each utility conduct the Practice Ratings for their utility and present results to all.
- Next, facilitators provide more technical training on Best Practices for NRW, and lead discussions, in plenary
- Then, participants return to their small groups to discuss and re-examine their Ratings, then develop revised Ratings and Action Plans. Each small group shares its plan, and the best ideas are merged into a utility-level plan.
- Participants realize that “gaming” on the Ratings serves no useful purpose.

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## 5. Sample Results – Brazil

### Concessionaire AEGEA, Brazil, 2014 – Towns in 3 States



*Different utilities under the same ownership have different Practice Scores*

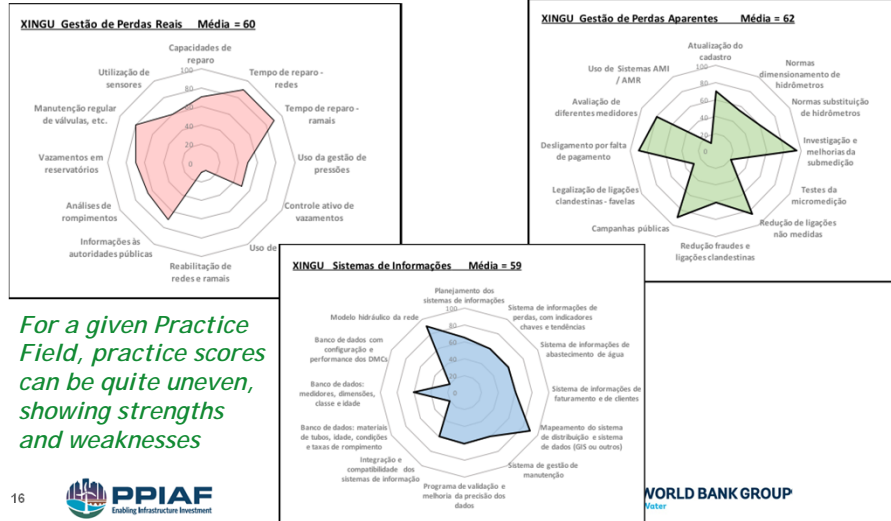
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## 5. Assessment of Results – Brazil Example

### Concessionaire AEGEA – Nascentes do Xingu, 2014



## 5. Results: Comparisons by Location

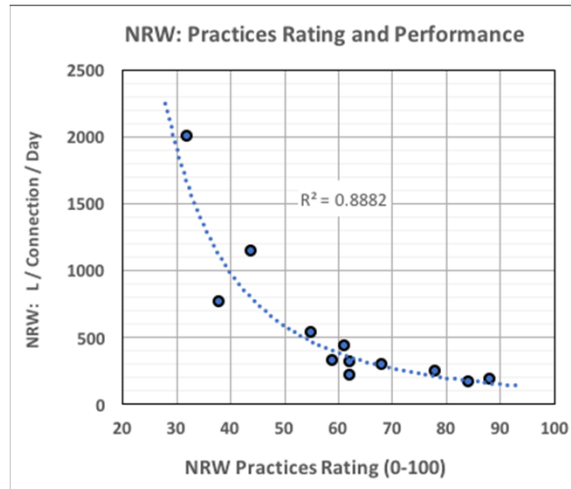


## 5. Results: Practices and Performance

### Locations

- Belize Water Services
- CAGECE, Brazil
- AEGEA, Brazil (5 sites)
- CORASAAN, DR
- INTERAGUA, Ecuador
- ETAPA, Ecuador
- ESSAP, Paraguay
- SAWACO, Vietnam

*Good Practices lead to Good Performance !*



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## 5. Detailed Analysis / Diagnostic of Real Loss

Location: <i>Aguas de Guaratuba</i>		Rating of NRW Practices						Period Covered: <i>2014</i>		
NRW Practices Field	Basic Score	None	Poor	Deficient	Adequate	Good	Excellent	Score	Weight	Net Score
		0	1	2	3	4	5			
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Prepared by: *Adriana Rojas*

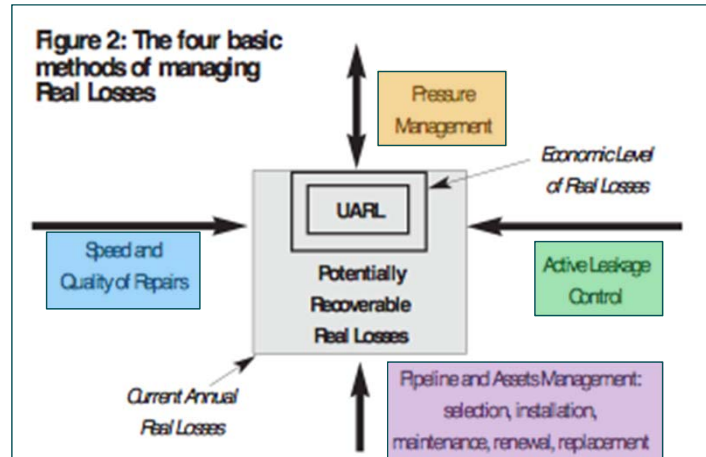
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*We can use Practice Ratings and Time Trends to identify "root causes" and make Action Plans*

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## 5. FIRST: The Four Pillars of Real Loss Control



