WATER GLOBAL PRACTICE • OPERATIONAL MANUAL

The Use of Performance-Based Contracts for Nonrevenue Water Reduction

Output of the Global Program on Developing Good PBC Practices for Managing NRW

SEPTEMBER 2018

Bill Kingdom, Jemima Sy, and Gerhardus Soppe

WORLD BANK GROUP

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Contents

Tables

Figures

Chapter 1 Introduction

This Operational Manual describes the process for planning and implementing performance-based contracts (PBCs) for nonrevenue water (NRW) reduction (hereafter, "NRW-PBCs" or "PBCs"). It outlines how to assess when NRW-PBCs will be useful and the design and implementation process to follow.

1.1. Audience

The primary users of this manual are those involved in assessing, preparing, and implementing NRW-PBCs. This includes governments, water utilities, regulators, consultants, contractors, and International Finance Institutions (IFIs).

1.2. How to Use the Manual

This manual can be read in its entirety for general knowledge of NRW-PBCs and the NRW-PBC preparation process. Practitioners can also reference individual sections of the guide during the NRW-PBC preparation process.

1.3. Organization of the Manual

Chapter 2 describes what NRW-PBCs are, what benefits they provide, and the differences between four types of NRW-PBCs. Chapter 3 describes the seven phases in the NRW-PBC preparation process and how they are related. Chapters 4 to 10 detail each phase, namely:

- Screening Phase—Determine, at low cost, if a location may benefit from an NRW-PBC.
- Initial Assessment Phase—Assess the viability of an NRW-PBC and prepare an initial NRW-PBC concept using data that is already available.
- Field Assessment Phase (Optional)—If needed, gather and analyze additional data to see if an NRW-PBC will be beneficial.
- NRW Reduction Strategy Phase—Define the specific objectives, scope, and targets for an NRW reduction; and develop a strategy.
- PBC Design Phase—Design the contract and confirm its viability by preparing a business case.
- Procurement Phase—Prepare the procurement documents and select a suitable contractor.
- Implementation and Oversight Phase—Ensure effective and efficient NRW reduction in line with the PBC, and ensure the sustainability of NRW reduction.

The appendices offer the following resources:

- Glossary and Related Diagrams—Contains definitions of key terms used in the manual, together with explanatory diagrams
- Guidance on Contract Type—Presents four NRW-PBC types and their variants. Also contains a sample term sheet
- Sample Terms of Reference (TOR)—Contains TORs for procuring consultants to advise on NRW-PBC assessment, design, and procurement
- Suggested Report Outlines—Lists the reports for each phase and their suggested outlines
- Tools for Assessing NRW-PBCs—Contains the tools for screening and assessment, as referenced in the main text.

Table 1.1 shows which documents, tools, and guidelines will be helpful and in which phase.

TABLE 1.1: Standard Documents, Tools, and Guidelines for Each Phase

Phase	Standard TORs	Tools and Guidelines
Screening (Chapter 4)	N/A	Screening Tool (Appendix E.1)
Initial Assessment (Chapter 5)	Standard TOR for Initial Assessment (Appendix C.1)	• Data Collection Sheet (Appendix E.2) • Trend Analysis Tool (Appendix E.3) • NRW Practices Rating Tool (Appendix E.4) • Water Balance (Appendix E.5)
Field Assessment (Chapter 6)	Standard TOR for Field Assessment (Appendix C.2)	Note: Tools listed above for initial assessment can also be used for the Field Assessment
NRW Reduction Strategy, PBC Design, and Procurement (Chapters 7, 8, 9)	Standard TOR for NRW Reduction Strategy, PBC Design and Procurement (Appendix C.3)	A sample Term Sheet for Performance-Based NRW Reduction Contracts (Appendix B.8)
Implementation and Oversight (Chapter 10)	Standard TOR for NRW-PBC Oversight Assistance (Appendix C.4)	N/A

Chapter 2 Overview of NRW-PBCs

2.1. What Is an NRW-PBC

An NRW-PBC is a performance-based contract for outsourcing technical, commercial, and construction activities related to nonrevenue water reduction, while providing the contractor with incentives to achieve the desired results. Unlike conventional NRW reduction contracts in which contractors are paid based on inputs (for example, number of connections replaced), NRW-PBCs pay the contractor for outputs, such as amount of water saved, number of illegal connections detected, or number of customers receiving 24/7 service.

NRW-PBCs differ from management contracts, concessions, leases, or other forms of private sector participation, in that the utility retains control of utility operations and assets. The PBC allows the utility to take advantage of the expertise and incentivized performance of specialized private sector firms to reduce NRW. NRW-PBCs do not entail privatization of management, operations, or assets.

2.2. Benefits of NRW Reduction

NRW-PBCs can help utilities provide people with safe, reliable drinking water, through quick and effective NRW reduction. Table 2.1 lists the service, financial, and societal benefits of NRW reduction.

2.3. Benefits of Using a PBC to Achieve NRW Reduction

Regression analysis shows that NRW-PBCs are 68 percent more effective in achieving NRW reduction than utility-led NRW reduction program (Wyatt, Richkus, and Sy 2016). PBCs work well because they provide financial incentives that motivate the contractor to achieve NRW reduction. Incentives include output-based remuneration ($/m^3/day saved or similar), targets (such as m^3/day saved), and financial penalties for not meeting targets. These incentives transfer project risk from the utility to the contractor.

TABLE 2.1: Benefits of NRW Reduction

Service benefits	Financial benefits	Societal benefits
• Reduces leakage • Provides service to more customers for longer hours • Improves water quality at tap by reducing contamination	• Reduces capital expenditure needed for new water sourcing and treatment plants • Increases utilities' revenue due to the sale of the water saved, or water that was previously not billed for • Reduces operating costs per unit sold by reducing the amount of energy and chemicals required per unit sold • Improves collections (if this is included in the program)	• Improves climate resilience by reducing demand on scarce water resources • Reduces emissions of greenhouse gases because less energy is required per unit of water sold • Makes cities more competitive due to improved service and less time spent collecting or treating poor quality water • Reduces government subsidies to utilities, allowing public funds to flow to other social programs

TABLE 2.2: Successful NRW-PBCs Around the World

Location	Achievements	Performance-Based Element
Kuala Lumpur, Malaysia	• Reduced NRW by 198,000 m^3/day (10% of production) • Avoided capital expenditure of about US$200 million	Lump-sum payment for achieving NRW reduction target
Bangkok, Thailand	• Saved 165,000 m^3/day of water • Avoided capital expenditure of about US$170 million	• Performance-based management fee, linked to actual water savings achieved
New Providence, Bahamas	• Saved 17,000 m^3/day of water (30% of production) • Reduced utility's EBITDA loss by over 50 percent	• 30% of compensation is performance-based, with payment based on the volume of NRW reduction
Sao Paulo, Brazil	• Increased revenue by US$72 million (of which 75% was kept by the utility) • Reduced under-reporting of consumption by 41,000 m^3/day, by replacing the meters of industrial and commercial customers	• Contractors paid based on increased volumes billed
Ho Chi Minh City, Vietnam	• Saved 122,000 m^3/day of water • Avoided capital estimated at US$120 million	• More than 70% of remuneration for leakage reduction activities and management services was performance-based, based on m^3/day saved

Sources: Kingdom 2006; World Bank, forthcoming; Wyatt 2018.

In addition, PBCs bring specialized expertise. World-leading firms in NRW reduction can provide innovative solutions and introduce new technology. Through capacity building or training required under the PBC, they can transfer their knowledge to the utility, ensuring sustainability of NRW reduction.

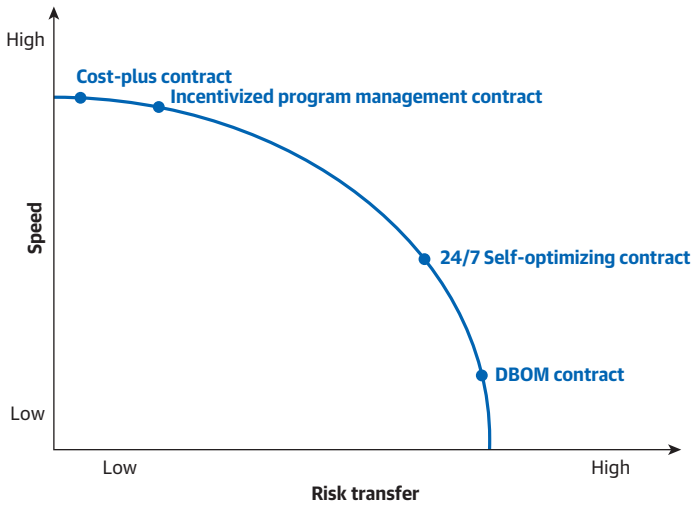
2.4. Examples of Successful NRW-PBCs

NRW-PBCs have been implemented around the world, in large cities and smaller towns, reducing both physical and commercial losses and improving utilities' financial performance. Table 2.2 gives examples of the benefits from NRW-PBCs, and notes how pay was tied to performance.

2.5. Overview of Contract Types

Many types of NRW-PBCs are possible, each with different risk allocations and information requirements. Figure 2.1 summarizes the tradeoff between transferring risk and moving quickly for four distinct contract types—Design-Build-Operate-Maintain (DBOM), 24/7 Self-Optimizing, Incentivized Program Manager, and Cost-Plus.

FIGURE 2.1: Tradeoffs in Selecting Contract Type



Starting on the bottom right side of the diagram (highest risk transfer, lowest speed), the four options are:

1. **DBOM Contract**—Design-Build-Operate-Maintain (DBOM) contracts provide high levels of incentive and risk transfer by making the contractor responsible for all costs, with payment dependent on the volume of loss reduction achieved. They also require construction of district metered areas (DMAs) and other physical infrastructure. They can be considered the NRW reduction equivalent of a DBOM contract for water production and treatment. This contract type has several variants. The differences between the variants mostly concern the degree of risk transfer to the contractor, and how prescriptive the network rehabilitation and remodeling requirements are.

   Experience has shown that DBOM contracts can take years to prepare, given the information needed, the analysis needed, and the time bidders require to prepare their bids. Thus, this contract type is not always the best choice. The value of risk transfer and value for money that it offers need to be weighed against the time it may take to get the benefits.

2. **24/7 Self-Optimizing Contract**—This model provides the contractor with incentives based on the value to the utility of key outputs—including customers moved to 24/7 supply and revenue collected—as well as the value of inputs, such as bulk water used. This design provides flexibility and reduces the engineering work required in contract preparation. So long as the utility can value the outputs it wants to achieve, the design of the works is adapted by the contractor as it gains more information.

3. **Incentivized Program Manager Contract**—Program management contracts separate the "brains" of the operation (planning interventions such as district metered areas (DMAs) and action leak control) from the "brawn" of implementing the works. A program management contract is a professional services contract, in which the utility pays a team of experts to design, procure, and supervise NRW reduction works. Actual implementation is done by third-party works contractors. The program manager is paid a program management fee—typically around 10 percent of the value of the works—and is also incentivized with performance pay for improvements on specified key performance indicators (KPIs).

4. **Cost-Plus Contract (for use in Competitive Discovery)**—Under this contract type, the contractor is paid for work done on NRW reduction at actual cost plus a margin. Actual cost is disclosed though an agreed "open book" process that allows the utility to see the costs the contractor incurred. The "plus" component would be a standard profit element, typically less than 10 percent over costs. Modest incentive payments for improvement in specified key performance indicators can also be included.

   The cost-plus contract is quick to implement, but typically does not maximize value for money. It is included because it can be used in a Competitive Discovery Approach. This

approach brings in several contractors to start work on selected zones. They share information with the utility that will generally be more useful than consulting engineers can gather, and which the utility can then use to prepare contracts with greater risk transfer for the rest of the network.

Appendix B provides greater detail on the key features of each contract type—including how the baseline is set, how capital and operating costs are paid, how incentives are provided, the level of flexibility, and indicative timelines.

2.6. Considerations for Contract Design

When designing an NRW-PBC, data availability, value of NRW reduction, and other factors are important considerations. Expert judgment, consultation, and adaptation of international precedents to local circumstances will be required—as set out in the subsequent chapters on process.

Chapter 3 Process Overview

This chapter provides a brief overview of the phases in the NRW-PBC project preparation process. These are illustrated in Figure 3.1.

KEY DECISIONS

Screening

- Is NRW reduction needed?
- Is an NRW-PBC suitable here?

Screening Phase

The purpose of screening is to quickly and cheaply discover if an NRW-PBC is likely to be a useful tool for a utility. A Screening Tool—that uses indicators such as the level of NRW, long-run marginal cost, variable operating costs, the capabilities and interest of the private sector, and existence of favorable laws and policies—is used to answer two questions: is NRW reduction needed, and if so, is an NRW-PBC the right approach?

KEY DECISIONS

Initial Assessment and Field Assessment

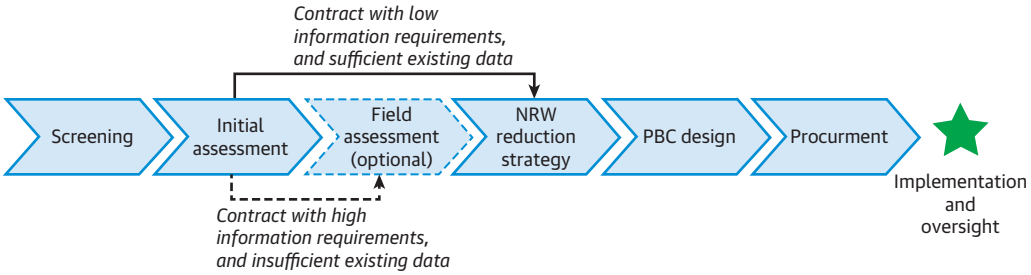
- Is NRW reduction needed?
- Is an NRW-PBC suitable here?
- What should be the objectives, scope, indicators, and targets?
- Is it likely an oversight contract will be needed?
- How to ensure sustainability?

Initial Assessment Phase

In the Initial Assessment, the viability of the NRW-PBC is confirmed, and a concept of the NRW-PBC is developed. The contract's objectives, scope, indicators, targets, contract type, risk allocation, and payment structure are defined.

In some cases, data on system operations and infrastructure is lacking, creating uncertainty in the components of NRW (Water Balance) and the cost of reducing NRW. If this is the case, a Field Assessment may be required to gather missing information. Alternatively, a contract that is robust to (strong enough to handle and compensate for) a lack of information, such as an Incentivized Program Manager Contract, may be chosen.

FIGURE 3.1: NRW-PBC Project Preparation Process



Field Assessment Phase (Optional)

The purpose of the Field Assessment is to fill any information gaps that prevented decisions on whether an NRW-PBC is a good idea, or what the project concept should be. A field assessment may involve updating the customer database and associated water meter database, testing the accuracy of master meters and customer meters, measuring consumption of unmetered connections, and conducting surveys to estimate the prevalence of illegal connections. Other activities may include developing computerized geographic information system-based (GIS-based) network maps, measuring continuity and pressure in different zones, tabulating the frequency of bursts and leaks on mains and service connections, and conducting step tests or night flow tests to estimate leakage.

NRW Reduction Strategy Phase

For DBOM contracts, the objective of the phase is to develop a program for NRW reduction, charting the optimal reduction path by identifying specific measures to implement and spelling out how the network should be configured.

For contracts with lower information requirements, this phase can be significantly streamlined. For instance, in an Incentivized Program Manager contract, little additional technical analysis will be required at this stage, as the program manager is expected to collect missing data and plan the approach once hired.

For any type of contract, this phase also includes a full financial and economic assessment of the project.

KEY DECISIONS

- Which measures to reduce physical and commercial losses are most effective and cost efficient in this situation?
- How should the project be staged to deal with intermittent supply and zone performance?
- Is the project economically and financially viable, and can it be financed?

PBC Design Phase

The objective in this phase is to design a PBC that will incentivize the contractor to achieve efficient and effective NRW reduction and to prepare a business case to support this design.

This phase entails specifying the contract's objectives, scope, responsibilities, risk allocation, indicators, targets, and remuneration mechanisms. The indicative contract design should be tested in a market sounding to gauge private sector interest and capabilities. A full business case setting out the economic, financial, legal, regulatory, and environmental feasibility should also be prepared.

KEY DECISIONS

- What should be the scope, objectives, responsibilities, risk allocation, indicators, targets, and remuneration mechanisms?
- Is there sufficient interest from the private sector?
- Is the PBC feasible on economic, financial, legal, regulatory, environmental, and social terms?
- Is financing available?
- How will the contract be supervised?
- How can sustainability be ensured?

Procurement Phase

After the PBC has been designed, the procurement starts. The objective is to choose the most suitable contractor to

KEY DECISIONS

- Which firms are qualified to bid?
- What level of emphasis should be placed on different proposal evaluation criteria to make the best selection?

KEY DECISIONS

- Is the PBC contractor complying with the terms of the contract?
- Is the quality of work and progress against targets as expected?
- What is the best approach to ensure sustainability of NRW reduction?

implement the NRW reduction project in a way that is competitive, transparent and provides best value. This involves generating market interest, conducting a qualification round to derive a short list, preparing a request for proposal (RFP), running the tender process, evaluating bids, and awarding the contract.

Implementation and Oversight Phase

Implementation and oversight starts when the PBC is signed and the contractor begins work. The objective is to ensure that NRW is reduced according to plan and that NRW reduction is sustained after the contract ends. Some utilities may hire an oversight contractor to perform these functions. Experienced utilities, or utilities implementing simple PBCs, may perform these oversight functions themselves.

Chapter 4 Screening Phase

The purpose of **Screening** is to quickly and cheaply discover if a location may be suitable for an NRW-PBC. It should be possible to carry out the screening in no more than a month or two using the Screening Tool (see Table 4.1).

The Screening Tool uses quantitative and qualitative criteria to answer two key questions:

- **Is NRW reduction needed?**—The Screening Tool checks for high NRW levels, a high long-run marginal cost (LRMC) of water, high variable operating costs, insufficiency of supply, and other factors that indicate NRW reduction is needed.
- **If NRW reduction is needed, is an NRW-PBC appropriate?**—The Screening Tool checks for red flags, such as a legal framework that prevents PBCs or stakeholder opposition to NRW-PBCs.

The tool uses a "stoplight" approach. Favorable conditions get a green light, unfavorable conditions get a red light, and mixed situations are marked with an amber light. If a location receives one or more red lights, an NRW-PBC may not be the best approach. Alternatively, all green lights would be a clear "go" signal, and an NRW-PBC is likely to be successful. Amber lights indicate "proceed with caution."

Information used for screening should be collected from several sources and cross-checked for reliability. The water supply regulator (if one exists), the water utility, and international financial institutions (IFIs) working in-country are good sources of information.

TABLE 4.1: Screening Tool for NRW-PBCs

Criterion		Red	Amber	Green	Your Utility or Zone within Your Utility
NRW levels		NRW <15%	15%<NRW<40%	NRW >40%	
		NRW <300L/C/D	300<NRW<800L/C/D	NRW >800L/C/D	
Water supply reliability			24-18 hours	<18 hours	
Variable operating costs			$0.00<cost<0.50/m³	cost >$0.50/m³	
Installed Capacity (Water Production)			IC>250lpcd	IC<250lpcd	
Resource scarcity		Unlimited high-quality water available with little pumping or storage costs	Between Red and Green	All available water allocated, solutions such as desal being considered	
Demand growth (%p.a.)			0%<Growth<4%	Growth >4%	
LRMC ($/m³)		LRMC <$0.30	$0.30<LRMC<$1.00	LRMC >$1.00	
Legal barriers to PBCs		Yes	Not Clear	No	
Social support for PBCs		No	Not Clear	Yes	
High priority on improving water service in this area	**Ministry of Water**	No	Not clear	Yes	
	Ministry of Finance	No	Not clear	Yes	
Conclusion of Screening					

• Red Light • Amber Light • Green Light

Note: See Appendix D.1 for a screenshot of the Screening Tool using different illustrative scenarios; L/C/D=[TBD]; m=meter; lpcd=[TBD]; p.a.={TBD}; LRMC={TBD].

Chapter 5 Initial Assessment Phase

The purpose of the **Initial Assessment** is to confirm the viability of the NRW-PBC and develop a concept for the NRW-PBC.

The Initial Assessment comprises five activities: compile data, confirm if NRW reduction is needed, decide whether a Field Assessment is needed, confirm if a PBC is suitable for NRW reduction, and develop the NRW-PBC project concept. The Initial Assessment should take 1 month to 3 months, depending on data availability. Appendix C.1 includes a TOR to hire consultants to perform the Initial Assessment.

5.1. Compile Data

Data should be compiled for key indicators in the following categories:

- Water production capacity and current production
- Distribution infrastructure
- NRW levels and components
- Service quality
- Finances

The Data Collection Template (see Appendix E.2) lists the indicators required. To the extent possible, multiple years of data should be compiled—including the past 3 years at an absolute minimum but preferably 5 years or more. The data should come from records provided by the utility or regulator.

BOX 2.1: TOOLS TO CONFIRM NEED FOR NRW REDUCTION

Water Balance Tool—Provides a "top-down" International Water Association (IWA) water balance as well as volumes and values of NRW components, KPIs, and error bands for uncertainty analysis. *Can be used to understand the size of the problem, and the robustness of the data.*

Trend Analysis Tool—Provides a framework for analyzing data trends on water supply, use, NRW, and related parameters for situational assessment. *Can be used to understand if things are improving, or getting worse.*

NRW Practice Rating Tool—Provides a framework for assessing and rating current NRW practices in utility municipality—which shows strengths and weaknesses and points to root causes of NRW. *Can be used to assess major challenges, and the extent to which the utility can or cannot address them on its own.*

5.2. Confirm Whether NRW Reduction Is Needed

The Trend Analysis Tool, NRW Practice Rating Tool, and Water Balance Tool can be used to confirm if NRW reduction is needed. What these tools do, and how they can be used for this assessment, are described in the box on the right. Examples of the outputs that the tools produce are included in Appendices E.3, E.4, and E.5.

Experts should also be consulted. Table 5.1 shows examples of the optimal decision criteria experts would use to assess if NRW reduction is needed, and rules of thumb that can be used when information is limited. The table is arranged by potential goals of the NRW-PBC—for example, provide 24/7 service—and specifies how NRW reduction can help achieve each goal.

TABLE 5.1: Project Goals and NRW Solutions

Goal	Type of NRW reduction that can help	Optimal decision criteria for when NRW reduction is desirable	Rule of thumb that may indicate NRW reduction is desirable
Provide 24/7 service to more customers	Reduce leakiness of infrastructure, so that that physical losses do not increase as hours of supply increase	Physical loss reduction is cheaper than equivalent increase in bulk supply	If physical losses $x \frac{24}{\text{current hours of supply}} > 30\%$ It is likely that physical losses reduction is warranted, unless adding to bulk protection in sufficient quantity to achieve 24/7 is unusually low cost (plentiful water nearby, gravity-fed, low treatment costs, low capital expenditure [capex] costs)
Expand water service to more customers	Reducing physical losses in existing network will increase water available to new customers	Physical loss reduction is cheaper than equivalent increase in bulk supply	If physical losses >15% and costs of new production are at typical levels (say US$1 million/MLD or more) NRW reduction is likely to be desirable
Ensure enough water is available to satisfy expected demand growth	Reducing physical losses will increase the amount of water available to meet future increases in demand	Physical loss reduction is cheaper than equivalent increase in bulk supply	If demand growth would require a significant new bulk water scheme to be constructed within 5 years, at a cost per million liters per day (MLD) of US$1 million/MLD (or more), and physical losses >15%, then NRW reduction is likely to be desirable
Increase resilience and security of supply in the face of climate change and other risks	Lower levels of physical losses in the network means that any given level of storage can provide supply for longer	NRW reduction is cheaper than providing an equivalent increase in storage	If physical losses >20%, then NRW reduction is likely to be desirable
Improve financial performance	• Reducing commercial losses will increase revenues • Reducing physical losses may increase sales, or reduce costs • Improving collections (not strictly NRW reduction, but closely related) will increase operating cash flow • Reducing energy consumption (not NRW reduction, but related) will reduce costs	Is the present value (PV) of the cost of the NRW reduction program less than the PV of the increase in operating cash flow expected, when discounted at the utility's cost of capital?	• If total NRW >30% then reducing NRW is likely to be desirable • If commercial losses >15%, then NRW reduction is likely to be desirable • If collection efficiency is <95%, then including collection improvement in any NRW reduction effort should be considered

Note: MLD=[TBD]; PV=present value.

5.3. Decide Whether Field Assessment Is Needed

In some cases, data on system operations and infrastructure is lacking, creating uncertainty in the components of NRW (Water Balance). If this is the case, a Field Assessment may be required to gather missing information (see chapter 6). Activities carried out during a Field Assessment, such as conducting night flow tests and updating the customer database, not only improve data quality but also allow the utility to get an early start on NRW reduction.

Alternatively, a contract that is robust to a lack of information, such as an Incentivized Program Manager Contract, may be chosen. Such contracts include activities to find out the level of NRW with increasing accuracy and give the contractor the flexibility to adapt the NRW reduction work based on emerging information collected.

A contract with low information requirements is often a promising option, as the cost and time involved in acquiring better data on NRW through a Field Assessment can be prohibitive. Getting good data on NRW may require installation of new production meters, which can cost millions of dollars and take a year to procure and install. Estimating actual consumption may require testing and replacing numerous consumption meters. Estimating theft requires a program to find illegal connections. In other words, it is often not possible to estimate NRW and its major components precisely without implementing many of the activities of an NRW reduction program.

5.4. Confirm Whether a PBC Is Suitable for Reducing NRW

If reducing NRW is desirable, the next question is whether a PBC is a good way to do it. Performance-based contracts often work well because they bring in specialized expertise and financial incentives that motivate performance. Whether or not using a PBC is a good idea depends on:

- The urgency and value of reducing NRW
- The capacity and maturity of the utility
- Stakeholders' views and interests

Table 5.2 lists indicators that can help determine if a PBC is a good choice. A checkmark in the "High" column indicates that a PBC would be preferable to a conventional option if the utility scores high on the indicator. For instance, if the urgency and value of reducing NRW is high, it is an argument in favor of PBCs, given their proven ability to mobilize skills quickly and get results through strong accountability (Wyatt, Richkus, and Sy 2016). A checkmark in the "Low" column indicates that a PBC would be preferable to a conventional option if the utility scores low on the indicator.

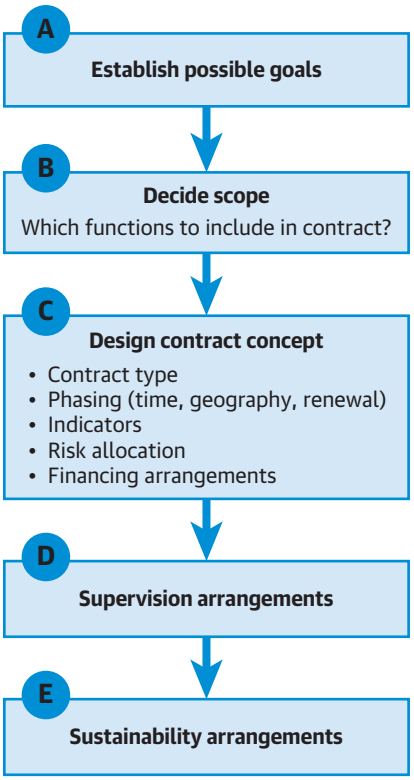
TABLE 5.2: PBC versus Conventional NRW Reduction Program

	Indicators	High	Low
NRW	Urgency of reducing NRW	✓	
	Value of reducing NRW	✓	
Utility	Capacity of the utility to manage complex new endeavors		✓
	Level of expertise in the utility on NRW reduction		✓
	Strength of incentives for good performance among utility managers and staff		✓
	Flexibility of expanding and contracting workforce to engage in NRW reduction activities		✓
Stakeholders	Willingness of stakeholders to engage private companies to carry out specific functions	✓	
	Willingness of utility staff to cooperate with a specialized contractor	✓	
	Ministry of Finance willingness to commit funds to the utility to manage		✓
	Water regulator's confidence in utility's ability to reduce NRW		✓
	Likelihood that skilled NRW reduction contractors will want to work in this location	✓	
	Successful experience in country with outsourcing, PBCs and other public-private partnership arrangements in the water sector or other sectors	✓	

5.5. Develop the NRW-PBC Project Concept

If a PBC is identified as a good approach, the next step is to develop a concept for the contract. Developing an NRW-PBC concept requires expert judgment, consultation, and adaptation of international precedents to local circumstances. While each case is unique, a useful approach can be to determine possible goals, the scope, and then the contract concept, supervision arrangements, and sustainability arrangements, as shown in Figure 5.1.

