**GUIDANCE NOTE**

**For Standard Bidding Document (SPD) for**

**Water Loss Reduction Performance Based Contract (WLRPBC)**



**JULY 2023**

Preface

This Guidance Note has been prepared as a companion to the World Bank Standard Procurement Document (SPD)- *Request for Bids, Water Loss Reduction Performance Based Contract* hereinafter “the SPD”.

The SPD is designed to be used for performance based contracting for water loss reduction (WLR) in water supply networks. Traditionally, contracts for water loss reduction or non-revenue water management have been works contracts that were based on bills of quantity and payment of the Contractor was not dependent on results. This gives the Contractor limited incentive to find the major leaks or to ensure that the remedies are sustainable. This SPD has been developed to include performance based contracting, focusing on outputs and sustaining those outputs.

The WLRPBC SPD applies a two-envelope bidding process with or without request for prequalification.

This Guidance Note is primarily intended to assist World Bank Borrowers who are planning to prepare projects for WLR in water supply networks and World Bank staff working on these projects. Its purpose is to help users decide whether a performance based contract (PBC) for WLR would be the right contract model for them and to provide guidance on how to apply, adapt, and further develop the SPD to fit the particularities of each project.

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Introduction

* 1. Objective

Development of Standard Procurement Documents and performance-based contract (PBC) for water loss reduction (WLR) to be used by World Bank Borrowers.

* 1. Background

The World Bank is increasingly being asked to finance projects with components for non-revenue water (NRW) management to help utilities become more efficient and reduce stress on scarce water resources. A key element of NRW management is water loss reduction (WLR) in the water supply network. As utilities in developing countries often do not carry out routine WLR or have staff dedicated to it, these services are typically contracted out to skilled specialist contractors.

Traditionally, contracts for WLR or NRW management have been works contracts that were based on bills of quantity and payment of the Contractor was not dependent on results. This gives the Contractor limited incentives to prioritize finding the major leaks or to ensure that the remedies are sustainable. This SPD has been developed to include performance-based contracting, focusing on outputs and sustaining those outputs.

WLR has some specificities which need to be taken into account when developing procurement documents:

1. design and management know-how are critical to achieving and maintaining levels of WLR, but the capital works component takes a significant share of the contract price;
2. optimization needs to be achieved between cost and efficacy of (works) interventions (e.g. Contractors could be fixing many small leaks or one big leak; Contractors could make significant reduction by blanket replacement of significant part of network, which would be costly);
3. as most assets are underground and leaks are hidden, it is not possible to prescribe ex ante an optimal set of interventions, or sometimes, even realistic levels of WLR; and
4. transfer of performance risk to the private Contractor can be used as the primary means to incentivize optimization.

NOTE: The following description presents a specific approach to PBC for WLR. However, this does not preclude the adaptation of the approach nor the use of other appropriate approaches for procuring services for NRW management.

Scoping and Preparation of the SPD

# Objectives of Scoping and Preparation Stage

The objective is to develop baseline documents that will help optimize WLR in the project and form the basis for the competitive bidding process. Key documents of the SPD WLRPBC to be prepared by the Borrower are the Bid Data Sheets, Specifications, Particular Conditions of Contract and an indicative Bill of Quantities (BOQ) for the establishment of DMAs and reduction of WLR to target levels, quality standards, etc.

* 1. Initial Assessment

First, an initial assessment of the PBC target area should be performed to ensure the required information to proceed with the project is either readily available or can be easily obtained. This task is led by the Borrower, potentially with support from a consultant to assist in preparation. The key findings of the assessment will be reflected in the Specifications section that will form part of the SPD WLR. A template Specifications to be used with the SPD WLRPBC is attached at annex 3.

This initial assessment includes:

1. Review of existing data on relevant technical, financial, institutional, and managerial parameters related to the extent, location, materials, age, condition and performance of the pipe networks and associated service connections (from the distribution pipe to the property boundary/meter);
2. Conducting additional data collection and confirmation activities, as necessary;
3. Completing a preliminary water balance for the system;
4. Developing a conceptual design for the implementation of a WLR PBC project, including oversight protocols on behalf of the Borrower and monitoring and evaluation, if deemed necessary; and
5. Developing a methodology for setting the overall project scope and the leakage targets for given duration and pressure of supply.
   1. Required information for preparing project and SPD
6. Outline design of the DMAs;
7. Current number of connections in project area and per district metering area (DMA) (recorded or estimated);
8. Indicative current losses for the project area for commercial and physical in liter per connection per day (lpcd);
9. Indicative targets for the project area (in lpcd) for given duration and pressure of supply in a format suitable for the SPD WLRPBC;
10. Estimated implementation schedules and contract duration – for leakage reduction activities and for the maintenance period after leakage reduction has been achieved;
11. Financial data of the Borrower/ service provider;
12. Indicative BOQ for all expected goods, works, and services according to which the bidders will be invited to submit bids (a sample for which is attached at Annex 4). The bids will be evaluated against the quantities specified in this indicative BOQ and the unit prices corresponding to these quantities, as submitted by the bidders in their individual bids;
13. Pre-bid estimate of BOQ (based on multiplication of indicative quantities by pre-bid estimates of unit prices) and estimated cost per reduction;
14. Technical Specifications, including quality standards for materials, workmanship and compliance with applicable standards and codes;
15. Qualification requirements and criteria for the technical and financial evaluation of bids; and
16. Terms of Reference (TOR) for the Supervising Consultant, a sample for which is attached at Annex 1;
17. Terms of Reference (TOR) for the Independent Expert, a sample for which is attached at Annex 2; and
18. Verification protocols to evaluate performance during the contract.

Contract Scope

# The Objective of the Contract is to achieve the desired level of WLR at an optimal cost using a learning period (Phase II A) that moderates the risk to the Borrower/ service provider and the Contractor, combined with payment structures that incentivize performance.

# The General Conditions and Particular Conditions set out the main provisions of the Contract. The Borrower should ensure that the Particular Conditions are completed to reflect the requirements of the project. The Specifications and Bill of Quantities also form integral parts of the Contract. Samples for each of these can be found at Annexes 3 and 4 of this Guidance Note.

# The Contract is typically for a period of up to 5-6 years, which will be broken down into phases (some of which may be concurrent):

* Phase I DMA establishment on a BOQ basis for each DMA;
* Phase II A WLR in an initial batch of DMAs on a BOQ basis (this can be running concurrently with establishment of further batches of DMAs);
* Phase II B - WLR in the remaining DMAs, based on an overall WLR target under a lumpsum contract;
* Phase III Maintenance Period (to end 12 to 18 months following completion of Phase II B).

Phase II A is designed to allow the Contractor to learn about the network and how it responds to interventions for WLR, assuming that there is limited data available at bidding stage. The Contractor is paid for activities under Phase II A through a Bill of Quantities for work actually done. Phase II A has only limited performance incentives for timely delivery and achievement of agreed service levels. If there is sufficient data to proceed from the outset with WLR interventions on a lump sum basis, then Phase II A may be deleted and bidding can proceed with a lump sum bid price for Phase II B.

# The phases of the Contract will typically include the following activities:

# Design and management services:

Services to design a WLR intervention program including diagnostics, hydraulic modelling, design of pressure zones, material analysis and assessment of active WLR management system needs, organization of material, labor and works for the efficient implementation of works and leak reduction activities. Management services covers the typical project management activities required throughout the project.

The Contractor will be paid their professional costs through the design and management fee. This will be a lump sum fee paid through the lifetime of the contract on a periodic basis. A portion of the design and management fees (e.g. up to 20%) could be retained to cover liquidated damages arising from time overrun and performance issues.

* + 1. **Phase I DMA Creation, Diagnostic and Establishment of Baseline**:

This phase seeks to establish DMAs[[1]](#footnote-2) within the project service area. The following activities are part of this phase:

* Institute hydraulically separable areas, and replace or install of bulk meters, and implement other works necessary to proceed to WLR reduction activities;
* Carry out tests and measure baseline level of WLR for each DMA[[2]](#footnote-3), once DMAs are completed. The baseline will be certified by the Borrower and will be the basis for measuring achievement in WLR levels in the following phases.
* Conduct assessments to determine WLR causes and propose a realistic WLR reduction targets and activities to achieve the target.

At the beginning of this phase, the Contractor will submit to the Borrower a detailed design of DMAs to be established as well as the number of DMAs needed. Completion of work against this detailed design will be paid on an admeasure basis using the unit prices quoted in the Contractor’s BOQ.

The DMAs that will be part of Phase II A are to be completed first. Phase II A can then commence and Phase II A activities can be carried out in parallel with completion of the rest of the Phase I Activities (ie establishment of the remaining DMAs).

* + 1. **Phase II Water Loss Reduction Activities**

**Phase II A**:

After the minimum number of DMAs has been established and certified in Phase I, as specified in the bidding documents (such as 20% to 30% depending on the size of the network and quality of available information on the system), WLR work in those DMAs (subsequently referred to as “Phase II A DMAs”) will commence. The objective of this Phase is to build a good understanding of required interventions and their costs versus the impact of these interventions on WLR levels. Working under an admeasurement contract and using the unit prices quoted in the Contractor’s BOQ, the Contractor will initiate work by measuring leakage levels (production minus consumption) in each DMA.

Phase II A seeks to improve the understanding of contracting parties about the efficacy and cost of various interventions to achieve an optimal level of WLR for the available resources. WLR typically includes the following activities:

* Check of customer database (illegal connections)
* Installation or replacement of customer water meters
* Installation of meters on stand posts
* Improvement of pressure control
* Repair of visible leaks
* Detection of invisible leaks (acoustic detection)
* Repair or replacement of service connections
* Repair or replacement of pipelines
* Improvement of flushing practices

From the baseline findings, the Borrower with inputs from the Contractor and its adviser, the Supervision Consultant (sample terms of reference for which are attached at Annex 1 of this Guidance Note) and inputs from the Independent Expert (terms of reference for which are attached at Annex 2 of this Guidance Note), will set the level of WLR for the Phase II A DMAs (the Phase II A Service Levels). The Contractor will submit a Program of Works (referred to as “Phase II A POW”) to meet this level of WLR. Among others, the Phase II A POW will provide technical details on the method; sequence of DMAs and of interventions; the expected levels of reductions from each DMA and specific interventions and the resourcing plan based on the unit rates in the BOQ. The Phase II A POW schedule needs to build in assessment periods for understanding the efficacy of interventions against this plan. Once the Phase II A POW is approved in accordance with the Contract, the Contractor will perform the services and carry out the works in Phase II A DMAs. Implementation of works will proceed “DMA by DMA” to a pattern set out in the POW, and as agreed by the contracting parties from time to time.[[3]](#footnote-4)

During this Phase, it is critical that the contracting parties have a protocol for continuously and jointly monitoring and assessing activities to understand the impact of interventions on different parts of the network (e.g. related to pipe age, pipe material, pressures, composition of customers and consumption patterns and so on) (Baseline and Service Level Verification Protocol, to be developed by the Independent Expert (see below)). This monitoring process will help achieve agreement on whether and how to proceed in the next stages, including an adjustment in the required level of WLR to be achieved, and adjustments in the POW.

The works in Phase II A will be conducted under an admeasure contract where payments are based on the quantity of completed work and tendered rates in the BOQ. The Contractor will also be paid his Design and Management Fees during this period. During Phase II A, significant performance risk is carried by the Borrower. To mitigate some of this risk, a small portion of the Design and Management Fees (e.g. up to 20%) may be paid on a performance basis by scaling the payment against achievement of Phase II A Service Levels. The focus of this phase, however, is on learning. Nevertheless, liquidated damages (LD) could be assessed for time overruns or quality issues if the Borrower deems appropriate.

The approach used in Phase II A should reduce uncertainties regarding the implementation of the Phase II B DMAs, which will justify the switch to more risk transfer in Phase II B to the Contractor via a lumpsum payment regime.

**Phase II B**:

The nature of activities under Phase II B are the same as those in Phase II A.

Based on the experience of Phase II A and investigation of Phase II B DMAs, the Borrower/ utility will set an overall level of WLR for Phase II B (Phase II B Service Level). The Contractor will submit a Phase II B proposal to achieve the target based on the experience learned from Phase II A. For its part, the Borrower, assisted by its Supervision Consultant and the Independent Expert, will estimate the quantities of labor and materials required to achieve a desired overall WLR target for the rest of the system – drawing on the information gained in Phase II A and the unit rates tendered in the BOQ by the Contractor. The Borrower will use these estimates to appraise the proposal developed by the Contractor. Depending on the amount of information available at the time of bidding, the estimates are likely to represent a reasonable estimate and be within +- 20%. The process for negotiating the lump sum for Phase II B, as well as the time frame, will be set out in the Contract and will be in the presence of a probity assurance provider.

ALTERNATIVELY: The Borrower can set an overall level of WLR for Phase II B and the Contractor will propose a price per unit reduction for which it will achieve this target. The Borrower will be able to assess the reasonableness of this price based on Phase II A. Once a price is agreed, the unit price multiplied by the units of reduction comprise a ceiling amount under which the Contractor will deliver results.

During this Phase II B phase, Design and Management Fees will continue to be made on a lumpsum basis.

Should the overall target level of water loss not be achieved at the end of Phase II B, payment of the lump sum for Phase II B will be reduced against a schedule (See example). In addition, LDs will be assessed for time overruns.

*Example Payment Reduction Schedule*

Total lumpsum payment at risk: Up to 30 percent

|  |  |
| --- | --- |
| **Level of Achievement** | **Payment** |
| 95% | 95% |
| 90% | 90% |
| 85% | 85% |
| 80% | 80% |
| 75% | 75% |
| Below 75% | 70% |

The Supervision Consultant for the Borrower will monitor and verify the Contractor’s progress, output and performance and certify periodic progress payment requests from the Contractor.