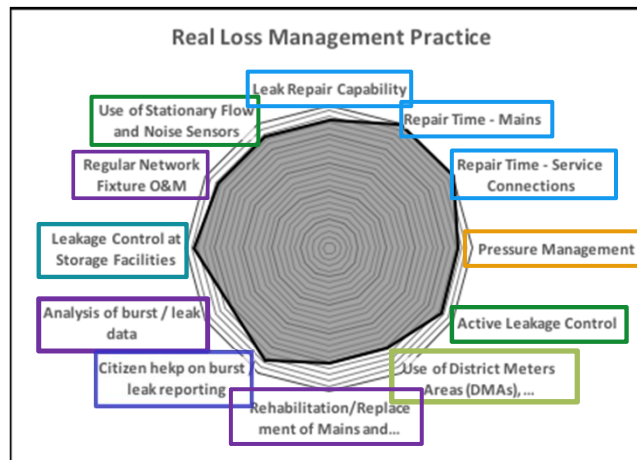
Source: IWA Blue Pages & Water 21 April 2004

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## 5. Real Loss Practice Scores

- Real Loss Performance is Very Good 90 / 100
- Performance is roughly even on all real loss control practices – but the **asset management scores** are a little lower
- The Four Pillars are here – separated out into specific practices



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## 5. Assessment of Real Loss Trend

WATER SYSTEM ATTRIBUTES	2009	2010	2011	2012	2013	2014	Notes
Average No. of Water Connections	241,504	252,029	267,875	284,155	294,896	314,044	Growth Rate = 5.4%
Connection Density (Conn/km)	71.3	73.5	77.1	80.0	82.3	86.4	
Customers with Meters, %	100%	100%	100%	100%	100%	100%	
Billed Water, m3/conn/month	13.8	14.3	14.4	14.3	14.3	13.7	
Average Network Pressure (m)	40	35	30	30	29	26	Reduction rate = 9.0%
Continuity of Service, %	100%	100%	100%	100%	100%	100%	
Mains Leaks / km of mains / year	0.73	0.60	0.60	0.48	0.51	0.52	Medium Unavoidable = 0.13
Connections Leaks / 1000 Conn / year	53.5	62.5	60.4	64.7	53.3	54.3	HIGH Unavoidable = 5.0
FINANCES and RESOURCES							
Operating Cost Coverage Ratio	2.46	2.56	1.60	2.10	2.10	2.09	Decline
Total Cost of Water Production, \$/m3 prod	RS 0.83	RS 0.96	RS 1.41	RS 1.22	RS 1.51	RS 1.70	15.4% increase; Inflation = 10%
Variable Cost of Water Production, \$/m3 prod	RS 0.21	RS 0.20	RS 0.25	RS 0.23	RS 0.21	RS 0.24	pretty stable = real decline
Effective Average Tariff, \$/m3 sold	RS 3.74	RS 4.28	RS 4.82	RS 5.18	RS 5.56	RS 6.25	10.8% increase; Inflation = 10%
NRW PERFORMANCE							
Non-Revenue Water, L / Conn/day	368	347	315	283	278	265	Reduction rate = 6.8%
Non-Revenue Water, %	44.8%	42.4%	40.0%	37.6%	37.2%	37.0%	Reduction rate = 3.9%
Apparent Losses, L / Conn/day	175	172	163	153	148	134	Reduction rate = 5.4%
Real Losses, L/Conn/Day	144	123	107	86	99	101	Reduction rate = 7.4%
Infrastructure Leakage Index (ILI)	3.0	2.9	3.0	2.4	2.9	3.3	Quite Good; Unavoidable = 1.0

Real losses have declined. Why ??

- Practice Ratings tell us that time to detect and repair leaks, pressure management are very good. Infrastructure management is not quite as strong.
- Time Trends tell us that pressure has been reduced, but that burst and leak rates are high and are not improving

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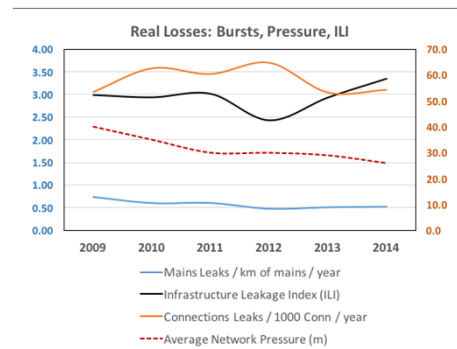


## 5. Diagnostic of Real Losses



- Drop in Real Loss from 144 to 101 Liters / Connection / Day (7.4%/year). Why?
- Certainly due to drop in average pressure from 40m to 26m (9.0%/year)
- Connection density has risen, which would also lead to a decline in real loss per connection.
- The Infrastructure Leakage Index (ILI) however, is above 3.0 is not declining, indicating more can be done to reduce real losses

- Mains Burst Rate is about 4 times unavoidable, and Mains Burst Rate per m of pressure is stable
- Connection Burst Rate is about 10 times unavoidable, and rate per m of pressure is rising !
- Key action: replace service connections**



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## 6. Discussion



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## Questions? Contact us

Alan Wyatt  
Independent Consultant  
Washington, DC  
aswater12@gmail.com

Gerard Soppe  
Sr. Water and Sanitation Specialist  
gsoppe@worldbank.org

Jemima Sy  
Sr. Infrastructure Specialist  
(Private Sector Development)  
jsy@worldbank.org



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