FIGURE 5.1: Steps in Developing NRW-PBC Concept



A. Establish possible goals

NRW reduction is not an end to itself. Rather, it is a means to achieve goals such as reduced cost, increased revenue, or improved service. Possible goals and how NRW reduction can help a utility achieve them were listed in Table 5.1.

In many cases, a utility will wish to implement complementary initiatives alongside an NRW-PBC, such as:

- **Improving collections**—If collection rates are low, many bills are not being paid. Adding measures to improve collections can help the utility improve its financial performance. Table B.4 provides examples of NRW-PBCs with complementary initiatives for improving collections.
- **Expanding production**—In many locations, a mix of expanding production and reducing physical losses will be the optimal way to provide 24/7 service and expand access. In this case, a loss reduction contract should be harmonized with investment to expand production. One option is to combine loss reduction and production expansion into a single contract. Advantages of doing this include reducing transaction costs, and making coordination between the two initiatives easier. An important disadvantage is that contactors that are good at production expansion may not necessarily be good at NRW reduction, and vice versa.
- **Universal metering**—If unmetered customers are charged flat monthly rates for water consumption, they may well consume more water than they would if they were charged volumetric rates. Universal metering and other demand control initiatives can help utilities improve financial performance and reliability of supply.

What goals the NRW-PBC should achieve, and if and how complementary initiatives should be pursued, should be determined in this stage.

B. Decide functional scope

The functional scope of the contract refers to the functions for which the contractor will be given responsibility. The desired functional scope will depend on the objectives of the program, the ease of contracting out any given function, and the synergies between functions. To be clear about functional scope, it may be useful to fill out a table like Table 5.3.

Instructions: Place a ✓ in each column as appropriate to indicate whether a function will be included in the contract, or be done by the utility, or not addressed at all.

TABLE 5.3: Functional Scope Checklist

Function	To be done by contractor	To be done by utility	Not included in project
Reduce Physical Losses			
Reduce Commercial Losses			
Increase Supply Continuity			
Increase Collection			
Increase Energy Efficiency			
Expand Production			

Note: A description of specific responsibilities or rows disaggregating the functions further should be added when appropriate. See Appendix B.8.4.

C. Choose contract type

Many types of NRW-PBCs are possible, each with different risk allocations and different information requirements. After objectives and scope have been decided, choosing the type of contract is the next task. Here, there can be a tradeoff between transferring risk and moving quickly.

These contract types, their advantages and disadvantages, and when to use them are described in Appendix B. Appendix B also provides sample term sheets to assist in developing the key technical and commercial terms of various types of NRW reduction contracts.

D. Develop supervision strategy

A strategy for effectively supervising the contractor to ensure the contractor meets performance targets and quality standards should be outlined. Whether the utility will need support for contract supervision should be determined. For experienced utilities or simple NRW-PBCs, an oversight contractor may not be needed.

Chapter 10 describes supervision arrangements (and sustainability arrangements) in greater detail. A Standard TOR for PBC Contract Oversight Assistance is included in Appendix C.4.

E. Include sustainability arrangements

The concept should include mechanisms to promote the sustainability of the NRW reductions achieved by the PBC. Options include requiring the contractor to train utility staff on how to use NRW management equipment or tools, and transferring said tools to the utility.

5.6. Key Decisions and Principal Criteria

Table 5.4 provides a checklist of the key decisions to be made during the Initial Assessment, and the principal criteria and analyses that should be used to make those decisions.

TABLE 5.4: Key Decisions Checklist

Key Decisions	Principal Criteria and Analyses
Is NRW reduction needed?	• Service benefits • Financial benefits • Societal benefits • Project Financial internal rate of return (IRR) compared to new source development and/or other interventions (approximate)
Is an NRW-PBC suitable in this situation?	• The urgency and value of reducing NRW • The capacity and maturity of the utility • Stakeholders' views and interests.
Is the quantity and quality of data and level of uncertainty in the Project Concept sufficient to proceed to detailed NRW reduction Planning, or is a Field Assessment needed?	• Specific data fields are needed to decide on the concept, and the methods for gathering such data • Alternatively, pursue a contract type that is robust to a lack of information

Chapter 6 Field Assessment Phase (Optional)

The purpose of the **Field Assessment** is to fill any information gaps identified in the Initial Assessment that prevented a decision being made on whether an NRW-PBC is a good idea, or what the project concept should be. After the missing information is collected, the steps from the Initial Assessment should be repeated.

The Field Assessment will typically be carried out over a period of 3 months to 18 months depending on the scope of NRW reduction, and the number of customer connections. A guide to the expected duration of the Field Assessment is provided in Table 6.1.

Appendix C.2 provides a standard TOR for a Field Assessment. The Field Assessment will usually require the purchase of measurement equipment and execution of minor civil works, such as installation of boundary valves, and small network reconfigurations for temporary DMAs. Such items can be built into the cost of the Field Assessment, as explained in more detail in the TOR.

To collect new data, "Early Start" activities should be carried out. Early Start activities not only improve data quality but also allow the utility to get started on NRW reduction. This is because tasks that would otherwise be performed by the contractor are carried out before the contractor is hired.

The information gaps identified in the Initial Assessment should determine which Early Start activities are carried out. Examples include:

- Updating/verifying network diagrams, specifications and condition data, customer databases, and customer meter data;
- Developing or updating geographical information systems for infrastructure and customer information;
- Calibrating or replacing bulk meters and customer meters;
- Conducting field surveys to identify illegal connections (perhaps just in selected areas) and measuring use at unmetered connections;
- Compiling and analyzing burst and leak data, including burst and leak type, flow rate and duration, by location or zone;
- Conducting detailed zone measurements of continuity, pressure, night flow, and other leakage parameters (such as N1) for use in conjunction with the real loss component analysis tool; such data could be compiled using temporary DMAs if network configuration allows zone isolation;

TABLE 6.1: Guide to the Expected Duration of Field Assessment

Functional Scope for Improved Data Quality	150,000-300,000 Connections	50,000-150,000 Connections	10,000-50,000 Connections
Commercial Losses	8–10 months	6–8 months	3–4 months
Physical Losses	8–10 months	6–8 months	3–4 months
Both Losses	8–18 months	6–14 months	3–7 months

- Upgrading/installing automated operational data systems (bulk metering, reservoir levels, distributed flow, and pressure measurement with telemetry connection to a control center), if applicable;
- Where it appears that heavy sectorization will be a part of the NRW-PBC, an Early Start activity here could be to develop or update a hydraulic model;
- Improving NRW practice information systems such as work order management, which contribute to leak and burst rate analysis, estimation of rate of rise, and so on.

After the missing data is collected, the steps from the Initial Assessment should be carried out, namely: confirm if NRW reduction is needed (Chapter 5.2), confirm if a NRW-PBC is suitable for reducing NRW (Chapter 5.4), and develop the NRW-PBC project concept (Chapter 5.5).

The key decisions to make in the Field Assessment Phase are the same as in the Initial Assessment Phase (see Table 5.4).

Chapter 7 NRW Reduction Strategy Phase

The **NRW reduction strategy** comprises three steps: develop indicative strategy for NRW reduction, assess economic and financial viability, and consult stakeholders.

The time spent on this phase depends on the contract type. For a DBOM, this phase requires the construction of complete DMA plans, estimating the cost of constructing DMAs and of physical loss reduction, and creating an accurate water balance. This would take about 5.5 months, as shown in Figure 7.1.

For contracts with lower information requirements, time spent can be considerably reduced. For instance, for the Incentivized Program Manager contract, little additional technical analysis will be required at this stage, as the program manager is expected to collect missing data and plan the approach once hired.

A sample TOR for a consultant to advise on the NRW reduction strategy, as well as PBC design and procurement (as described in Chapter 8 and Chapter 9), is attached in Appendix C.3. The same consultant should advise on all three phases because the insights that come from developing the NRW reduction strategy are essential to the design of the contract and the procurement.

7.1. Develop Indicative Strategy for NRW Reduction

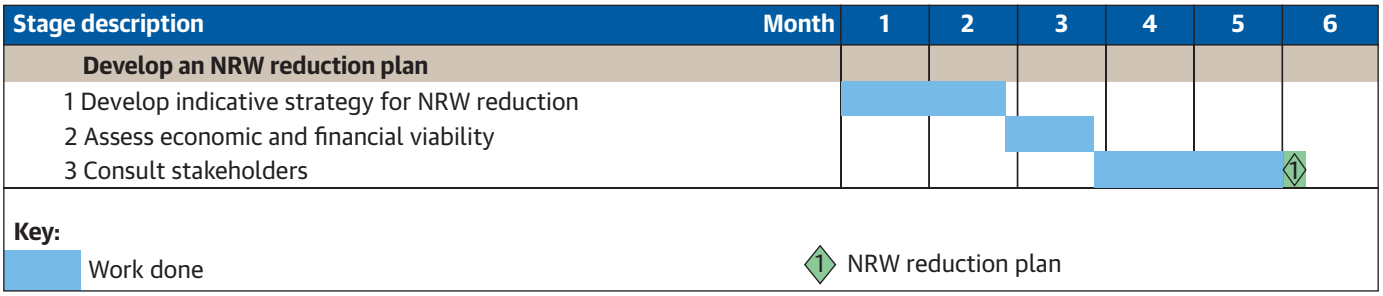
To develop an NRW reduction strategy, the following information may be required:

- Reports from Initial Assessment and Field Assessment (if applicable)
- Any strategic plans for the utility or development master plans for the locality
- Capital improvement and expansion plans, including investment projects under way and their financiers
- Government financial support to the utility, past and planned

This strategy may include the following activities:

- Recommendations on changes in network configuration, sectorization, network operating practices, information systems, and analytic monitoring approaches

FIGURE 7.1: Detailed Timeline for NRW Reduction Strategy for DBOM Contract



BOX 7.1: GOING FASTER—TECHNICAL PLANNING

If the DBOM Progressive Roll-Out contract is selected, the technical work could be limited to an indicative sketch of DMAs to be developed, along with indicative costs for DMA construction and leak reduction, and physical loss reductions.

If the Competitive Discovery approach is selected, the technical work could be limited to identifying a few areas suitable for the initial pilots. These would be areas close to the distribution input that can be easily isolated and that are broadly representative of the city.

In the case of a Self-Optimizing 24/7 contract, very little technical planning is needed as the contract gives the contractor the incentive to plan optimally. Similarly, for an Incentivized Program Manager contract, the program manager is expected to collect missing data and plan the approach once hired. Therefore, the technical analysis could be taken directly from the Initial Assessment Report.

Guidance on Contract Type (Appendix B) can be referenced for details.

- Recommendations on the best measures to reduce commercial losses. Options to consider include fixing, replacing, or installing meters; introducing electronic systems to reduce of data handling and billing errors data; or a survey of legal connections to understand the number of people served per connection.
- Recommendations on the best measures to reduce physical losses. Options to consider include network pressure management, replacement of service connections, fixing leaks, improving the speed and quality of repairs, rehabilitation or replacement of mains, or the use of DMAs to monitor leakage levels on an ongoing basis.
- The selection of a zone-based approach in the case of intermittent supply. Under these circumstances, the approach may be to work zone by zone, reducing physical and commercial losses, and restoring 24/7 service. Rehabilitated zones would be "ring-fenced," and the contractor would move to adjacent zones.
- The timeline, impact, and performance indicators for the project.

BOX 7.2: GOING FASTER—ECONOMIC AND FINANCIAL ANALYSIS

It is not necessary to calculate the exact economic benefit or the exact financial impact. Rather, what is needed is to show that the economic benefit is above a certain threshold and that the project is financially viable.

Because NRW reduction projects are often highly economically beneficial, project will likely yield an economic benefit above the threshold even if very conservative estimates are used. This means that estimates can be based on information with a wide margin of error, such as international benchmarks, greatly reducing the data collection needed.

A similar approach can be taken for the financial analysis. Using conservative assumptions, if the project yields an increase in operating cash flow that has a present value greater than the capital cost of the program, then the project is financially viable. Provided the contract type allows the costs of the program to be capped and financing for that amount has been identified, the project may be considered financeable.

7.2. Assess Economic and Financial Viability

The indicative strategy for NRW reduction should be assessed if it is a good use of public resources and if it is able to provide good commercial returns. The strategy can be assessed using economic cost-benefit analysis and financial analysis. Where a thorough justification is needed, the analyses should be done for the following three scenarios:

- NRW-PBC
- Conventional NRW reduction program
- No NRW reduction program (this scenario may include other measures to achieve the goal, such as by increasing water supply)

The analyses should consider the capacity of the water utility to change its tariff structure and the capacity of the government to provide public finance.

7.3. Consult Stakeholders

The utility, key public sector decision makers, and other stakeholders should consult with each other to achieve consensus on the indicative strategy and adjust as needed. An illustrative outline for a summary report that could be produced at this stage is provided in Appendix D.4.

7.4. Key Decisions and Principal Criteria

Table 7.1 provides a checklist of the key decisions to be made during the NRW reduction strategy phase and the principal criteria that should be used to make those decisions.

TABLE 7.1: Key Decisions Checklist

Key Decisions	Principal Criteria
1. Which measures to reduce commercial losses are most effective and cost efficient in this situation?	• Level and value of commercial losses • Cost and results from different interventions to reduce commercial losses
2. Which measures to reduce physical losses are most effective and cost efficient in this situation?	• Level and value of physical losses • Cost and results from different interventions to reduce physical losses
3. How should the project be staged to deal with intermittent supply and zone performance?	• Information on continuity of supply, water supply availability, pressures, and network condition by zone
4. Decision to proceed with an NRW-PBC	• Results of an integrated optimal NRW Program • Economic viability • Financial comparison of the NRW-PBC to a no-project option and to a conventional NRW program option

Chapter 8 PBC Design Phase

The purpose of the **PBC design** phase is to design a PBC that will incentivize the contractor to reduce NRW efficiently and effectively. A business case should be prepared to support this design so decision-makers can be confident in approving the project.

The PBC design phase comprises four stages: finalize NRW-PBC project concept, develop indicative contract design, conduct market sounding, and assess feasibility of indicative contract design. The PBC design phase has three outputs: the final contract design, the business case, and a financial model containing the assumptions and calculations that support the business case.

The design of a large DBOM contract would take about 4.5 months, as shown in Figure 8.1. If other contract types are chosen, the period for contract preparation will be shorter. For example, an Incentivized Program Manager contract might take just 2 months to develop. The TOR for a consultant to advise on PBC design (along with the NRW reduction strategy and PBC procurement) is included in Appendix C.3.

8.1. Finalize NRW-PBC Project Concept

At the start of this phase, the fundamental parameters of the contract should be finalized, including:

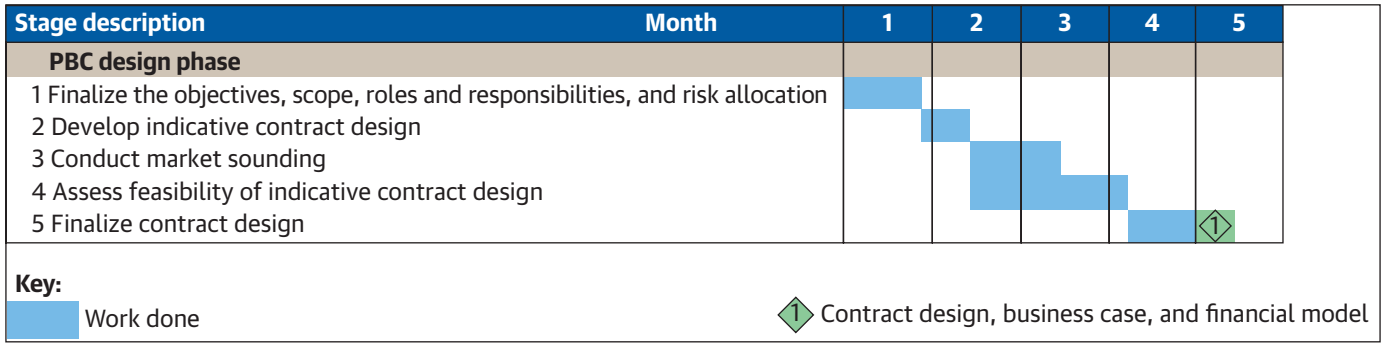
- The **objectives and scope** of the contract based on the proposed NRW reduction strategy
- The **roles and responsibilities** of the PBC contractor, the utility, and the oversight contractor (see Chapter 10) as well as the roles of any national agencies
- The **allocation of risk** under the contract and the responsibilities of the utility and the contractor

8.2. Develop Indicative Contract Design

The indicative contract design should specify:

- Key performance indicators (KPIs) and targets

FIGURE 8.1: Detailed Timeline for PBC Design of DBOM Contract



- Methods for measuring performance on the KPIs
- Provisions and process for adjusting baselines or targets considering new information or cases of force majeure
- Payment mechanisms
- Scope of work, including the diagnostic/planning phase (if any), the reduction phase, and the maintenance phase
- Mechanisms to ensure that NRW reductions are sustained after the contract ends. These may include training and transfer of systems

A good approach is to consider several possible designs and evaluate them against each other, comparing the advantages and disadvantages of each.

8.3. Conduct Market Sounding

The purpose of market sounding is to ensure that firms are interested in the opportunity and to learn the type of contract that will attract competitive bids. The activity consists of contacting firms—both experienced international operators and local firms—about the opportunity.

The channel of communication can be an online survey or a telephone interview. Firms would be asked questions about their level of interest in the transaction and factors that would make them likely to bid. The indicative contract design should be amended based on the results of the market sounding.

8.4. Assess Feasibility of Indicative Contract Design

Once an indicative contract design has been developed, the feasibility of the design should be assessed as follows:

- Confirm availability of financing from sources including governments, IFIs, and commercial banks based on discussions with the potential financiers
- Prepare a business case to demonstrate that the proposed NRW-PBC design is feasible, effective, better than alternatives, and appealing to bidders (an outline business case is provided in Appendix D.5)
- Prepare a financial model to support the business case. The model should include clearly stated assumptions and forecasts of costs and revenues
- Conduct legal and regulatory due diligence to ensure that the proposed contact complies with legal requirements and identify approvals needed
- Conduct environmental, safety, and social due diligence to assess impact and ensure compliance with standards

8.5. Key Decisions and Principal Criteria

Table 8.1 provides a checklist on the key decisions to be made during the PBC design phase and the principal criteria and analyses that should be used to make those decisions.

TABLE 8.1: Key Decisions Checklist

Key Decisions	Principal Criteria / Analyses
1. Is the NRW-PBC design developed in this phase feasible, effective, and cost-efficient?	All stakeholders review and assess the Final Transaction Design and Business Case Report, determining if it: • Has a rational allocation of responsibilities • Has appropriate objectives, targets, and incentives • Is effective and cost efficient compared to alternatives • Has manageable risks • Complies with regulations • Is of interest to potential bidders.
2. Do key stakeholders agree that the NRW-PBC should proceed?	Stakeholders agree to proceed if: • The Contract Design meets the criteria directly above • They are willing to take on the roles proposed for them in the contract design.

Chapter 9 Procurement Phase

The purpose of the **Procurement** phase is to select a suitable contractor for an NRW-PBC. The selection process should be competitive, transparent, and provide best value. This phase comprises four stages:

- Generate market interest in the transaction
- Develop request for qualifications (RFQ) and prequalify Proponents
- Develop request for proposal (RFP) and other documents, run tender, and evaluate proposals
- Reach closure on the transaction

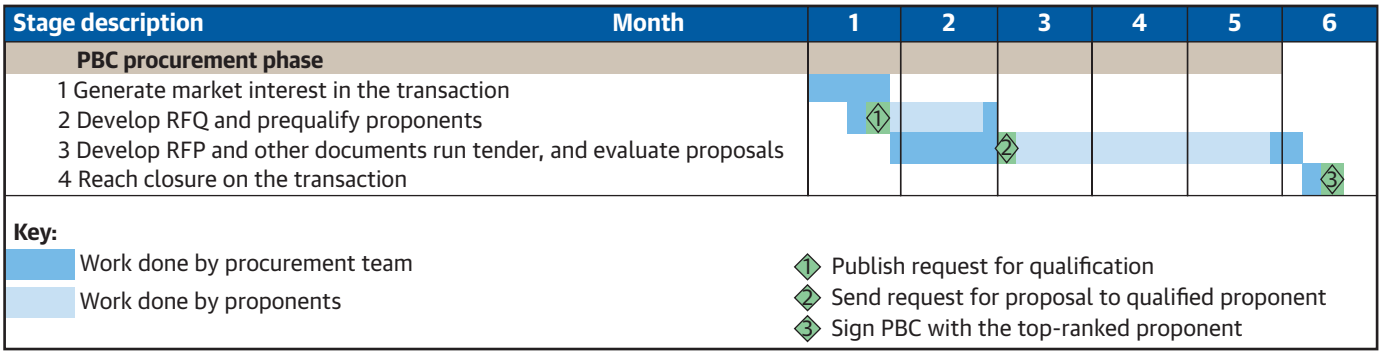
The procurement of a large DBOM contract would take about 6 months, as shown in Figure 9.1. Other types of contracts could be procured more quickly. For example, an Incentivized Program Manager contract could be procured in 4 months because there is less information for both the Proponents and for the procurement entity to review. Similarly, a Cost-Plus contract with competitive discovery approach could be procured in 3 months if, instead of prequalification, proponents were required to submit their qualifications along with their bids.

A sample TOR for a consultant to advise on NRW-PBC procurement (along with the NRW reduction strategy and PBC design) is attached in Appendix C.3.

9.1. Generate Market Interest in the Transaction

The aim here is to make sure that qualified contractors are motivated to compete for the contract. To do this, key information about the opportunity (type and size) must be communicated to prospective proponents. Prospective proponents to contact may include both international specialist operators and local firms. Channels of communication may include national papers, trade press, industry journals, and direct communications with firms.

FIGURE 9.1: Detailed Timeline for Procurement of DBOM Contract



9.2. Develop Request for Qualifications and Prequalify Proponents

The aim of this stage is to prequalify the firms or consortia that have the technical and financial capacity required to perform the contract successfully. This can be done by issuing a RFQ.

Any firms or consortia that meet the prequalification criteria set out in the RFQ would be prequalified. Generally, it will be desirable to include criteria covering the following topics:

- **Previous experience**—For example, proponents may need to show they have implemented at least two similar contracts that have led to measurable NRW reduction. Client references may also be requested.
- **Skilled personnel**—For example, proponents may need to propose specific staff members who have implemented similar contracts and who have the appropriate qualifications and years of experience for their proposed roles.
- **Financial capacity**—For some contract types, like a DBOM contract, proponents may need to demonstrate that they can finance a substantial capital works program. However, for other types of contracts, such as an Incentivized Program Manager contract, limited financial capacity would be required.

The RFQ should also include an overview of the opportunity, an overview of the RFQ process and timelines, and detailed instructions to proponents.

After the RFQ has been issued and submissions have been received, the firms that meet the qualification criteria are prequalified and informed accordingly.

9.3. Develop Request for Proposal (RFP) Package, Run Tender, and Evaluate Proposals

The aim of this stage is to select a suitable contractor for the NRW-PBC. The RFP package should be issued to the pre-qualified firms, inviting them to participate in a competitive tender for the opportunity to win the contract. The RFP package should set out the project structure, requirements, and the details of the tender process. Documents in the RFP package may include:

- An information memorandum describing the project objectives, functional and geographic scope, indicators, targets, minimum scope of work to be undertaken, phases, duration, and cost estimate
- A draft NRW-PBC that reflects the final PBC design from the previous phase
- The bid factor (see Table B.1 for how the winning bidder should be selected according to different contract types)
- Evaluation criteria
- Copies of any permits or approvals obtained for the project
- Technical and financial information on the site
- Detailed bid rules and instructions

- A timetable for the tender
- Bid bond requirements (if any)
- Stipulations to protect all parties from liability

After the RFP is sent out, time should be allocated for responding to inquiries from proponents and hosting a proponents' conference. Once the submissions have been received, the technical and financial proposals should be evaluated within the framework of the evaluation criteria outlined in the RFP. Based on the criteria, the utility (with other relevant decision makers) should decide which proposal to accept.

9.4. Reach Closure on the Transaction

To reach closure on the transaction, the utility should negotiate with the top-ranked proponent to sign the contract. If the financing structure includes private finance, financial close must also be reached.

It is generally best practice to leave as few unresolved details as possible to negotiations. In negotiations, the competitive pressure on the contractor is reduced, and the contractor may push to reduce its risk allocation. To mitigate this, the following approaches may be useful:

- Work with proponents before proposals are due to ensure that little or no changes to the contract will be needed during negotiations.
- Specify that proponents must indicate in their proposals a willingness to sign the contract without change. Alternatively, specify that proposed changes to the contract must be included in the proposal, and explain that any changes that lower the value for money of the NRW-PBC will result in a lower evaluated score.
- Run competitive negotiations with two proponents. Arrive at a contract that is acceptable to both proponents and the public authority. Then ask both proponents to make their Best and Final Offers (BAFO) on the negotiated contract, and select the proponent with the better BAFO.
- If private finance is involved, ask the financier(s) to be involved in the negotiations. Otherwise, there is a risk that after signing the contract (commercial close) the financier(s) will demand more changes before agreeing to release the funds (financial close).

If a consultant has been engaged to advise the utility, assistance should continue through the start of the contract. The consultant can help the utility manage communications with the contractor and stakeholders as well as to help all parties understand their obligations per the contract.

9.5. Key Decisions and Principal Criteria

Table 9.1 provides a checklist on the key decisions to be made during the procurement phase, and the principal criteria that should be used to make those decisions.

TABLE 9.1: Key Decisions Checklist

Key Decisions	Principal Criteria
1. Which firms should be selected in the qualification process?	• Previous experience • Skilled personnel • Financial capacity
2. What level of emphasis should be placed on different proposal evaluation criteria?	• Corporate technical experience on projects of similar scope and scale • Personnel proposed • Adherence of the proposed plan of action to the NRW reduction plan • Innovation in the methodology • Familiarity with NRW in the country • Performance references • Cost per unit of NRW reduction and total cost • Weighting of technical and financial parameters in the selection process
3. How should the PBC contractor be selected?	• Criteria as stated in the RFP

Chapter 10 Implementation and Oversight Phase

Implementation and oversight starts when the NRW-PBC is signed and the contractor begins work. During this phase, it is in the utility's interest to ensure that NRW is reduced according to plan and that NRW reduction is sustained after the contract ends.

Many utilities should outsource these oversight functions to a contractor who would monitor compliance of the NRW-PBC contract with the terms of the NRW-PBC and provide advisory support. A standard TOR for PBC Oversight Assistance is included in Appendix C.4.

For experienced utilities or simple NRW-PBCs an oversight contractor may not be needed.

10.1. Ensure NRW Reduction According to PBC

The oversight contractor would carry out the following activities:

- **Monitor contract compliance**—Monitor the compliance of the NRW-PBC contractor and the utility with the terms of the NRW-PBC.
- **Assess achievement of targets**—Review reports and conduct inspections or verifications to certify that specific targets have (or have not) been met and recommend remedial measures.
- **Provide an independent review of proposed technical adjustments to NRW-PBC terms**—Perform an independent evaluation of any proposed adjustment or assist in adjustments to contract technical terms such as baseline values, NRW targets, physical loss targets, commercial loss targets, average pressure, or continuity in project zones.
- **Provide advisory services**—Advise the utility and consultant in cases where support is critical to achieving the desired outcome of the NRW-PBC. These services could range from technical advice on a measurement issue to mediating a dispute between the utility and the contractor.

10.2. Sustain NRW Reduction

Several options for sustaining the benefits of the PBC beyond the contract term are possible, namely:

- **Follow-on contract**—Another PBC could be competitively tendered for extended NRW maintenance or further reduction. This option may make sense if the utility feels that it does not yet have the capacity to manage NRW itself and NRW is still significantly above long-term targets.
- **Full transfer**—The PBC contractor would transfer full responsibility for NRW management back to the utility. The PBC contractor's activities may include capacity building of utility staff and management and transferring NRW reduction tools and systems to the utility.

The utility would be responsible for ensuring that its staff are appropriately trained to use the tools and systems transferred over by the PBC contractor

- **Gradual transfer**—The utility would initially take back some NRW management functions while continuing to have a PBC contractor manage other functions. The utility may gradually take on more functions as it further develops its capacity and improves its financial condition. Which functions to keep outsourced and which to transfer to the utility may be determined by geographic area or by the complexity of the activities.

The oversight contractor would help by advising on how to structure and carry out a plan to sustain NRW reduction after the PBC has ended. The oversight contractor would supervise the transitioning and training activities and monitor the effectiveness of the transition and sustainability efforts.