* + 1. **Phase III Maintenance Phase**

The Contractor will be responsible for maintaining the level of WLR that was required to be achieved in each of Phase II A and II B DMAs. Activities here include adjusting/managing pressure, active leak detection, installation of monitoring and management systems and training of staff. The unit prices and indicative amounts for remuneration for the Contractor for activities during the maintenance phase will be set out in their bids. The maintenance period will start at the end of Phase II A and will extend for a minimum of one year after the end of Phase II B. As DMAs are completed under Phase II the Contractor will be responsible to maintain them. The level of WLR is reconciled periodically, and, at the end of the maintenance period, against water loss level taken at the baseline when the DMA establishment was certified. In the course of the periodic monitoring, a rise in levels beyond a specified tolerance level, usually up to 2%, will need to be cured by the Contractor against deductions for non-performance.

During this phase, Contractor remuneration will be based on the basis of unit rates and indicative quantities price such as the number of connections or length of pipeline in the area covered by the contract multiplied by the period of time (e.g. 12 months). Payment will be reduced in the event of failure to meet the service levels at the end of the maintenance period either by reducing the Design and Maintenance fee (i.e., a specified penalty rate per m3/day of non-compliance per DMA) or drawing on a performance security (if reduction in maintenance fee is insufficient incentive) or both.

The Contractor will therefore, have an incentive to complete high-quality WLR activities in Phases II A and II B, since doing so would tend to lower the costs incurred by the Contractor and should increase profits during the Phase III Maintenance Phase.

During the Phase III Maintenance Period, the Contractor will be responsible for training the Borrower/ service provider staff in WLR and to ensure the Borrower will have sufficient serviceable equipment (or new equipment) when the system is handed over.

**3.5 Key Borrower/ Service Provider Obligations:**

* To operate the network in the service area, including the provision of water to each DMA at the required duration and pressure;
* To provide the Contractor with access to the system, arrange permits and wayleaves for construction and digging up roadways etc.;
* To agree updated WLR baseline as recommended by the Consultant;
* To agree with the Contractor on service levels, targets and schedules, and the lump sum for Phase II B and to administer the Contract. The Borrower/ service provider will be assisted by the Supervision Consultant, as necessary;
* To ensure that there is water in the network.

Appointment of a Supervision Consultant to the Borrower/ Service Provider

The Borrower/ service provider will appoint a Supervision Consultant who will, by delegation of authority from the Borrower/ service provider, oversee the performance of the Contractor. The Consultant will review and certify for the Borrower/ service provider approval, all designs, outputs and payments for completed works. Progress payment requests submitted by the Contractor to the Borrower/ service provider will require the Consultant to verify the Contractor’s admeasurements of the quantities of completed work, inspect the completed works/DMAs and confirm progress towards completion. The Supervision Consultant will advise on the accuracy of the WLR baseline level for each completed DMA and test and certify the level of WLR achieved.

In Phase II A, the Supervision Consultant will review that the Contractor’s POW is reasonable in terms of scope, quantities and potential efficacy to achieve the specified levels of WLR. In Phase IIB and Phase III, the Supervision Consultant will review that the Contractor’s level of effort and works program are reasonable to achieve the desired overall level of reduction for the remaining DMAs and reflect the experience of Phase II A.

Sample terms of reference for the Supervision Consultant are set out in Annex 1.

Appointment of an Independent Expert to the Borrower/ Service Provider and the Contractor

The Borrower/ service provider will appoint (solely or jointly with the Contractor, as appropriate) an Independent Expert who will provide advice and support on the various WLR interventions. The Contractor will reimburse 50% of the fees and costs of the Independent Expert.

The Independent will help advise the Service Provider (and Technical Consultant) and the Contractor on the methodology and efficacy of WLR measures, provide feedback on the design of WLR reduction activities, draft a protocol for monitoring and reporting standards and support the Service Provider the Contractor to reach agreement on the service standards and fees for Phase IIB of the Contract. The Independent Expert is to act independently from the Borrower and the Contractor and to provide objective advice.

Sample terms of reference for the Independent Expert are set out in Annex 2.

Specifications

The bid documents will include the Specifications for services and works needed for the Project and the corresponding Bill of Quantities (BOQ). The scope of work will, for example, cover specifications and standards for establishing DMAs, pipe connection and replacement, meter installations, active leak detection and management services, etc. Bidders will present their proposed unit rates against the BOQ. The total cost of the financial proposal will be based on the unit rates and the indicative BOQ that will be specified in the bid documents. However, the amounts paid for Phase II B will be a lump sum to be agreed between the Employer and the Contractor after Phase II A, subject to adjustment for performance.

Sample Form of Specifications are attached at Annex 3 of this Guidance Note. Sample form of BOQ is set out in Annex 4 of this Guidance Note.

A set of precise and clear Specifications is a prerequisite for bidders to respond realistically and competitively to the requirements of the Borrower. The Specifications must be drafted to permit the widest possible competition and, at the same time, present a clear statement of the required standards of workmanship, materials, and performance of the goods and services to be procured.

The Specifications should require that all goods and materials to be incorporated in the Works and Services be new, unused, of the most recent or current models, and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.

The Specifications should cover all classes of workmanship, materials, and equipment commonly involved in construction, although not necessarily to be used in a particular Works and Services Contract. Deletions or addendums should then adapt the Specifications to apply them to the particular Works and Services.

Any additional sustainable procurement technical requirements (in addition to the environmental and social requirements) should be clearly specified. The sustainable procurement requirements shall be specified to enable evaluation of such requirements. To encourage Bidders’ innovation in addressing sustainable procurement requirements, Bidders may be invited to offer works and services that exceed the specified minimum sustainable procurement requirements.

Care must be taken in drafting the Specifications to ensure that they are not restrictive. In the Specifications of standards for goods, materials, and workmanship, recognized international standards should be used as much as possible. Where other particular standards are used, whether national standards of the Borrower’s country or other standards, the Specifications should state that goods, materials, and workmanship that meet other authoritative standards, and which ensure substantially equal or higher quality than the standards mentioned, shall also be acceptable.

Procurement Process

The Borrower develops procurement documents based on the SPD WLRPBC and carries out procurement process consistent the Bank’s “Procurement Regulations for IPF Borrowers”. This process should be preceded by:

* Market sounding to ensure that an adequate number of potential contractors would be interested in submitting proposals and to decide on the best bidding strategy;
* A pre-bid conference to answer any questions that potential bidders may have; and
* Amendments may then be made as appropriate to the bidding documents for WLR and the draft contract as derived from these pre-bid initiatives.

Prequalification may be carried out if appropriate. The SPD requires application of rated criteria as part of the bid evaluation framework.

***Technical Component of Bid*** - The technical part is evaluated in accordance with the criteria and evaluation framework specified in the RfB document.

***Financial Component of the Bid*** - The evaluation of the financial part would be based on the unit prices entered by the bidder against the itemized indicative BOQ for the works in the SPD, the professional fee component for the design services and construction management in Phases I and II A, and the maintenance fee in Phase III. The BOQ should provide sufficient information on the estimated quantities of all works for the calculation of the bidders’ bid prices. However, a caveat should be added, that the estimated BOQ quantities will be adjusted after Phase I, when the DMA(s) are established and then again, after Phase II A when additional information has been collected on WLR reduction interventions.

***Bid Parameters***

Bidders will be asked to bid against the indicative quantities in the initial BOQ provided in the bidding documents. While the unit prices for labor and materials quoted by the bidders against this indicative BOQ will be binding for the duration of the project, the actual quantities, required for DMA construction and WLR reduction works will necessitate adjusted BOQs during implementation.

The bid parameter for evaluation of the financial bids would be:

Bid Price = + +

Maintenance Fee (unit prices offered in bid \* quantities in the indicative BOQ) (for Phase III)

Professional Fees (for design services and construction management during the project period)

Works (unit prices offered in bid \* quantities given in the indicative BOQ) for Phases I and II (IIA and IIB)

+

The most advantageous bid will be selected based on this Bid Price (assuming the bidder has met the technical qualifying criteria, as part of the evaluation of the bidder’s Technical Part of the bid).

Additional Considerations: Per the Bank’s Procurement Regulations, contract award should consider “value-for-money”, so that the contract is awarded to the “most advantageous bid”, according to pre-disclosed criteria, besides the lowest evaluated bid price. This may provide further opportunities to customize the bid evaluation criteria and methodology in the WLR SPD to capture the complexities of reducing leaks, at the least cost, through a competitive and manageable procurement approach.

Incentive/Penalty Structure

The contract is designed to incentivize the Contractor to:

1. Complete the Phase 1 work in a timely manner;
2. Meet the target level of WLR;
3. Meet the target WLR level in a timely manner[[4]](#footnote-5);
4. Meet the target WLR level in a cost-effective manner; and
5. Maintain target WLR levels up to the end of the maintenance period.

Complete Phase 1 in a timely manner:

The Contractor will be required to complete Phase 1 by an Intended Completion Date. The Borrower in designing the Contract should specify whether failure to complete by that date should lead to liquidated damages for delay.

Meet the target level of WLR:

An indicative overall target level of WLR for the Contract will be defined in the bid document. The target service levels and intended completion dates for Phase II A will be set by the Borrower at the beginning of the phase. The target service levels and intended completion dates for Phase II B will be finalized as part of the negotiation of the service levels, completion dates and lump sum in accordance with the Contract. Failure to achieve the required level of WLR in Phase II will result in the reduction of the remuneration to the Contractor, or, in extremis, cancelation of the Contract. Failure to complete Phase II A or Phase II B by the Intended Completion Dates will result in liquidated damages for delay. [Over achievement may be rewarded through a bonus clause, subject to a strong cost-benefit case being determined during project preparation if the Borrower so specifies.]

Meet the target WLR level in a timely manner – Phase II A:

The indicative target level of WLR and intended completion date will be carefully specified in the contract and/or agreed in the POW, including the verification protocol, following international good practices.

Failure to achieve the performance standard by the Intended Completion Date for Phase II A and/or Phase II B period[[5]](#footnote-6) will result in the application of liquidated damages subject to a maximum amount equal to the estimated profit on the Contractor’s activities. Liquidated damages may be captured through adjustments to the final remeasure payments to the Contractor or drawing on a performance security (in event that the final remeasure is insufficient), or both.

Early achievement of Phase II A Service Levels in the Phase II A DMAs may, if the Contract so specifies, be rewarded through a bonus clause, subject to a strong cost-benefit case being determined during project preparation.

Meet the target WLR level in a cost-effective manner – Phase II B only:

In Phase II B, payment to the Contractor is based on the negotiated lump sum price for the Phase II B DMAs. Thus, the Contractor bears the performance risk and will be paid on achievement of the required target WLR level for Phase II B DMAs. Progress payments may be arranged if the lump sum is large.

The Contractor’s lumpsum can be subject to deductions for failure to meet the Phase II B Service Levels, if so specified in the Contract. The Contractor will also be subject to Liquidated Damages for delay in completing Phase II B, which can be deducted from the lump sum or the performance security.

Maintain target WLR levels during Phase III Maintenance period:

The Contractor will be paid to maintain the performance standard up to the end of the maintenance period.[[6]](#footnote-7) To ensure the Contractor is fully incentivized during this period, the payments to the Contractor will be reduced in the event of failure to meet the performance standard at the end of the maintenance period and/or the performance security will be called on. Specified levels of deviations from previous period’s achievement will also require the Contractor to ‘cure’ or correct the deviations back to the target levels, subject to LDs.

Payments to the Contractor

1. Payments for DMA Establishment and WLR reduction:

For the construction of the DMAs in Phase I and the initial WLR reduction in Phase II A, payments to the Contractor will be based on the unit rates for labor and materials that were entered by the Contractor in the indicative BOQ provided with the SPD and subsequently applied by the Borrower during the bid evaluation. The Contractor will be paid for actual work completed, with claimed quantity measurements and total sums to be verified by the Supervision Consultant for each progress payment by the Borrower/ service provider. However, actual quantities of work completed for the DMA construction and the initial WLR reduction may vary significantly from the estimated quantities shown in the indicative BOQ because of the lack of robust data in the beginning.

For the DMAs in Phase II B, the Contractor will be remunerated by the Lump-Sum amount that has been calculated based on the unit prices set out in the contractor’s BOQ. However, the Contractor will indicate in each periodic request for payment against this Lump-Sum, the quantities of measurable outputs already executed and a forecast of outputs to be executed, in order to achieve the Phase II B Service Level. Upon confirmation of progress towards achieving the required performance standard and certification by the Consultant, payments will be made periodically for executed measured outputs. The unit prices for labor and materials to be used for calculating outputs will be those stated in the BOQ. A percentage of each payment will be retained by the Borrower and will, if necessary, be used to reduce the Lump Sum for not achieving the performance standard, according to a schedule included in the contact.

Phase III, in order to achieve the maintenance performance standard, will be paid on an admeasure basis for activities carried out.

During the Contract Period the Contractor will be paid a Design and Management Fee for professional services. This will be a lump sum divided into periodic payments throughout the Contract. If the Contract so specifies, the Borrower will be entitled to reduce these payments on a daily basis, as long as a relevant performance standard is not achieved or against Liquidated Damages for delay. The methodology for reducing payments to the Contractor in this case will be detailed in the contract.