10.3. Key Decisions and Principal Criteria

Table 10.1 provides a checklist on the key monitoring parameters during implementation and the methods used to achieve these monitoring tasks.

TABLE 10.1: Key Monitoring Checklist

Key Decisions	Principal Criteria
1. Is the PBC contractor/water utility complying with the terms of the contract, especially in the work program proposed?	• Activity reports • Inspections/verifications on activities
2. Is progress on project targets on track, and if not, what remedial measures are needed?	• Verify measurements, calculations, and analyses on contractor reports on progress toward targets
3. Are any requests reasonable?	• Verify key assumptions/assertions that are the basis of the requests • Assess based on good engineering practice
4. How should NRW reduction be sustained?	• Assess competencies of the utility to absorb NRW management responsibilities • Assess existing NRW level and value of further reduction.

Appendix A Glossary and Related Diagrams

Term	Definition
Authorized Consumption*	The volume of metered and/or unmetered water taken by registered customers, the water supplier, and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. It also includes water exported across operational boundaries. Authorized consumption may include: Firefighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, and in some cases, schools, mosques, etc. These may be billed or unbilled, metered or unmetered, per local practice. Authorized consumption includes leakage and waste by registered customers that are unmetered. See Table A.1 for a diagram of the water balance components.
Bill of Quantities (BOQ)	A document used in tendering in the construction industry in which, when complete, tabulates the quantities and unit costs of many specific materials, parts, and labor rates for different categories of personnel. A sample BOQ is provided in Table B.8.
BOQ-Basis	As used in this manual, refers to a procurement and contracting approach in which: – The RFP specifies an indicative BOQ in which the types of units required, and the indicative numbers of each unit, is specified, but the unit costs are left blank. – Each bidder fills in the unit rates it would charge, and presents its expected cost of implementing the contract as the indicative quantities of each unit as specified in the RFP, multiplied by the unit rates proposed by the bidder. – The winning bidder is free to adjust the actual quantities of the items used, within set parameters and according to set procedures, and the final price is derived from the actual quantities of each item, times the bid price of each item.
Billed Authorized Consumption	Those components of authorized consumption which are billed and produce revenue. The Billed Authorized Consumption includes billed metered consumption plus billed unmetered consumption. See Table A.1 for a diagram of the water balance components.
Collection Efficiency	The percentage of the total amount billed that is collected. That is, the amount collected divided by the amount billed expressed as a percentage.
Commercial Losses	Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). Commercial losses are also known as "apparent losses." See Table A.1 for a diagram of the water balance components.
Component Analysis of Losses	The determination and quantification of the components of the water balance.
Connections	The fixtures, joints and pipe connecting from the main to the measurement point or the customer curb stop, or where several registered customers share a physical hookup. The number of service connections variable is required for the calculation of several performance indicators.
Continuity of Service	The period of uninterrupted water distribution to customers divided by the maximum possible period (24 hours per day, 365 or 366 days per year).
Contractor	As used in this manual, the party to an NRW-PBC which is responsible for reducing NRW or achieving other results required by the NRW-PBC.
Coverage	The population with access to water services (either with direct service connection or within reach of a public water point) as a percentage of the total population under the utility's service responsibility.
Customer	An individual or organization which is an authorized recipient of water services from the utility.

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table continued

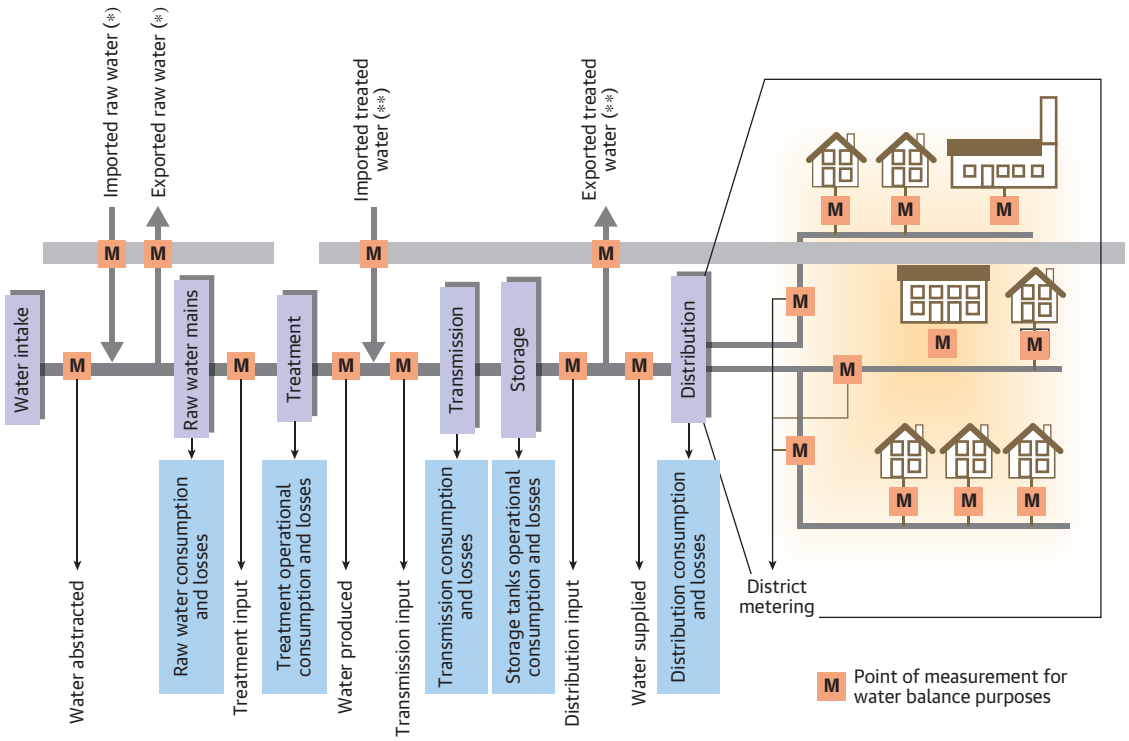
Term	Definition
Customer Metering Inaccuracies and Data Handling Errors	Commercial water losses caused by customer meter inaccuracies and data errors in the meter reading and billing system. Customer Metering Inaccuracies: Apparent water losses caused by customer meter inaccuracies, typically from meters under-registering consumption and thereby measuring a lower volume than the customer population consumed. Data handling errors: Apparent losses caused by structural or random errors existing in the customer reading and billing systems, data transfer (to the billing system), accounting or archival functions of customer consumption management.
Distribution System	The totality of the network infrastructure, comprising service reservoirs, mains, service lines, valves, and fittings of all types used to deliver water from the utility's treatment plants or points of delivery of imported treated water to the point of delivery to the customer. The distribution system also includes the treated water transmission system.
Distribution Input*	The volume of treated water input to a distribution system during the assessment period. See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
District Metered Areas (DMAs)	A defined and permanent small zone in the distribution system (usually containing 500-3,000 properties) with one or more inflow points equipped with bulk meters. DMAs facilitate rapid discovery of unreported leaks, illegal connections, for minimum night flow testing, and pressure measurements. In some cases, DMAs are also equipped with pressure reduction valves.
Field Assessment	The phase of work described in Chapter 6 of this manual. Its purpose is to gather additional data needed to allow decisions on whether to and how to proceed with an NRW-PBC.
Fixed Payments	As used in the manual, a payment to a contractor under an NRW-PBC that does not vary according to either the amount of work done, or the results achieved.
Incentive Payments	As used in the manual, a payment to a contractor under an NRW-PBC that varies according to the results achieved Incentive payments are also known as "pay for performance."
Initial Assessment	The phase of work described in Chapter 5 of this manual. Its purpose is to confirm the viability of the NRW-PBC and develop a concept for the NRW-PBC. In some cases, the data on system operations and infrastructure is lacking, creating uncertainty in the components of NRW (water balance). If this is the case, a Field Assessment may be required to gather missing information.
Intermittent Supply	When piped water, service is available to customers less than 24 hours per day for extended periods.
Leakage	Water lost from leaks, breaks, and overflows on transmission and distribution pipelines, service connections, or storage tank structures. See Table A.1 for a diagram of the water balance components.
Leakage Control	Any form of planned activities to reduce or control leakage. These include Active Leakage Control as well as other activities to reduce or control leaks such as can be through a regular planning of DMA inflow and billing checks.
Long Run	The period that, in theory, is long enough for everything to be varied, specifically the factors of production.
Long Run Marginal Cost (LRMC)	The minimum increase in total cost caused by an increase of one unit of output when all inputs (including capital) are variable. cf Marginal Cost (MC); Short Run Marginal Cost (SRMC)
Management Contract	An arrangement under which a service operator provides management services to the utility in return for a fee.
Nonrevenue Water* (NRW)	The difference between the volumes of system input and billed authorized consumption. Nonrevenue water includes not only the real losses and apparent losses, but also the unbilled authorized consumption. Equal to unbilled authorized consumption plus physical and commercial water losses. See Table A.1 for a diagram of the water balance components.

Term	Definition
NRW-PBC **(Nonrevenue Water Performance-Based Contract)**	A Performance-Based Contract which requires the reduction of NRW, or the achievement of other results which depend on controlling NRW.
Objectives	As used in this manual, the principal "big-picture" goal(s) of the NRW-PBC. These may be expressed as reducing NRW, or as improving service, or improving aspects of financial performance.
Oversight Contractor	A consultant engaged to assist a utility in monitoring and managing the PBC contractor (see chapter 10).
Performance-Based Contract (PBC)	A results-oriented contracting method that focuses on the outputs, quality, or outcomes achieved by the contractor, and ties at least a portion of a contractor's payment, contract extensions, or contract renewals to the achievement of specific, measurable results.
Performance Indicators	The technical, financial, or operational parameters by which baseline performance will be determined, and by which performance will be measured over the contract period.
Physical Losses	Actual water losses from the system and the utility's storage tanks, up to the point of customer use. In metered systems, this is the customer meter. In unmetered situations, this is the first point of use (tap) within the property. Physical losses are also known as "real losses."
Pressure Management	Control of pressure at various points in the water network. The objective is often to reduce leakage while still providing adequate pressure at the connection. Pressure Reducing Valves are often used for pressure management.
Pressure Reducing Valves	A valve which maintains a uniform fluid pressure on its outlet side if pressure on the inlet side is at or above a design pressure.
Raw Water* **(imported or exported)**	The volumes of bulk transfers of raw water across operational boundaries during the assessment period. The transfers can occur anywhere between the abstraction point and the water treatment plants.
Regulator	A specialist agency of the government responsible for controlling the service levels provided by a provider, the tariffs charged, and sometimes other aspects of a provider's performance or behavior.
Revenue Water	Those components of authorized consumption which are billed and produce revenue (also known as billed authorized consumption). Equal to billed metered consumption plus billed unmetered consumption. See Table A.1 for a diagram of the water balance components.
Risk	As used in this manual, an unpredictable variation in a parameter of importance to a stakeholder. Typically used to refer to a variation from expected values that would have negative consequences for one or more stakeholder. As an example, "earthquake risk" would refer to the probability that, contrary to expectations, an earthquake would occur at cause damage. "Interest rate risk" would refer the possibility that interest rates in the future would differ from what is currently expected.
Scope	The functions and activities to be undertaken by the contractor, together with the geographic area to which the contract applies.
Screening	The purpose of screening is to quickly and cheaply discover if a location may be suitable for an NRW-PBC. Screening should last 1 month to 2 months, depending on the ease of access to data. The recommended approach to screening is described in chapter 4.
Service Contract	A contract under which a company provides selected services apart from management (such as meter reading or billing and collection) to a utility in return for a fee.
Short Run	A period that is so short that changes cannot be made to factors of production.
Short Run Marginal Cost (SRMC)	The change in Short Run total cost as a result of a one-unit change in output in the Short Run, meaning over a period in which Capital Stock is fixed.
Supplied Water*	The distribution input minus the treated water exported. *When it is not possible to separate transmission from distribution, supplied water is the transmission input minus the treated water exported.*

Term	Definition
System Input Volume*	The volume input to water supply system during the assessment period. If the water balance calculation relates to a part of the global system, the system input volume should correspond to that part. See Table A.1 for a diagram of the water balance components.
Targets	The expected outcome value or net change in the value of a performance indicator, based on the work of the contractor (and associated parties).
Tariff	The price or prices a water provider charges its customers for water services.
Transmission Input*	The volume of treated water input to a transmission system during the assessment period. See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
Treated Water* **(imported or exported)**	The volumes of bulk transfers of treated water across operational boundaries during the assessment period. The transfers can occur anywhere downstream treatment. The volume of water (if any) that is abstracted and delivered to consumers without any treatment shall also be accounted for as treated water in the scope of the water balance. See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
Treatment Input	The volume of raw water input to treatment works during the assessment period. See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
Unauthorized Consumption	Any unsanctioned use of water. This may include illegal water withdrawal from hydrants, illegal connections, bypasses to customer meters, or meter tampering. See Table A.1 for a diagram of the water balance components.
Unbilled Authorized Consumption	Those components of authorized consumption which are legitimate but not billed and therefore do not produce revenue. Equal to unbilled metered consumption plus unbilled unmetered consumption. See Table A.1 for a diagram of the water balance components.
Utility	A formal provider of water or sanitation services through a network.
Water Abstracted*	The volume of water obtained for input to water treatment plants (or directly to the transmission and distribution systems) that was abstracted from raw water sources during the assessment period. See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
Water Balance*	A top-down audit of physical (real) losses of the whole system, starting with the total system input. A well-established water balance requires estimates of volumes of water to be made at each measurement point applicable to the system being evaluated. Where there are actual measures, data should be used. But in the absence of meters, a "best estimate" based on other related available data and sound judgement may be required. A water balance is normally computed over a 12-month period, and thus represents the annual average of all components. See Table A.1 for a diagram of the water balance components.
Water Produced*	The volume of water treated for input to water transmission lines or directly to the distribution system during the assessment period. *The volume of water that is distributed to consumers without previous treatment shall be also accounted for in water produced.* See Figure A.1 for a sample diagram of the water supply system inputs and outputs.
Water Services	Services involving the supply of water to people and organizations, the removal of wastewater from their premises, and the drainage of water from areas where it is not wanted.

*Denotes water supply system inputs and outputs as defined by Alegre and others (2017).

FIGURE A.1: Water Supply System Inputs and Outputs



(*) = Can be located anywhere between the water intake and the treatment.

(**) = Can be located anywhere downstream treatment.

Source: Alegre and others 2017.

TABLE A.1: Components of a Water Balance

A	B	C	D	E
System input volume [m^3/year]	Authorised consumption [m^3/year]	Billed authorised consumption [m^3/year]	Billed metered, consumption (including water exported) [m^3/year]	Revenue water [m^3/year]
			Billed unmetered consumption [m^3/year]	
		Unbilled authorised consumption [m^3/year]	Unbilled metered consumption [m^3/year]	Nonrevenue water [m^3/year]
			Unbilled unmerered consumption [m^3/year]	
	Water losses [m^3/year]	Apparent losses [m^3/year]	Unauthorised consumption [m^3/year]	
			Metering inaccuracies water losses [m^3/year]	
		Real losses [m^3/year]	Real losses on raw water mains and at the treatment works (if applicable) [m^3/year]	
			Leakage on transmission and/or distribution mains [m^3/year]	
			Leakage and overflows at transmission and/or distribution, storage tanks [m^3/year]	
			Leakage on *service? connections* up to the *measurement point* [m^3/year]	

Source: Alegre and others 2017.

Note: Consumption of water by registered cuscomers who pay indirectly through local or national taxation is deemed to be billed authorised consumption for the purpose of the water balance.

Appendix B Guidance on Contract Type

B.1 Guidance on Contract Type

There is no single best design for NRW-PBCs. Each contract will be implemented under unique conditions. The quality of the water utility's data, the availability of funds, the availability of water, and the objectives of the program, will vary from place to place.

To help decision-makers consider which type of contract could work well in their situation, this Appendix presents four distinct contract concepts—DBOM, 24/7 Self-Optimizing, Incentivized Program Manager, and Cost-Plus (for use in Competitive Discovery). Each has its advantages, disadvantages, and conditions in which it is likely to be suitable. The following tables provide information about the four contract types as follows:

- Table B.1 **describes** each contract in summary form, with its typical objective, how costs are paid, how baselines are set and performance incentivized, and the degree of flexibility the contractor has.
- Table B.2 **evaluates** each contract type, indicating its strengths and weaknesses on factors such as information requirements, speed, and risk transfer.
- Table B.3 **guides** decision-making by taking typical situations—defined according to the objective, information availability, and the need for speed—and indicating which contract types should be considered in each situation.

The contract types described here focus on reduction of physical losses, though they can also include reduction in commercial losses and improvements in collections. In some cases, a contract that focuses solely on commercial losses or collections is what is needed. To help in designing such contracts, Table B.5 provides references to case studies of commercially-focused PBCs.

Following the tables, there are longer descriptions of each contract type. These descriptions are in turn followed by sample term sheets intended to help practitioners specify various types of NRW-PBCs.

TABLE B.1: Contract Types—Key Features

	DBOM			24/7 Self-Optimizing	Cost-Plus (suggested with Competitive Discovery Approach)	Incentivized Program Manager (PM)	
	Full Risk Transfer	HCMC Variant	Progressive Roll-Out			Higher Risk	Lower Risk
Objective	Decrease physical losses and sometimes also commercial losses	Decrease physical losses and sometimes also commercial losses	Decrease physical losses and sometimes also commercial losses	Number of customers on continuous supply	Any combination of: decrease physical losses; increase the number of customers on continuous supply; increase revenue/ receipts	Any combination of: decrease physical losses, increase the number of customers on continuous supply, increase revenue/ receipts	
Baseline *(how is it set)*	Extensive consultant study before bid	Extensive consultant study before bid	By contractor as each DMA is created, verified by auditor	By contractor in first phase, verified by auditor	By contractor in first phase, verified by auditor	By program manager in first phase, verified by auditor	
Measurement System *(how is it created)*	Before bid, by utility/ consultant	Before bid, by utility/ consultant	By contractor as each DMA is created, verified by auditor	By contractor as each DMA is created, verified by auditor	By contractor as each DMA is created, verified by auditor	By contractor as each DMA is created, verified by auditor	
Capital Cost *(how is it paid for)*	Contractor bears the capital works costs; price paid per m^3 reduced (bid by contractor at level to cover costs)	DMA creation paid on BOQ basis; leakage control, meter installation, and illicit connection detection costs borne by contractor; fee to reach target m^3 reduction bid by contractor at level to cover costs	DMA creation paid on BOQ basis; leakage control meter installation, and illicit connection detection costs borne by contractor; fee to reach target m^3 reduction bid by contractor at level to cover costs	Partially on BOQ basis, partially through the fees paid per connection on 24/7 (the extent of incentive and risk transfer can be adjusted by changing the ratio of payments)	Client pays actual costs, verified on open book basis	Utility pays Program Manager which pays works contractors	Utility pays works contractor directly, based on competitive bid price, and certification of works by program manager
Contractors, Staff and Operating Cash *(how is it paid for)*	Cost born by contractor; fee per m^3 saved bid at level to cover these costs	Costs related to DMA construction covered through DMA BOQ; cost related to active leak control and commercial loss reduction activities covered through fee	Costs related to DMA construction covered through DMA BOQ; cost related to active leak control and commercial loss reduction activities covered through fee	Partly on a fixed fee to cover contractor's overhead, partly through the fee paid per connection on 24/7	Covered through a standard mark-up on the actual cost of works	Covered through a program management fee, which is a standard percentage of the cost of works	

Incentive *(how is it provided)*	Payment is per m^3 saved. If savings for the budget are greater than expected, contractor profits	If target level of loss reduction is not achieved, contractor is penalized per m^3 shortfall, and incentivized for exceeding target with additional payments	Payment per m^3 saved above a minimum, on rising block basis	Payment per connection on 24/7 (above a threshold) incentives performance. Penalties for use of excess water input or reduction in service levels also incentivize efficiency	Could have small incentive payments for achieving specific results; could be desire to win follow-on work	Program manager's profit depends in part on contractors delivering to specified levels and budget	Incentive payments to program manager based on achieving desired results
Flexibility for Contractor	Only minor DMA adjustments; level of active leak control; level of illegal connection detection	Only minor DMA adjustments; level of active leak control; level of illegal connection detection	Freedom to adjust DMA number and design, as well as active leak control activities and illegal connection detection activities	High, subject to meeting construction quality standards	Substantial freedom to choose approach within set budget	Substantial freedom to design and adapt a program	
Bid Factor	Lowest cost per m^3 to reach target loss reduction	Lowest cost to reach target loss reduction and for standard DMA program, bid as unit rates against BOQ	Lowest cost for standard DMA and metering program, bid as unit rates against BOQ	Minimum number of customers to be put on 24/7 before incentive payments start	Quality of contractor, methodology, and team	Maximum quality of team and methodology provided for fixed budget, or QCBS with strong quality rating	

Note: BOQ=bill of quantities; DMA=district metered area; QCBS=[TBD??].

TABLE B.2: Information, Speed, and Risk By Contract Type

	DBOM			24/7 Self-Optimizing	Cost-Plus (suggested with Competitive Discovery Approach)	Incentivized Program Manager (PM)	
	Full Risk Transfer	HCMC Variant	Progressive Roll-Out			Higher Risk	Lower Risk
Overall Information Requirements	**High**		**Moderate**	**Moderate**	**Low**	**Low**	**Low**
Information Required	Enough to cost loss reduction program to meet targets, including: Components of water balance to narrow confidence intervals Cost of constructing DMAs, and of physical and commercial loss reduction Complete plan of DMAs to be constructed and location of customers. May require GIS maps and a hydraulic model		Simple indicative maps showing number and location of DMAs; cost to construct DMAs; customers in each DMA	Bulk supply available; value of moving a customer on to 24/7; approximate costs of reducing NRW	Specification of areas in which improvement sought; rules for competitive procurement and information disclosure	Specification of areas in which improvement sought; rules for competitive procurement and information disclosure; indicative scope of work	
Overall Speed[1]	**Slow**		**Medium**	**Medium**	**Fast**	**Medium**	**Fast**
Time Required to Develop Information[2]	12 months		3 months	6 months	2 months	2 months	1 month
Time to Draft Contract and RFP	6 months		3 months	3 months	1 month	3 months	1 month
Prequalification-Time Required[3]	3 months		3 months	3 months	3 months	3 months	2 months
Bidding-Time Required[4]	6 months		4 months	4 months	3 months	3 months	2 months

	DBOM			24/7 Self-Optimizing	Cost-Plus (suggested with Competitive Discovery Approach)	Incentivized Program Manager (PM)	
	Full Risk Transfer	HCMC Variant	Progressive Roll-Out			Higher Risk	Lower Risk
Flexibility to Adjust *(during contract)*	Low (must largely follow DMA and meter installation instruction plan)		Moderate (may vary DMA size and design)	High	High	Moderate	High
Riskiness *(for contractor)*	Maximum	High	High	Moderate to High (depends on % performance pay)	Low	Moderate	Low
Risk Transfer *(for utility)*	Maximum	High	Moderate	Variable	Zero	Moderate	Zero

Note: DBOM=Design-Build-Operate-Maintain; DMA=district metered area; RFP=request for proposal.

1. Procurement stages can be done partly in parallel, so that the award will be less than the sum of time for all stages. Actual times will depend on the size of the network and complexity of local conditions, so timelines need to be planned for each project individually. The important information from this table is the relative speed for each contract type, as these relativities should hold better than the absolute estimates.
2. Indicative, assuming Initial Assessment has been done.
3. From call for prequalification to decision.
4. From RFP issue to contract signature.

TABLE B.3: Which Contract Type to Use

Goal	Information Availability	Importance of Speed	Contract Type (likely to be suitable)	Comment
Reduce Physical Losses to:	High	Low	DBOM Contract—Full Risk Transfer variant	Gives optimal risk transfer when time and information are not constraints
• Ensure enough water is available to satisfy expected demand growth • Increase resilience and security of supply in the face of climate change and other risks	Low	High	Competitive Discovery using cost-plus contract	The competitive discovery approach (Box B.1) allows for quick contract implementation, while providing information for contracts with stronger incentive properties to be procured in a second phase
			DBOM Contract—Progressive Roll-Out variant	Rolling out the DBOM contract DMA by DMA may require more information up-front than the competitive discovery approach, but compared to competitive discovery, may give stronger incentives and avoid the complexity of a two-phase procurement
			Incentivized Program Manager Contract	Fast and flexible option, but with limited risk transfer
Improve Service to: • Provide 24/7 service to more customers • Expand water service to more customers • Achieve multiple goals	Moderate to High	Low	24/7 Self-Optimizing Contract	Provides flexibility within the contract to trade-off complex variables such as hours of service, revenue collection, and bulk water inputs required
			Revise DBOM Contract (to focus on 24/7)	The DBOM models focus on reduction of physical losses. They could be redesigned so that targets and payments depend on number of customers on 24/7. However, this redesign would require time and high levels of skill. Also, it might not be suitable for projects within multiple objectives
	Low	High	Incentivized Program Manager—Low risk	Flexible and fast contract to implement. Program managers can be incentivized to meet various desired goals, and can adjust over time to achieve them
			Competitive Discovery using cost-plus contract	An initial cost-plus phase can be quickly implemented. Phase one provides the time and information needed for development of a more complex, incentivized contract for phase two (see Box B.1)
Increase Financial Performance	—	—	Information on several contracts that have been used to increase revenue and collection is provided in Table B.3	

Note: DBOM=Design-Build-Operate-Maintain; DMA=district metered area.

Box B.1: Competitive Discovery Approach

The competitive discovery approach has two phases. In the first phase, the utility brings in three highly qualified firms to each reduce NRW in a selected part of the network. To speed up this phase, cost-plus contracts are used. In the process of getting NRW down in the selected zones, the contractors will reveal information about the level and composition of NRW, and how much it costs to reduce.

The utility uses this information to design the contracts for the second phase. These contracts may be DBOM or 24/7 Self-Optimizing contracts. The utility could offer one contract for the whole network, or divide the network into two or three zones and offer a contract for each. All three contractors from the first phase would be eligible to bid, as well as perhaps other firms.

The advantage of the competitive discovery approach is not just that NRW reduction starts faster, but that better information can be uncovered than what may be possible through traditional NRW field assessments. The logic is as follows. DBOM contracts transfer a lot of risk to the contractor, so both the contractor and the client need to know how much NRW reduction can be achieved, and how much it will cost. If these numbers are not known, the contractor may bid a price or target which it cannot reach, and lose a lot of money. Conversely, if bidders bid conservatively, the utility might end up paying much more than it really needs to for the NRW reduction.

The obvious solution might appear to be engaging consulting engineers to estimate NRW levels and costs before bidding out the contract. Indeed, this is often done. However, the consultants are often unable to estimate the data with any precision, even if they spend months trying. This is because, in many cases, the only way to find the data needed is by implementing components of the NRW program. As examples, system input is often not known because production meters are lacking—installing production meters may cost millions of dollars, and take 6 months or more, given public procurement rules. Leakage often cannot be estimated because there are no hydraulically isolated zones with metered inflows, in which night tests can be done—in other words, creating at least one DMA may be a prerequisite for estimating leakage. The value of losses due to illegal connections—and feasibility and cost of reducing those losses—cannot be assessed without finding and regularizing illegal connections on a sample basis.

In a situation where it is near-impossible to gain the data needed except by starting to implement the NRW reduction program, it makes sense to just get on with NRW reduction, rather that waste time and money on extensive fieldwork. However, contractors cannot take risk on the cost of reducing NRW by a specified amount until they have information. Therefore, a cost-plus contract is a good way to start the process.

The next challenge then becomes, "How can the utility use the information that the contractors reveal to get better value for money through stronger incentives and more

risk transfer?" This is where the second phase of the competitive discovery approach comes in.

Rather than remain with a cost-plus contract for the entire network, the utility uses the information from phase one just as it would use a traditional field assessment. With this information, consultant can help the utility prepare highly-incentivized contracts for the rest of the system. All the information from the first phase is made available to all bidders, to reduce uncertainty levels, and so encourage more aggressive bids.

TABLE B.4: Commercially-Focused PBC Case Studies

Contract Objectives	Name/Location/Date of Contract	Brief Description	Further Information/References
Increase revenues at SABESP, the water utility serving the State of Sao Paulo, Brazil	SABESP Large Meter Program, SABESP, Sao Paulo, Brazil, 2000–2003	Replacement of 28,000 large volume customer meters using five 100% performance-based contracts. SABESP revenues increased by US$72 million, with a PBC cost of US$18 million.	IDB (2004)
Reduce small customer water meter error, and increase revenues in Porto Ferreira, Brazil	Small Meter Replacement Program, Porto Ferreira, Brazil 2002–2004	Replacement of small customer meters using a performance-based contract. Utility metered volume increased 30% and revenues increased 20%.	IDB (2004)
Improve commercial management, including customer cadaster, metering and billing	Performance Based Service Contract, ONEA Burkina Faso 2001-2006	PBC Contractor Veolia conducted a program to improve commercial and financial operations, with embedded staff at ONEA. Over the 5 years, revenues increased 50%, the collections ratio improved from a minimum of 78% to 95%. Project cost about US$4.5 million over 5 years.	Marin, Fall, and Ouibiga (2010)
Increase billing and revenue collection, through improved, GIS-based customer databases and improved billing and collections operations	Micro-PSP Project, Madaba, Jordan, 2006–2009. In 2010, the project was replicated in Balqa and Karak Governorates	A PBC was developed by the Water Authority of Jordan to improve revenue in Madaba Province. The contractor was paid a fixed fee for establishing a new GIS-based customer database and billing system, and also awarded a performance fee, based on 14% of the increase in revenue collected. Project has a payback period of about 2 years.	GTZ (2009)

Contract Objectives	Name/Location/Date of Contract	Brief Description	Further Information/References
Improve all aspects of customer service including new connections, metering, billing and customer service	Customer Service PBC Contract, EAAB, Bogota, Colombia 2003–2007	Operate all aspects of customer service including establishing new connections, customer database updates, installing service lines and meters, meter reading, billing and customer service, with specific standards on time frames for different activities. Payment was based on a mix of indicators including volume of water sales, amount of commercial loss, complaints, and collections rate. Large increase in revenue achieved.	IDB (2015)
Increase revenues at SABESP, the water utility serving the State of Sao Paulo, Brazil	SABESP Large Meter Program, SABESP, Sao Paulo, Brazil, 2000–2003	Replacement of 28,000 large volume customer meters using five 100% performance-based contracts. SABESP revenues increased by US$72 million, with a PBC cost of US$18 million.	IDB (2004)
Reduce small customer water meter error, and increase revenues in Porto Ferreira, Brazil	Small Meter Replacement Program, Porto Ferreira, Brazil 2002–2004	Replacement of small customer meters using a performance-based contract. Utility metered volume increased 30% and revenues increased 20%.	IDB (2004)
Improve commercial management, including customer cadaster, metering and billing	Performance Based Service Contract, ONEA Burkina Faso 2001–2006	PBC Contractor Veolia conducted a program to improve commercial and financial operations, with embedded staff at ONEA. Over the 5 years, revenues increased 50%, the collections ratio improved from a minimum of 78% to 95%. Project cost about US$4.5 million over 5 years.	Marin, Fall, and Ouibiga (2010)
Increase billing and revenue collection, through improved, GIS-based customer databases and improved billing and collections operations	Micro-PSP Project, Madaba, Jordan, 2006–2009. In 2010, he project was replicated in Balqa and Karak Governorates	A PBC was developed by the Water Authority of Jordan to improve revenue in Madaba Province. The contractor was paid a fixed fee for establishing a new GIS-based customer database and billing system, and also awarded a performance fee, based on 14% of the increase in revenue collected. Project has a payback period of about 2 years.	GTZ (2009)

table continues next page

TABLE B.4: continued

Contract Objectives	Name/Location/Date of Contract	Brief Description	Further Information/References
Improve all aspects of customer service including new connections, metering, billing and customer service	Customer Service PBC Contract, EAAB, Bogota, Colombia 2003–2007	Operate all aspects of customer service including establishing new connections, customer database updates, installing service lines and meters, meter reading, billing and customer service, with specific standards on time frames for different activities. Payment was based on a mix of indicators including volume of water sales, amount of commercial loss, complaints, and collections rate. Large increase in revenue achieved.	IDB (2015)

Each contract concept is described further below, including:

- The contractor's responsibilities
- How contractors are paid
- How contractors are selected

Appendix B.8 contains sample terms sheets, which can be used to further develop and implement these contract concepts.

B.2 DBOM Contract—Full Risk Transfer

A DBOM contract bundles most or all components of an NRW reduction program into a single contract. Like a Design-Build-Operate-Maintain contract for a water abstraction and treatment facility, the contractor plans, designs, and carries out the loss reduction work.

B.2.1 Contractor's Responsibilities

The contractor is responsible for both managing and implementing the NRW reduction program under its own account. This will typically include the installation of DMAs and other specified works for physical and commercial loss reduction.

B.2.2 Payments

There are two options:

- The contractor is paid a set amount per m^3 saved. This amount is calculated to be sufficient to cover all the costs of the program. The contractor bids its cost for achieving a set target level of reduction, but is then paid per volume of reduction achieved.

- The utility sets a budget. The contractor bids the quantity of reduction it can achieve for the budget. Over- or under-performance against the bid quantity is paid at the average cost per m^3 implied by the bid.

B.2.3 Selection Method

Typically, contractors would first be pre-qualified, after which an RFP would be issued. The winning bid would be the one offering:

- Lowest cost to achieve target (option 1)
- Highest quantity for fixed budget (option 2)

B.3 DBOM Contract—Ho Chi Minh City

This contract is based on the one implemented in Ho Chi Minh city by Saigon Water Corporation. It differs from the full risk transfer model in that the establishment of DMAs is paid on a BOQ basis. A sample of Ho Chi Minh City's DBOM contract is available at: https://ppp.worldbank.org/public-private-partnership/library/water-performance-based-leakage reduction-contract-example-1.

B.4 DBOM—Progressive Roll-Out

The contractor establishes DMAs and instrumentation, and is paid on a BOQ basis for doing so. As each DMA is completed, baseline losses for that DMA are established. The contractor reduces physical and commercial losses, and is paid a specified monetary amount for each m^3 of loss reduction above a specified level.

B.4.1 Contractor's Responsibilities

The contractor's responsibilities in a progressive roll-out contract are divided into two main tasks.

Task 1: DMAs and Instrumentation

DMAs. The contract requires the contractor to construct DMAs across the zone. The expected number of DMAs and average number of connections per DMA are also specified in the contract. An indicative map of DMAs is provided on best expert judgement (not based on a thorough study). The contractor is free to deviate from the map where this is warranted. The contractor is paid as each DMA is completed and certified.

Instrumentation. The contractor installs any instrumentation and controls that are needed to assess performance, such as: production meters, district meters, and pressure sensors. These are installed in each DMA as it is created. Instrumentation needs are specified in the tender document, and bid on a BOQ basis. The contractor is paid for works on BOQ basis.[1]

Task 2: Control NRW

As each DMA is completed, the contract moves on to NRW control in that DMA. This consists of the following steps:

1. Establishing the NRW baseline for that DMA. Typically, this will involve:
   a. Put that DMA on 24/7 supply for period of [8] weeks
   b. Estimate total NRW and physical losses to establish baseline
   c. Certify baseline with independent expert
2. Reducing physical losses, through: burst repairs, active leak detection, fixing leaks, connection replacements, and mains replacement.
3. Reducing commercial losses (optional). If commercial functions are included in the contract, the contractor may be required to do some or all of the following: install meters, replace faulty meters, detect and regularize illegal connections, correct customer information in billing database, improve bill delivery, and collect arrears (not explicitly part of commercial losses).

B.4.2 Payments

Payment is made on a BOQ basis for Phase 1. That is, the contractor is paid an amount calculated from the units of actual work done, times the rate per unit that the contractor bid.

For Phase 2, the contractor is paid for losses reduced, at a set rate of $/m^3. The payment per unit saved should be set with reference to the long-run marginal cost of water and the likely cost of loss reduction. The amount paid per unit could be on a rising-block basis, with modest payments for NRW reductions that are easily achievable, through to larger payments as greater reductions achieved. Payment could be at different rates for physical and commercial loss reduction, if these can be differentiated. Most of the performance pay would be paid at the end of the contract, to ensure payment is only made for sustainable gains.

To achieve budget certainty, the utility could establish an overall cap on the total amount of BOQ payments and performance pay over the life of the contract. This would encourage the contractor to optimize all parts of the work—Phase 1 as well as Phase 2. This budget certainty would be especially important for utilities that are doing the project using an IFI loan, and that have no finance of their own to cover costs in excess of the loan amount.

B.4.3 Selection Method

Contractors are selected, following prequalification, based on lowest cost offered by a qualified bidder.

- Qualification Criteria—Pass/fail. Demanding criteria are set to ensure only well qualified operators can be selected
- Bid Factor—Lowest works price for assumed BOQ. The contractor bids a cost to construct a standard DMA, according to a pre-specified BOQ expected to be typical of the actual DMAs to be constructed.

B.5 Self-Optimizing 24/7 Contract

A utility may use a self-optimizing 24/7 contract where it has intermittent supply and wants to quickly increase the number of customers with continuous supply while keeping the distribution input volume constant. The contractor first installs a system that allows performance to be measured. Then, the contractor carries out the physical works and leak detection and repair needed to bring as many people as possible onto 24/7 service, within a fixed water budget and a fixed budget for works.

B.5.1 Contractor's Responsibilities

The contractor's responsibilities in a self-optimizing 24/7 contract are divided into two main phases: first installing a performance measurement system, and then increasing the number of customers on 24/7 supply.

Phase 1: Install Performance Measurement System

As the first step, the contractor must install a system that measures the number of customers on 24/7 supply for a given volume of water. Therefore, the minimum requirements for the performance measurement system would be:

- All distribution input metered
- Pressure sensors or surveys to estimate hours of service for all customers in the zone

Next, the contractor establishes a baseline for input volumes and hours of service. An independent expert would then certify this baseline as accurate.

Phase 2: Increasing Number of Customers on 24/7 supply

The operator will be free to carry out whatever works and leak reduction activities it judges are needed to increase the number of customers on 24/7 supply, subject to remaining within the total budget specified.

B.5.2 Payments

The costs of Phase 1 would be paid on a BOQ basis. Unit rates would be specified in the bidding documents. The contractor would then be paid for work done based on actual quantities times the unit rates.

During Phase 2, the contactor's payment is structured so that it optimizes results, using these three components:

- A fixed fee that covers (some fraction of) the expected cost of the contractor's management team. The riskier the situation, the higher the operator fee should be, to encourage contractors to commit their staff to the program.

- A results payment for value that is calculated as follows:

  The number of additional customers on 24/7 (above the minimum set in the contract) Incentive pay per new customer on 24/7 ($/customer)[2]

- A penalty payment that is calculated as follows:

  Excess system input volume taken (m^3) multiplied by the value of bulk water ($/$m^3$)

  Plus

  Deterioration of service for other customers (hours) multiplied by Value of deterioration ($/hour)[3]

B.5.3 Selection Method

Contractors are selected by competitive bid following prequalification:

- Qualification Criteria—Pass/fail. Demanding criteria to ensure qualified operator.
- Bid Factor—Specified minimum number of connections put on 24/7 before results-based payments start to apply.

B.6 Cost-Plus Contract (with Competitive Discovery)

The utility procures three contractors to each reduce NRW in a selected zone. This work is done largely on a cost-plus, open-book basis. The utility uses the information on cost of NRW reduction revealed through this process to design a Phase 2 contract. The Phase 2 contract may be a DBOM or 24/7 Self-Optimizing contract. One or more Phase 2 contracts are then bid out competitively.

Phase 1: Open-Book Pilots

The first phase begins after the utility selects three pilot zones. Zones should be as suitable as possible for NRW reduction, and typical of conditions elsewhere in the network. These zones could be large (for example 7,000 connections per zone); however, there is a trade-off between rapid impact and ensuring value for money (VFM). A larger zone means more rapid progress, but because in the pilot phase payment is on a cost-plus basis, the cost of improvements may be expected to be higher than in the subsequent phase.

The utility then selects three contractors, one for each zone. Each contractor is given a fixed budget and tasked to maximize a service target within the fixed budget. Service targets may be one or more of the following:

- Reduce bulk water requirement for constant service level
- Increase number of customers on 24/7 for fixed bulk water budget
- Increase revenue or collections for fixed bulk water budget

Contractor's Responsibilities

The contractor's responsibilities in a competitive discovery contract are divided into two main phases, open-book pilots and competitive offers.

The contractor will be required to design and build an adequate system for measuring performance. Typically, this would require metering all inflows to the zone and closing or metering outflows from the zone. Surveys, pressure sensors, or other systems are needed to assess progress toward a 24/7 supply target.

In other respects, the contractor would be free to design and build whatever system it considers most effective achieving the goal within the budget. As an example, one contractor could construct DMAs, while another might proceed directly to replacing all connections, while the third invests in pressure reducing valves and active leak detection and repair.

B.6.1 Payments

There are several says in which procurement could be managed. One option is, during Phase 1, the contractor discloses all costs to the utility on an open-book basis, and the contractor recovers actual costs plus a margin. This margin would be specified in the bidding documents. In addition, performance payment may be made for progress on indicators. Performance payment would start from when the operator had established a baseline, and the baseline was certified as reliable by an independent expert. Alternatively, the desire to position for success in Phase 2 might be incentive enough.

B.6.2 Selection Method

The water utility should pre-qualify six or more contractors for a panel. Then, the utility will select three contractors from the panel for the cost-plus contracts. This competitive selection will be based on quality. The quality factors considered will include: experience, team, references, and technical approach.

B.6.3 Moving to Phase 2

Once sufficient information on the cost of NRW reduction was available, the utility, assisted by a consultant, would design and bid out the Phase 2 contract. The consultant would review information emerging from the contractors, and discuss with them a suitable contract design and indicative budget. The consultant would then prepare one or more contracts covering the remainder of the network. All three operators in the city, plus other pre-qualified operators in the pool, would be invited to bid on the Phase 2 contracts.

B.7 Incentivized Program Manager Contract (Lower Risk Option)[4]

An incentivized program manager contract separates contracting for professional skills and intelligence from contracting for construction. After the utility engages a program manager (PM), the PM designs, procures the implementation of, and supervises on behalf of the utility, the required NRW reduction activity. The implementation is done by competitively selected works contractors. These separate works contracts would be signed with the utility, but designed, tendered, and supervised by the PM. The program management fee consists of: a fixed component, a percentage of capital-works costs, and an incentive payment based on level of improvement achieved for fixed capital expenditure budget.

B.7.1 Contractor's Responsibilities

The contractor's responsibilities in a performance-based program management contract are divided into three main phases: planning, procurement, and supervision.

Phase 1: Planning

The PM would provide an indicative NRW reduction plan in its proposal. This plan would be included in the contract with the water utility. After the contractor started work, the PM would optimize the plan considering the new information. Minor changes to the plan (for example, timing, budget, and types of intervention) would be at the PM's discretion. Major changes to the plan would require authorization from the water utility. The PM could justify major changes to the utility by showing how the proposed change would increase net benefits for the utility.

Phase 2: Procurement

During Phase 2, the PM would decide on the best strategy for procuring contractors to carry out NRW reduction tasks. First, the PM would group tasks into optimal procurement packages. Second, the PM would run a competitive procurement for the contracts. The procurement would follow public procurement rules, and whatever procurement standards had been agreed with the client and funders. Third, the PM would evaluate the bids, select a preferred bidder, and then either award the contract (operating as the utility's agent), or submit the contract for approval and award by the utility.

Phase 3: Supervision

During Phase 3, the PM would supervise the contractors to ensure quality. The water utility would delegate the following responsibilities to the PM: inspecting the works done, ordering work to be redone, and certifying completion of milestones for payments. The utility would pay the contractors on approval of their invoices by the PM.

B.7.2 Payment

Payment to the PM depends on Payment Terms Sheets, which describe how the contractor will be compensated for performance. Typically, the program management fee would have three components:

- A fixed component that covers management and design services
- A percent (for example, 5 to 10 percent) of capital works costs
- An incentive payment based on level of improvement achieved for a fixed capital expenditure budget

Alternatively, the incentive payments could be structured as sharing in cost savings. First, the water utility estimates the CAPEX needed for the project. It then sets this money in a capital investment "pot," which the PM uses to complete capital works. The firm is then paid

a percentage of any money left in the pot after the specified NRW reduction amount (or another target) has been met.

B.7.3 Selection Method

Under an incentivized program manager contract, program managers would first be short-listed. The PM would then be selected from among the shortlisted firms using selection based on cost and quality. Quality factors would include the bidder's relevant experience, the indicative program proposed, and skills/experience of the team members. The cost factor considered would be a fixed fee. The scoring system should weight the quality component heavily.

Alternatively, a fixed budget evaluation could be used, in which the program management fee is pre-specified, and the contract is awarded to the bidder with the highest technical score.

B.8 Sample Terms Sheet for NRW-PBCs

A Terms Sheet describes the basic terms and conditions of a proposed NRW-PBC. The sample terms sheet is divided into three main sections:

- **Roles, Responsibilities, and Authorities of the Contractor**—This part provides generalized sample terms for a DBOM contract, and for an Incentivized Program Manager Contract
- **Key Performance Indicators and Targets**—This part is designed for use with any type of contract
- **Payments**—This part is suitable for use with DBOM, 24/7 Self-Optimizing, and Incentivized Program Manager contracts

B.8.1 Roles, Responsibilities, and Authorities of the Contractor

Please note that all text in *italics* serves as instructions.

NRW reduction Activity	Type of Performance-Based Contract	
	DBOM Contract	**Incentivized Program Manager Contract**
Specific Works	The contractor shall design and implement the Specified Works and Services set out in Annex A	The contractor shall design, procure the implementation of, and supervise on behalf of the utility, the Specified Works and Services set out in Annex A
Leakage-Control Services	The contractor shall design and implement on the network a leakage control plan which may include any or all the elements in Annex B, at the discretion of the contractor	The contractor shall design, procure the implementation of, and supervise on behalf of the utility a leakage control plan which may include any or all the elements in Annex B, at the discretion of the contractor
Commercial Services	The contractor shall design and implement on the network a commercial improvement plan which may include any or all the elements in the Annex C, at the discretion of the contractor	The contractor shall design, procure the implementation of, and supervise on behalf of the utility a commercial improvement plan which may include any or all the elements in the Annex C, at the discretion of the contractor

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table continued

NRW reduction Activity	Type of Performance-Based Contract	
	DBOM Contract	**Incentivized Program Manager Contract**
Management of Utility Staff	The contractor shall manage those utility staff specified in Annex D If no staff are specified, the contract shall not manage any utility staff Whatever functions the contractor is not able to perform with utility staff, it shall perform with staff it hires itself	The contractor shall manage those utility staff specified in Annex D If no staff are specified, the contract shall not manage any utility staff Whatever functions the contractor is not able to perform with utility staff, it shall perform with staff it hires itself
Capacity Building	The contractor shall build the capacity of the utility staff by carrying out the activities specified in Annex E, to the standards there specified	*Choose one of the following options:* The contractor shall design, procure the implementation of, and supervise on behalf of the utility a capacity-building program, which will include the activities specified in Annex E, to the standards there specified The contractor shall build the capacity of the utility staff by carrying out the activities specified in Annex E, to the standards there specified
Handback	*Specify handback provisions as to quality of works done, or systems installed, if applicable*	*Not applicable*

B.8.2 Key Performance Indicators and Targets

Instructions

The key performance indicators (KPIs) are quantifiable measures that the water utility can use to gauge performance and to compare performance to targets. Performance KPIs will often be used to determine incentive payments or penalties.

Two tables with standard KPIs are provided, namely:

- Table B.5 is suitable for contracts which focus on reducing NRW, such as the DBOM contract, and some cost-plus and program management contracts
- Table B.6 is suitable for use with contracts focused on achieving 24/7 supply

Readers should choose the appropriate table for their contract type.

B.8.3 Payments

Instructions

How payment is structured will depend on whether the PBC is a DBOM, a 24/7 self-optimizing, or an incentivized program manager contract. Table B.7 lists the various types of payments that a contractor can receive. The designer should fill in numbers for those payments included within the contract design, and delete the rest.

TABLE B.5: NRW-Driven Indicators and Targets

	NRW-Driven Indicator	Unit	Target or Actual	Quarter				Comments
				Q1	Q2	Q3	Q3	
	Objectives							
2.1.1	Total NRW reduction	m^3/day	Target					*Where possible, specify commercial and physical loss reduction separately. Where that is done, total NRW reduction must be sum of two. If that is not possible, specify total NRW reduction.*
			Actual					
2.1.2	Physical loss reduction	m^3/day	Target					
			Actual					
2.1.3	Commercial loss reduction	m^3/day	Target					
			Actual					
		local currency units	Target					
			Actual					
		cash collected	Target					
			Actual					
	Constraints							
2.1.4	Average hours of service per day	hours/day	Target					
			Actual					
2.1.5	Minimum pressure across system	mWc[1]	Target					
			Actual					

1. mWc is a unit that measures pressure. It stands for "meters of water column."

TABLE B.6: Output-Driven Indicators and Targets

	Output-Driven Indicator	Unit	Target or Actual	Quarter				Comments
				Q1	Q2	Q3	Q3	
	Objectives							
2.2.1	Revenue increase	Local currency units	Target					*If operator is responsible, include collections increase, and consider not using the revenue increase, since increased revenue should flow through to increased collections.*
			Actual					
			Actual					
2.2.2	Collections increase	% change in collections rate	Target					
			Actual					
		cash collected	Target					
			Actual					
2.2.3	Number of customers with 24/7 service	Number of customers	Target					
			Actual					
	Constraints							
2.2.4	Bulk supply input	m^3/day	Target					
			Actual					
2.2.5	Minimum pressure across system	mWc	Target					
			Actual					

Note: mWc=meters of water column.

TABLE B.7: Contractor Payment Types

	Payments	DBOM Contract/24/7 Self-Optimizing Contract	Incentivized Program Manager Contract
3.1	Management fee	*Specify here any cost-based fee that is to be paid for providing a team of managers, or overhead management functions, independent of results.*	*Specify here any cost-based fee that is to be paid for providing a team of managers, or overhead management functions, independent of results.*
3.2	Performance Fee[1]	*Payments that are based on performance depend on whether the contract uses NRW-driven indicators or commercially-driven indicators.* **Objective** / **Payment per Unit** **NRW-driven indicators** Total NRW reduction — US$/m³/day reduced Physical loss reduction — US$/m³/day reduced Commercial loss reduction — US$/US$ saved **Commercially-driven indicators** Revenue increase — US$/US$ saved Collections increase — US$/% increase in collections rate Number of customers with 24/7 service — US$/additional household on 24/7 supply	*This should be like the DBOM version, but with the payments reduced by the value of investments financed by the utility under the program manager version.*
3.3	Fee for Specified Works and Services	Payment to the contractor will be on the basis of a BOQ with unit rates (see sample in Table B.8).	*This will typically be percentage of the capital cost (for example, 5% to 10%) as utility pays the actual capital costs to the works contractor, and the Program Manager only receives a program manage fee.*
3.4	Input-based payments for leakage control services	*Specify here any payments to be made for physical inputs to leakage control that are made at the contractor's discretion. In many cases this will be zero, since the discretionary investment will be made to earn the Performance Fee. However, where the investments will have benefits beyond the contract life, and this is not compensated through the performance fee, some payment toward the value expected after the end of the contract will be justified. This can be based on a BOQ with Unit Rates like that for Annex F. Unit rates will typically below cost, to offset the expected return to the contractor through the performance fee.*	*The program manager will be able to recommend additional investments, and the utility will be free to implement them. The payment will be made to the works contractors by the utility. The program manager will receive a percentage of the capital cost (for example, 5% to 10%) for design and supervision of the works.*
3.5	Input-based payments for commercial improvement services	As for the leakage control payments, but for the discretionary investments aimed at reducing commercial losses or increasing collections.	*As above.*

<table>
<tr><th></th><th>Payments</th><th>DBOM Contract/24/7 Self-Optimizing Contract</th><th>Incentivized Program Manager Contract</th></tr>
<tr><td>3.6</td><td>Capacity Availability Fee</td><td>In the event that some capital works will be privately financed, and the financing costs will not be met through performance fees or other payment over the life of the contract, a capacity fee should be paid to cover the unmet financing costs of the investment, subject to the capital works financed continuing to perform as planned.</td><td>Not applicable</td></tr>
<tr><td>3.7</td><td>Financing</td><td>If there are capital works that the contractor is expected to pay for (as opposed to being paid by the utility for as construction milestones are reached) those should be specified here.

It should also be noted how the contractor is expected to be able to make back the costs (including the cost of finance), for example through the Performance Fee, or the Availability Fee.</td><td>Not applicable</td></tr>
<tr><td>3.8</td><td>Liquidated damages</td><td>Penalties depend on whether the contract uses NRW-driven indicators or output-driven indicators.[2]
<table><tr><th>Constraint</th><th>Penalty per Unit</th></tr><tr><td>Average hours of service per day</td><td>US$/average-hour of service per day below target</td></tr><tr><td>Minimum pressure across system</td><td>US$/mWc below minimum level, as stated in the target</td></tr><tr><td>Bulk supply input</td><td>US$/m^3/day of bulk water that is used in excess of the target</td></tr></table></td><td>As on the left, but should be expressed as a deduction from the performance fee only—liquidated damages in excess of the performance fees would be waived.</td></tr>
</table>

1. Please refer to the optimization framework described in World Bank (2016).
2. Penalties should generally be based on the economic value of the breach—Please refer to the optimization framework described in World Bank (2016).

B.8.4 Annexes Referenced from Sample Term Sheets

Instructions

These annexes provide much of the commercial and technical details of the contract, and are referenced from the term sheets.

Annex A: Specified Works and Services

1. List works the utility knows it wants implemented such as:

	Specification	Number	Locations
Installation of Bulk Meters			
Creation of DMAs			
Creation of SCADA or Telemetry systems			
Pressure zoning			
Replacement of certain mains			
Replacement of connections			
Testing of meters and replacement of those that are faulty			

2. List services known to be required such as:

Services	Detailed Description
Creation of Hydraulic Model of the Network	
Development and Maintenance of Water Balance Tool	
Improvements to the customer cadaster	
Improvements to the billing system	
Improvements to the payment system (for example to allow payment by mobile money)	
Management of the billing system	
Management of the payment system	
Management of the collection of past due accounts, and	
Development of KPI Reporting System and Reporting of KPIs	
Creation of Hydraulic Model of the Network	

Annex B: Leakage Control Works and Services

List Works and Services that the Contractor/Program Manager may perform on the network in pursuit of contractual targets and incentive payments, such as:

- Creation of Hydraulic Model of the Network
- Development and Maintenance of Water Balance Tool
- Creation of a DMA Plan
- Creation of a Pressure Zoning and Control Plan
- Creation of a leaks and bursts reporting system
- Active leak detection
- Excavation of pipes and repairing of leaks and burst
- Replacement of pipe sections
- Replacement of connections

Annex C: Commercial Services

List Services that the Contractor/Program Manager may perform in pursuit of contractual targets and incentive payments, such as:

- Improvements to the customer cadaster
- Improvements to the billing system
- Replacement of meters
- Entry of new or updated customer records in the billing system
- Improvements to the payment system (for example to allow payment by mobile money)
- Management of the billing system
- Management of the payment system
- Management of the collection of past due accounts

Annex D: Staff

List here any staff that will be transferred to the Contractor/PM to manage, and their roles, and key terms and conditions that will apply such as the extent of direction that may be given, the working conditions that need to be respected, and whether the utility will continue to pay the staff for all work done, or if the contractor will make any payment.

Specify if the contractor is managing any existing groups of staff, such as a leak detection team or a billing department.

Annex E: Capacity Building

Specify capacity building measures that must be taken, and when, such as:

- Training of utility staff
- Creation of new organization structure, processes, job-descriptions, person-specifications
- Ensuring that staff attain certifications professional or tertiary training organizations
- Ensuring that utility systems attain certifications, for example ISO 9001 certification
- Creation and transfer of management information tools such as Water Balances tools, Hydraulic Models
- Creation and transfer of certain management processes and systems such as Telemetry Systems, Billing Systems or Payment Systems
- Hand over to utility of certain equipment such as vehicles, acoustic couplers, meter repair equipment

Annex F: Bill of Quantities with Unit Rates

A sample Bill of Quantities can be found in Table B.8 below, outlining how to record the unit prices for all equipment.