1. Payment Processes:

| **Project Phases** | **Activities** | **Payment Basis** | **Adjustments** | **Payment Method** |
| --- | --- | --- | --- | --- |
| Design and Construction Management Services | Services   * Design * Modeling * Training * Construction Management * Borrower/ service provider Coordination | Professional Fee from Letter of Bid – Financial Part | No adjustment | Periodically (determined by local conditions)  Retention – 10%  Linked to progress |
| Phase I  DMA construction | Initial DMA construction based on detailed design | Indicative BOQ and Unit Rates from Letter of Bid – Financial Part/ BOQ | Borrower may authorize increased quantities in indicative BOQ; Contractor’s unit rates from submitted bit remain in place | Contractor submits Request for Progress Payment; Contractor’s claimed quantities measured & certified by Consultant for payment by Borrower |
| Phase II A  WLR reduction | DMA reduction – Initial batch of DMAs | Adjusted BOQ as agreed between the Borrower and the Contractor, with primary focus on achieving WLR target;  Only quantities can be adjusted but not Contractor’s unit rates from the indicative BOQ; | Admeasure of approved BOQ. | Contractor submits Request for Progress Payment; Contractor’s claimed quantities measured & certified by Consultant for payment by Borrower/ service provider  Link between payments made and progress towards achieving WLR reduction target will require effective contract management. |
| Phase II B  Lump Sum contract | WLR reduction- of remaining DMAs  [Estimated to cover about 80% of remaining DMAs] | Executed outputs to achieve WLR reduction target and forecast of required outputs to achieve Phase II B Service Level | No adjustment of performance standards, unless agreed by parties as a contract modification | Periodic payments linked to executed outputs and achieving service level. Retention from each payment to reduce Lump Sum for not achieving service level, if necessary. |
| Phase III | Maintenance | Performance Based on maintaining the WLR reduction for maintenance period | No adjustment | Lump sum payment to the Contractor based on:  - Maintenance of pipeline (km)  - Maintenance of connections (#) as set out in Annex [ ],  subject to maintenance of service levels. Otherwise, payment deductions for non-performance. |

1. Design and Management Fees

The Fees payable to the Contractor will cover all required actions, services, interventions, etc. expected from the Contractor during the term of the Contract. In particular, it compensates the Contractor for design and construction management services in each DMA.

The Fee is established competitively through the Letter of Bid in which it must be spelled out by each bidder; it is a cost factor in calculating and comparing bid prices. The Fee amount will not vary with the expected changes in quantities between the indicative BOQ and the adjusted BOQ in Phases II A.

The Contractor will be entitled to bill the Borrower for the activities covered by the Fee, as long as the Contractor’s performance remains substantially compliant with the contract and the work is completed in accordance with the agreed time schedule. A portion of the Fee will be retained at each periodic payment and may be used to as a source for liquidated damages.

Annex 1 – Sample Terms of Reference for Supervision Consultant

**Project Title: Contract Supervision Consultant for Performance-Based Water Loss Reduction and Management Contract (PBC)**

**Contracting agency: [ ] (the “Utility”)**

**Project manager: <XXXX>**

**Manager: <XXXX>**

**Location: [country]**

**Appointment Type: Individual Consultant**

**Date of Assignment: xxxxxx,**

**International Recruitment: x yes 🞏 no**

|  |
| --- |
| * **Background and Objectives**   The Utility faces inefficient management of the resources as Non-Revenue Water (NRW) is high and service levels are low. The [World Bank Project] aims to i) improve the capacity of the Utility to reduce water losses (WL), one of the key features of NRW; and (ii) deliver improved continuity of service through the implementation of performance-based contracts (PBCs). This is a step that will help the Utility achieve significant reduction of WL.  This project aims to capitalize on the successes of recent NRW and WL reduction projects around that world that have been structured as PBCs and initiate a similar project for the Utility. The overall activity will focus on improving the financial and technical performance of the Utility through a performance-based engagement to reduce both physical and commercial losses. The result is expected to improve network efficiency, increase revenues, and improve service standards.  **Objective of the project**  The overall objective of this initiative is to reduce WL (WLR) for the Utility while simultaneously improving the network efficiency, service standards and customer base leading to increased revenues in the Utility.  **Objective of this Assignment**  The objective of the assignment is for the consultant (Supervision Consultant) to:   * Assist the Utility with the tender, procurement and contracting processes of the PBC * Provide the Utility with an objective review of the performance of the PBC Contractor * Help the Utility manage the PBC Contractor, and * Build contract oversight supervisory capacity in the Utility.   **Summary of the Scope of Work**  Under the scope of the proposed assignment, the Supervision Consultant shall:   * Help the Utility prepare a prequalification evaluation report and provide other support as requested in this respect * Review procurement documents, help the Utility prepare the procurement and support it in reviewing the bids, responding to bidder’s questions * Help the Utility prepare a tender evaluation report and provide other support as requested in this respect * Prepare an oversight/support plan for the duration of the PBC * Verify PBC Contractor reports, activities and results * Provide technical and programmatic advisory services to the Utility on PBC compliance, quality control and monitoring * Supervise PBC implementation including support the Utility in approval of DMA design, approval of DMA commissioning as well as approval of the baseline assessment for each DMA * Support the Utility in estimating types and quantities of interventions required to achieve the water loss reduction targets for the rest of the system based on the experiences of Phase IIA of the PBC ([20-30% of total project area]) and support the Utility in negotiations with the Contractor on the performance-based lump-sum remunerations of Phase IIB * provide training to the Utility on PBC compliance, quality control and monitoring and will coordinate a small team within the Utility which is dedicated to supervising the PBC under the guidance of the Supervision Consultant * such ancillary activities as are required to achieve the objectives of the assignment as the Utility shall request from time to time. |
| 1. **ScOPE of Work**   **Task 1: Procurement process and bid evaluation**  The Supervision Consultant will review the tender documents and support the Utility to procure a qualified PBC Contractor, including help with responding to questions from bidders. The Supervision Consultant will review bids and prepare a bid evaluation report and support the Utility to contract the PBC.  **Task 2: Preparation of an Oversight Support Plan**  The Supervision 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 be aligned coordinated and tuned to the phases, scope, objectives, targets and milestones of the specific contract.  **Task 3: Verification of Contractor Reports, Activities and Results**  The Supervision 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 include the following:   * support of the Utility in approval of District Metering Area (DMA) design, * coordination of supervision of the civil works with the construction supervisor, * oversight of the installation of customer meters, operation of billing and commercial systems, installation and operation and maintenance (O&M) of monitoring/information systems and associated monitoring equipment, * support of the Utility in approval DMA commissioning, NRW reduction and control activities, * approval of pipe replacements, oversight of the quality of materials used or workmanship utilized and coordination with construction supervisor accordingly, required studies or analyses (such as baseline updates or target adjustments), * support of the Utility in approval of baseline assessment for each DMA, requests for Contract modifications, approval of Training and Transfer of Technology Program or similar deliverables under the PBC Contract.   Note: the supervision of construction work (pipe work, chambers, etc.) will be carried out by a construction supervisor under a separate assignment. The Supervision Consultant must coordinate with this firm in terms of quality assurance accordingly (e.g. advising the Construction Supervisor on standards and specifications of civil and pipe installation work).  **Task 4: Technical and programmatic advisory services to the Utility on PBC Contract Compliance, Quality Control and Monitoring**  The Supervision 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. This includes supporting the Utility in estimating types and quantities of interventions required to achieve the water loss reduction targets for the rest of the system based on experiences of Phase IIA (note: in Phase IIA water loss reduction interventions are carried out on a BoQ basis in [20-30%] of total project area). Further the Supervision Consultant will support the Utility in negotiations with the Contractor on the performance-based lump-sum remunerations of Phase IIB.  **Task 5: Training to the Utility on PBC Contract Compliance, Quality Control and Monitoring**  The Supervision 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. A Utility team of a few staff will be dedicated for the PBC supervision. The Supervision Consultant will guide this team, instruct in supervision activities and will coordinate with the team whenever the Supervision Consultant is not on site.  An Independent Expert is also to be hired to support the Employer and the Contractor in implementing the PBC. The Independent Expert will draft the Baseline and Service Level Verification Protocol, on which the Contractor will base its baseline reporting, and draft recommendations for the scope of Phase II B Activities, Intended Time for Completion of Phase II B Activities and Phase II B Service Levels. The Supervision Consultant will consult and seek feedback from the Independent Expert on the draft Programs, progress against milestones and efficacy of particular interventions.  The Supervision Consultant will provide a series of reports, as outlined in Section C below. |
| 1. **METHOD**   The work will be somewhat qualitative, but mostly quantitative and will draw on experience in project oversight, contract management, compliance, quality assurance and outcome monitoring. The utility and Contractor will provide all available data, provide site access and cooperate with the Supervision Consultant to ensure that the best possible data is provided and the correct analysis can be made.  The Supervision Consultant should provide objective advice and perform its activities in accordance with good international engineering practice. It will consult with the Independent Expert (under a separate consultancy) on issues relating to the setting of baseline, Phase II A activities and efficacy of interventions and Phase II B scoping.  [The position is foreseen as a part-time position with numerous site visits of approximately 10 working-days per visit (2 weeks). The Supervision Consultant will spend periods of time on-site and away. The peak working time will be the [second] year of the assignment, when the DMAs are being established.] |
| 1. **DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT**   Based on the above tasks the following reports to be produced:   1. 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. The inception report will be prepared as a draft in the first month of the assignment and completed within 2 months after the Contractor has started its activities on the ground. 2. Prior to the start of Phase IIA the Supervision Consultant will prepare a report on the proposed activity plan of the Contractor for Phase IIA. 3. Notice specifying scope of Phase II B Activities, Phase II Service Levels and Intended Time for Completion for Phase II B Activities, taking into account recommendations of the Independent Expert. 4. After submission of the Activity plan for Phase IIB by the Contractor the Supervision Consultant will provide a written report on the proposed approach of the Contractor and give a judgement on its appropriateness to achieve the levels of NRW set. 5. 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. 6. 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. 7. 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. 8. Draft and Final Report on Oversight/Support for the subject PBC Project, including overall results, lessons learned, recommendations for any follow-on activities, and recommendations for future NRW PBC Oversight Support Contracts. |
| 1. **SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT**   The Utility 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. |
| 1. **SPECIAL TERMS & CONDITIONS/SPECIFIC CRITERIA**   **Language**  All primary reports (listed above) should be prepared 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 xxxxxx. The duration of the assignment will be for an initial period of [ ] months (the time required to start the PBC (from the contract) and for the PBC Contract (4 years)), but may be extended, should the Utility [and the World Bank] 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).  **Expected level of input**  The total level input is expected to be about [ ] months ([ ] days) in a period of [ ] of which a minimum of [ ] days needs to be provided on site. The number of days foreseen is [ ] days in year 1, [ ] days in year 2, [ ] days in year 3 and [ ] days in year 4…. In total a number of [ ] flights is estimated.  **Reporting**  The Supervision Consultant will report to the Project Management Unit of the Utility who will be responsible for the implementation of the PBC, for the attention of [the manager] [address].  **Payment Schedule**  Payments should be on quarterly basis according the project progress respectively reports submitted as follows:  Inception Report [4]% of total Consultancy Fee  Report on Activity plan of Phase IIA [4]% of total Consultancy Fee  Report on Activity plan for Phase IIB [4]% of total Consultancy Fee  Quarterly/Annual Reports (20 reports in total) [4]% of total Consultancy Fee each (80% total)  Final Report [8]% of total Consultancy Fee  Travel and accommodation must be arranged by the Supervision Consultant and expenditures (including daily allowance and eligible expenditures on the basis of WB rates) invoiced to the Utility after every trip together with the quarterly invoices (note: the Supervision Consultant has to include all cost for travel and living including per diem in its offer). All kind of insurances need to be covered by the Supervision Consultant.  **Required Qualifications and Experience**  The Supervision Consultant will have the following qualifications   * Water Specialist/Engineer – The Water Specialist shall have demonstrated successful experience in Non-Revenue Water projects. At all times, the Specialist will be available for support and backstopping to the Utility. S/he must have at least 10 years of experience in water supply in similar country contexts with demonstrated experience in NRW issues and quality of network management. The engineer will have experience in supervision and quality control of distribution network development. Specific expertise on designing NRW projects will be a plus as well as experience in PBC projects. The Specialist will have practical experience in the use of spreadsheets, project monitoring and oversight, the IWA Water Balance, field measurement techniques related to NRW and component analysis tools.   **Key Background Documentation**   * Program Concept Note * ToR for Initial Assessment, plus Report(s) from Initial Assessment * ToR for Development of NRW Reduction Investment Plan and PBC Project Design and Procurement, plus reports prepared under this TOR * The draft PBC Contract, * 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. |