TABLE B.8: Bill of Quantities with Unit Rates

Item	Description	Unit	Quantity	Total			
				USD	Other Currencies		
					1	2	3
1	**Installation of bulk meters**						
1.1	Supply and installation bulk meters: • DN 75 • DN 200	#	*Specify*				
2	**Creation of District Meter Areas (DMAs)**						
2.1	Establishment of one DMA, complete with investigations, detailed designs, tests, supply and installation of materials and equipment (including the laying of up to 20m of distribution mains), reinstatement of road and sidewalk surface, preparation of as-built drawing and other documentation, commissioning of PRV, and other miscellaneous works	Lump sum	*Specify*				
2.2	Construction of additional DMA of inflow chamber for DMAs that require more than one inflow point, complete with investigations, detailed designs, tests, supply and installation of materials and equipment (including the laying of up to 20m of distribution mains), reinstatement of road and sidewalk surface, preparation of as-built drawing and other documentation, commissioning of PRV, and other miscellaneous works	#	*Specify*				
2.3	Supply and installation of Ductile Iron pipelines and all fittings, including connection to the network, up to 2m in depth, including: detailed design, removal, and disposal of old pipe; sand bedding, testing, and disinfection; re-instatement of road, sidewalk, or any other surface • DN 200mm • DN 250mm • DN 300mm • Extra-over item for pipelines to be installed in more than 2m depth	m	*Specify*				
2.4	Disconnection of service connections from DMA customer supplied from a main outside the DMA, disconnection at the customer metering point and the pipe saddle, replacement of pipe saddle with repair clamp, installation of new HDPE service connection from metering point to new connecting point inside the DMA, complete with sand bedding, reinstatement of road, sidewalk, or any other surface, including the supply of all materials up to a maximum pipe length of 10m 1-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m 2-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m	• a) # • b) # • c) # • d) m	*Specify*				

Item	Description	Unit	Quantity	Total			
				USD	Other Currencies		
					1	2	3
	3-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m						
3	**Creation of SCADA or telemetry systems**						
3.1	Creation of SCADA	#	1				
3.2	Installation of Telemetry system	#	1				
4	**Pressure zoning**						
4.1	Supply and installation of pressure sensors • 0-2.5 bar, 4-20 mA, 0.25% FS • 0-6 bar, 4-20mA, 0.25% FS	#	*Specify*				
4.2	Construction of chamber of pressure regulators • DN 100 • DN 200	#	*Specify*				
4.3	Supply and installation of pressure regulation valve • DN 100 • DN 150 • DN 200 • DN 250	#	*Specify*				
5	**Replacement of certain mains**						
5.1	Supply and installation of uPVC pipelines and all fittings, including connection to the network, up to 2m in depth, including: detailed design, sand bedding, testing, and disinfection; re-instatement of road, sidewalk, or any other surface • OD 121.9mm • OD 177.3mm • Extra-over item for pipelines to be installed in more than 2m in depth	m	*Specify*				
5.2	Supply and installation of Ductile Iron pipelines and all fittings, including connection to the network, up to 2m in depth, including: detailed design, sand bedding, testing, and disinfection; re-instatement of road, sidewalk, or any other surface • DN 200 • Extra-over item for pipelines to be installed in more than 2m in depth	M	*Specify*				

table continues next page

TABLE B.8: continue

Item	Description	Unit	Quantity	Total			
				USD	Other Currencies		
					1	2	3
5.3	Detailed design, supply, and installation of sluice valves, complete with connection to the existing distribution network, complete with all fittings and materials required, including re-instatement of road or sidewalk surface • DN 80-100mm • DN 100-125mm • DN 125-150mm • DN 200mm • DN 250 mm • DN 300mm • DN 350mm • DN 400mm	#	*Specify*				
6	**Replacement of connections**						
6.1	Supply and installation of service connections for new customers, installation of new HDPE service connection from (and including) the pipe saddle to metering point, complete with sand bedding, reinstatement of road, sidewalk, or any other surface, including supply of all materials up to a maximum pipe length of 10m 1-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m 2-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m 3-inch service connection to be connected to main of diameter: • a) 80-125mm • b) 150-250mm • c) >250mm • d) Extra-over item for pipe length >10m	#	*Specify*				
7	**Testing of meters and replacement of those that are faulty**						
7.1	Read meters	#	*Specify*				
7.2	Maintain meters • ½ inch • ¾ inch • 1 inch • 1½ inches	#	*Specify*				

Item	Description	Unit	Quantity	Total			
				USD	Other Currencies		
					1	2	3
	• 2 inches						
	• 3 inches						
	• 6 inches						
7.3	Reposition meter chamber	#	*Specify*				
7.3	Relocate meter chamber	#	*Specify*				
7.4	Supply and replace meter, in course of maintenance	#	*Specify*				
	• ½ inch						
	• ¾ inch						
	• 1 inch						
	• 1½ inches						
	• 2 inches						
	• 3 inches						
	• 6 inches						
8	**Creation of hydraulic model of the network**						
8.1	Hydraulic model of network	#	1				
9	**Development and maintenance of water balance tool**						
9.1	Water balance tool	#	1				
10	**Improvements to the customer cadaster**						
10.1	*Describe a specific improvement to the customer cadaster*	*Specify*	*Specify*				
11	**Improvements to the billing system**						
11.1	*Describe a specific improvement to the customer cadaster*	*Specify*	*Specify*				
12	**Improvements to the payment system**						
12.1	Configuring payment system so mobile money payments are accepted	#	1				
13	**Management of the billing system**						
13.1	Bills sent in a timely manner	%	*Specify*				
14	**Management of the payment system**						
14.1	*Describe a specific improvement to the management of the payment system*	*Specify*	*Specify*				
15	**Management of the collection of past due accounts**						
15.1	Financial arrangements reached with accounts that are over [*specify number of days*] days past-due	US$	*Specify*				
15.2	Past-due accounts collected on	#	*Specify*				
15.3	Report on number and value of past-due accounts collected and to be collected	#	*Specify*				
16	**Development of KPI reporting system and reporting of KPIs**						
16.1	KPI Reporting System	#	1				
16.2	Reports on KPIs prepared on time and to an adequate quality	#	*Specify*				

Note:

- Payment will be made at the fixed price per unit of work done
- If the number of units varies from what was expected, payment will be on actual units, subject to a process that validates that any increase in units above projections is justified
- If the payments are specified in a currency that is expected to devalue in real terms over the contract period, the unit rates should be subject to annual inflation indexation.

Notes

1. Payment on BOQ basis is the actual units times the rate per unit bid.
2. The bid documents will specify the "value of 24/7" on a $ per customer basis. This should be an estimate of the benefits to a customer of moving from intermittent to continuous supply. The value of 24/7 per customer is derived from the total cost of bringing a customer onto 24/7 through increase in input volumes. Alternatively, it could be calculated through contingent valuation methodology, health and times savings, or revealed customer preferences.
3. The bid documents would specify what the contractor is to be charged for excess bulk water use, or reductions in service to other customers.
4. The higher risk variant is not described here. The difference between the higher and lower risk variants can be seen in Table B.1.

Appendix C Terms of Reference

C.1 TOR for Initial Assessment Phase

DRAFT TERMS OF REFERENCE

Project/Assignment Title:	**Initial Assessment of Suitability of Performance-Based Contracts for NRW reduction in <Location XXXX>**
Location:	**<XXXX>**
Date of Assignment:	**<XXXX>**

A. BACKGROUND AND OBJECTIVES

Country, Municipality, Utility

[In this section a description on country, municipality, and utility background should be described.]

Objective of this Assignment

The objective of this assignment is to assess local qualitative and quantitative data to make several key decisions on the best path forward in NRW project preparation, including:

- **Assess the level of NRW, and impact of NRW on the utility and customers**, in more detail than conducted in the Rapid Screening Activity. Does the level warrant an NRW Project or not? If not, the project preparation should stop, and perhaps other sites be considered. If the level or impact is high, analysis and planning should proceed
- **Prepare an initial Project Concept**, including Scope, Objectives, Targets, a rough cost estimate and explanation of the level of uncertainty of the in the Project Concept, to the extent possible with the available data and time frame.
- **Does an NRW-PBC look like a good approach?** In other words, does the local situation conform with the technical, financial and socio-cultural conditions under which PBCs are most conducive? If not, a conventional NRW Project should be designed and implemented. If so, preparatory work would continue, as described below:
- Is the quantity and quality of data about the water supply infrastructure and utility operations sufficient to proceed directly to detailed NRW Reduction Planning and PBC Design, or **is a Field Assessment required to better understand the NRW situation?** Criteria Include data quality, preliminary water balance uncertainty, depth of understanding of the causes of NRW, utility capacity, skills and practices, etc.

As indicated in the project preparation Flowchart, the Initial Assessment follows and builds on the results of the Screening Activity. Steps after the Initial Assessment could

include a halt of project preparation activity, initiation of a Field Assessment Activity, or initiation of detailed NRW Reduction Planning.

Summary of the Scope of Work

The scope of this Initial Assessment assignment includes:

- Compilation of existing data on relevant technical, financial, institutional and managerial parameters, as well as rating of existing NRW practices.
- Situational Assessment: An analysis of the recent trends on volume and value of losses, approximate water balance, water supply coverage and service quality, to define a broad scope, objectives, targets, approximate cost of a NRW program, and level of uncertainty given current information and key constraints to address in the Program Design.
- Review of the suitability of the PBC approach, including technical and financial analyses and an assessment of the interest, any concerns about, and capacity to oversee a PBC approach.
- Preparation of a Project Concept Paper, succinctly outlining the scope, objectives, targets, approximate cost, financial viability, and suitability of a PBC approach for implementation of the NRW program. The Project Concept Paper should also succinctly address the level of uncertainty given current information, need for oversight assistance for the utility (to work with the PBC contractor), preliminary ideas for sustainability/follow-on activities after the PBC and key constraints/risks to address in the PBC design.
- If warranted, preparation of the TOR for a Field Assessment Activity.

The output/deliverable several reports covering the topics above. It is expected that the activity will have an approximate duration of 2–3 months, and require 6 to 8 work weeks of a team of 2 experienced NRW consultants—one focusing on technical aspects and the other focusing on financial and institutional aspects—and 1–2 local consultants to support data collection and analysis activities. The duration and level of effort should be refined, considering the local situation, data availability, logistics, size of the city, etc.

Previous work assessing suitability of NRW Reduction

This assignment builds on work already done to investigate the suitability of a Performance-Based Contract for NRW reduction to achieve the goals of the utility. [Describe here the work done in the Screening. State that those reports will be provided to the shortlisted consultants. Describe any other preparatory work done.]

Related work

[If the NRW-PBC is part of a larger investment or reform project, describe here the other components of the project. Mention useful reports and other documents, and say that they will be made available to the shortlisted consultants.]

B. SCOPE OF WORK

1. Compile Existing Relevant Data

Based on available records from the utility, discussions with the different departments within the utility and national water institutions, compile existing relevant data to support the decisions/assessments for this assignment. Parameters for data collection are listed in the Data Requirements for Initial Assessment Table (see Annex), but, broadly speaking, include the following categories:

- Water supply resources, facilities, operations
- Total volumes produced and billed to customers, on a monthly or at least quarterly basis
- Distribution infrastructure specifics
- Water Supply Service Quality
- Utility Commercial Operations and Finances
- Current NRW Practices
- Recent NRW Performance Trends

While such a standard will be difficult in some locations, a general target of 5 years of data is highly desirable. Three years is a bare minimum, and 10 years would be excellent.

2. Situational Assessment

Based on the Analyses outlined in the Data Requirements for Initial Assessment Table (see Data Collection Template), the consultants will work with the utility to compile a preliminary assessment of the recent trends in water resource availability, water supply coverage and service quality, volume and value of losses, approximate water balance, current NRW Practices, utility management effectiveness in order to estimate the root causes of NRW components, key technical, managerial and financial challenges to NRW management. The results of this analysis should be:

- A recommendation on whether an NRW reduction program appears likely to be economically and financially viable, as well as technically desirable; and
- Defined scope, objectives targets, approximate cost of an NRW program, and level of uncertainty given current information.

Recommended Tools for use throughout the Initial Assessment include: Data Requirements for Initial Assessment Trend Analysis, NRW Practices Rating, World Bank EasyCalc Software, NRW Project Benchmarking, NRW Diagnostic Summary, Target Setting/Optimization, and NRW Project Financial Comparison.

3. Review of the Suitability of the PBC approach

The consultant should conduct extensive discussions with utility officials, local government officials, and other relevant stakeholders to analyze the suitability of a PBC

approach based on the following conditions, under which a PBC approach is most viable:

- Major constraints exist on water resource availability, currently or expected in the future
- High levels of NRW, especially in combination with water scarcity, low coverage, and poor water supply service with intermittent water supply
- High water production cost, such as using desalination or high energy costs and requirements
- Limited or low utility expertise in NRW planning and reduction
- Utility cannot expand staff to reduce NRW and then scale back staff to maintain low NRW
- Well established local companies with experience in utility operations and NRW
- Successful experience in country with outsourcing, PBCs and other public-private partnership arrangements in the water sector or other sectors

The consultant should make a recommendation on whether a PBC is likely to be an effective way of implementing a cost-effective NRW reduction plan. This recommendation should consider the factors in Table 5.2.

4. Preliminary Recommendation on Contract Type and Scope

The consultant should note the desired objectives of a NRW reduction project, and recommend the area, functional scope, and type of contract that would be most suitable for achieving the objectives in the specified area. The consultant should then prepare a Draft Project Concept Paper providing an outline of the potential project, including:

- Executive Summary
- Profile of the utility: service territory, water resources, production facilities, coverage, technical and commercial networks, operations, service quality, management structures, effectiveness, resources and capacities, cost structures, financial condition, etc.
- Findings on the NRW Trends, NRW Practices, Preliminary Water Balance
- Impact of NRW on the utility and customers, approximate targets and benefits of reduction
- Outline NRW reduction Program Strategy
- Suitability of the PBC Approach
- Recommend contract goals, scope, and type
- Risks to implementation–operational, technical, institutional, financial and policy/regulatory
- Local in-house utility capacity and how to build it if it is not in place, to ensure sustainability when the PBC contractor has gone

- Preliminary recommendations on a strategy for supervision, including on the need for an oversight contractor
- Preliminary recommendations on sustainability mechanisms
- Recommendation on the need for a Field Assessment Phase, based on current data quality and the level of uncertainty in the data and Project Concept overall

This assessment will be used only for an initial estimation of the potential scope of an NRW Reduction Program, a realistic reduction target given a discussion on the time period and magnitude of financing needed to pursue such an NRW Reduction Program, as well as the concept for a suitable PBC. This information is often used as input to a development financial institution's Project Concept Note (such as the World Bank) and to national and local government institutions in their discussions and planning of forward investment programs and budget. The findings from the Initial Assessment will be refined, and detail added, in the later stages of the process.

After presentation/discussion of the Draft Project Concept Paper with stakeholders, the consultant will prepare a final version.

5. Review the Need for a Field Assessment

Where the current available information is not sufficient to allow stakeholders to proceed with an NRW-PBC, or to develop a practical contract concept, the consultant should discuss, the need for a Field Assessment to gather more data to be able to arrive at an International Water Association (IWA) water balance with error bands under plus or minus 20 percent. The consultant will clarify why such an activity is necessary, and what issues the follow-up assignment needs to take into consideration. Next the consultant will prepare a customized TOR for a Field Assessment assignment, adapted from the template Field Assessment TOR, given the situation and needs/requirements of the utility.

In preparing the TOR for a Field Assessment, the consultant will identify any minor civil works or equipment needed, such as installation of bulk meters or creation of one or more pilot DMAs. The consultant will provide cost estimates for any such works and equipment, and assess whether the utility can procure and pay for them, and whether these items should be included in the scope of work for the Field Assessment.

C. METHOD

The consultants will work with utility staff and managers. Most of the work is envisioned to be conducted in-situ. The consultants will develop an inception report with his/her work plan, data requirements and methodology and whenever necessary to familiarize the different stakeholders in the utility and national oversight institutions during inception, provide a short orientation about NRW Reduction and performance-based contracts.

The work will be qualitative and quantitative and will draw on information made available by the utility and data collected by the consultant in cooperation with the utility. The utility will provide all available data and cooperate with the consultant to ensure that the best possible data is provided and the correct analysis can be made.

D. DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT

Based on the above tasks the following reports to be produced:

- Report A: Inception Report (Work Plan and Method)—1 week from mobilization
- Report B: Draft Situational Assessment Report—3-4 weeks from mobilization
- Report C: Draft Project Concept Report—6-7 weeks from mobilization
- Report D: Final Project Concept Report—8-9 weeks from mobilization
- Report E: TOR for Field Assessment Activity (if required)—9-10 weeks from mobilization

E. SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT

The Client will make available all relevant documents. All information should be treated as confidential and not used for any other purpose.

F. SPECIAL TERMS & CONDITIONS / SPECIFIC CRITERIA

Language

All primary reports (Reports A, B, C, D, and E) should be prepared in the primary language of the client (in this instance: [xxxx]) as well as in English and delivered in Word format.

Timing/Assignment Duration

The Consultancy will start on [xxxx]. The assignment is expected to be completed in [xxxx] days.

Reporting

The Consultants will report to [xxxx] based in [xxxx].

Payment Schedule

[xxxx]

Required Qualifications and Experience

Team Leader—The NRW Engineer or the Utility Finance, Economics, and Institutional Specialist should be proposed as Team Leader.

NRW Engineer—The NRW Engineer shall have demonstrated successful experience in Nonrevenue Water projects. S/he must have at least 10 years of experience in water supply in similar country contexts with demonstrated experience in NRW issues. Specific expertise on designing NRW projects is required. Extensive familiarity with the use of the IWA Water Balance tools, methods of assessment and reduction of real losses (pressure management, active leak detection, DMAs, etc.) and apparent losses (customer metering, control of illegal connections) and in the use of performance-based contracts is required.

Utility Finance, Economics, and Institutional Specialist—The Utility Finance, Economics, and Institutional Specialist will have at least 5 years of experience working with financial, commercial, and institutional aspects of utility management of utilities, including customer metering, billing systems, collections management, control of illegal connections, utility accounting, financial management, budgeting, tariffs) structures and demand management programs, bills collection) in developing countries. The Utility Finance/Management Specialist will have financial analysis skills and will be able to develop a preliminary financial assessment of the proposed NRW-PBC program. The Specialist will be familiar with the use of the IWA Water Balance as well as billing systems, collections, financial management, budgeting, organizational frameworks, management practices, tariff structures, and in the use of performance-based contracts

Local Engineer/Utility Management Specialist—The national engineer/utility Management Specialist will be an experienced engineer/utility manager and have at least 10 years of experience dealing with water supply, water distribution, metering, NRW projects, and utility operations. The specialist will have experience and knowledge about both apparent (commercial) and technical (physical) losses. S/he will be familiar with the operations of the relevant water network and familiarity with the terrain of the service area. S/he will have advance level skills in the use of Excel and working familiarity with the IWA Water Balance tools. The Specialist will have good interpersonal skills and able to organize and support stakeholder dialogues with customers, utility staff, and other stakeholders.

Key Background Documentation

- Program Concept Note
- NRW-PBC Operations Manual, with Annexes
- Relevant utility reports and documents

Potential Downstream Work (if applicable)

Downstream work is possible following this assignment, for participation in the potential Field Assessment Activity, the NRW Reduction Planning, Contract Design, Transaction Management or Supervision.

C.2 TOR for Field Assessment Phase

DRAFT TERMS OF REFERENCE

Project/Assignment Title:	**Field Assessment for Nonrevenue Water Reduction and Preparation of Performance-Based Contract Project**
Location:	**[xxxx]**
Date of Assignment:	**[xxxx]**

A. BACKGROUND AND OBJECTIVES

Country, Municipality, Utility

[Describe here the background of the country, municipality, and utility.]

Objective of this Assignment

The objective of this assignment is to work with [utility] in [country] to gather information needed to make a decision on whether an NRW-PBC is desirable in [location], and if so, what kind of contract it should be.

This assignment follows an Initial Assessment in which available information was assessed to see if an NRW-PBC was a good option, and additional information needed before a decision would be made was identified.

It is expected that the Field Assessment will supply the information needed, and if a decision is made to proceed with an NRW-PBC, feed into detailed design and implementation of that PBC.

Summary of the Scope of Work

The scope of the proposed assignment includes four sections:

1. Situation Analysis
2. Initiate Early Start Data Quality Activities
3. Conduct a Detailed Baseline/NRW Assessment
4. Develop the NRW Reduction Program Strategy

SCOPE OF WORK

Section 1 Inception

The consultants will need to update/field validate and complete the data collected and identified for improvement during the Initial Assessment step, and then gather the additional information as specified below.

The consultant will prepare an **Inception Report**, including 1) the new information or factors identified that were not considered in the TOR or Initial Assessment, and 2) a detailed work plan that specifies the inputs and resources required for the activities under this TOR, the necessary time frame, and contents of the outputs.

Note: The TOR for the Field Assessment should be prepared by the consultant for the Initial Assessment, and should specify precisely the additional information or analysis that is required. What follows are various components that may typically be required. The consultant can draw on these, but should delete whichever component is not needed for making the relevant decisions, and add any other components not listed here that are required.

Component 1: Early Start Data Activities

Early start activities to improve data accuracy, improve the level of interest of bidders, and to get an early start on preparation activities for NRW reduction. Such activities may include the following:

- Updating/verification of network diagrams, specifications and condition data,
- Updating/verification of customer databases, and customer meter data
- Conducting field surveys to identify illegal connections (perhaps just in selected areas)
- Measurement of use at unmetered connections to improve estimates of unmetered use
- Development or updating of geographical information systems (GIS) for infrastructure and customer information
- Detailed zone measurement of continuity and pressure
- Upgrading/installation of automated operational data systems (bulk metering, reservoir levels, distributed flow and pressure measurement with telemetry connection to a control center), if applicable
- Calibration/replacement of bulk meters
- Calibration/replacement of large customer meters
- Additional testing of customer meters
- Improvements to NRW practice information systems such as work order management, which contribute to leak and burst rate analysis, estimation of rate of rise etc.
- Creation of temporary DMAs (areas of 2,000–5,000 connections) including inflow metering and ring fencing customer database
- Creation of pilot DMAs for leakage monitoring, network assessment, and training purposes
- Hydraulic modeling (in situations where major pipe network changes are needed)

- Where it appears that heavy sectorization will be a part of the NRW-PBC, an early start activity here could be to develop or update a hydraulic model—note this will not always be needed and will often be generated by the PBC contractor but in some cases, it will be appropriate to have at this stage to give better information to the bidders and ensure the interest of bidders as well as ensuring that the PBC contractor can ramp up to start saving NRW faster.

Note: it will not always be possible to install permanent DMAs at this stage or at the beginning of the PBC as there may simply not be reasonable pressure or hours of water supply available to do so. Permanent DMAs are only really required when the utility has the capacity in place to respond "next day" to a new leak. Many utilities are not there yet. In many situations around the world just undertaking a visual survey will greatly exceed the number of leaks which can be properly fixed by the utility. However, setting up temporary DMAs to properly validate the components of real loss, and the elements/consumers within the area is a good idea and can be done using the consultants' temporary equipment. The number of temporary DMAs will depend upon the confidence required and the variability of the initial results and can start with a few and build up to a maximum for the value in the contract. Where there has been a rapid assessment undertaken, an idea should be given as minimum and maximum.

This phase will extend near to the end of the contract, but work on Section 3 and 4 can begin several months after the start of Section 2.

Component 2: Prepare a Baseline

The consultants will work with the utility to prepare a detailed baseline that will include:

- Improved network plans (GIS if available) and updated customer information.
- Results of testing in pilot DMAs (areas of 2,000—5,000 connections) including inflow metering and ring fencing customer database.
- Results of field tests on each of the aspects of the IWA water balance such as: Source meter accuracy, customer meter accuracy, illegal connections, household consumption patterns, night time consumption, determine the level of NRW etc. and test NRW reduction activities, both commercial and technical.
- Results of bottom up pressure leakage and time leakage field tests to identify what will happen when changes are made to time of supply or operating pressure, or both.
- Calculations of improved estimations of the system input and output volume for the period.
- Reviews of billing records and determine the volumes of billed consumption. Determine the potential losses due to inefficiencies of the billing system and/or the billing process.
- Estimates for unbilled authorized consumption components and the total volume of unbilled authorized consumption.

- Estimates for the various components of unauthorized consumption and determinations of the annual volume of unauthorized consumption based on information to be made available and/or provided by the utility.
- Improved calculations volume of NRW, volume of physical losses and commercial (real and apparent) losses.
- Undertake a disaggregated component analysis of the volumes of real and apparent losses
- Having mapping and modeling in this stage will also help to build local capacity by having local engineers and technicians working with the Field Assessment contractor
- Conduct a careful analysis of the revenue and cost structure of the utility and unit variable and long run marginal costs of utility operations and maintenance that would inform the NRW Reduction Program Strategy planning.

Component 3: Prepare the Water Balance

Based on the available information/analysis, discussions with the different departments within the utility, the consultants will prepare an improved water balance for the entire network for a period of 12 to 24 months in accordance with the format of the International Water Association, and assessment of resulting uncertainty. World Bank (WB) EasyCalc Software is highly recommended.

Component 4: Analyze the Data and Describe the Root Causes of NRW

Based on all data collected, field tests undertaken, NRW Trends, NRW Practices ratings, and component analysis of both physical and commercial losses, describe the root causes of NRW and the most effective and realistic interventions to reduce the losses.

Review the total volume and value of the NRW components for the short, medium, and long term using optimized routines directed towards the highest NPV based around the minimum scope of work (heavy or light on infrastructure).

Component 5: Recommendations on NRW Program Components

Based on the findings above, the consultants will recommend measures to reduce physical and commercial losses, which may include:

- Physical (Real) Losses
    - Flow measurements—bulk metering
    - Sectorization and District Metered Areas (the latter if appropriate)
    - Pressure management—pressure zones
    - Leakage control—speed and quality of leak repair, active leak detection
    - Network rehabilitation/replacement, especially service connections

- Commercial (Apparent) Losses
  - Customer metering—meter under registration, full metering
  - Meter management—domestic and commercial customers
  - Meter reading—Illegal connections
  - Data handling—improve accuracy

Component 6: Appraise the Financial Desirability of the NRW Reduction Program

The consultants will cost out the NRW reduction Program and conduct a financial appraisal (preliminary FIRR, NPV, pay back) of the proposed NRW Reduction Program.

Final Report: Comprehension Outline

Prepare a report outlining the Key Findings of this Assignment, which will include:

- Executive Summary
- Introduction—Key summary facts of the utility: technical and commercial network, operations, management, resources and capacities, cost structures, service area and demand and hydraulic features
- Situation Analysis—Presentation of findings on the Preliminary Water Balance
- NRW reduction Program Strategy and Potential NRW Improvement Measures
- Gaps in good standard operating procedures (SOP) for purchasing, inspection, installation, maintenance, and suggestions how to improve
- Review of the hydraulic model scenarios where applicable for heavier infrastructure projects
- Local availability of good materials or justification for imported products for the PBC
- Financial and Implications and Appraisal
- Recommendations
- Minimum scope of work to be undertaken by each key activity for the PBC contractor (This is critical and ensures and apples to apples comparison of the offers when it comes to bid analysis)
- Risks to implementation—Looking at operational, technical, institutional, financial, and policy/regulations
- Local capacity in-house, outsourced, how to build it if it is not in place to ensure sustainability when the PBC contractor has gone
- TOR for an oversight contractor if required based on local capacity review above

Note: Delete those elements not required—add other elements that are required.

B. METHOD

The work will be qualitative and quantitative and will draw on information made available by the utility and data collected by the consultant in cooperation with the utility. The utility will provide all available data and cooperate with the consultant to ensure that the best possible data is provided and the correct analysis can be made.

Any modest civil works (for DMAs etc.) required to be undertaken in Sections 2 and 3 could be carried out primarily through the support of the utility and undertaken and paid for outside this contract. However, experience has shown that it may be better to bundle modest civil works and equipment in the Consulting contract and not have to rely on installations and payments from the utility who in many cases may not have the capacity or the urgency at this point in the process. Therefore, the consulting firm should provide details of the anticipated works that in their proposal in and updated in their inception report and agreed with the utility. The equipment necessary to be used in undertaking Sections 2 and 3 will be brought in by the consulting firm and leased through the firms' contract and will be included as part of their financial proposal.

C. DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT

Based on the above tasks the following reports to be produced:

A. Inception Report: Assessment of the Current Nonrevenue Water Situation, Work Plan, and Preliminary Recommendations

B. Report on Early Start Data Quality Activities and Detailed Baseline

C. Report on new information found

D. Reports like in the Initial Assessment (desirability of NRW reduction; suitability of PBC; scope and type of contract)

E. Draft TOR for Oversight Contract, if required

F. In addition, every 3 months a short progress report will be prepared, highlighting issues and problems encountered, deviation from schedule, and updated planning

D. SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT

The Client will make available all relevant documents. All information and background documents provided as part of this RFP are for the sole purpose of preparing the Technical and Financial proposal for this assignment. All information should be treated as confidential and not used for any other purpose.

E. SPECIAL TERMS & CONDITIONS / SPECIFIC CRITERIA

Language

All primary reports (Reports A, B, C, D) should be prepared in the primary language of the client utility as well as in English, unless otherwise specified, and delivered in Word format. The primary reports will be concise, management reports that are in the range of 30-50 pages.

The progress reports should be in the language of the client and an executive summary in English.

Timing/Assignment Duration

The Consultancy will start on [xxxx]. The assignment is expected to be completed in [Initial Assessment consultant to indicate] months.

Reporting

The Consultants will report to [xxxx] based in [xxxx].

Payment Schedule

[xxxx]

Required Qualifications and Experience

The Core Team will be composed of a Team Leader (Water Specialist), Lead Engineer, and Utility Commercial Specialist. In case the Core Team is composed of international consultants (because of for instance lack of capacity and experience with PBC for NRW in the country), it shall then also include local experts guaranteeing thorough local presence and coordination with the local partners. The Consultant will be responsible for mobilizing the necessary Due Diligence and Survey Team and administrative back-stop on the ground to complete the assignment in the time required.

The Core Team will have the following qualifications:

- Team Leader—Either the Water Specialist/Engineer or Utility Finance/Management Specialist should be proposed as the Team Leader.
- Water Specialist/Engineer—The Water Specialist/Engineer shall have demonstrated successful experience in Nonrevenue Water projects. S/he must have at least 15 years of experience in water supply in similar country contexts with demonstrated experience in NRW issues. Specific expertise on designing NRW projects will be a plus. The Team Leader Specialist will have practical experience the use of the IWA Water Balance, uncertainty analysis, field measurement techniques related to NRW and component analysis tools.
- Utility Finance/Management Specialist—The Utility Finance/Management Specialist will have at least 5 years of experience dealing with commercial, financial, and

managerial aspects of utility management in developing (customer metering, billing systems, collections management, control of illegal connections, utility accounting, financial management, budgeting, tariffs) structures and demand management programs, bills collection) in developing countries. The Utility Finance/Management Specialist will have advanced financial analysis skills and will be able to develop financial assessment of the proposed NRW-PBC program.

- Analyst/Specialist—A national analyst will support the team in logistics and data collection and analysis. The Specialist will have 10 years of experience in urban water supply in the country. S/he will be familiar with the operations of the relevant water network and familiarity with the terrain of the service area. S/he will have advance level skills in the use of excel and working familiarity with the IWA Water Balance tools, hydraulic analysis and GIS where applicable. The Analyst/Specialist will have good interpersonal skills and able to organize and support stakeholder dialogues with customers, utility staff and other stakeholders.
- Engineer—The national engineer will be an experienced engineer and have at least 10 years of experience dealing with water supply, water distribution, metering, NRW projects and utility operations. The engineer will have experience in developing baselines and have knowledge on both apparent (commercial) and technical (physical) losses. S/he will be familiar with the operations of the relevant water network and familiarity with the terrain of the service area. S/he will have advance level skills in the use of excel and working familiarity with the IWA Water Balance tools, hydraulic analysis and GIS where applicable. The Analyst/Specialist will have good interpersonal skills and able to organize and support stakeholder dialogues with customers, utility staff and other stakeholders.
- Data collection technicians—The data collection technicians will be familiar with the challenges of collection field data, updating plans, locating assets, and leak detection and repair supervision in developing country situations. The technicians will be local where the assets exist and a mixture of expat and local where they do not in order to build capacity. They should have a minimum of ten years experience and be educated to technician level.

Key Background Documentation

- Program Concept Note
- TOR for Initial Assessment
- Report(s) from Initial Assessment
- TOR for Development of NRW Reduction Investment Plan and PBC Project Design and Procurement

Relevant project documents as available, including, in all cases, a background note outlining the situation of the specific country/city project.

Potential Downstream Work (if applicable)

Downstream work is possible following this assignment for the repetition or scale-up of the approach, including the support envisioned under the accompanying Terms of Reference for the Country Support: Development of a Performance-Based Contract in Nonrevenue Water Management.

C.3 TOR for NRW Reduction Strategy and PBC Design and Procurement

DRAFT TERMS OF REFERENCE

Project/Assignment Title:	**Country Support: Development of NRW Reduction Investment Plan and PBC Project Preparation and Transaction**
Location:	**[xxxx]**
Date of Assignment:	**[xxxx]**

A. BACKGROUND AND OBJECTIVES

Country, Municipality, Utility

[Describe background of country, municipality, and utility.]

Objective of this Assignment

The objective of this assignment is to develop a Performance-Based Contract for NRW Reduction, and procure a suitable contractor, in order to [state Objectives for the NRW Reduction Program determined at the previous stage. These objectives should be what will be achieved by the NRW Reduction Program and may include: improve continuity of supply; improve water quality; enable expansion of access; improve the financial position of the utility; reduce energy consumption and greenhouse gas (GHG) emissions].

Summary of the Scope of Work

The scope of work is divided is divided into three phases:

1. Develop a NRW Reduction Plan, including technical and commercial aspects, and demonstrate its economic and financial viability
2. Design a Performance-Based NRW Reduction Contract that is attractive to the market and stakeholders
3. Manage competitive process to select contractor and assist with start-up

Progress to the second and subsequent phases will depend on (a) satisfactory completion of the previous phase by the consultants; (b) recommendation by the consultants that it is advisable to proceed to the next phase; (c) agreement by the utility and other key decision makers to proceed.

Previous work assessing suitability of NRW Reduction

This assignment builds on work already done to investigate the suitability of a Performance-Based Contract for NRW reduction as a way to achieve the goals of the utility. In particular, [Describe here the work done in the Initial Assessment and (if one was done) the Field Assessment. State that those reports will be provided to the shortlisted consultants. Describe any other preparatory work done.]

Related work

[If the NRW-PBC is part of a larger investment or reform project, describe here the other components of the project. Mention useful reports and other documents, and say that they will be made available to the shortlisted consultants.]

B. SCOPE OF WORK

Phase 1: Develop an NRW Reduction Plan

The consultant is to develop an NRW Reduction Plan that indicates the technical and commercial approach to reducing NRW. The Plan is to show how this approach will achieve the objectives given above, and give an indicative cost. The consultant is also to report on the economic viability of the plan, and how likely it is to receive financing.

In developing the Plan, the consultant shall carry out the following tasks.

1.1 Review the existing Assessment to check conclusions and identify risks and mitigants

At the start of the assignment the consultant will:

- Review the Assessment of NRW previously carried out
- Identify any areas in which the consultant has doubts about the conclusions from the previous assessment
- Confirm that the key stakeholders are interested in proceeding with a NRW-PBC
- Identify data gaps and risks, and propose ways these gaps and risks can be addressed in development of the plan, the contract, and the transaction

The output from this task will be an **Inception Report** which describes the above items and modifies the approach the consultant submitted in its proposal, to the extent justified by new information.

1.2 Document the existing situation

Note: While all the information listed in 1.2 is needed, if that information has been recently gathered in the Assessment Phase, the information can simply be made available to the consultant, and the need to gather it removed.

To ensure a common understanding of the context in which the NRW reduction plan must operate, the consultant shall provide a summary assessment of the organization of the utility, its service levels and financial performance. This summary assessment shall include:

- A description of the service area, services provided, customer consumption profile, geographical/hydraulic context, availability of water and demand forecast
- A brief history of the organization and current management
- Capital improvement and expansion plans (current and planned). Investments projects under way and their financiers
- Government financial support to the utility, past and planned
- Identification of main issues and challenges facing the utility in general
- A NRW assessment, developed by the consultant, building on the work done in the previous assessment. This shall be done to the level of detail permitted by availability of information, and shall identify confidence intervals so that the effect of inadequate data can be understood. This assessment shall include:
    - A completed IWA Water Balance
    - An estimate on accuracy of the collected data and a description how the data was collected (giving sources) for each of the water balance items
    - Relevant data on commercial and technical performance of the utility, including age of the network, adequacy of billing systems, etc.
    - All relevant activities in the past 10 years to reduce NRW
    - Staff and equipment availability for NRW reduction, as well as staff capacity and experience with NRW reduction
    - An assessment of record keeping on NRW levels, and of asset condition
- Recommendations on the areas to focus a NRW improvement strategy on. These recommendations must be demonstrably based on:
    - The levels of the key components of NRW (commercial, technical, theft, metering problems) in the utility
    - A clear analysis of the various causes of NRW
    - An indicative analysis of the value of reducing both physical and commercial losses, considering the value of water saved and of increases in revenue

The output from this task will be an **Inception Existing Situation Report** covering the above items.

1.3 Develop Indicative Strategy for NRW Reduction

Note: The strategy shall be sufficiently detailed to enable its cost, and benefits and financial implications to be identified. However, if the contractor will be given discretion in how to reduce NRW, it does not need to be developed to be optimal, or at the level of specificity that it could be bid out as a works contract. In other words, the strategy should show the feasibility of NRW reduction and indicate an approach that will work, but it need not be the optimal approach. Detailed designs are not needed at this stage. Optimization and detailed design may be left to the contractor, provided the intention is to draft a contract that provides for this. The information below should be edited to make clear the degree of detail and precision required from the consultant.

The consultant shall prepare an Indicative Strategy for Reduction of NRW. The Indicative Strategy shall be based on successful approaches adopted in other similar situations, and shall include:

- Recommendations on changes in the network configuration, including, where appropriate: production metering, creation of DMAs, retail metering, pressure management, and similar initiatives
- Changes in network operating practices, including in areas such as: passive and active leak detection and repair, response to mains burst, and scheduling of supply
- Changes in commercial strategy, such as: improvement of the customer cadaster, changes in metering practices, changes in metering reading, billing and collection processes and practices
- New information systems and analytic approaches, which may include: improvements in monitoring elements of the water balance, use of GIS, and hydraulic modelling of the network
- Any other investments or changes in operational practices that would be required

In addition, the consultant shall provide:

- Estimates of the cost of implementing the strategy
- An indicative timeline, showing the likely phasing and duration of each component of the plan
- Quantified estimates of the effect the strategy will have on physical and commercial losses, and other physical and financial benefits it will offer, such as more customers on 24/7 supply, or increased revenue and cash receipts
- Key Performance Indicators which can be used to track progress on the NRW reduction plan, and the levels on these indicators that would be expected to be reached at various points in the plan

The strategy should explain how all elements will be integrated and phased, and how they will together achieve the objectives sought.

The output from this task will be an **Indicative Strategy for NRW Reduction** covering the above items.

1.4 Assess the economic and financial viability of the indicative strategy

Note: The degree of detail and precision required in the economic and financial assessment should be consistent with the type of contract being developed (See Guidance on Contract Type and Manual Section 4). It should also be acceptable to show that economic and financial parameters exceed specified minimum thresholds—with a high degree of likelihood, as opposed to calculating them precisely. Section 1.4 below should be amended appropriately.

The consultant shall provide an economic cost benefit analysis of the proposed program, a financial analysis, and an indicative financing strategy. This shall include the following components:

- An economic analysis, which shall be guided by the Optimization Framework presented in Discussion Paper 4 of World Bank (2016), and include:
    - An estimate of the net economic benefits of the Indicative Strategy
    - An analysis of whether the Indicative Strategy is the least cost way to achieve the benefits (among a range of plausible alternatives, including supply augmentation and demand side management)
    - An analysis of the sensitivity of the estimate of net benefits to key assumptions, including assumptions on the value of physical water saved, the value of reductions in commercial losses, and the discount rate
    - Suggestions on opportunities for economic optimization of the strategy
    - The approximate confidence intervals on the estimates
    - The major risks to achievement of the net benefits expected
- A financial analysis of the Indicative Strategy, both at the project and utility level. This analysis shall include an historical analysis, and financial projections over a forecast period, which shall be the proposed period of the strategy implementation, and at least 5 years thereafter. The following components are to be included in the financial analysis:
    - An analysis the utility's financial performance over at least the last five years. This shall include a review of five years of financial statement and cashflows, calculations of standard financial ratios related to financial viability and bankability, and a brief commentary on the main drivers of the financial performance

- Projections of the utility's financial performance over the forecast period, under a situation in which the NRW reduction strategy is not implemented—this shall include projections of the Income and Expenditure statement and Balance Sheet, as well as projections of operating cashflows and net cashflows
- Forecasts of the change in cashflows that would result from the Indicative NRW Reduction Strategy, for each year of the forecast period
- Relevant financial indicators for the Indicative Strategy, including the break-even period, the Financial IRR, and the NPV (at various plausible discount rates)
- Projections of the utility's financial performance over the forecast period, under a situation in which the NRW reduction strategy is implemented—this shall include projections of the Income and Expenditure statement and Balance Sheet, as well as projections of operating cashflows and net cashflows
- Relevant financial indicators of viability and bankability for the utility, over the forecast period, under the assumption that the Indicative Strategy is implemented

- An Indicative Financing Strategy. This strategy shall:
  - Indicate the financing required by the Indicative Strategy
  - Identify any additional financing the utility will require to be able to perform effectively over the period
  - Identify possible sources of such financing, and their advantages and disadvantages
  - Recommend sources of financing for the NRW Reduction Strategy, as well as sources for any additional financing the utility will require

The output from this task will be an **Economic and Financial Analysis**, covering the above items.

1.5 Consult on the Indicative NRW Reduction Strategy

The Consultant shall consult with the utility, key public sector decision-makers, and other stakeholders, with a view to achieving consensus on the NRW Reduction Strategy to be followed. In doing this, the Consultant shall:

- At the commencement of the project, identify all key stakeholder, and develop a communication strategy for all stakeholders
- At or soon after Project Inception, brief the key stakeholders on the objective of the assignment and the proposed workplan
- Consult with stakeholders as appropriate during the analysis

- Present the Indicative Strategy and Economic and Financial Analysis to key stakeholders—be clear that the intention is that the plan is for the strategy to be implemented with assistance of a specialized firm under a Performance Based Contract
- Take stakeholders comments and wishes into account in finding ways to improve the Indicative Strategy, from a technical, commercial, economic, financial and stakeholder acceptability perspective

The output from this task will be a **Stakeholder Consultation Report**, summarizing how stakeholders have been consulted, the views they expressed, and how the consultant proposes to incorporate those views in the NRW Reduction Plan.

1.6 Proposed NRW Reduction Plan

The Consultant shall prepare a Proposed NRW Reduction Plan by:

- Improving the work done already under this phase, to consider stakeholder comments
- Integrating the improved analytic work into a Draft NRW Reduction Plan
- Submitting the Draft NRW Reduction Plan for comments
- Taking into account the comments and producing the Proposed NRW Reduction Plan

The outputs from this task will be a **Draft NRW Reduction Plan**, and a **Proposed NRW Reduction Plan**. Each of these outputs will include the same content as required in the Indicative Strategy and the Economic and Financial Analysis, integrated into a coherent whole, and updated as needed based on comments from stakeholders and the client.

The client will then consider the Proposed NRW Reduction Plan and decide whether to proceed to design of a Performance Based Contract for NRW Reduction.

Note: Consider agreeing with the client that the work will automatically proceed to Phase 2 after 4 weeks of consideration by the client, unless the client requests a different approach within that 4-week period.

Phase 2: Develop Design for a Performance Based NRW Reduction Contract

The Consultant is to develop the concept, transaction structure and term sheet for a suitable Performance Based Contract for NRW Reduction. In developing this Contract Design, the consultant shall carry out the following tasks.

2.1 Define the objectives, scope, responsibility and risk allocation for the contract

The Consultant shall define the objectives and scope of the contract, including:

- The service improvements, cost savings, and revenue increases the contract is expected to produce, by itself or in combination with other initiatives. These are to be expressed as objectives, and also as indicative quantified targets

- The NRW reduction that that the contract is expected to achieve. This shall be disaggregated into physical and commercial improvements. Indicative targets are to be provided. Physical loss reduction should be expressed in cu.m per time period (not as a percentage of input volume). The benefits from reductions in commercial losses should be expressed in currency units. Relationships between the expected gains and other factors such as network pressure, hours of supply, extent of network, number of connections, tariffs, and availability of bulk water supply, should be described in quantitative terms.
- The scope of the contractor's responsibility. This should be defined in general terms, considering possible elements such as:
    - Work related to creation of information, such as installation of production meters, SCADA systems, GIS systems, and development of hydraulic models and water balances
    - Work on the network, such as creation of DMAs, pressure management, pipe replacement, replacement of connections, passive and active leak detection, leak repair, burst repairs
    - Work related to the commercial function, such as customer cadaster, testing or replacement or installation of customer meters, improvements in meter-reading, billing systems, bill preparation and delivery, and collection of bills
    - Work that is outside traditional NRW reduction contracts, such as improvements in energy efficiency, collection of overdue accounts, improvements in customer service and call centers, adoption of mobile money, installation of pre-payment metering systems, installation of water dispensers, and the like
    - Maintenance of the system after the targeted gains have been made
    - Training, capacity-building, and hand-back.

The Consultant shall propose an allocation of risks under the contract, and the responsibilities of each of the parties. To do this the Contractor shall:

- Define the contractor's responsibility and the utility's responsibility for each item in the scope. For example, in some cases the Contractor could be responsible for all aspects of that item (such as installing DMAs), and the utility could be responsible only for approving plans, and providing access to the network. In other areas, the Contractor might be responsible just for advising the utility, and the utility might be responsible for implementation. The degree of discretion accorded to the Contractor in each area shall be defined.
- Create a risk register that includes all material risks in implementing the NRW Reduction Plan.

- For each risk, advise on whether it should be allocated to the contractor, the utility, or shared or allocated to some other party. Provide a justification for the recommendations.

The output from this task will be an **Objectives, Scope, Responsibilities, and Risk Report**, covering the areas mentioned above.

2.2 Develop an Indicative Transaction Design

After receiving feedback from the client on the Objectives, Scope, Responsibilities and Risk Report, the Consultant shall revise that report and develop it into an Indicative Contract Design. The Indicative Contract Design shall include:

- A Terms Sheet that sets out:
  - Responsibilities of the Contractor
  - Responsibilities of the Utility and other public sector entities
  - Objectives and targets
  - Payment structures
  - Governance, monitoring, and dispute resolution arrangements
- Funding and financing mechanisms, which set out:
  - How the capital costs of the program will be financed
  - How the contractors program management costs will be funded
  - How the costs of monitoring and dispute resolution will be covered
  - How the utility will be able to fund its operations and any complementary investments needed to enable the desired objective to be achieved
- Any other matters needed to make the contractual design a success.

The output from this task will be an **Indicative Transaction Design**, covering the areas mentioned above.

2.3 Carry out a market sounding to ensure there is market interest in the proposed contract concept

The consultant will sound out suitable, potential bidders to see if there is sufficient market interest in the transaction to create competitive tension, and if necessary take the results into account to propose amendments to the Indicative Transaction Design. To do this, the consultant shall:

- Identify suitable potential contractors that it would want to bid on the opportunity
- Develop a suitable mechanism—such as a survey, or a structure interview template—to learn from these potential contractors their level of interest in the transactions,

and factors that would make them more or less likely to bid, and apply that mechanism

- Summarize the findings
- Recommend any changes to the Indicative Transaction Design warranted by the report

The output from this task will be a **Market Sounding Report**, summarizing the level of market interest, and detailing any changes to the design proposed, with reasons.

2.4 Confirm availability of finance for the project

The consultant shall confirm that finance is available for the project. The consultant shall:

- Check that the financing strategy developed in Phase 1 is still realistic
- Talk with potential suppliers of finance to ascertain their interest in providing the finance needed, and check the conditions that would have to be met for them to provide finance
- Confer with the utility and other key public sector decision makers to ascertain their willingness to comply with the conditions
- Set out the financing strategy and structure for the transaction, and how the conditions for attracting finance can be achieved

The output from this task will be a **Finance Strategy**, summarizing the proposed financing sources, how the financing will be structured, and how the financing conditions can be met.

2.5 Legal and Regulatory Due Diligence

The consultant shall carry out a legal and regulatory due diligence. This shall identify any standards that the PBC needs to comply with. Among the legal questions that must be considered are relevant contract law, labor law, delegation of public authority, licenses, utility regulation, and rights of way and access to land and infrastructure.

The output from this task will be a **Legal and Regulatory Due Diligence Report**, summarizing the above items to the extent that they are relevant to the design of the transaction.

2.6 Environment, Safety and Social Due Diligence

The consultant will assess the extent to which the Indicative Strategy and Transaction Design will have environmental, safety, or social implications, and recommend what needs to be done to ensure compliance with local and national standards, in these areas. Cost implications must also be identified.

The output from this task will be an **Environment, Safety and Social Due Diligence Due Diligence Report**, summarizing the above items.

2.7 Produce Business Case for Proposed Contract Design

The consultant shall produce a Business Case for the Proposed Contract Design. This Business Case will pull together the results of the preceding analysis to demonstrate that the proposed NRW Reduction Strategy and Performance Based Contract Design are feasible, beneficial, and better than alternatives.

The output from this task will be a **Business Case** which includes:

- The proposed Contract Design
- The expected costs, benefits, and financing arrangements for the proposed Contract Design and NRW Reduction Strategy
- An indicative procurement strategy
- An indicative timetable for implementation
- A summary of the main risks that could affect the proposal, and how they may be mitigated
- A comparison of the recommended option with two other options for the delivery of the NRW reduction strategy. One of these options shall be a plausible approach to delivering NRW reduction by the utility itself. The Business Case shall describe, and in so far as possible, quantify the advantages and disadvantages of the different delivery mechanisms.

2.8 Consult with stakeholders on the Contract Design

The consultant shall consult with the utility, key public sector decision-makers, and other stakeholders, with a view to achieving consensus on the Contract Design to be adopted. To do this the consultant shall:

- Consult with stakeholders as appropriate during the analysis for Phase 2
- Present the Business Case to key stakeholders
- Take stakeholders comments and wishes into account in finding ways to improve the Contract Design and other aspects of the proposed approach

The output from this task will be a **Contract Design Stakeholder Consultation Report**, summarizing how stakeholders have been consulted, the views they expressed, and how the consultant proposes to incorporate those views in the Contract Design.

2.9 Finalize Contract Design

Taking into account the consultation with stakeholders, the consultant is to finalize the Transaction Design and Business Case, and recommend whether to proceed to Phase 3.

The outputs from this task will be a **Final Transaction Design and Business Case**.

The client will then consider the Final Transaction Design and Business Case and decide whether to proceed to design of a Performance Based Contract for NRW Reduction.

Note: The degree of detail, and the time required for all the above works should be specified considering: the work already done in the Assessment Phase; the type of contract that was envisaged in the Assessment Phase; and the size of the contract. Also, consider agreeing with the client that the work will automatically proceed to Phase 3 after 4 weeks of consideration by the client, unless the client requests a different approach within that 4-week period.

Phase 3: Manage Competitive Selection Process for Contractor

The consultant shall run a competitive process to select a suitable contractor to implement the NRW Reduction Strategy under the approved Performance Based Contract. To do this, the consultant shall perform the below tasks.

3.1 Generate market interest in the transaction

The consultant shall develop a strategy to inform potential bidders about the transaction, and generate bidder interest. After the client agrees to the strategy, the Consultant shall implement it. This strategy may include generating coverage in the trade-press, advertising the opportunity, and contacting potentially interested firms directly.

3.2 Develop qualification criteria and qualify prospective bidders

The consultant shall develop and apply an appropriate set of qualification criteria. This shall include:

- Recommending a qualification strategy, including:
  - Qualification criteria
  - Information to be used to assess if the criteria are met
  - Whether to do prequalification
- Agreeing the approach to qualification with the client

If prequalification is chosen, the consultant will then:

- Develop Prequalification documents
- Assist the client in issuing prequalification documents
- Assist the client in receiving the prequalification document
- Prepare a prequalification report for the client indicating for each applicant the extent to which it meets the qualification criteria
- Assist the client in communicating to applicants if they were pre-qualified or

The outputs from this task will be a **Recommended Qualification Strategy** and, (if prequalification is chosen), the **Prequalification documents**, and a **Prequalification report**.

3.3 Developing Performance Based Contract and any related documentation required for the transaction

The consultant will develop all transaction documentations required, including the Performance Based Contract. Other documents required might include: Guarantees, Performance Bands, or Implementation Agreements, depending on the situation and type of contract. The Contract and other documents must reflect the agreed Transaction Design, and be consistent with international best practice and local law.

3.4 Setting targets, incentives payments, and determining bid variable or other evaluation criteria

The consultant will finalize the incentive payments, targets, bid variable, and evaluation criteria to be used in the transaction. These shall be designed with reference to Discussion Paper 4 found in World Bank (2016). In particular, the consultant shall prepare, for inclusion in the Contract or RFP

- Clear description of the performance indicators to be used in the contract
- Current baseline for each indicator (where available and required for the contract)
- Targets for each individual indicator, and specification of their contractual significance (if any)
- Specifications for how each indicator is to be measured under the contract
- Rules for setting or adjusting baseline values after an initial phase of work, if required
- Payment or other incentive mechanisms related to progress on the performance indicators
- Other payment formula
- Payment disbursement arrangements
- Mechanisms for monitoring performance, including as applicable by independent monitoring consultants. Data for setting baselines, targets, cost-estimates, should be those produced in Phase 2

3.5 Developing Request for Proposal

The consultant shall develop a Request for Proposal (RFP) document. This RFP shall:

- Provide bidders with the information they need on the opportunity
- Explain the bidding process and rules
- Make the evaluation criteria clear
- Include all transaction documents
- Protect the client, and government, from liability

The consultant shall provide a Draft RFP to the client and then adjust it following client comments to produce the Final RFP.

The outputs produced under this task are a **Draft RFP** and the **Final RFP.**

3.6 Running transaction process

The consultant will run the transaction for the client. This will include

- Proposing a transaction strategy and agreeing it with the client
- Advertising the opportunity (unless the client chooses to do this itself)
- Issuing the RFP to pre-qualified firms (or interested firms, if prequalification is not used)
- Running a data room, bidders conference, and site visits, if appropriate
- Responding to bidder queries.

The consultant shall establish and follow high quality processes and systems to ensure the integrity of the competitive selection process.

3.7 Assisting the client to receive and evaluate bids

The consultant will assist the client in receipt and evaluation of the bids by:

- Organizing a secure system for receipt of bids in accordance with the transaction rules
- Assisting the client to evaluate bids by preparing a report which, for each bid, assesses:
    - It compliance with the bid requirements
    - The extent to which the bidder meets the qualification criteria
    - The score on the bid variables
- Assisting the client to notify bidders of the result, in accordance with the bid rules

The output produced under this task will be an **Evaluation Report** document compliance, qualification, and evaluation score, for each bidder.

3.8 Reaching commercial (and if relevant financial close) on the transaction

The consultant will assist the client to negotiate with the one or more bidders, in accordance with the bid rules, in order to reach a successful signature of the contract and other transaction documents.

If the transaction structure includes private finance, the consultant will assist the client to reach financial close.

3.9 Supporting the client during the first 3 months after the contractor mobilizes

The consultant will assist the client in the first 3 months of implementation of the contract. To do this the consultant must dedicate at least 24 days of input from relevant

staff, at least half of whom must be based at the client's site. During this period the consultant will help the client to:

- Interpret the contract
- Understand and perform its own obligations
- Respond to questions and requests from the contractor
- Ensure the contractor delivers as required by the contract
- Manage stakeholder communications

C. METHOD

The work will be qualitative and quantitative and will draw on information made available by the utility. The utility will provide all available data and cooperate with the consultant to ensure that the best possible data is provided and the correct analysis can be made.

D. DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT

The deliverables are for this work are divided by Phase and listed below.

- **Phase 1: Develop a NRW Reduction Plan**
  - Inception Report
  - Inception Existing Situation Report
  - Indicative Strategy for NRW Reduction
  - Economic and Financial Analysis
  - Stakeholder Consultation Report
  - Proposed NRW Reduction Plan
- **Phase 2: Develop Design for a Performance Based NRW Reduction Contract**
  - Objectives, Scope, Responsibilities, and Risk Report
  - Indicative Transaction Design
  - Market Sounding Report
  - Finance Strategy
  - Legal and Regulatory Due Diligence Report
  - Environment, Safety, and Social Due Diligence Report
  - Business Case

- Contract Design Stakeholder Consultation Report
- Final Transaction Design and Business Case

- **Phase 3: Manage Competitive Selection Process for Contractor**
  - Recommended Qualification Strategy (if prequalification is chosen)
  - Prequalification documents
  - Prequalification report
  - Draft RFP
  - Final RFP
  - Evaluation Report

E. SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT

The Client will make available all relevant documents. All information and background documents provided as part of this RFP are for the sole purpose of preparing the Technical and Financial Proposal for this assignment. All information should be treated as confidential and not used for any other purpose.