Annex 2 – Sample Terms of Reference for Independent Expert

**Project Title: Independent Expert for Performance-Based Water Loss Reduction** **and Management Contract (PBC)**

**Contracting agency: [ ] the Utility**

**Project manager: <XXXX>**

**Manager: <XXXX>**

**Location: [ ]**

**Appointment Type: Individual Consultant**

**Date of Assignment: xxxxxx,**

**International Recruitment: x yes 🞏 no**

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| * **Background and Objectives**   The Utility faces inefficient management of the resources as Non-Revenue Water (NRW) is high and service levels are low. The [World Bank Project] aims to (i) improve the capacity of the Utility to reduce water losses (WL), one of the key features of NRW; and (ii) deliver improved continuity of service through the implementation of performance-based contracts (PBCs). This is a step that will help the Utility achieve significant reduction of WL.  This project aims to capitalize on the successes of recent NRW and WL reduction projects around that world that have been structured as PBCs and initiate a similar project for the Utility. The overall activity will focus on improving the financial and technical performance of the Utility through a performance-based engagement to reduce both physical and commercial losses. The result is expected to improve network efficiency, increase revenues, and improve service standards.  **Objective of the project**  The overall objective of this initiative is to reduce WL (WLR) for the Utility while simultaneously improving the network efficiency, service standards and customer base leading to increased revenues in the Utility.  **Objective of this Assignment**  The objective of the consultant (Independent Expert) is to:   * Improve the understanding of Utility and PBC Contractor on the efficacy of WLR measures in the Utility * Provide feedback on the design of WLR reduction activities * Ensure agreement on the monitoring and reporting standards * Support the Utility and PBC Contractor to reach agreement on the service standards and fees for Phase IIB of the PBC.   **Summary of the Scope of Work**  The scope of the proposed assignment includes the following tasks:   * Develop and agree the monitoring arrangements and reporting standards between the Utility (supported by a Supervision Consultant) and the PBC Contractor * Review the proposed WLR reduction methodology for Phase IIA * Monitor WLR reduction activities and prepare a report based on the results of WLR reduction activities of Phase IIA * Review and advise on the approach and lump sum arrangement for Phase IIB |
| 1. **ScOPE of Work**   **Task 1: Monitoring and reporting standards**  Prepare a Baseline and Results Verification Protocol, , based on project planning documents, the PBC, and input from both the Utility and the PBC Contractor and submit it to the Contractor and the Supervision Consultant of the Utility within [ ] weeks of the start date of the Independent Expert’s engagement. The Baseline and Results Verification Protocol should be coordinated and consistent with the phases, scope, objectives, targets and milestones of the PBC. The Independent Expert will review the monitoring and reporting arrangements in the PBC and prepare a detailed protocol for determining the baseline for measurement of service levels and to verify results. The Independent Expert shall incorporate comments of the Supervision Consultant and the PBC Consultant within 2 weeks of receipt of those comments. To the extent that the Independent Expert does not agree with a comment its opinion shall prevail.  **Task 2: Baseline setting**  At the end of the Phase I activities, the PBC Contractor shall prepare the Baseline report for the Phase II A DMAs based on the Baseline and Results Verification Protocol and submit this to the Supervision Consultant for the review, with a copy to the Independent Expert. In the event that the PBC Contractor and the and the Supervision Consultant do not agree on a baseline of an individual DMA, the Independent Expert will review the Baseline report prepared by the PBC Contractor and provide advice on the draft baseline which the Supervision Consultant may take into account when finalizing and approving the Baseline for that DMA.  **Task 3: Review of Draft Program for each Phase of Works and Services**  For each Phase of Works and Services other than Phase 1 the Independent Expert shall review the draft Program submitted by the Contractor and provide comments thereon within [ ] days of receipt of the Program.  **Task 4: Review proposed WLR reduction methodology and results of WLR activities of Phase IIA**  The PBC Contractor shall provide to the Independent Expert a copy of each report submitted by the PBC Contractor to the Supervision Consultant on approaches and results for WLR in each DMA and provide written comments to the Supervision Consultant when requested.  The Independent Expert will discuss the methodology for WLR reduction in Phase IIA with the PBC Contractor and the Supervision Consultant and provide written feedback on the appropriateness of the approach and requirements for monitoring the efficacy of individual interventions to the Utility and the PBC Contractor (note: in Phase IIA WLR interventions are carried out on a BoQ basis in [20-30% of total project area]). While the ongoing supervision and monitoring of WLR activities in Phase IIA will be carried out by a Supervision Consultant (under a separate contract), the Independent Expert under this assignment will examine the activities carried out by the PBC Contractor and provide written feedback on the efficiency and efficacy of individual activities in DMAs and the associated costs. This exercise will start once WLR activities in the first DMA has been concluded. Four weeks prior to the scheduled date for completion of Phase IIA activities, based on the results, costs and approach of each of the individual measures achieved in Phase II A against the Baseline established in Phase I, the Independent Expert will prepare and submit a report to the Utility (Supervision Consultant) and Contractor that sets out the impact on WLR and cost-benefits of WLR activities as well as lessons learned (Phase II A Report).  **Task 5: Phase IIB**  The Independent Expert will then meet the PBC Contractor and Supervision Consultant to discuss the scope of work for Phase II B, the service levels and the intended time for completion of Phase II B. The Independent Expert will submit a written recommendation within [ ] days of the meeting on the scope of the Phase II B Activities, the Phase II B Service Levels and the intended time for completion of Phase II B. In the event that either Party has any comments on the recommendations of the Independent Expert, then they will send written comments within [ ] days of receipt of the draft recommendations to the Independent Expert. The Independent Expert shall then update the recommendations as he deems appropriate and send them to the Supervision Consultant. The Supervision Consultant on behalf of the Employer will then issue the required Phase II B Service Levels and intended time for completion of Phase II B, taking the Independent Expert’s recommendations into account.  Once the Level II B Service Levels have been specified, the Contractor shall propose within [ ] days of such determination a detailed scope of activities for Phase II B and a lumpsum for the Phase II B Activities (Phase II B Fee) to achieve the Continuing Service Levels, indicating the level of effort in terms of works and services required. The lumpsum shall be based on the unit prices set out in the Bill of Quantities. The Independent Expert will provide within [ ] days of the Contractor’s submission a written opinion (Phase II B Report) to each of the Parties as to whether the proposal of the Contractor is reasonable, and if not, provide detailed comments on areas where it does not consider the proposal reasonable. The Contractor and the Employer will then use reasonable endeavours and good faith to agree the Phase II B Fee.  In the event that the parties do not agree these elements then they will proceed to dispute resolution in accordance with the PBC. The Employer has the right in this circumstance to require the Contractor to proceed with Phase II B Activities on an admeasure basis using the Bill of Quantities and the Continuing Service Levels determined under this task until such time as the parties agree the Phase II B Fee or it is resolved under the dispute resolution. The Independent Expert will support the Utility and Contractor to reach agreement on these.  The Independent Expert will provide a series of reports, as outlined in Section C below. |
| 1. **METHOD**   The work will draw on global experience in WLR strategies, base line setting, quantitative monitoring, WLR efficiency. The Independent Expert in providing it services will act independently of each party and will provide its services objectively in accordance with good international engineering practices.  The Utility and PBC Contractor will provide all available data and cooperate with the Independent Expert. |
| 1. **DELIVERABLES/SPECIFIC OUTPUTS EXPECTED FROM ASSIGNMENT**   Based on the above tasks the following reports to be produced:   1. draft Baseline and Verification Protocol. 2. Written comments on Program for each Phase and on progress reports. 3. Written comments on proposed approach for Phase II A the Independent Expert will present a written response on the proposed approach by the PBC Contractor for Phase IIA. It will also provide written comments on progress reports under Phase II A. 4. Phase IIA Report: After completion of Phase IIA the Independent Expert will report on the efficacy of measures and present an analysis of the measures against the WLR target. 5. Recommendations for Phase II B Activities, Continuing Service Levels and time for completion of Phase II B Activities. 6. Phase II B Report: The Independent Expert will review the proposed detailed scope of activities for Phase II B and lump sum proposal of the PBC Contractor for Phase IIB. |
| 1. **SPECIFIC INPUTS TO BE PRESENTED BY THE CLIENT**   The Utility [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. |
| 1. **SPECIAL TERMS & CONDITIONS/SPECIFIC CRITERIA**   **Language**  All primary reports (listed above) should be prepared 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 xxxxx,. The duration of the assignment will be for [ ] years with focus on the first two Phases (I, IIA and IIB) of the PBC, but could be extended, should the Utility [and World Bank] so request, 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).  **Expected level of input**  The total level input is expected to be a maximum of [ ] days in a period of [ ] years of which a minimum of [ ] days needs to be provided on site. In total [ ] trips to the Utility are foreseen.  **Reporting**  The Independent Expert will report to the Project Management Unit of the Utility who will be responsible for the implementation of the PBC, for the attention of [the manager] [address] and to the PBC Contractor.  **Payment Schedule**  The Independent Expert will be engaged on a time-based contract with a maximum of [ ] days of input (approximately [ ] days in year 1, [ ] days in year 2, [ ] days in year 3 and [ ] days in year 4…). Payment will be monthly, based on actual time spent and upon submission of an invoice, timesheet, daily allowance, and eligible expenditures. Travel and accommodation must be arranged by the Independent Expert and expenditures invoiced to the Utility after ever mission (note: the Independent Expert has to include all cost for travel and living including per diem in its offer). Payment requests must explicitly identify the progress that has been made towards at least one of the deliverables listed above. All kind of insurances need to be covered by the Independent Expert.  **Required Qualifications and Experience**  the Independent Expert will have the following qualifications   * demonstrated successful experience in Non-Revenue Water and/ or Water Loss Reduction projects. S/he must have at least 10 years of experience in water supply in similar country contexts with demonstrated experience in NRW issues and quality of network management. * experience in monitoring and analyzing NRW data. Specific expertise on designing NRW projects will be a plus. * Good knowledge of WB’s PBC methodologies for NRW/ WL reduction is crucial and PBC project experience is required. * practical experience the use of spreadsheets, the IWA Water Balance, field measurement techniques related to NRW/ WLR and component analysis tools.   The Independent Expert will have to be 100% independent from both, utility and Contractor. Thus, any kind of present or past partnership or joint venture or ownership relationship of the Independent Expert with either the PBC Contractor or the Utility is not permissible.  **Key Background Documentation**   * Program Concept Note. * ToR for Initial Assessment, plus Report(s) from Initial Assessment * ToR for Development of WLR Investment Plan and PBC Project Design and Procurement, plus reports prepared under this TOR * The draft PBC Contract, * 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.] |

Annex 3 – Sample Specifications

**A. GENERAL**

1. Basic Concept
   1. The objective of the Water Loss Reduction[[7]](#footnote-8) (WLR) PBC contract (WLRPBC) is to reduce water losses [in order to achieve a continuous water supply] in the Service Area in an efficient and sustainable way.

**Design and Management Services:** during each phase the Contractor will provide all the required design services that are needed to complete the Water Loss Reduction (WLR) activities;

The phases of the Performance Based Contract are:

**Phase I DMA Establishment**: the establishment of District Metered Areas (DMAs) within the Service Area designated by the Employer (BOQ admeasurement basis);

**Phase II A Activities**: works and activities carried out on an BOQ-based admeasurement basis to reduce Water Losses in an initial batch of DMAs (percentage as specified in the Data Sheet (determined on a case by case basis but usually to be in range of 20-30 % of total DMAs)) to achieve the required performance standard (maximum leakage amount at defined minimum network pressures) set out in the Phase II A Service Levels, with the intention to learn about the cost and efficacy of different interventions;

**Phase II B Activities**: works and activities to reduce Water Losses in the remaining DMAs to achieve the required performance standard, to be determined by the Supervision Consultant on behalf of the Employer at the end of Phase II A in accordance with the Contract] (Continuing Service Levels), against a lumpsum payment to be agreed following Phase II A using unit prices set out in the BOQ in accordance with the Contract. Time for Completion of Phase II B will be determined in accordance with the Contract; and

**Phase III Activities**: activities to maintain the level of Water Loss at the Continuing Service Levels, following certification that a DMA has reached the relevant Service Level in Phase II.

* 1. The contract duration is [ ] years. The contract duration will be divided into phases:
     1. Mobilization Phase of 2 months from Effective Date;
     2. Phase I - phase of [ ] months for design and establishment of DMAs;
     3. Phase II A – phase of [ ] months for the water loss reduction activities for Phase II A DMAs (this can overlap with Phase I as it can commence once Phase I for the initial DMAs has been completed);
     4. Phase II B – phase provisionally estimated at [ ] months for water loss reduction activities for Phase II B DMAs;
     5. the Phase III Maintenance Phase starting from the first DMA reaching the required Service Level and ends on the date which is [ ] months following the completion of Phase II B, in which the levels of water loss achieved during Phases II A and II B for relevant DMAs are to be maintained.
     6. The Intended Completion Dates are set out in respect of each Phase.

B. DESIGN AND MANAGEMENT SERVICES

1. Work description

This section describes the specific Design and Management Services that are required overall and in each of the specific phases. The services include: (i) general management, (ii) design activities, (iii) GIS services, (iv) data management. Services that are not specified are expected to be executed under the Works and Services elements of the contract.

* 1. **Design and Management Services** 
     1. **Design Services**

The Contractor shall design the DMAs and shall submit the DMA outline design map to the Supervision Consultant for approval. The DMAs to be established shall cover the entire Service Area. The DMA outline design map shall be submitted as early as possible but in no case late than 6 (six) months from the end of the Mobilization Phase.

* + 1. **Management Services**

The Contractor shall provide all management services and coordination that is needed to complete the Works and Services successfully. In general, the management services include:

1. Overall project management (overhead, fixed cost, insurances, guarantees);
2. Office establishment and running cost, Contractor’s yard and warehouse including security;
3. staffing cost including all associated cost like social charges, taxes, accommodation, local and international travel;
4. Communication cost;
5. Health and safety precaution related cost;
6. Cost of permits of all kinds.
   1. **Phase I Activities - DMA Establishment Works**

The Contractor shall, based on the indicative drawings of the Employer, prepare a detailed design the DMAs. The scope of services for each DMA includes:

1. detailed Service Area investigation and updating of the existing rudimentary distribution network drawing;
2. preparation of a calibrated hydraulic model based on the overall network to verify hydraulic sufficiency. Hydraulic modeling as a basis for optimum DMA design and determination of feeder main diameter and critical pressure points. The Contractor shall use either the free EPANET or any other software [ ] [Employer to determine] that has the same functionality or better;
3. detailed design of:
4. all pipelines to be laid;
5. location and installation details of new boundaries valves;
6. DMA inflow point arrangement design, pressure reducing valve chamber complete with all pipework and structural design; inflow meter and PRV specifications; location and design of above ground instrumentation box;
7. standard design and map with location of all customer connections to be relocated;
8. all other civil, mechanical, installation or plumbing works that might be required;
9. submission of the complete detailed design to the Supervision Consultant for approval;
10. set up data transfer to a server accessible from the offices of the Employer, Supervision Consultant and Contractor;
11. report the baseline levels of each DMA to the Supervision Consultant, to be agreed with the Supervision Consultant; and
12. preparation of as-built drawings.
    1. **Phase II A Activities - Water Loss Reduction (initial DMAs)**

Prior to commencement of Phase II A Activities, the Contractor will agree with Employer the target level of water losses and minimum pressures for each DMA in Phase II A based on the baseline data established during Phase 1 and will carry out all works and services, and supply such equipment and software as are required to achieve the Phase II A Service Levels. The following (non-exhaustive) list summarizes the works and services that this Phase would typically include:

1. prepare an activity schedule and adjusted BOQ prior to starting any activities;
2. incorporating all existing customers (geo-referenced) into the GIS;
3. geo-tagging new customers and updating GIS database simultaneously with customer meter installation, recording customer meters;
4. leak tagging – collecting all leak and leak repair information and updating the GIS;
5. update distribution network drawings in GIS, based on employer’s stipulated platform;
6. prepare an analysis of the interventions and the effects on the level of WLR and cost effectiveness;
7. investigate the DMAs for Phase II B to determine their similarity to Phase II A DMAs;
8. provide all required information to the Independent Expert to assist him to prepare a report on the cost efficiency of measures in Phase II A, including copies of the analysis that are provided to the Supervision Consultant;
9. prepare a Water Loss Reduction plan for Phase II B DMAs to reduce Water Losses to the Phase II A Service Levels whilst also maintaining the Phase II A Service Levels for the Phase II A DMAs. Proposal to be reviewed by the Supervision Consultant and amended as necessary, taking into account also feedback from the Independent Expert; and
10. agree with Employer on a lump sum arrangement for achievement of the Phase IIB performance requirements (Phase II B Service Levels) (with assistance of the Independent Expert).
    1. **Phase II B Activities - Water Loss Reduction remaining area**

After Phase II A, the Employer shall specify the service level for Phase II B and the Employer and the Contractor shall agree the lump sum for the work in Phase II B in accordance with the Contract. The following (non-exhaustive) list summarizes the activities that the Contractor would be expected to carry out in this Phase for each DMA improved:

1. incorporating all existing customers (geo-referenced) into the GIS;
2. geo-tagging new customers and updating GIS database simultaneously with customer meter installation, recording customer meters;
3. leak tagging – collecting all leak and leak repair information and updating the GIS;
4. final seven-day inflow and pressure measurement after the leakage reduction activities have been concluded; and
5. continuous monitoring of DMA inflow, pressure and minimum night flow.
   1. **Phase III Maintenance**

During the Maintenance Phase the Contractor will ensure that the Continuing Service Levels are maintained, the works and services to be provided in this Phase are (non-exhaustive list):

1. continuous monitoring of DMA inflow, pressure and minimum night flow and execution of leak detection and repair should the tolerance limits be exceeded;
2. training of the Borrower/ service provider staff to take over the network and maintain Water Losses at Continuing Service Levels after completion of the Contract;
3. handover of the equipment to the Borrower/ service provider at the end of the Contract in accordance with the Contract; and
4. handover of the network drawings, hydraulic model and customer information in accordance with the Contract.
5. Distribution Network Drawings

From the Effective Date, the Employer will provide the Contractor with access to the (rudimentary) GIS and other potentially available drawings.