F. SPECIAL TERMS & CONDITIONS / SPECIFIC CRITERIA

Language

All reports should be prepared in English, unless otherwise specified, and delivered in Word format. The financial model shall be delivered in Excel format.

An executive summary of the various documents may be provided in the primary language of the client.

Timing/Assignment Duration

The Consultancy will start on [xxxx]. The assignment is expected to be completed in 21 months. Each phase should follow the timelines set below:

- Phase I: 7 months
- Phase II: 5 months
- Phase III: 9 months

Reporting

The Consultants will report to [xxxx] based in [xxxx].

Payment Schedule

[xxxx]

Required Qualifications and Experience

The Core Team will have the following qualifications:

- Team Leader—Shall have demonstrated successful experience in leading the design and implementation of utility improvement projects involving performance based contracts. S/he must have at least 10 years of experience in structuring and implementing performance based contracts in water supply in similar country contexts, with demonstrated experience in NRW issues. Specific expertise on designing and implementing PBC for NRW will be a plus. One of the other specialists may fill the Team Leader role.
- NRW Reduction Specialist—Must be a qualified Engineer and have at least 10 years of experience dealing with NRW projects and operations. Must have experience in developing baselines and have knowledge on both apparent (commercial) and technical (physical) losses, including in developing countries (as well as experience dealing with NRW under conditions of intermittent supply [to be included if intermittent supply is characteristic of the client utility]).
- Contract Design Specialist—Must be qualified in law or economics (or preferably both) and have at least 5 years of experience in designing performance based contracts for infrastructure. Experience with water utilities, and NRW reduction, is desirable.
- Financial Specialist—Must have at least 5 years of experience with financial modelling of infrastructure, with proven experience with water projects in developing countries. Specific experience in modelling NRW projects—whether PBC or traditional TAs—will be a plus.
- Utility Commercial Specialist—The Utility Commercial Specialist will have at least 10 years of experience dealing with commercial aspects of utility management of utilities (customer metering, billing systems, control of illegal connections and thefts, tariff structures and demand management programs, bills collection) including in developing countries
- Legal Specialist - Must have 5 years of experience advising on complex commercial contracts related to infrastructure, and must be familiar with the laws of the country concerned as regards utility regulation and licensing, contracts, and labor law.
- Environmental and Social Specialist—Must have at least 5 years of experience advising on environmental and social impacts and compliance for infrastructure projects, and in the country in which the project is located.

In case the Core Team is composed of international consultants (because of, for instance, lack of capacity and experience with PBC for NRW in the country), it shall also include local experts for local knowledge and coordination with the local partners. The consultant will be responsible for mobilizing the necessary team to complete the assignment in the time required.

Key Background Documentation

Program Concept Note—Relevant project documents as available, including in all cases a background note outlining the situation of the specific country/city project.

Potential Downstream Work (if applicable)

Downstream work is possible following this assignment for the repetition or scale-up of the approach.

C.4 TOR for PBC Oversight Assistance

DRAFT TERMS OF REFERENCE

Project/Assignment Title:	**Oversight/Support Contract for Nonrevenue Water PBC Reduction Contract in [xxxx]**
Location:	**[xxxx]**
Date of Assignment:	**[xxxx]**

A. BACKGROUND AND OBJECTIVES

Country, Municipality, Utility

[In this section describe the background of the country, municipality, and utility.]

Objective of this Assignment

The objective of the Oversight/Support Contract is to:

- Provide the utility with an objective, third-party review of the performance of the PBC Contractor
- Assess the contractor it in comparison to the terms and conditions of the PBC Contract, to facilitate the best possible project outcome
- Help the utility manage the contractor
- Build contract oversight supervisory capacity in the utility

Summary of the Scope of Work

The scope of the proposed assignment includes the following tasks:

- Preparation of an Oversight/Support Plan
- Verification of Contractor Reports, Activities, and Results

- Provision of technical and programmatic advisory services to the utility on PBC contract oversight/compliance, quality control, and monitoring
- Consultant-led training for the utility on PBC contract oversight/compliance, quality control, and monitoring

Organization and Design of Activities in this ToR

This Activity should be conducted by a firm, specialized in management of water sector infrastructure and O&M projects, or possibly a group of individual consultants reporting to the Team Leader, with clear and effective management and accountability. A large project will require the use of a firm, but a smaller one may only require one or two consultants.

If applicable and possible, consultants involved in the Initial Assessment, Field Assessment, or subsequent phases of the project preparation should be involved in this Oversight/Support Contract, at least in an advisory capacity to the firm, or in a supervisory capacity.

Experience with previous oversight projects has led to the conclusions that 1) the decision to have an oversight contract and 2) the magnitude ("weight") of that contract needs to be examined from the start of the project design process, and certainly not after the fact (as has happened in several cases). The project objectives and minimum scope of work need to be analyzed along with the flexibility the PBC contractor may have, in the final contract, to identify a correct level of oversight. Also, as the PBC contractor is being selected the previously mentioned considerations need to be weighed with the capability of the selected PBC contractor to ensure:

- The oversight contractor has enough authority and "backing" from the utility to properly monitor and ensure that the PBC contractor and utility are undertaking their respective roles, and so that the PBC contract has sufficient flexibility so that useful interventions from the oversight contractor can be implemented easily and in time.
- In the case of a strong PBC contractor and a weak utility, the oversight contractor needs to have a sufficient budget and influence so they will be a technical and project support arm involved not only in helping to keep the contract on track, but also in ensuring capacity building and sustainability.

B. SCOPE OF WORK

Task 1: Preparation of an Oversight Support Plan

The Consultant will prepare a Project Oversight/Support Plan, at the beginning of the activity, based on Project planning documents, the PBC Contract, and input from both the utility and the PBC Contractor.

The Oversight Plan should be fully coordinated and tuned to the phases, scope, objectives, targets and milestones of the specific contract. Depending on the skill level of the utility and the PBC contractor, specific areas of emphasis should be added.

Task 2: Verification of Contractor Reports, Activities and Results

The consultant will review all PBC Contractor reports, verify the accuracy of the reported outputs and outcomes and/or identify any material discrepancies that should be understood and potentially addressed by the utility. The scope of the Oversight will be designed based on the scope of the PBC Contract and the capabilities of the utility, but could include the following: civil works, installation of customer meters, operation of billing and commercial systems, installation and O and M of monitoring/information systems and associated monitoring equipment, NRW reduction and control activities, the quality of materials used or workmanship utilized, required studies or analyses (such as baseline updates or target adjustments), requests for Contract modifications, or similar deliverables under the PBC Contract.

Note: The specific activities under this task will depend on phases, scope, objectives, targets and milestones of the specific contract. Specific activities for which such advisory services are to be provided should be added.

Task 3: Provision of Technical and Programmatic Advisory Services to the Utility

The consultant will provide technical and programmatic advisory services to the utility to assist it to address any discrepancies it wishes to address or modifications desired to reports, or procedures used under the PBC Contract.

Note: The specific nature of that advisory services will depend on phases, scope, objectives, targets and milestones of the specific contract. Specific activities for which such advisory services are to be provided should be added.

Task 4: Consultant-led Training for the Utility

The consultant will provide training to the utility on PBC Contract oversight, quality assurance and project monitoring, towards the objective that the utility could conduct such activities in the future, without external assistance.

Note: The specific nature of that training will depend on the specific context. Specific training needs, based on the specific tasks under the PBC and overall oversight experience of the utility, should be added.

The consultant will provide a series of reports, as outlined in Section D below.

C. METHOD

The work will be somewhat qualitative, but mostly quantitative and will draw on global experience in project oversight, compliance, quality assurance, and outcome monitoring. The utility and PBC contractor will provide all available data and cooperate with the consultant to ensure that the best possible data is provided and the correct analysis can be made.

D. DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT

Based on the above tasks the following reports to be produced:

A. Inception Report: Describing an updated project Oversight/Support Plan, refined and updated from the preliminary Oversight/Support plans developed during project preparation, the consultant's proposal for this assignment, and the results of extensive discussions with the utility and PBC Contractor.

B. Regular Quarterly Reports: Every 3 months a summary report will be prepared, highlighting activities conducted, summary results, issues and problems encountered, deviation from schedule, and updated planning, if any.

C. Regular Annual Reports: Every 12 months a more detailed report with Executive Summary will be prepared, outlining activities conducted, results achieved, issues and problems encountered, deviation from schedule, and updated planning, if any.

D. Report on Capacity Building: At the end of the capacity building, a report should be delivered saying what was done, what effect it had, and any further capacity building recommended.

E. Draft and Final Report on Oversight/Support for the <<xxxx>> PBC Project, including overall results, lessons learned, recommendations for any follow-on activities, and recommendations for future NRW-PBC Oversight Support Contracts.

Note: The dates and formats of reports should be adjusted to match the requirements of the contract.

E. SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT

The Client will make available all relevant documents. All information and background documents provided as part of this RFP are for the sole purpose of preparing the Technical and Financial proposal for this assignment. All information should be treated as confidential and not used for any other purpose.

F. SPECIAL TERMS & CONDITIONS/SPECIFIC CRITERIA

Language

All primary reports (listed above) should be prepared in the primary language of the client utility as well as in English, unless otherwise specified, and delivered in Word format. The primary reports will be concise, management reports.

Compiled monitoring data/indicators will be provided in a consistent Excel format and will be user friendly.

Timing/Assignment Duration

The Consultancy will start on [xxxx]. The duration of the assignment will be the same as the PBC Contract, but could be extended, should the Client request so, to allow for ongoing monitoring, technical assistance and training and other forms of support to ensure that the impact of the PBC is fully measured and benefits are sustained (to the extent they can be with advisory support activities).

Reporting

The Consultant will report to [xxxx] based in [xxxx].

Payment Schedule

[xxxx]

Required Qualifications and Experience

The Project Team will be composed of the following specialists

- Water Specialist Team Leader/Engineer—The Team Leader shall have demonstrated successful experience in Nonrevenue Water projects. At all times, the Team Leader will be available for support and backstopping to the Technical Team. S/he must have at least 10 years of experience in water supply in similar country contexts with demonstrated experience in NRW issues. Specific expertise on designing NRW projects will be a plus. The Team Leader will have practical experience the use of spreadsheets, statistical packages, project monitoring and oversight, the IWA Water Balance, uncertainty analysis, field measurement techniques related to NRW and component analysis tools. The Team Leader will also have experience in project management in the context of water and sanitation utilities.
- Analyst—A national analyst will support the team in logistics and data collection and analysis. The Specialist will have 10 years of experience in urban water supply in the country. S/he will be familiar with the operations of the relevant water network and familiarity with the terrain of the service area. S/he will have advance level skills in the use of excel and working familiarity with the IWA Water Balance tools, hydraulic analysis and GIS where applicable. The Analyst/Specialist will have good interpersonal skills and able to organize and support stakeholder dialogues with customers, utility staff and other stakeholders.
- Data collection technicians—the data collection technicians will be familiar with the water system construction activities, instrumentation, meters, pressure transducers, etc., the challenges of collection field data, the practical necessity for updating plans and procedures in developing country situations. The number of technicians will depend on the scale of the project, but at least 2—one on civil works and quality control and the other on instrumentation and monitoring. The technicians will be local to where the assets exist. They should have a minimum of 5 years experience and be educated to technician level.

- Financial analyst—position to be included if reduction in commercial losses, improvements in collections or other improvements in financial performance are targeted by the contract. The analyst should be qualified with a degree in finance, economics, or accounting, and have at least 5 years experience on projects focused on improving the financial performance of water utilities in developing countries, including experience with efforts to reduce NRW and improve collections.

Key Background Documentation

- Program Concept Note
- ToR for Initial Assessment, plus Report(s) from Initial Assessment
- ToR for Field Assessment, if applicable plus Reports from the Field Assessment, if any
- ToR for Development of NRW Reduction Investment Plan and PBC Project Design and Procurement, plus reports prepared under this TOR
- The PBC Contract, and any amendments to the PBC Contract
- PBC Contractor Reports including, potentially, baseline refinement studies, updated plans (with, indicators, revised targets, time frames, etc., other major technical or managerial reports, and regular progress reports
- Other relevant project documents as available

Potential Downstream Work (if applicable)

Downstream work is possible following this assignment for extension of the duration of the oversight support activities, and/or repetition or scale-up of the approach.

Appendix D Suggested Report Outlines

D.1 Screening Phase

Screening Report:

- Executive Summary (process undertaken, criteria used, summary of results, and any follow up actions that may be needed before proceeding to the Initial Assessment)
- Introduction (initial input from stakeholders and geographic scope selected)
- Methodology (data requirements, data availability, data quality)
- Ranking (criteria, weightings, deliberations)
- Results (initial results, feedback from stakeholders, and final results)
- Discussion (level of confidence in the results, span of ratings across different candidate locations)
- Recommendations
- Annex with data collected and rating/ranking information

D.2 Initial Assessment Phase

Initial Assessment Report:

- Executive Summary (analyses undertaken, summary of results and key decisions and any follow up actions needed before proceeding in the preparation process)
- Introduction (profile of the utility and overview of the TOR)
- Data Collection (data requirements, data availability, data quality)
- NRW Situational Assessment (water supply and NRW trends, volumes and values of NRW, initial water balance and uncertainty level, NRW practices)
- Suitability of a NRW-PBC (technical, financial, and institutional considerations)
- Indicate NRW-PBC project concept, including objectives, contract type, and key indicators
- Perspectives on Project Oversight and Sustainability of Results
- Risks to implementation-operational, technical, institutional, financial and policy/regulatory
- Recommendations on next steps and PBC NRW Concept
- Recommendation on the need for a Field Assessment Phase, based on current data quality and the level of uncertainty in the data and Project Concept overall
- Annex with data collected and results of analyses
- Annex with TOR for Field Assessment, if needed

D.3 Field Assessment Phase

Field Assessment Report:

- Executive summary (data collection and analyses undertaken, summary of new findings/implications, changes to the Project Concept, key decisions, and any follow up actions needed)
- Introduction (profile of the utility, summary of Initial Assessment, and overview of the site-specific TOR for Field Assessment)
- Data collection (target data parameters, data collection mechanisms, results, and any limitations observed)
- Revised NRW Situational Assessment (water supply and NRW trends, volumes and values of NRW components, results of component analysis, revised water balance and uncertainty level, and NRW practices)
- Suitability of a NRW-PBC (technical, financial, and institutional considerations)
- Revised Project Concept (scope, objectives, indicators, targets, time frame, approximate cost, results of FIRR and EIRR, Draft Plan on Transition/Sustainability of Results)
- Recommendations on next steps
- Summary of key decisions and recommendations
- Annex with data collected and results of analyses

The consulting team/consultant should also prepare a presentation version of the Executive Summary to be used in dialogue with country stakeholders.

D.4 NRW Reduction Strategy Phase

Report of NRW Reduction Strategy Phase:

- Executive Summary—Data collection and analyses undertaken, summary of new findings/implications, changes to the Project Concept, key decisions, and any follow up actions needed
- Introduction—Profile of the utility, summary of Initial Assessment, and overview of the site-specific TOR for Field Assessment
- Short-term activities that can begin in parallel if necessary, such as updating of system plans, census, loading customers, etc.
- Development of the Indicative NRW reduction Strategy options identified, method and results of optimization routines, and approach in the case of intermittent supply and cost
- Proposed NRW reduction Strategy: work proposed, operational changes proposed, timeline, impact, and performance indicators for the NRW reduction project

- Economic appraisal of the NRW reduction Strategy—Analyses conducted and results
- Financial appraisal of the NRW reduction Strategy—Analyses conducted and results
- Suitability of a NRW-PBC—Technical, financial, and institutional considerations
- Draft Plan on Project Oversight/Support Contract and Transition Sustainability Activities
- Recommendation on whether to proceed with a NRW-PBC
- Recommendation of next steps
- Summary of key decisions and recommendations; and
- Annex with data collected and results of analyses

D.5 PBC Design Phase

Reports of PBC Design Phase

Final Transaction Report:

- Executive Summary
- Introduction—Background and topics covered
- Results of the market sounding and implications for the Contract Design
- The proposed Contract Design, including responsibilities of the Contractor, responsibilities of the utility and other public sector entities, objectives and targets, payment structures, governance, monitoring, and dispute resolution arrangements
- A comparison of the recommended option with two other options for delivery of the NRW reduction strategy (one of these options shall be a plausible approach to delivering NRW reduction by the utility itself)
- An indicative NRW-PBC procurement strategy
- Draft Plan on Project Oversight/Support Contract
- Next steps
- Summary of key decisions/recommendations
- Annex with data collected and results of analyses

Business Case Report:

- Executive Summary
- Introduction—Background and topics covered
- The expected costs, benefits, timetable, and financing arrangements for the proposed Contract Design and NRW reduction Strategy
- A summary of the main risks that could affect the proposal, and how they may be mitigated

- A comparison of the recommended option with two other for delivery of the NRW reduction strategy (one of these options shall be a plausible approach to delivering NRW reduction by the utility itself)
- Summary of key decisions/recommendations
- Annex with data collected and results of analyses
- A financial model setting out the assumptions which support the business case

The consulting team/consultant should also prepare a presentation version of the Executive Summary to be used in dialogue with country stakeholders.

D.6 Procurement Phase

The Procurement Phase has two expected reports: the prequalification report and the evaluation report. These reports are to help the contract authority evaluate the applications to be prequalified and to evaluate the proposals.

D.7 Implementation and Oversight Phase

Reports of the Oversight Contractor:

- Inception Report—Describing an updated project Oversight/Support Plan, refined and updated from the preliminary Oversight/Support plans developed during project preparation, the consultant's proposal for this assignment, and the results of extensive discussions with the utility and PBC Contractor.
- Monthly Reports—Every month a summary report will be prepared, highlighting activities conducted, summary results, issues and problems encountered, deviation from schedule, and updated planning, if any.
- Annual Reports—Every 12 months a more detailed report with Executive Summary will be prepared, outlining activities conducted, results achieved, issues and problems encountered, deviation from schedule, and updated planning, if any.
- Report on Capacity Building—At the end of the capacity building, a report should be delivered saying what was done, what effect it had, and any further capacity building recommended.
- Draft and Final Report on Oversight/Support for the PBC Project, including overall results, lessons learned, recommendations for any follow-on activities, and recommendations for future NRW-PBC Oversight Support Contracts.

Appendix E Tools

E.1 Screening Tool

The **Screening Tool**—a qualitative and quantitative scorecard—is used to identify cities, towns or locations which may be good candidates for NRW-PBC Projects. Below you will find a screening tool example (Table E.1), as well as background data (Table E.2 and Table E.3).

TABLE E.1: Screening Tool Example

Criterion		Red	Amber	Green	Ajuga	Moreno	Nkane	Rallamah
NRW levels		NRW <15%	15%<NRW<40%	NRW >40%	🟡	🟢	🟢	🟢
		NRW < 300L/C/D	300<NRW< 800L/C/D	NRW > 800L/C/D	🟡	🟡	🟡	🟢
Water supply reliability			24-18 hours	<18 hours	🟡	🟡	🟢	🟢
Variable operating costs			$0.00-0.50/m^3	cost >$0.50/cu.m	🟢	🟡	🟡	🟡
Installed Capacity (Water Production)			IC > 250lpcd	IC < 250lpcd	🟡	🟡	🟡	🟢
Resource scarcity		Unlimited high-quality water available with little pumping or storage costs	Between	All available water allocated, solutions such as desalination being considered	🟢	🟡	🟡	🟢
Demand growth (%p.a.)			0%<Growth<4%	Growth >4%	🟡	🟡	🟡	🟢
LRMC ($/cu.m)		LRMC <$0.30	$0.30<LRMC<$1.00	LRMC >$1.00	🟢	🟡	🟡	🟢
Legal barriers to PBCs		Yes	Not Clear	No	🟢	🟡	🟡	🟡
Social support for PBCs		No	Not Clear	Yes	🟢	🟡	🔴	🟢
High priority on improving water service in this area	**Ministry of Water**	No	Not clear	Yes	🟢	🟡	🟢	🟢
	Ministry of Finance	No	Not clear	Yes	🟡	🔴	🔴	🟢
Conclusion of Screening					🟡	🔴	🔴	🟢

TABLE E.2: Scenarios—Data Availability versus Continuity of Supply

	Continuous supply	intermittent supply	
		Adequate Production	**Insufficient Production**
		NRW reduction will allow 24×7	*NRW reduction will not allow 24×7*
Good data *Information on variables in checklist is readily available*	 1 **Ajuga** Continuous supply and good data	Assumed for data in most cases	
Poor data	 2 **Moreno** Continuous supply and good data	 3 **Nikane** Continuous supply and good data	 4 **Rallama** Continuous supply and good data

TABLE E.3: Scenarios—Key Attributes

Name	**Ajuga**	**Moreno**	**Nkane**	**Rallamah**
				
Description	Small Tropical Island	Provincial Town	Medium City	Major City
Data Availability	Good	Poor	Poor	Poor
No. of Connections	50,000	50,000	100,000	250,000
Water Production Capacity	High	Adequate	Low	Low
Continuity of Supply (Hours/day)	24	24	12	6
Average Operating Pressure (m)	40	25	20	15
NRW (%)	34%	51%	53%	53%
Level of NRW, L/C/D	478	482	704	956
Level of NRW, L/C/D (wsp)	800	800	2400	
Level of Apparent Loss, L/C/D	120	unknown	unknown	unknown
Level of Real Loss, L/C/D (wsp)	360	assumed to be high	assumed to be high	assumed to be high
Extent of Customer Metering	100%	50%	50%	50%

Name		Ajuga	Moreno	Nkane	Rallamah
					
Expected Growth in Demand (m^3/month)		3%	1%	2%	6%
Current Cost of Water ($/$m^3$ produced)		$1.00	$0.50	$0.40	$0.65
Average Variable Operating Costs		$0.40	$0.15	$0.15	$0.30
Long-Run Marginal Costs (LRMC)		$2.00	$0.50	$0.50	$2.50
Cost of Water from Next Supply ($/$m^3$ produced)		$1.50	$0.75	$0.50	$1.00
Average Tariff ($/$m^3$ sold)		$2.00	$0.50	$0.40	$0.30
Operating Ratio (operating revenues/operating costs)		1.00	0.80	0.65	0.50
Social Opposition to Performance-Based Contracts (PBCs)		Low	Moderate	High	Moderate
Political Support for Water Supply improvements	**Ministry of Water**	High	Moderate	High	High
	Ministry of Finance	Moderate	Low	Low	High

E.2 Data Collection Template

Area	Importance	Parameter	Data
Water Supply	High	Water Production Maximum Capacity, 1,000 m^3/day for each supply facility	
	Medium	% of pumped versus gravity feed supply	
	Medium	Type of pumps where majority of pumped supply	
	High	Raw water storage volumes	
	High	Type of supply metering with description of meter calibration procedures	
	Medium	Inter-annual variations (L, M, H)	
	High	System Input Volume, 1,000 m^3/day	
	High	Measured Billed Volume, 1,000 m^3/day	
	High	Estimate of Unmeasured Billed volume, 1,000 m^3/day, with rationale used	
	High	Number of Authorized Customers (accounts) (residential, commercial, etc.)	

Area	Importance	Parameter	Data
Distribution Infrastructure	High	No. of Connections (active, inactive, illegal, legal but tampered)	
	High	Length of Mains, km	
	Medium	Lengths of different types of pipe material, by diameter	
	Medium	Distribution storage volumes	
	Medium	Description of extent of sectorization	
	Medium	Presence and use of District Metered Areas (DMAs), if any	
	High	Number of connections and customers with micro-metering	
	Medium	Number, type, and average age of most common customer meters	
	Medium	Results of customer meter accuracy testing, if any (and process used)	
Service Quality	Medium	Coverage of water supply services with direct connections	
	High	Average time supply is provided (hours/week)	
	High	Number of connections with 24/7 supply year-round	
	High	Extent of the use of roof tanks, if any	
	High	Utility minimum pressure requirements at property line	
	Medium	Utility corporate attitude on supply to 2/3 story buildings instead of jockey pump	
	High	Average distribution system pressure, by zone if possible	
	Medium	Results of water quality testing at connections, if any (potability)	
Finances	High	Recent Financial Statement (audited if possible)	
	Medium	Components of Operating Costs	
	Medium	Capacity, Timing, and Cost of next Supply Facility	
	High	Tariff Structure—classes, steps, unit prices, fixed charge	
	Medium	Monthly Management Reports (if they exist)	

E.3 Trend Analysis Tool

The **Trend Analysis Tool**[1] is a method to assemble utility context and performance data in a systematic and complete manner. This tool can help to: understand of the evolution of performance over recent years; benchmark current performance; and monitor progress over time. The trend analysis tool complements other tools included with the Operations Manual, including the IWA Water Balance Tool (World Bank EasyCalc) and the NRW Practices Rating Tool. Together they form a powerful suite of tools for to identify important aspects of NRW for improvement, or to evaluate the impact of projects or programs to reduce or control NRW and related parameters.

E. 3.1 Principal Parameters Tracked

There are several parameters tracked using this tool, including:

- System Attributes and Operations
  - Coverage within Utility Service Territory

- Connections
  - Customers
  - % Metered Customers
  - Length of Mains
  - Connection Density
  - Supply Continuity, %
  - Average Pressure
  - Production Capacity
  - Capacity Utilization, %
  - Water Production
  - Total Water Billed
  - Total Nonrevenue Water
  - Water Billed, liters/connection/day
  - NRW, Liters/Connection/Day
  - Reported Leaks on Mains/100 km of Mains/Year
  - Unreported Leaks on Connections/1,000 Connections/Year
  - Infrastructure Leakage Index (ILI)

Note that this is a complete, ideal, list of parameters and indicators. Many utilities will not have the full set of data available. Even with only partial data some useful trends can be found,

Figure E.1 and Figure E.2 shows samples of the graphical presentation of the information, for the case of Belize Water Systems. In the first, overall consumption is rising as connections rise, but total NRW is falling, yielding a roughly constant requirement for water production. The second figure shows the same parameters by connection, where we can see billed water per connection is nearly constant, but as NRW is decreased, so is water production requirement.

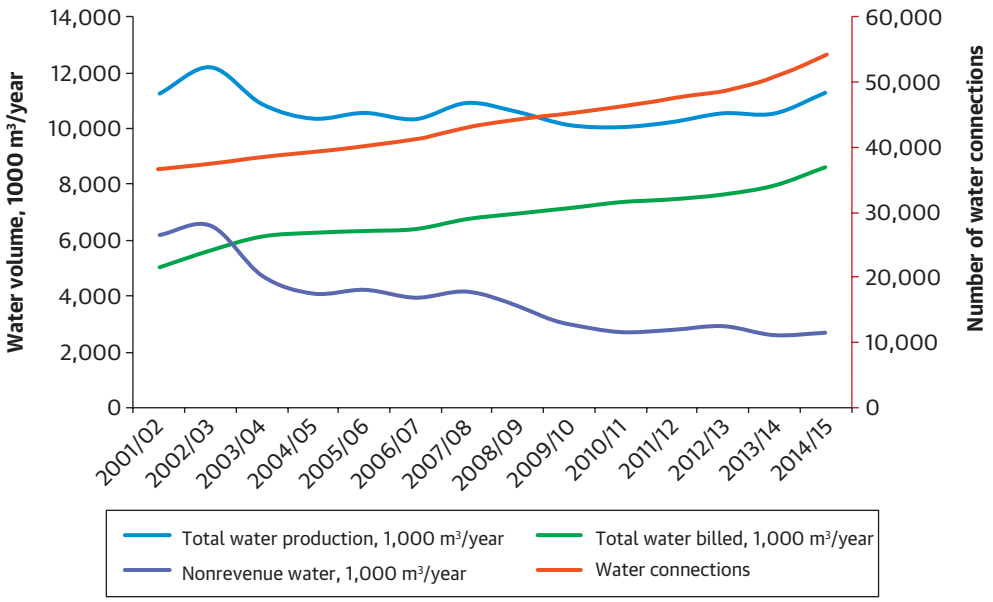
- Water Utility Finances
  - Operational Revenue from Water Services
  - Operational Revenue from Sewerage Services
  - Other Operational Revenue
  - Non-Operational Revenue
  - Total Revenue
  - Operational Cost of Water Services
  - Operational Cost of Sewerage Services

- Administrative Costs
- Other Operational Costs
- Total Operational Costs
- Earnings before Interest, Tax, Depreciation and Amortization (EBITDA)
- Depreciation
- Earnings before Interest and Taxes (EBIT)
- Debt Service
- Taxes, if Any
- Net Earnings
- Operating Costs Recovery Ratio
- Revenue Collection Ratio
- Cost of Water Production/Volume Produced
- Revenue per Volume Billed (average tariff)

Note that this is a complete, ideal, list of parameters and indicators. Many utilities will not have the full set of data available. Even with only partial data some useful trends can be found.