It is assumed that the available drawings are incomplete and as such the information on pipeline location, diameters and materials, are in many cases, inaccurate or missing. The Contractor is expected to improve the GIS information.

1. Monitoring Water Loss Levels

The Contractor is obliged to assign qualified staff, whose task is to verify continuously the leakage levels in the DMAs in general and loss reduction achievements in particular. That staff will also be responsible for the generation and presentation of the information needed by the Contractor for all reports required under the Contract. In general terms, the staff will be responsible to maintain, at all times, a detailed and complete record of leakage levels in all DMAs included under the Contract and all the information needed in order to efficiently manage the DMAs and maintain the achieved leakage levels. The staff will carry out, in close collaboration with the Supervision Consultant, all DMA baseline measurements as well as all other inflow and pressure measurement contractually required.

1. Periodic Reporting
   1. At the end of every month, the Contractor shall submit a one-page summary of key issues arising in the Service Area during that month and expected issues in the next month.
   2. At the end of each quarter, the Contractor shall submit a Quarterly Report, comprising a summary of all works carried out during the last quarter and water loss reduction achieved, a work program for the quarter ahead and all other information that might be requested by the Supervision Consultant. The form of the Quarterly Statement and Quarterly Report are to be agreed with the Supervision Consultant.
   3. At the end of the Maintenance Phase, the Contractor shall submit a Project Completion Report that provides the following information:
2. final performance fee calculations;
3. summary tables of all pipe and connection replacement, leak repair and customer meter installation;
4. summary tables of number and types of leaks detected and repaired;
5. updated GIS and a hard copy of the distribution network drawings of all DMAs;
6. updated calibrated hydraulic model of the project area;
7. as-built drawings for all main pipes installed and chambers constructed;
8. table with target and intervention minimum night flow for all DMAs;
9. DMA data management guidelines;
10. pressure management guidelines that include maintenance recommendations and (if any) specific information for each PRV; and
11. descriptive summary of works carried out and problems encountered.
12. Minimum Key-Personnel Requirements
    1. In general, staffing levels and qualifications are to be decided by the Contractor. However, to make bids comparable, the following minimum number of experienced key personnel must be available.
    2. The number of man-months for each position is to be understood as the absolute minimum requirement. Evidence of the physical presence of these listed staff members has to be provided in the quarterly progress reports and through attendance registers maintained by the project office.
    3. If the Contractor finds that it is necessary to bring more specialists to the Service Area in order to achieve the objectives of the Contract, all costs of such additional personnel are assumed to be included in the Design and Maintenance Fee.
       1. WLR Manager[[8]](#footnote-9)

A minimum of @@ man-months of a person meeting the following minimum experience criteria:

1. [15] years’ experience with water distribution networks;
2. Technical University degree, for example, Water and Sanitary Engineering, Civil Engineering or Mechanical Engineering;
3. Project management experience;
4. 10 years of developing country experience; and
5. 5 years’ experience with water loss reduction projects.
   * 1. Design Engineer

A minimum of @@ man-months of a person meeting the following minimum experience criteria:

* 1. 5 years’ experience with design of water distribution networks and appurtenances;
  2. Technical University degree, for example, Water and Sanitary Engineering, Civil Engineering or Mechanical Engineering;
  3. 5 years’ civil engineering design experience; and
  4. 2 years of developing country experience.
     1. Construction Manager

A minimum of @@ man-months of a person meeting the following minimum experience criteria:

1. 10 years’ experience with water distribution networks;
2. Technical University degree, for example, Water and Sanitary Engineering, Civil Engineering or Mechanical Engineering;
3. 5 years’ construction management experience; and
4. 3 years of developing country experience.
   * 1. DMA and Pressure Management Specialist(s)

A minimum of @@ man-months of one or more person(s) meeting the following minimum experience criteria:

1. 5 years’ experience with leakage reduction projects, particularly with pressure reducing valves, controllers, data loggers and similar; and
2. 2 years; developing country experience.
   * 1. Leak Detection Specialist(s)

A minimum of @@ man-months of one or more person(s) meeting the following minimum experience criteria:

1. 5 years’ experience with leakage reduction projects, particularly with pressure reducing valves, controllers, data loggers and similar; and
2. 2 years developing country experience.
   * 1. Metering Specialist

A minimum of @@ man-months of a person meeting the following minimum experience criteria:

1. 5 years’ experience with selection, testing and installation of bulk and customer meters.
   * 1. Hydraulic Analyst

A minimum of @@ man-months of a person meeting the following minimum experience criteria:

* + 1. 10 years’ experience with water distribution networks;
    2. Technical University degree, for example, Water and Sanitary Engineering, Civil Engineering or Mechanical Engineering;
    3. 5 years’ hydraulic modelling experience; and
    4. 2 years of developing country experience.

1. Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the materials and other supplies to be furnished, and work performed or tested, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to the date of bid submission shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be accepted subject to the Supervision Consultant’s prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Supervision Consultant at least 28 days prior to the date when the Contractor desires the Supervision Consultant’s approval. In the event the Supervision Consultant determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents.

C. PHASE I DMA Establishment

1. Scope of Work
   1. Scope of DMA establishment works

The main activity of this section is the establishment of DMAs. Under the design and management services the Contractor will verify and update distribution network drawings, prepare a calibrated hydraulic model and prepare designs.

* 1. Scope of work for each DMA

The scope of work for each DMA to be established includes (but is not limited to):

1. detailed site investigations, complete with all trial holes that might be required to verify pipe connections (and the consequent reinstatement of road, sidewalk or any other surface);
2. site investigation for verification of suggested DMA boundaries, locating of existing boundary valves, functioning and tightness checks of existing boundary valves, identification of location for additional boundary valves to be installed, identification of locations where the pipes will be disconnected and capped;
3. selection of location for DMA inflow chamber(s);
4. comprehensive customer database review to align with DMA boundaries;
5. collection of billed water consumption data within the DMA (including meter reading for the purpose of the baseline);
6. identification of customer service connections that have to be relocated from a trunk or distribution main outside the DMA (or in a neighboring DMA) to a distribution main inside the DMA;
7. construction of PRV chamber, underground installation of electromagnetic flow meter, construction of above ground instrumentation box, including supply of all required pipes, materials, fittings and equipment, as per the specifications;
8. construction of the critical point above ground instrumentation box, including supply of all required materials, fittings and equipment, as per the specifications;
9. execution of all other civil, mechanical, installation or plumbing works, including supply of all required pipes, materials, fittings and equipment required for DMA establishment, as per the specifications, this include laying of main pipelines up to a cumulated length of 50 m;
10. for all works carried out: reinstatement of road and sidewalk surface;
11. supply and installation of multiple channel data logger (two pressure- and one flow channel) at the inflow point, setting up of data transfer to a central server (SMS, GPRS or similar data transfer), supply and installation of respective software;
12. supply and installation of single channel data logger at the critical point (point with lowest pressure in the DMA), setting up of data transfer to a central server (SMS, GPRS or similar data transfer);
13. commissioning of PRV and controller;
14. execution of zero-pressure-test and execution of all subsequent investigations and works should the first zero-pressure-test have failed until the test is successfully performed;[[9]](#footnote-10)
15. baseline seven-day inflow and pressure measurement per DMA.

In some DMAs it will be necessary to modify or reinforce the distribution network and install additional distribution mains (for example, network reinforcement for hydraulic considerations, changed network configuration, connecting the DMA to a trunk main). If hydraulically possible, DMAs should be single or double feed. Only in cases where it is advisable (for hydraulic or other reasons) to establish multiple feed DMAs, and if approved by the Supervision Consultant, more feeds are permissible.

* 1. Commercial scope of work for each DMA

The Employer shall provide the Contractor the customer database and billing history for the service area. The Contractor will investigate the quality of the database and will ensure a good understanding of the database. The Contractor will use the billing history of customers to identify any anomalies and discuss these with the Employer.

* 1. Baseline establishment

The Contractor will provide the Supervision Consultant with a report on the baseline water loss levels within seven (7) days from the baseline measurements for each DMA.

* + 1. Baseline Inflow and Pressure Measurement

The baseline inflow and pressure will be measured using the following methodology:

1. Conduct a 7 (seven)-day DMA inflow measurement. Flow meter data to be logged with an electronic pressure logger using 15 minutes logging intervals.
2. Calculate the average daily baseline DMA inflow IB (m3/d).
3. During the same period, measure the DMA average pressure with the pressure data to be logged using two electronic pressure loggers at 15 minutes logging intervals. The loggers will be installed at the DMA inflow point (Pi) (after the PRV, in case a PRV is already installed) and at the critical point (Pc)
4. Calculate the average baseline pressure over the 7-day period as follows: PB (m) (average of Pi and Pc).
   * 1. Customer consumption levels

After completion of the customer database the baseline consumption will be measured using the following methodology:

1. The Contractor will read the customer meters on one day and keep a record of the reading time;
2. Repeat the reading of all meters after 7 days (on one day, keeping record of reading time);
3. Calculate average daily DMA Baseline Consumption (CB) (total of all meters) taking meter reading time into account.

During the period of measurement of the Baseline Consumption, the DMA inflow and pressure as described for the “Baseline and Inflow Measurement” will also be recorded.

* + 1. Baseline Water Loss Level

After the Baseline Consumption is measured using the methodology above, the Baseline Water Loss Level will be calculated as follows:

WLB = IB – CB (m3/d)

In which:

WLB Water Loss Baseline

IB Inflow Baseline

CB Consumption Baseline

1. Items in the Bill of Quantities
   * 1. The Bill of Quantities is set out in Annex [].

[SAMPLE BOQ IS ATTACHED AT ANNEX 4 OF THIS GUIDANCE NOTE]

1. Time Schedule
   1. Based on the indicative DMAs, the Contractor shall complete the establishment of a minimum number of DMAs per quarter from the commencement of Phase 1. The figures per quarter (Q) indicate the cumulative number of DMAs that have to be operational (accepted by the Supervision Consultant) before the end of the respective quarter of Phase I (the Intended Completion Dates):

Q1 0

Q2 0

Q3 @@

Q4 @@

Q5 @@

Q6 @@

If these targets are not met, and this failure it not due to the action or inaction of the Employer or the Supervision Consultant, and no successful corrective action has been taken to achieve them within a 90-day grace period, liquidated damages will apply if so specified in the PCC.

* 1. Within 6 (six) months from the start of Phase I, the Contractor shall submit a Program of Performance and may suggest a modified, more ambitious, DMA establishment schedule.
  2. Should the Contractor conclude that the DMAs should be reconfigured, with a change to the number of DMAs change during the Contract, the Contractor shall submit updated versions of the Program of Performance (respectively, the DMA establishment time schedule) to the Supervision Consultant for approval.

D. PHASE II A Water Loss Reduction (Initial DMAs)

1. General

This Phase is intended to collect information about the network condition, WLR components and efficiency of different water loss reduction activities. The activities need to be implemented in batches as to be able to monitor the effect of each activity.

1. Target setting

In Phase II A the Employer shall determine a target level of WLR for each DMA individually, based on the Baseline Water Loss level for each DMA and the expected level of effort to achieve the target level (the Phase II A Service Levels).

1. Activity plan

The Contractor shall prepare an activity plan for each DMA based on the target level set by the Employer in the bidding documents in accordance with the Baseline and Service Level Verification Protocol to learn the effectiveness of each activity. In this “learning” phase the activity plan is expected to be based on an incremental approach to leakage reduction starting with those interventions which are most cost effective and then moving on to the next most cost-effective solutions and so on – monitoring the impact on leakage levels for each intervention. Based on the activity plan and unit rates the Contractor shall prepare a costing of the activities and shall submit it to the Supervision Consultant and the Independent Expert. The Supervision Consultant shall approve the activity plan, or give reasons for rejecting it, in writing, within 20 working days of submission by the Contractor. The Supervision Consultant’s feedback will take into account advice from the Independent Expert.