In this case, we can observe that the financial situation in this government owned corporation has vastly improved—EBITDA has risen from about BZ$6 million to BZ$14 million, and net earnings has risen from a negative number to a positive one. Cost of water production, effective average tariff, and operating cost coverage ratio have remained roughly constant.

FIGURE E.1: Production Trends



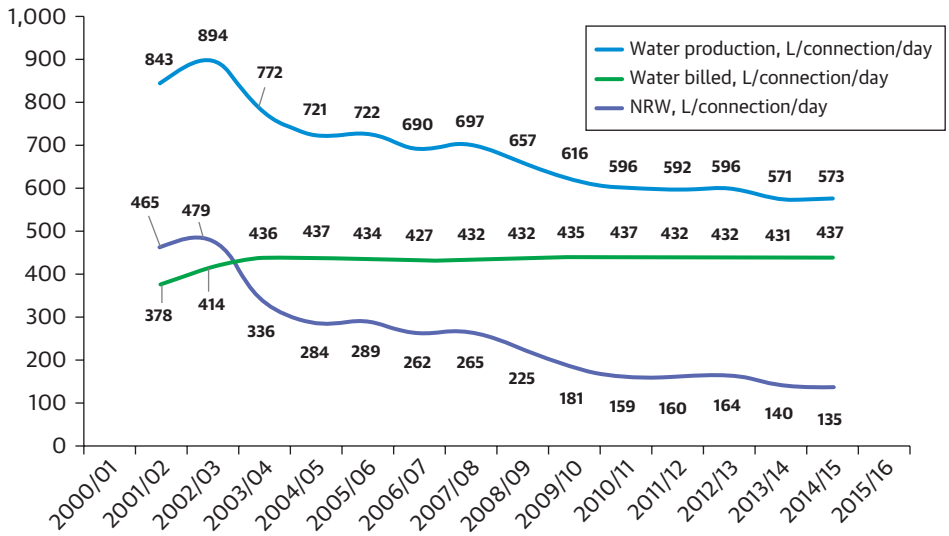
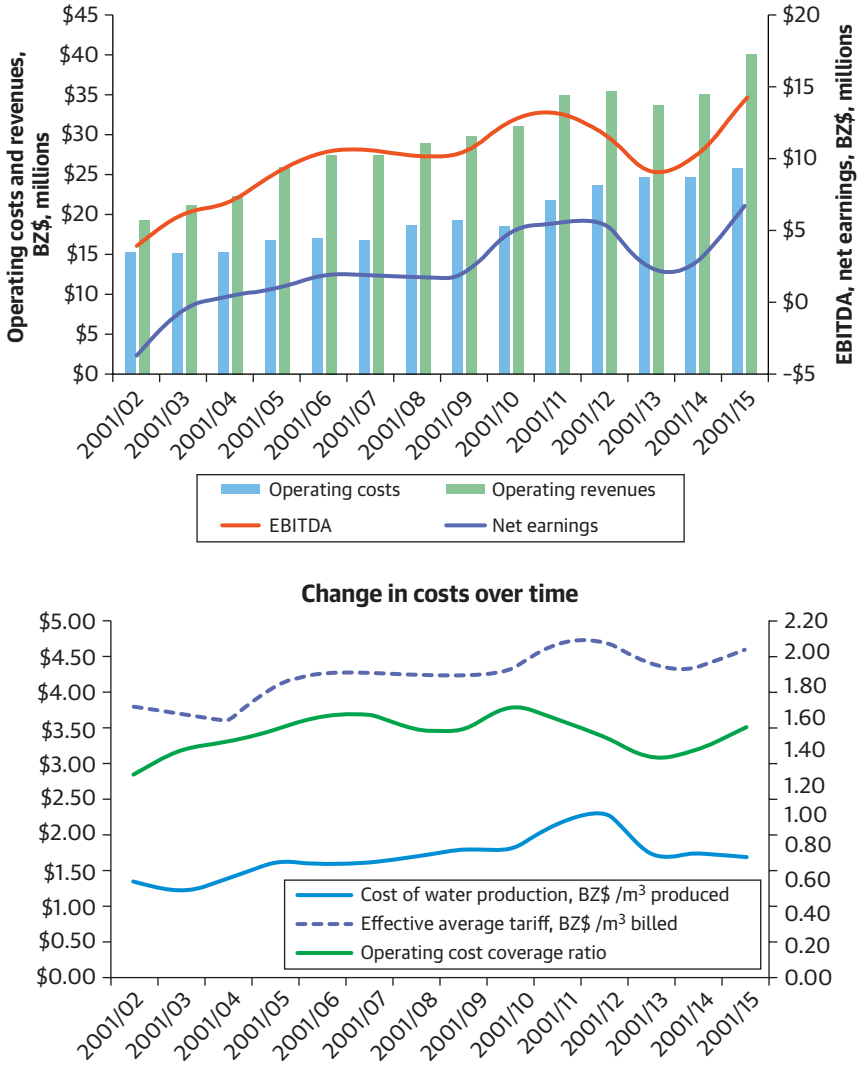


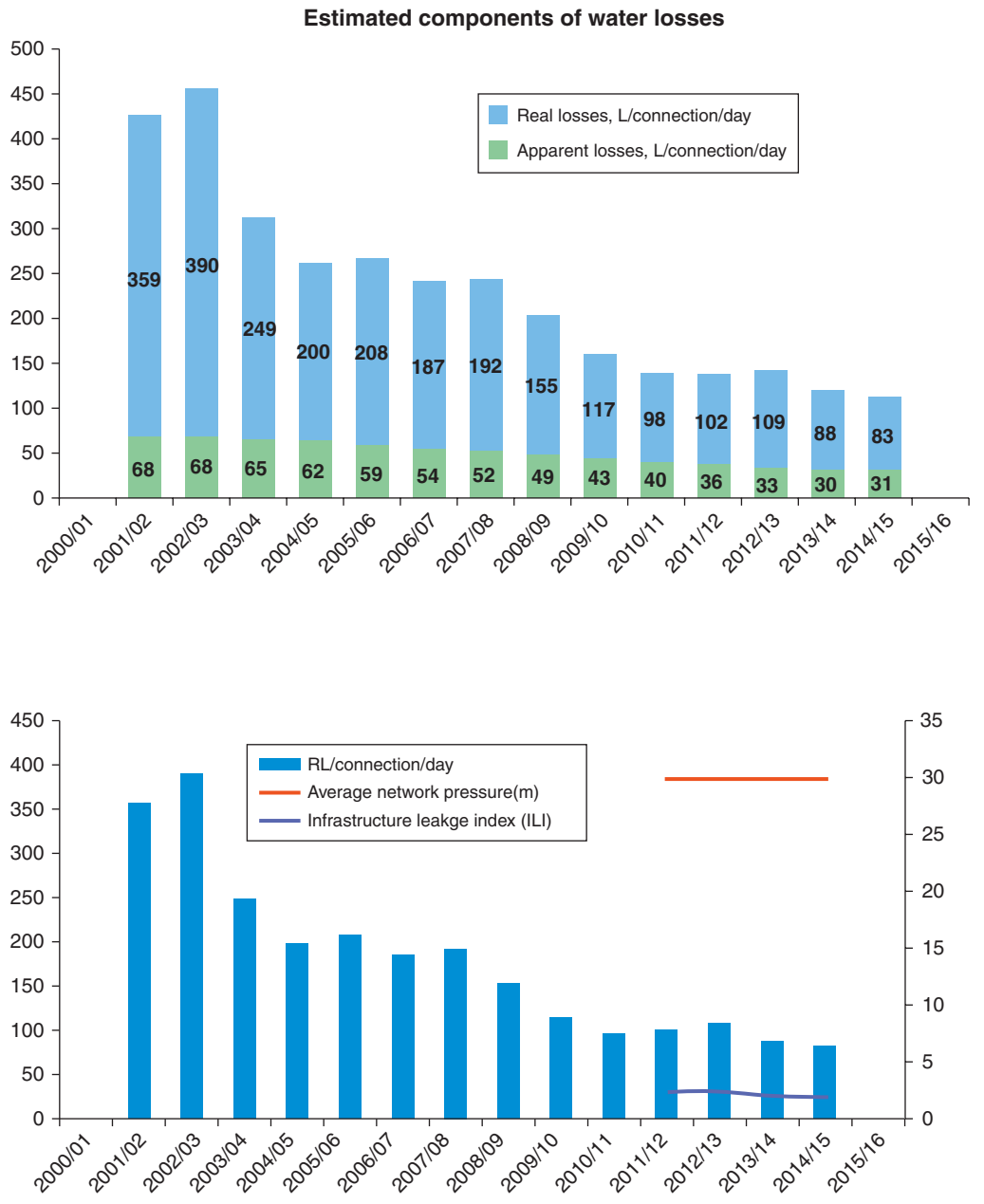
FIGURE E.2: Financial Trends



NRW Components

Figure E.3 shows the estimated top down water balance over time, a two-fold reduction in apparent losses, and about a fourfold reeducation in real losses. For the last four years, the graph of real loss shows only small loss reductions and only minor reductions in the Infrastructure Leakage Index, given constant pressure.

FIGURE E.3: Water Loss Trends



E.3.2 Results Summary

The table below shows a tabulation of key parameters and indicators generated by this tool.

	Cascal Ownership					Belize Water Services, Ltd								
WATER SYSTEM ATTRIBUTES	**2001/02**	**2002/03**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Average Water Network Mains Length (km)	895	910	950	958	981	1002	1044	1073	1084	1134	1182	1228	1322	1359
Average No. of Water Connections	36,620	37,404	38,616	39,414	40,107	41,119	42,983	44,223	45,074	46,237	47,421	48,522	50,619	54,019
Connection Density (Connection/km)	40.9	41.1	40.7	41.1	40.9	41.0	41.2	41.2	41.6	40.8	40.1	39.5	38.3	39.7
Customers with Meters, %								100%	100%	100%	100%	100%	100%	100%
Billed Water, m^3/Connection/month	11.5	12.6	13.3	13.3	13.2	13.0	13.1	13.1	13.2	13.3	13.1	13.1	13.1	13.3
Average Network Pressure (m)											30	30	30	30
Continuity of Service, %											100%	100%	100%	100%
Reported Mains Leaks/km/year														
Reported Connections Leaks/1,000 Connections/year														
FINANCES and RESOURCES														
Operating Revenue, 1,000 BZ$	$19,301	$21,167	$22,301	$25,909	$27,322	$27,448	$28,866	$29,673	$31,047	$34,869	$35,327	$33,583	$34,923	$39,821
Operating Costs, 1,000 BZ$	$15,270	$15,030	$15,236	$16,861	$16,905	$16,868	$18,705	$19,216	$18,494	$21,810	$23,673	$24,512	$24,640	$25,724
Operating Cost Coverage Ratio	1.26	1.41	1.46	1.54	1.62	1.63	1.54	1.54	1.68	1.60	1.49	1.37	1.42	1.55
Cost of Water Production, BZ$/$m^3$	$1.36	$1.23	$1.40	$1.63	$1.60	$1.63	$1.71	$1.81	$1.82	$2.17	$2.31	$1.74	$1.75	$1.71
Variable Cost of Water Production, BZ$/m3														
Effective Average Tariff, BZ$/$m^3$ sold	$3.821	$3.743	$3.627	$4.123	$4.304	$4.279	$4.264	$4.256	$4.334	$4.728	$4.725	$4.391	$4.383	$4.618

NRW PERFORMANCE														
Nonrevenue Water, L/Connection/day	465	479	336	284	289	262	265	225	181	159	160	164	140	135
Nonrevenue Water, %	55.1%	53.6%	43.5%	39.4%	40.0%	38.0%	38.1%	34.2%	29.4%	26.7%	27.0%	27.6%	24.5%	23.6%
Water Losses, L/Connection/day	427	459	314	262	267	241	244	203	159	138	138	143	118	113
Apparent Losses, L/Connection/day	68	68	65	62	59	54	52	49	43	40	36	33	30	31
Real Losses, L/Connection/day	359	390	249	200	208	187	192	155	117	98	102	109	88	83
Apparent Loss/Billed Authorized Consumption	18.0%	16.5%	15.0%	14.3%	13.5%	12.8%	12.0%	11.3%	9.8%	9.1%	8.4%	7.7%	7.0%	7.0%
Real Losses, m3/km/day	14.7	16.0	10.1	8.2	8.5	7.7	7.9	6.4	4.8	4.0	4.1	4.3	3.4	3.3
Infrastructure Leakage Index (ILI)											2.43	2.59	2.07	1.96
Pressure Manangement Index (PMI)											1.50	1.50	1.50	1.50
Global Leakage Index											3.65	3.89	3.10	2.95

E.3.3 Instructions for Use of the Spreadsheet

A blank spreadsheet is provided on the PBC webpage with this description for use in project preparation and monitoring. The spreadsheet itself is quite straightforward in that year-by-year data can simply be added into the respective lines. Rows with gray shading contain formulas, and should not be adjusted. The graphs should populate correctly, although time scales and axes scales may have to be manually adjusted.

The more difficult part of the task of Trend Analysis is obtaining the data, and conducting some quality control. In general, data sources include:

- The utility itself
- A national or state/province-level regulator, if applicable
- Sector studies performed by an oversight Ministry
- Sector studies by regional or global development finance organizations
- Specific project analyses for the utility or region in question from websites of donor organization
- Associations of regulators such as Asociación de Entes Reguladores de Agua Potable y Saneamiento de las Américas (ADERASAS) in Latin America
- Other utility benchmarking sites
- The International Benchmarking Network for Water and Sanitation Utilities (IBNET), the World Bank database on utility parameters

It will often happen that various sources contradict each other. In general, it is best to start with the base parameters as opposed to derived parameters. For example, start with total volume produced, and total volume billed, and derive NRW in the spreadsheet to verify the derived data. Simple typos can be present even in official reports. One common source of data confusion is that many organizations are not fully transparent on the time frame for a reported parameter or derived indicator. For example, a volume of water production could be reported as a total over a year, but the number of connections could be reported as an end-of-year figure. The ratio of these two values would give an inaccurate value of average volume produced per connection, over the year. An average number of connections over the year should be used, which could be approximated from the average of 1) the connections at the end of the year in question and 2) the number of connections at the end of the previous year. Therefore, detailed notes should be made for each parameter as to the source, assumptions made and any corrections made.

If an important parameter is missing, this gap should be noted. Provisional values may be used, but they should be highlighted.

E.4 NRW Practice Rating Tool

The purpose of the **NRW Practice Rating Tool** is to 1) document the practices being conducted to reduce and control NRW, and 2) provide a quantitative rating on the completeness and maturity of practices in different domains of NRW management. The results show strengths and weaknesses of the current fields of practice.

The NRW Practice Rating Tool can be used to prepare:

- An initial assessment of existing practices at the water utility
- A work plan to introduce new or improved practices
- A training program to introduce new or improved practices
- A monitoring report (for example, repeat every 6 months to measure progress on practice improvement)
- Information to assist in decision making on possible outsourcing of specific practices or functions, to improve practices or reduce NRW
- A comparison of the NRW Practices and performance with other utilities

This version of the tool has a two-level assessment approach. The 12 Rating Fields are separated into two groups—a set of 8 Basic Fields, and 4 additional Advanced Fields. If a quick analysis is required a rating can be prepared using just the 8 Fields. Any comparison of Practices in different utilities is to be made the number of Fields utilized should be consistent.

This version of the tool has six Practice Rating Fields, including:

1. NRW Program Management
2. Information Systems
3. Water Balance Practice
4. Apparent Loss Reduction and Control
5. Real Loss Reduction and Control
6. Monitoring and Analysis

Table E.4 shows the Rating Fields and Criteria. The table on the next page shows the actual rating system for one of the fields—NRW Management. This detailed table provides guidance on the specific practices associated with a given rating. The example provided is for the case of Aguas de Guariroba, a concession operator in Brazil.

TABLE E.4: NRW Practices Assessment Rating Fields and Criteria

Nonrevenue water practices assessment rating fields and criteria

Practices field		Program management	Information systems	Water balance practice	Apparent loss reduction an control	Real loss reduction and con	Mtronlitoring and analysis
Description of practices field		Rates utility practices on NRW program leadership, organization, planning, budgeting, human and material resources, incentives and use of outside 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 policies and activities on all components of apparent loss reduction and control	Rates utility policies and activities on all components of real loss reduction and control	Rates utility practices on use of experiences, program results, and information system data to assess plans and procedures, and revise strategies, plans and targets
Criteria for Basic NRW Practices Assessment	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 analyses	Leak repair time—service connections	(Large) customer consumption monitoring
	4	NRW program planning and budgetting	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 arrears and deliquent accounts
	6	Technical skill level and training of NRW personnel	Maintenance management system	Estimation of unbilled authorized consumption	Reduction of the number of unmetered connections, especially large uses (goverment, 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 bursts	Regular NRW monitoring reports
Criteria for Advanced NRW Practices Assessment	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 "legitimize" 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 unknown 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 overflows or leakage	Quaility control on crews or contractors which conduct leak detection, repairs, rehabiliation 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, PRVs, 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/perssure/noise sensors to detect leakage	Use of SCADA for real time monitoring and operational optimization

TABLE E.5: NRW Management Rating Scale

NRW Management		Enter Rating	Practices Rating Scale					
Rates utility practices on NRW leadership, organization, planning, budgeting, human and material resources, incentives and use of		which best describes the situation	None	Poor	Deficient	Adequate	Good	Excellent
			0	1	2	3	4	5
1	Top management interest / leadership regarding good NRW management	4.5	Top management has no understanding, information or concern about NRW	Top management has very little understanding, information or concern about NRW	Top management has some understanding, information or concern about NRW	Top management thinks NRW is important but does not want to allocate resources to improving it	Top management thinks NRW is important, reviews information on NRW status, but has only allocated limited resources to improving it	Top management requests and reviews NRW reports, provides financial and other support to NRW activities and holds staff accountable
2	NRW management organization	5	There is no unit for the management of NRW – no particular unit is in charge of NRW	There is no Unit for the management of NRW but different departments communicate periodically on what they are doing	There is no Unit for the management of NRW but different departments communicate consistently and coordinate their activities to some degree	There is a cross-unit task force for the management of NRW, with a designated leader to ensure consistent communication and coordination	There is a specific unit for the management of NRW, with a designated leader; however there are some responsibility overlaps with other departments	There is a specific unit for NRW management with its own staff and a high level leader who reports to top management and works with other departments as necessary
3	Communication and coordination among departments regarding NRW	4.5	The communication between departments is nonexistent: planning, commercial, water production, water distribution, finance	The communication between departments (planning, commercial, water production, water distribution, finance) is very infrequent: for example, only in writing during the annual planning process	The communication between departments is loosely structured but infrequent – semi annually or quarterly—is no coordination of NRW related activity	The communication between departments is well structured but infrequent—semi annually or quarterly. There is little coordination of NRW related activity	The communication between departments is well structured and fairly frequent. The various "functions" meet quarterly or monthly, and coordinate activity on NRW	The communication between departments is well structured and frequent—various "functions" meet monthly, coordinate activity on NRW and informally exchange information and ideas frequently
4	NRW program planning and budgeting	4.5	The utility has no targets, plans or budget for NRW management, and has little if any interest to develop them	The utility has no targets, plans or budget for NRW management, but sees that this should be started	The utility has only informal targets, plans, or budget for NRW management, which are part of budget for distribution or another department	The utility has some targets and plans, but no formal budget for NRW; targets are based on "rule of thumb," without a reliable baseline	The utility has a short run NRW management plan, with a rough baseline, targets, activities, and a program budget but does not monitor progress closely	The utility has a 10 year NRW management plan, with targets, strategies, activities, financial analyses, and a program budget for capital and operational expenditures

5	Oversight of plans and budgets	**4.75**	Utility management does not supervise activities focusing on NRW	Utility management pay no attention to progress on plans and expenditures on NRW management.	Utility management only briefly reviews progress on plans and expenditures on NRW management, once each year	Utility management only briefly and sporadically reviews progress on plans and expenditures on NRW management, for example twice a year, and provides comments.	Utility management regularly reviews reports and convenes quarterly meetings with staff working on NRW to assess progress and help solve problems	Utility management reviews reports and convene broad monthly meetings with staff working on NRW to assess progress and help solve problems
6	Technical skill level and training of NRW personnel	**4.5**	The skill level of engineering personnel and operational crews is very poor and they receive no NRW training	The skill level of engineering personnel and operational crews is poor, and they receive no training	The skill level of engineering personnel and operational crews is poor to adequate, but there is interest in improving skills	The skill level of engineering personnel and operational crews is adequate, and there is some interest in more training	The skill level of engineering personnel and operational crews is good and both staff and the company want to improve skills	The skill level of engineering personnel and operational crews is excellent, staff want to learn more, and some training is underway
7	Technical resources available	**4**	The utility has no special equipment for NRW work, such as pipe locators, listening devices, leak correlators, pressure sensors and data loggers	The utility has some special equipment for NRW work, but the equipment is rarely used out of lack of interest or training	The utility has some special equipment for NRW work, but the equipment is rarely used due to its age and poor condition	The utility has a modest supply of special equipment for NRW work, such as pipe locators, listening devices, and which are used	The utility has a reasonable supply of special equipment for NRW work, such as pipe locators, listening devices, leak correlators, pressure sensors, and data loggers	The utility has a full supply of special equipment for NRW work, such as pipe locators, listening devices, leak correlators, pressure sensors and data loggers, and investigates new technologies
8	Reporting and public information on NRW progress, targets, plans, and budgets	**4.75**	No reporting or distribution of information to the public on NRW is carried out	The utility has no program to provide information to the public regarding NRW	The utility has a small program to provide information to the public by providing summary reports to newspapers and local municipal officials	The utility has a small annual program to provide information to the public by providing summary reports to newspapers and more detailed information to local officials and the public via its website	The utility has a modest quarterly program to provide both summary and detailed information to politicians, newspapers, NGOs, and the public, via print media, their website, and social networking tools	The utility has a strong, proactive quarterly program to provide both summary and detailed information to politicians, newspapers, schools, NGOs, and the public, via print media, their website, and social networking tools

table continues next page

table continued

9	Advanced, ongoing, staff training/ capacity building	**4.75**	No staff ever receive any training	Staff training is seen as important but is not planned, budgeted, or conducted	Some senior staff receive sporadic training	Senior and mid-level staff receive some training at least every 2 years	Senior and mid-level staff receive some training at least every year, as part of an ongoing program	The utility has a comprehensive staff development and retention plan.
10	Use of internal awards and recognition for excellent staff performance	**3**	There are no programs to give awards or recognition to staff for good performance	There are sporadic programs to give awards or recognition to staff for good performance, but the reasons for the choices are not communicated	There are sporadic programs to give awards or recognition to staff for good performance, and the reasons for the choices are clearly communicated to all	There are quasiregular programs to give a few annual awards or recognition to staff for good performance , and the reasons for the choices are clearly communicated to all staff	There are regular monthly programs to give multiple awards or recognition to staff for good performance, across many departments and the reasons for the choices are clearly communicated to all staff	The utility has a regular monthly programs to give multiple awards and recognition to staff for good performance, across all departments; top management are clearly visible in the process
11	Performance-based compensation bonus systems for staff	**4.75**	There is no linkage between staff performance and compensation	A pay scale with at least some performance incentive is desirable, but not premitted	Staff who exhibit good performance received non-financial "rewards" for their performance	A small portion of senior and mid-level staff compensation is based on performance	A major portion of senior and mid level staff compensation is based on performance	All staff have some form of incentive pay for good performance.
12	Experience in contracting for NRW services	**3**	The organization has no experience or interest in utilizing external resources for NRW activities	The organization has considered utilizing external resources for NRW activities, but have no experience or internal capabilities to do so.	The organization has considered utilizing external resources for NRW activities, and have identified specific areas where external expertise would be most beneficial, but have no experience or internal capabilities to do so	The organization has used external resources for NRW activities, specific areas where external expertise would be most beneficial, but procurement mechanisms are cumbersome and impede good use of these resources	The organization and its staff have made some use of external resources for NRW activities, and know specific areas where external expertise is most beneficial	The organization and its staff have considerable experience utilizing external resources for NRW activities, make good choices on which activities to outsource and which not to, and the best methods to procure the services
NRW Management Rat		**4.3**		**NRW Management Rat 100**	**87**	Comments:		

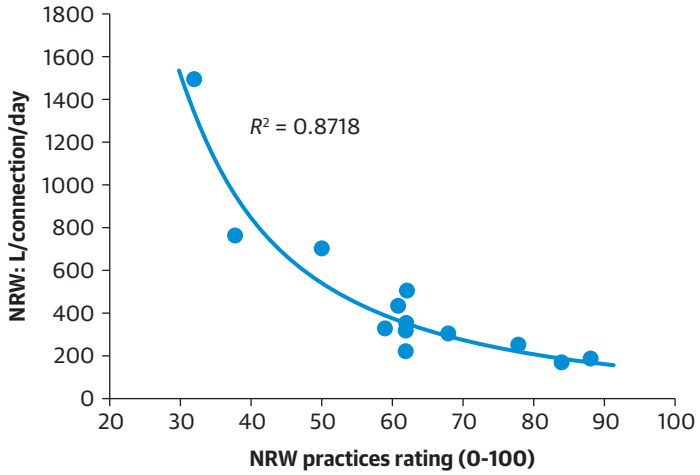
TABLE E.6: Sample Tool—Aguas de Guariroba NRW Practices Rating

Location:	Águas de Guariroba							Period covered:	2014	
NRW practices field	Rating of NRW practices							Weighted scoring to 100		
	Basic score	None 0	Poor 1	Deficient 2	Adequate 3	Good 4	Excellent 5	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
Overall NRW practices rating	4.4							88	100	88
Prepared by:	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%									
Arturo Vegas										
Date:	Comments:									
9/12/2015										

Note: The overall NRW practices score for Aguas de Guariroba is 88 out of a possible 100 points—very high for NRW practices. The rating in the different fields are all strong.

Lastly, it is important to note that a correlation can be made between the Practices Scores in different Latin American utilities and their NRW Performance. Figure E.4 shows a very clear correlation—utilities with a high Practices Score have low NRW, and vice versa.

FIGURE E.4: Practice Rating versus Performance Correlation Example



E.4 Water Balance Tool

The **Water Balance Tool** is a spreadsheet-based software called WB-Easy Calc, found on the PBC website. It is used to understand inflow, consumption, and losses of a water utility. Water balance in its simplest form means that the total levels of water consumption and losses equals the system input. This tool helps to benchmark, understand basic relationships, and ultimately prioritize work and investments. The water balance tells the magnitude of the different components of NRW, as well as the confidence level attached to the estimates.

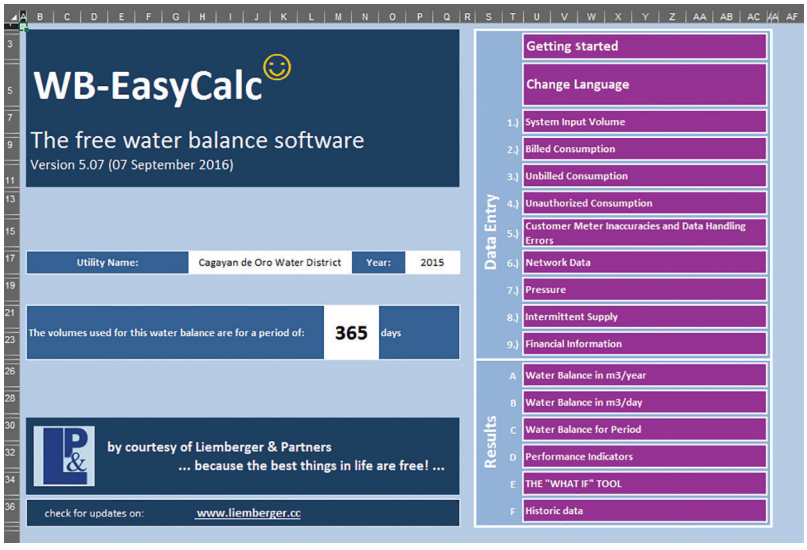
Application

This tool operates in many languages, and reveals the water loss situation, and ultimately the availability/reliability of data, level of understanding, and current problems and issues. Calculating the Water Balance with this tool takes four steps:

1. Determine system input volume
2. Determine authorized consumption (billed and unbilled)
3. Estimate apparent (commercial) losses
4. Calculate real (physical) losses

Figure E.5 shows the home screen of the WB-EacyCalc tool.

FIGURE E.5: Homepage of the WB-EasyCalc Tool (Excel)



Note: WB-EasyCalc Version 5.07, accessed September 2016.

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