1. Scope of Work
   1. Water Loss Reduction in DMAs

The Contractor shall take all necessary actions, provide all required services and materials and equipment and carry out all works required to achieve the main objective of the Contract and reduce Water Losses in the DMAs. The following (non-exhaustive) list summarizes the activities the Contractor is normally expected to carry out (without limiting the Contractor's obligations and the scope of work):

1. No water loss reduction works shall be carried out prior to the seven-day inflow and pressure baseline measurement to be carried out by the Contractor, jointly with and supervised by the Supervision Consultant;
2. The Contractor will generate a weekly overview of the daily inflow patterns into the DMA and agree with the Supervision Consultant the Night Flow Levels, pressure and minimum night flow;
3. Prepare an activity schedule and adjusted BOQ prior to starting any activities. Activities will be executed sequential to monitor the efficiency of each type of activity;
4. Pressure management: stabilizing, managing and reducing average DMA pressure using PRVs and controllers and various techniques as appropriate, when doing pressure reduction, the Contractor shall ensure that the volume of water supplied to customers in the DMA is the same or better than the baseline levels at the start of the project. The minimum pressure will depend on the type of housing and the general availability of tanks, but shall not be less than @@ meter at the critical point in the DMA. Pressure management shall be done in close cooperation with the Employer and customers in the DMA to reduce the risk of complaints;
5. House-to-house survey, incorporating all existing customers (geo-referenced) into the GIS;
6. Detection and reporting of illegal connections;
7. Identification of faulty and inaccurate meters based on a comprehensive analysis of meter performance;
8. Customer Meter Installation: detailed design, supply and installation of class [ ] customer meters for customers, complete with all fittings and a steel protection box including reinstatement of the sidewalk surface. The meters to be replaced will be of the following categories: (i) all currently unmetered customers, (ii) all illegal connections that are converted to a legal connection, (iii) replacement of non-functioning meters, and (iv) inaccurate meters that have been identified and agreed upon by the Contractor and Supervision Consultant.
9. Service Connection Replacement: it is anticipated that many of the service connections are leaking or are in bad condition. To determine which need to be replaced the Contractor will provide an overview of conditions and locations to the Supervision Consultant to decide which will be replaced. Detailed standardized design, supply and installation complete with all fittings and road and sidewalk reinstatement are included;
10. Installation of Additional Service Connections: detailed standardized design, supply and installation of service connections for new customers, complete with all fittings, including reinstatement of road or sidewalk surface;
11. Leak detection surveys: (using all kind of equipment and technologies, from simple sounding with a listening stick to leak noise correlators and leak noise loggers as appropriate), note that all required leak detection equipment has to be provided by the Contractor (and will revert to the Employer at the end of the Contract);
12. Leak repair on distribution pipelines: shall be done by any appropriate methodology, for example, by installing repair clamps or replacing pipe sections, all material supply, installation and road reinstatement works are included;
13. Pipe Replacement: based on the leak detection surveys (leaks/km) the Contractor will provide a pipe replacement plan with financial justification as most cost-effective solution to the Supervision Consultant. This will include detailed design. The works will include supply and installation of pipelines and all fittings, including connection to the network, including, fine sand bedding, testing and disinfection, reinstatement of road or sidewalk surface.
14. Installation of Appurtenances: detailed design, supply and installation of sluice valves, air valves or fire hydrants, complete with all fittings and materials required, including reinstatement of road and sidewalk surface.
15. Retrofitting public stand posts with heavy duty taps to avoid water wastage;
16. Establishment of the final Night Flow Level (NFL) in m3/h after completion of all water loss reduction activities in a DMA and continuous monitoring of inflow, pressure and minimum night flow to become aware of new leaks;
17. Repeating leak detection and repair, should the minimum night flow exceed the tolerance limits (see @@);
18. Establish the final level of WLR for the DMA as described in Paragraph 16;
19. Any other works that may become necessary to achieve the objectives of the Contract.
20. Items in the Bill of Quantities
    1. The BoQ for Phase II A is as set out in Annex [] of the Contract.
21. Performance Measurement and Monitoring
    1. Performance achievement of the Contractor will be measured in volumetric terms, specifically the reduction of Water Loss in the DMAs measured in m3 per day for the agreed set of activities implemented to deliver the required service standard (maximum amount of leakage at given minimum pressures).
    2. After implementation of a batch of activities (meter installation for example) the Contractor will determine the effect on Water Loss either through billing increase, Night Flow Levels or by conducting a Water Loss Measurement.
       1. The Water Loss Measurement will be conducted using the following methodology:

Using the recorded DMA inflow data, calculate daily average inflow of the last 30 days of the respective quarter (IQ).

Read all customer meters for a period of at least 7 days and calculate average daily consumption (CQ).

Calculate the Water Loss Level as follows:

**WLQ = IQ – CQ (m3/d)**

In which

WLQ Average daily Water Loss during that Quarter (in m3/day)

IQ Average daily Inflow into the DMA during that Quarter

CQ  Average daily Consumption in the DMA during that Quarter

* + 1. Calculation of the Water Loss Reduction Achievement

After obtaining the results from the baseline and the measurements of each DMA, the achieved volume of Water Loss Reduction (WLR) for the DMA where the average pressure during baseline measurement was higher than or equal to the pressure observed during the quarterly measurement (PB > PQ) will be calculated as follows:

**WLR = WLB - WLQ (m3/d)**

In cases where the average DMA pressure during the quarterly measurement is more than 1 m higher than it was during the baseline measurement, a pressure correction factor will be applied:

**WLRcorrected = (WLR / PB) x PQ**

* 1. After completion of the activity plan, the Contractor shall prepare a report that shows the analysis of the DMA (distribution network, meters, quality of the customer database, illegal connections etc.), the baseline levels, the achieved levels of Water Loss reduction, the activities performed, and the efficiency of each activity in relation to the costs. The Contractor will make the report and all relevant data available for the Supervision Consultant and the Independent Expert.

E. PHASE II B Water Loss Reduction (Lump Sum)

1. General

This Phase is intended to reduce the level of water loss through WLR activities in the remaining DMAs in the Service Area on a lump sum basis.

1. Target setting for remaining DMAs

In this Phase IIB the Employer shall:

(a) propose a target level of water loss based on the Baseline Water Loss level of the completed DMAs;

(b) Prepare a Water Loss Reduction plan for Phase II B DMAs to reduce Water Losses to the required level (indicated by the Employer) whilst also maintaining the end line levels of leakage in Phase II A in accordance with the Contract. The plan and the service levels (Phase II B Service Levels) will be reviewed and agreed in accordance with the Contract; and

(c) Agree with Employer on a lump sum arrangement for achievement of the Phase II B Service Levels, and the maintenance of the Phase II A Service Levels as provided in the Contract;

1. Activity plan

The Contractor will prepare an activity plan based on the agreed Phase II B Service Levels. Based on the activity plan and unit rates the Contractor shall prepare a costing of the activities and shall submit it to the Supervision Consultant and the Independent Expert. This shall be reviewed and agreed in accordance with the Contract.

1. Scope of Work
   1. Water Loss Reduction inside the DMAs

The Contractor shall take all necessary actions, provide all required services and materials and equipment and carry out all works required to achieve the main objective of the Contract and reduce Water Loss in the Service Area. The following (non-exhaustive) list summarizes the activities the Contractor is normally expected to carry out (without limiting the Contractor's obligations and the scope of work). It is expected that the Contractor will use the same criteria to determine the implementation of activities such as meter- or pipeline replacement or leak repair as in Phase II A:

1. No water loss reduction works shall be carried out prior to the seven-day inflow and pressure baseline measurement to be carried out by the Contractor, jointly with and supervised by the Supervision Consultant;
2. The Contractor will generate a weekly overview of the daily inflow patterns into the DMA and agree with the Supervision Consultant the Night Flow Levels, pressure and minimum night flow;
3. Pressure management: stabilizing, managing and reducing average DMA pressure using PRVs and controllers and various techniques as appropriate, when doing pressure reduction, the Contractor shall ensure that the volume of water supplied to customers in the DMA is the same or better than the baseline levels at the start of the project. The minimum pressure will depend on the type of housing and the general availability of tanks, but shall not be less than @@ meter at the critical point in the DMA. Pressure management shall be done in close cooperation with the Employer and customers in the DMA to reduce the risk of complaints;
4. Customer Meter Installation: detailed design, supply and installation of Class B customer meters for customers, complete with all fittings and a steel protection box including reinstatement of the sidewalk surface. The meters to be replaced will be of the following categories: (i) all currently unmetered customers, (ii) all illegal connections that are converted to a legal connection, (iii) replacement of non-functioning meters, and (iv) inaccurate meters that have been identified and agreed upon by the Contractor and Supervision Consultant;
5. Service Connection Replacement: it is anticipated that many of the service connections are leaking or are in bad condition. The Contractor will decide which will be replaced. Detailed standardized design, supply and installation complete with all fittings and road and sidewalk reinstatement are included;
6. Installation of Additional Service Connections: detailed standardized design, supply and installation of service connections for new customers, complete with all fittings, including reinstatement of road or sidewalk surface;
7. Leak detection surveys: (using all kind of equipment and technologies, from simple sounding with a listening stick to leak noise correlators and leak noise loggers as appropriate), note that all required leak detection equipment has to be provided by the Contractor (and will revert to the Employer at the end of the Contract);
8. Leak repair on distribution pipelines: shall be done by any appropriate methodology, for example, by installing repair clamps or replacing pipe sections, all material supply, installation and road reinstatement works are included;
9. Pipe Replacement: based on the leak detection surveys (leaks/km) the Contractor will provide a pipe replacement plan with financial justification as most cost-effective solution to the Supervision Consultant. This will include detailed design. The works will include supply and installation of pipelines and all fittings, including connection to the network, including, fine sand bedding, testing and disinfection, reinstatement of road or sidewalk surface.
10. Installation of Appurtenances: detailed design, supply and installation of sluice valves, air valves or fire hydrants, complete with all fittings and materials required, including reinstatement of road and sidewalk surface.
11. Retrofitting public stand posts with heavy duty taps to avoid water wastage;
12. Continuous flow and pressure data logging and data transfer to the central server;
13. Establishment of the final Night Flow Level (NFL) in m3/h after completion of all water loss reduction activities in a DMA and continuous monitoring of inflow, pressure and minimum night flow to become aware of new leaks;
14. Repeating of leak detection and repair, should the minimum night flow exceed the tolerance limits (see @@);
15. Establish the final level of Water Losses for the DMA as described in Paragraph 16; and
16. Any other works that may become necessary to achieve the objectives of the Contract.
17. Payment for Phase II B
    1. The Contractor will be paid during Phase IIB for:
       1. Quarterly fixed Design and Management Fee for management services; and
       2. Lump Sum Payment based on quarterly progress (cumulative arrangements with a review of all DMAs per quarter as set out in the Contract) adjusted to take into account any performance deductions in accordance with the Contract.
18. Performance Measurement and Monitoring
    1. Performance achievement of the Contractor will be measured in volumetric terms, specifically the reduction of Water Loss in the DMAs measured in m3 per day.

For Payment and Performance Monitoring the Contractor shall on a Quarterly basis determine the effect on Water Loss levels either through billing increase, Night Flow Levels or by conducting a Water Loss Measurement.

* + 1. The Water Loss Measurement will be conducted using the following methodology:

Using the recorded DMA inflow data, calculate daily average inflow of the last 30 days of the respective quarter (IQ).

Read all customer meters for a period of at least 7 days and calculate average daily consumption (CQ).

Calculate the Water Loss Level as follows:

**WLQ = IQ – CQ (m3/d)**

In which

WLQ Average daily Water Loss during that Quarter (in m3/day)

IQ Average daily Inflow into the DMA during that Quarter

CQ  Average daily Consumption in the DMA during that Quarter

* + 1. Calculation of the Water Loss Reduction Achievement

After obtaining the results from the baseline and the measurements of each DMA, the achieved volume of Water Loss Reduction (WLR) for the DMA where the average pressure during baseline measurement was higher than or equal to the pressure observed during the quarterly measurement (PB > PQ) will be calculated as follows:

**WLR = WLB - WLQ (m3/d)**

In cases where the average DMA pressure during the quarterly measurement is more than 1 m higher than it was during the baseline measurement, a pressure correction factor will be applied:

**WLRcorrected = (WLR / PB) x PQ**

* 1. After computation of the WLR in each DMA in Phase IIB the combined WLR will be calculated as follows:

WLRtotal = WLR1 + WLR2 + WLR3 + WLR@

**F. PHASE III Maintenance**

1. Maintaining the level of Water Losses
   1. The Maintenance Phase will start once the Supervision Consultant has confirmed that the Phase II B Service Level for the Phase II A Service Area has been achieved.
   2. At the end of the Maintenance Phase the Contractor will provide a final report which will include the relevant data to ascertain that the Phase II A Services Levels have been maintained in the Phase II A Service Area and that the Phase II B Service Levels have been maintained in the Phase II B Service Area. The indicator used to monitor any increase of Water Loss is the minimum night flow.
   3. After completion of all WLR activities in a DMA the Contractor shall establish the TNFL in m3/h for the DMA which is an indicator for the level of leakage, as well as the overall losses based on System Input Volume and Customer meters in lpcd and submit this information to the Supervision Consultant.
   4. If the 7-day average of the minimum night flow in a DMA increases by 5 liters/hour per service connection (that is, for a DMA with 1,000 connection this would mean by 5 m3/h) above the TNFL, the Contractor will:

i. investigate whether there is any new, additional night consumption and, if this is the case, inform the Supervision Consultant who will establish a revised TNFL;

ii. if the night flow increase is caused by an unintended pressure increase, readjust the PRV to reduce night pressure to previous levels;

iii. if the night flow increase is caused by an intended pressure increase or by increased night consumption, inform the Supervision Consultant who will establish a revised TNFL; and

iv. if neither of the situations above applies, carry out leak detection and repair activities to reduce the minimum night flow to an acceptable level – preferably a level not exceeding the TNFL.

* 1. If the 7-day average of the minimum night flow to a DMA has increased by 5 liter/hour per service connection and the Contractor has not started to take corrective action within 7 days after the limit was exceeded, the Contractor will be liable to deductions for failure to perform. Such deductions will be calculated per m3/h increased night flow for every day (starting 14 days after the limit was exceeded) until the night flow is reduced to at least below the limit of +5 liter/hour per service connection above TNFL.

1. Information transfer
   1. The Contractor will ensure proper documentation of all assets and activities executed. For all works involving chambers and pipelines “as built” drawings and/or manuals are required, the Contractor shall supply them by the dates stated in the @@. The Contractor will be responsible for the quality of the information on customers, assets and pipelines. During the Maintenance Phase the Contractor will hand over this information through automated databases (customer database, GIS, as built drawings).
   2. The Contractor will ensure that Borrower/ service provider staff know the physical location in the field of all the assets that have been developed, this includes, non-exhaustive; pipelines, customer meters, bulk meters, isolation valves.
   3. If the Contractor does not supply the drawings and/or manuals by the dates stated in the PCC, or they do not receive the Supervision Consultant’s approval, the Employer shall deduct an amount stated in the PCC from payments due to the Contractor.
2. Knowledge transfer
   1. During the Maintenance Phase, the Contractor will train the Employer’s staff and transfer all technology to enable the Employer to take over DMA management, hydraulic modelling, maintenance of pressure reducing valves, leak detection scheduling and execution, leak repair management and all other activities required to manage the DMA system and maintain the achieved water loss levels. The Contractor may decide to bring Employer’s staff in during Phase II B to improve transfer of knowledge. The Contractor will for that purpose propose involvement of the Employer’s staff to the Supervision Consultant.
   2. During Phase II and Phase III, the Employer may decide to second water loss management and reduction staff to work jointly with the Contractor’s staff on a daily basis. The Employer will continue to pay salaries of seconded staff but the Contractor may pay incentive bonuses that are in accordance with bonuses paid to his own staff. Seconded staff will follow the Contractor’s instructions and will work as part of the Contractor’s team. The Contractor will ensure that it will follow all local labor laws with respect to the Employer’s staff and will treat the same with equity and fairness.

If the Contractor is unsatisfied with the performance of a seconded staff member, he will inform the Employer. If the unsatisfactory situation continues, the Contractor is allowed to reject further secondment of the staff concerned and the Employer may nominate a replacement.

1. Training
   1. At the end of the Phase II B, the Contractor will submit a detailed Training and Transfer of Technology Program that will be based on the respective section of the Contractor's Technical Proposal but will also take the experience gained during Contract implementation into account. The Program will be approved by the Supervision Consultant.
   2. All activities in respect to training, transfer of technology and development of the asset management strategy are included in the Management Services Fee.
   3. In case international study tours are agreed upon, the cost of international travel for study tours will be reimbursed using the provisional sum from @@. Budgets for study tours need to be submitted to the Supervision Consultant for approval. All travel expenses need to be documented and receipts need to be provided.
2. System and Equipment Transfer

The Contractor shall hand over fully functional equipment and systems (loggers, computer equipment and software, leak detection equipment etc.) relevant to WLR management in the Service Area.

1. Items in the Bill of Quantities
   1. Lump sum payment on the following items:
      1. Maintenance of pipeline (km)
      2. Maintenance of connections (#) as set out in Annex [ ].
2. List of documents to be submitted by Contractor

|  |  |
| --- | --- |
| Document | Requires approval of Supervision Consultant |
|  | Yes/ No |
|  | Yes/ No |
|  |  |
|  |  |

**G. Sample (for demonstration purposes)- Technical Specifications of Equipment and Materials**

|  |  |
| --- | --- |
| 1. General | * 1. Bidders have to include detailed information on all proposed equipment and materials in their bid. All proposed equipment and materials have to be in accordance with the specifications below or equivalent international standard.   2. All miscellaneous equipment and materials not listed hereunder shall be of similarly high quality.   3. Should the Contractor want to use other equipment/materials than the ones included in the bid, such equipment/materials must also meet the minimum specifications below and may only be used upon the Project Manager's approval.   4. For all materials specified below, equivalent national standards will be acceptable provided it is equal or better than ISO standards. |
| 1. Pipes, fittings and installation standards | * 1. Main Pipes   In compliance with the water utility pipe quality and installation standards (very specific per utility) |
| 1. Service Connections | * 1. Domestic Connections: High-Density Polyethylene (HDPE) Pipes shall be according to ISO 4427-1:2007 and ISO 4427-2:2007 and shall be suitable and approved for use with potable water at a working pressure of min. PN 16 bar. |
| 1. Appurtenances and Pipe Saddles | * 1. Valves   In compliance with the water utility valve quality standards (very specific per utility)   * 1. Pipe Saddles for rigid pipes   Pipe saddles for rigid pipes should be in compliance with the water utility quality standards. In the case of missing standards, the following guidelines apply:  Pipe saddles shall be of the universal type with flexible strap for DI, steel and AC pipes and shall be suitable and approved for use with potable water at a nominal working pressure of 16 bar.  The body of the pipe saddle shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 DIN 1693), and shall be epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476, inside and outside.  Saddle strap and bolts/nuts/washers shall be made of stainless steel 304. Strap shall be rubber lined to avoid direct contact between the stainless-steel strap and the pipe. Gaskets shall be of EPDM or NBR (suitable and approved for potable water).   * 1. Pipe saddles for plastic pipes   Pipe saddles for flexible pipes should be in compliance with the water utility quality standards. In the case of missing standards, the following guidelines apply:  Pipe saddles for use on plastic pipes shall be of the full collar type with a minimum length of 120 mm to support the plastic pipe and with a fully rubber lined sealing area around the full circle with multiple O-rings or multiple lip seals around the outlet.  The body of the pipe saddle shall be made from ductile iron EN-GJS-400-15 acc. to EN 1563 (GGG 400 DIN 1693) for a nominal working pressure of 10 bar and shall be epoxy powder coated with a minimum coating thickness (DFT) of 250 ¬µm in accordance to DIN 30677-2 and DIN 3476, inside and outside.  Stud bolts with nuts and washers and shall be made of stainless steel 304, gaskets shall be of EPDM or NBR (suitable and approved for potable water). |
| 1. Flow Meters | * 1. All meter sizes - General   Flow Meters of all sizes shall:   1. Contain a minimum of wearing parts; be capable of correctly recording low rates of flow and withstanding flows in excess of the maximum rated capacity for short periods without damage to the mechanism; 2. Record through flow in cubic meters; 3. The serial number of the meter cartridge must be clearly visible from the position that the meters are normally read 4. Be suitable for operation in water at all temperatures between 2oC and 40oC; 5. Have straight reading pattern cyclometer counters indicating completed m3, having a reading sequence from left to right, with one coloring system to indicate m3 and another coloring system or multipointer counters for sub multiples; 6. Meters offered shall not be affected by outside magnetic influences; 7. Have inlets and outlets to each meter supplied sealed against ingress of foreign matter with plastic blanking caps for meters with threaded connections. Meters with flanged connections must be supplied in independent rigid cartons complete with a set of gaskets 8. Have robust hinged covers of adequate strength to protect the meter counters; 9. Have a body free of blow holes and other flaws and be accurately machined; 10. Be suitable to withstand a test pressure of 2,400kPa without deformation, leakage or subsequent impairment of the meter’s metrological integrity. 11. Have underwater fittings of bronze or other 12. Approved non-corrosive materials; 13. All internal plastic components to be constructed of virgin materials and may not contain any materials of scrap value; 14. Have all threads other than inlets and outlets compatible with ISO metric sizes. 15. The meter body shall have an option of being supplied with an integral flow straightener for difficult installations that do not have the required straight length before and after the meter.     1. Domestic meters: water utility standards apply. **Domestic meters specifications is very hard to generalize since utilities have their preferences due to a number of variables: cost of water, quality of water, available resources, etc.**   In addition, the 15 and 20mm meters should:   1. have a meter counter with a direct mechanical drive to prevent magnetic interference and tampering; 2. have a wet dial meter counter to prevent condensation under the lens; 3. be approved, and comply with regulations relating to water meters published in terms of INTERNATIONAL RECOMMENDATION MID OIML R49; 4. be fitted with an inlet screen to trap solid particles, without significantly interfering with the flow performance and 5. have an optional non-return valve to prevent the meter from being turned around in the line.   In addition, the 25mm meters should:   1. Be approved, and comply with regulations relating to water meters published in terms of the Trade Metrology Act, 1973 (Act 77 of 1973) and Regulations; 2. Be certified by the NRCS to be compliant with regulations relating to water meters in terms of the national standard for water meters: sans 1529 - 1:2003 or the latest applicable national standard; 3. Bear proof of having been assized in terms of the trade metrology act, 1973 (act 77 of 1973); 4. Include in the meter tender price for the assize fee for each sum, in terms of the Trade Metrology Act, 1973 (Act 77 of 1973); 5. Be of robust construction to permit installation above ground without protection; 6. Be equipped to generate a high frequency pulse output (2 pulses per litre); 7. Be fitted with a non-return valve; and 8. Plastic bodied meters are to be manufactured from UV stabilised plastic.    1. Bulk meters – mechanical:   The meters shall conform to ISO 4064 standards for Class “B” horizontal Woltmann meter. Meters must be designed with an accuracy limit of ± 2% for the maximum, minimum and transitional flow and ± 5% for minimum flow. The meter manufacturer must warrant that the new meter will meet this accuracy standard. The main body of the meter shall be made of cast iron. The meter must be capable of installation in any allowable position with no change in accuracy of measurement. The meter must have the capability for both optical and reed switch pulse outputs ranging shall be from 10 liters/pulse up to 1,000 liters/pulse. The water meter shall be capable to operate in an ambient temperature of up to 50°C. Pressure loss through the inlet and outlet of the water meter shall not be greater than 0.1 bar at nominal flow. The water meter marking must be well defined with the following identifications such as metrological class, flow direction indicator, rated nominal flow rate in m3 per hour, working pressure, serial number, manufacturer’s trademark and approval marking and certificate numbers.  Q4 (Qmax) – Maximum Permissible Flow Rate: the overload flow rate for which the meter is designed and at which the meter may operate for a short period of time.  Q3 (Qn) – Permanent Flow Rate: the flow rate for which the meter is designed and at which the meter is required to give indication within the permissible tolerance (which for this specification is ±2%) and under normal conditions of use e.g. under steady or intermittent flow conditions (Qn).  Q2 (Qt) – Transitional Flow Rate: A flow rate that occurs between the permanent flow rate and the minimum flow rate and at which the flow rate range is divided into two zones, the upper zone (which for this Contract is 2%) and lower zone (which for this specification is ±5%), each characterised by a specific permissible tolerance on flow rate indication.  Q1 (Qmin) – Minimum Flow Rate: the lowest flow rate at which the meter is required to give indications within the permissible tolerance (which for this specification is ±5%). It is determined in terms of Qp.  Qs – Starting Flow Rate: A flow rate at which the meter starts measuring the water passing through but is not accurate.    In addition, the 50mm to 300mm ND meters shall also comply with the requirements below:  (a) Shall fully comply with the requirements of INTERNATIONAL RECOMMENDATION MID OIML R49;  (b) All flanged water meters tendered for sizes ND 40mm up to ND 300mm shall be in-line through-flow type, mechanical turbine bulk water meters;  (c) The meter bodies must be coated with a high quality sintered epoxy powder coating, both internally and externally, to provide maximum protection against corrosion. The coating dry film thickness is to be a minimum of 200 microns so as to permit installation above ground without further protection. The cover bolts must be stainless steel to facilitate easy removal of mechanisms and must be installed with stainless steel washers;  (d) The body shall have provision for a pressure tapping point that does not interfere with the structural integrity of the meter body.  (e) Mechanical meters shall be fitted with hermetically sealed, copper can, dry dial, glass faced registers sealed to IP68 protection to prevent ingress of dirt or moisture. These meters must be equipped with registers, which comprise 6 digit cyclometer-type totalizers, registering in m³;  (f) The meters shall have body lengths that comply with the following Table;    (g) The meters shall have flanged inlets and outlets in accordance with BS EN 1092-1 or 1092-2;  (h) Tenderers must provide full details of the minimum lengths of straight pipe required upstream and downstream from each type of perturbance, so that the accuracy of the meters remains within the specified accuracies;  (i) The performance of the meters offered shall not be affected by outside magnetic influences; and  (j) The registers must have as a standard feature at least one pulse output facility so that the flow can be logged with the data loggers currently used by the Client. Tenderers must provide full details of the types and capabilities of the pulser units available. If it is not a standard feature, Tenderers must stipulate the extra cost per water meter for the provision of a pulse output facility in order to be compatible with the data loggers used by the Client. Besides standard reed switch type pulse outputs tenderers must provide details of alternative high resolution optical and/or inductive outputs capable of identifying reverse flow and be suitable for remote reading (AMR) applications.   * 1. o |
| 1. DMA Inflow Meters | In addition to previous Bulk meter standards, DMA meters should comply with:   * 1. Full-bore electromagnetic flow meter for potable water with accuracy margin of ±0.5% of measured value and built-in data logger that sends pressure and flow data on desired sending intervals via GPRS or SMS communications. Built-in data logger can be set into minimum of one (1) minute sampling interval for data analysis purposes. The battery life should be not less than 10 years under normal operating conditions. Transmitter/converter cable length must be not less than 10 m. Ingress protection rating of IP68 for both converter and sensors. Built in data logger to have at least two (2) pressure channels for pressure monitoring upstream and downstream of a pressure reducing valve.   2. Specific requirements:  1. Minimum conductivity: 5µS/cm 2. Nominal Pressure: PN 6 to PN 250 3. Liquid Temperature: 0°C to 50°C 4. Electrodes: Stainless steel AISI 316 5. Repeatability: ±0.5% |
| 1. Above Ground Instrumentation Box | Fiber-reinforced plastic (FRP) cabinet spacious enough to enclose the electromagnetic flow meter converter, PRV controllers, data logger and accessories. It must be pad mounted in concrete pedestal for ease access and protected inside a > 4 mm φ wire mesh cage and secured by weather proof durable padlock. |
| 1. Data Loggers | General requirements   * 1. Pressure data logger capable of transferring data via GPRS/SMS communication. Input pressure range of 0 - 20 bars, accuracy ± 0.5%, and repeatability ± 0.1%, with re-zero function for offsetting. Memory must be not less than 50,000 readings, and can be set in cyclic or start-stop (block). Logging interval can be set 1 second, 1 min, 15 mins, 30 mins, hourly etc. Capable to export data to comma-separated values (csv) file format or Excel spreadsheets. Software supports statistical data (average, maximum, mean and standard deviations). Ingress Protection rating of IP68, with minimum battery life of 5 years.   2. Data loggers must be compatible with the Employer’s telemetry software. |
| 1. Pressure Reducing Valves | The Pressure reducing valves (PRV) installation shall consist of a correctly-sized pressure reducing valve, flow meter and isolating valves inside a protective chamber. PRV’s shall be sized according to known demands and take into consideration any planned expansion of the network.  PRV sizing software shall be used to correctly size the valve to avoid under- or over-sizing and cavitation.  The low water pressure in the mayor part of the distribution system requires careful PRV and PRV controller selection. The valve shall be a full bore or reduced bore diaphragm actuated (no piston) hydraulically controlled by a 3-way pilot valve (allowing full opening when upstream pressure drops below the required downstream set pressure).  Design standards:   1. Each PRV installation shall consist of an in-line PRV according to the technical specification for pressure reducing valves included in “PRV Technical requirements” section; 2. Each PRV installation shall include a mechanical flow meter and upstream protective dirt box/strainer, equipped with a pulse output. The flow meter shall conform to the attached technical specification for flow meters included in “DMA Inflow Meters” section; 3. Each PRV installation shall include a minimum of two isolating valves to allow isolation of the PRV and enable easy PRV maintenance and/or removal of the control valve for replacement in the future if required; 4. The pipework shall be sized for future demand requirements, while the pressure reducing valve will be sized for short-term demand requirements with an option for upsizing with minimal disturbance. In this regard, the use of reduced port PRV’s will be encouraged (this will also assist with increased pressure break ratio capability across the valve); 5. Each PRV will be installed on a bypass from the main pipeline, with the main line having an isolating valve installed in the normally closed position – this can be opened in case of emergency and/or maintenance of the PRV. This is deemed to be the most flexible operational installation and has many advantages over the in-line PRV installation – an in-line installation, when closed for any reason, has no alternative water supply and cuts off water supply to the entire downstream zone, whereas on a bypass arrangement water can continue to be supplied to consumers. NOTE: By-pass installation option vs in-line installation option will need to be discussed with the utility. The Consultant will present pros and cons of both alternatives, and his professional recommendation.   PRV Technical and Quality requirements:   1. Supply a Pressure Reducing Control Valve of various diameters from 50mm ND to 300mm ND as required, in either a full port or reduced port configuration as specified. 2. Function: The valve shall be a pilot operated pressure reducing valve which will reduce a high inlet pressure to a constant or fixed lower outlet pressure. The valve shall maintain a relatively constant downstream pressure regardless of fluctuations in supply pressure or flow rate. 3. Operation: The pilot shall be a normally open Pressure Reducing Pilot that reacts to small changes in downstream pressure which acts to modulate the main valve bonnet pressure to hydraulically adjust the inner valve assembly position to maintain a constant downstream pressure. 4. The control valve shall be tested prior to final shipment and delivery. The standard test shall include a functional stroke, pressure and leak test of valve body, seat, fitted pilots and accessories. 5. The control valve shall be covered by a minimum three (3) year warranty against defects in materials and workmanship. The AISI 316 stainless steel seat ring shall be covered by a lifetime guarantee. 6. All control valve maintenance and repairs shall be possible without removing the main valve body from the line, when installed in accordance with manufacturer's recommendations. 7. The valve body and bonnet made of Ductile Iron GGG50 or higher grade and shall be epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476, inside and outside. 8. Each PRV should be hydrostatically tested at 160% of the rated pressure. A test report should be supplied with each valve. 9. Each valve shall be supplied with a variety of springs, taking the extremely low pressure situation into account 10. Main Valve shall have Stainless Steel Seat Ring and stainless steel stems. 11. All external fasteners and washers shall be stainless steel 18/8 or better 12. PRVs must have either NSF (American, http://www.nsf.org/ ) or WRAS (UK, http://www.wras.co.uk/ ) or other substantially equivalent internationally accepted certificate (such as Japan, Europe, etc.). All supporting documents must be included in the bid. 13. Manufacturer must be able to provide support and maintenance services in the employer’s country. In case a manufacturer is not doing business in the employer’s country, the Contractor should ensure that the concerned manufacturer, before contract signing or an appropriate timing as agreed with the Employer, shall arrange a representative Agent in the country equipped and able to carry out the maintenance, support, repair and stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications. 14. Contractor to supply a reasonable number (to be agreed with the Project Manager) of valve repair kits containing all internal valve and pilot parts for the various valve types and diameters at the end of the Maintenance Period.   Pilot Control:   1. Pilot circuit isolation valves for inlet, outlet and valve head isolation 2. The pressure reducing pilot shall be a normally open pilot with a spring to adjust the pressure setting. The pilot shall be self-cleaning and self-flushing with the outlet of the pilot located at the bottom of the pilot flow with the pilot stem out of the waterway and guide free from any debris build-up. 3. The pilot trim, consisting of a seat ring, stem and yoke shall be constructed of AISI 316 stainless steel. 4. The pilot elastomers: diaphragm, inner valve and seals, shall be of EPDM or Buna-N. 5. The adjustable pilot spring range shall be supplied with a downstream spring range of 1.38bar to 13.8bar (or 0.66bar to 5.5bar or 6.9bar to 20.6bar) as scheduled. The pilot shall be factory pre-set at 4bar. 6. The pilot body and spring casing shall be constructed of ASTM B62 bronze. 7. A fixed restriction shall be supplied as AISI 303 stainless steel with an orifice bore selected by the manufacturer based on the valve size and operation. 8. The adjustable flow stabilizer shall be a self-cleaning opening speed control, supplied as a stainless-steel assembly. 9. The pilot fittings shall be supplied as B12 brass compression fittings. 10. The pilot tubing shall be supplied as ASTM B280 seamless copper. 11. Valves will be supplied with three pilot isolation ball valves shall be supplied as standard. Pilot isolation ball valves shall be constructed of B16 brass with stainless steel handle operator. 12. Pilot system shall have been designed for stable regulation in wide range of flow speed, from near-zero to maximal designed flow.   PRV advance controllers:  Since it shall be in the interest of the Contractor to use only best quality industry standard controllers, the specifications hereunder are kept at a minimum:   1. Controller to be easily retro fitted to any pressure reducing valve to convert the valve from a fixed regime to advance control. Compatible with Singer, Dorot, Bermad, Bayard, ClaVal, Ross and all diaphragm-actuated globe-type PRVs. 2. The pilot valve should use the system inlet pressure to control modulation and perform as a normal pilot system. The use of alternate liquids or pneumatics to control the PRV is not allowed. In the event of a hardware failure these controllers may run the risk of contaminating the water supply. 3. Units to be fully sealed to IP68 standards, the pressure connections to be of quick-fit type. 4. Controller to be powered by a fully-sealed internal battery, with an expected operational life of 5 years and with low power indicator. 5. The controller must be capable of remote adjustment and optimisation of pressure flow modulation relationships. The system must be capable of automatically learning the DMA pressure flow characteristics and able to automatically optimise the control relationships through a remotely accessible interface. 6. Ability to control pilot speed movement from 2m per minute to 60m per minute. 7. The controller must be able to make changes to pressures regularly in response to changing network demand. The controller must therefore be capable of reviewing and responding to demand changes within 2 minutes, and be capable of at least 300 adjustments per day (i.e. average change interval of approximately 5 minutes). |

1. **Sample (for demonstration purposes)- Technical Specifications for Installation and Repair Works – Particular for NRW Projects**

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| 1. General | | * 1. It is expected that all installations are done in accordance to the current applicable specifications - Employer’s standard specifications. Wherever no specific works and installation specifications are available, the following general specifications apply.   Contract Health and Safety Standards should be implemented at all constructions and installation stages.  The Contractor is furthermore expected to execute all works in accordance with international best practice and with all relevant regulations and norms of the country.  The Contractor is required to take digital photos showing BEFORE-AFTER effect at all stages of the work progress. Detailed instructions will be given by the Project Manager.  All old pipes, valves and other appurtenances shall be returned to the Employer unless otherwise instructed by the Project Manager. |
| 1. Pipeline Trenches | | * 1. Trench Width  1. Trench dimensions and width shall be sufficient to install the various pipes, specials, closures, fittings, valve chambers, and anchorages. 2. The width at the top of the trench shall be not more than the outside diameter of the pipe plus 300mm, or 400mm in total, whichever is the larger.    1. Start of Excavation   Where a trench is excavated in a paved surface, whether of asphalt, concrete, or other material, the Contractor shall start by carefully cutting through the paved surface and foundation along the lines of the trench, without loosening or damaging the adjacent parts.   * 1. Trench Cross Section   The trench sides shall be excavated as follows unless specifically varied by the Project Manager:   1. With stable soil conditions: vertical sides. 2. With soil of low stability: the excavation faces shall be supported by shoring or sheet piling. Additional trench width shall be included to allow proper tamping of backfill and the placing or removal of piles or shoring. 3. Trench depth shall permit the pipe to be laid to the gradients and elevations. 4. At pipe joints, additional excavation shall be made for the pipe joints. 5. Pipeline depth shall be in accordance with the Employer’s standard specifications. 6. Health and Safety standards should be implemented at all constructions and installation stages.    1. Length of Trench Left Open   The trench open ahead of pipe laying operations shall be limited to the length of pipe which can be laid in one day except as otherwise authorized by the Project Manager.  If natural or artificial conditions create hazardous operations in the performance of excavation, the Project Manager may specify further limitation in the length of open trench permitted.  The Contractor shall ensure that safety measures with respect to open trenches will be provided to the satisfaction of the Project Manager. |
| 1. Reinstatement of Surfaces | | * 1. Temporary Reinstatement   After backfilling the pipeline trench up to the specified level or as directed by the Project Manager, the Contractor shall install and compact temporary road surface reinstatement.  To accommodate settlement, temporary surface materials shall be to the same standard as the road.  The Contractor shall maintain the reinstatement and top restore additional material as necessary, to accommodate settlement for a period of not less than two months   * 1. Permanent Reinstatement of roads and pavements   Contractor shall restore them to their original condition.  The permanent reinstatement shall be carried out in accordance with the specifications and requirements of the Employer. |
| 1. Pipeline Installation and Connections to Existing Water Mains | | * 1. General   The Contractor shall provide labor, materials, tools, equipment, and plant for the installation and handing, laying and installation of the pipes and fittings to the lines, grades and elevations shown on the design drawings.   * 1. Pipes to be Clean   Pipes and fittings shall be carefully cleaned of foreign substances which may have been collected therein before installation and kept clean at all times thereafter, to ensure that there is no difficulty later with flushing and sterilization of the pipe lines on completion.  Before leaving the work for the night or for holidays or at other times when pipe installation is to stop, all pipeline ends shall be closed with suitable wood or metal bulkheads to prevent ingress of animals or persons. The Contractor shall make all necessary arrangements to maintain dewatering pumps in operation so that the pipeline do not fill with dirty water.  The Contractor shall be deemed responsible for any delays caused to its installation program arising from its failure to keep the interior of the pipes clean.   * 1. Inspection of Pipe at Trench Site   Each length of pipe shall be carefully examined before it is lowered into its laying position to ensure that only new undamaged pipe shall be installed following the approval of the Project Manager.  Any pipes found damaged shall be rejected and removed from the Site for repair, cutting off the damaged portion if short, or disposal, subject to the opinion of the Project Manager.   * 1. Pipe Cutting   Cutting of pipes shall be carried out in accordance with the pipe manufacture’s recommendations, without damage to the pipe or the protective coating, and so as to leave a smooth face normal to the pipe axis, chamfered as necessary for subsequent jointing.  All cutting shall be done with proper cutting tools and apparatus, and the Contractor shall always be responsible for the accuracy of the measurement of the cut pipe required.  With ductile iron pipes, the cut ends shall be coated with quick drying epoxy paint to the approval of the Project Manager which shall be dry before the joint is made.  The Contractor shall remove all unused offcuts from the site on completion, and return them to the Employer’s stores. Such offcuts shall be set against the Contractor losses, provided the offcuts did not arise from the repair of damaged pipes.   * 1. Pipe Bedding   Bedding shall form a continuous, sound and uniform bearing for the full length of the pipe except for small grooves for removal of sling, and at the ends of joint.  All such grooves shall be filled and thoroughly compacted with bedding material after removal of the sling and completion of jointing.   * 1. Pipe Installation   Pipes shall be carefully lowered into the trench.  The bedding shall have been prepared and compacted to the required line and level, so that the pipe will be lowered directly onto the bedding. Temporary supports on blocks will not be permitted.  Larger pipes should be supported by the crane during jointing to reduce the jointing effort.   * 1. Flotation   The Contractor shall take all precautions necessary to prevent pipes from floating due to accidental flooding or from any other cause, and shall be responsible for the consequential cost of remedial work delays.  The Contractor shall include details of precautionary methods proposed for pipe restraint with his method statements for the execution of the work.   * 1. Jointing      1. Spigot and Socket Type   The spigot and socket to be joined shall be thoroughly cleaned just before joining and the joint rubber gasket and lubricant supplied by the manufacturer shall be installed and applied in accordance with the manufacturers’ recommendations. The joint lubricant to be used must be suitable for potable water.  When a joint deflection is needed to accommodate a grade or an alignment adjustment, the deflection should be made only when the joint has been made as described above.  The amount of the joint deflection must not exceed the limits imposed by the design or recommended by the manufacturer.   * + 1. Mechanical Couplings   In the case of mechanical couplings, the bolts shall be tightened gradually so that the components of the coupling are drawn together uniformly.  The manufacturer’s recommendation shall be followed.   * + 1. Flanged joints   Flanged joints shall be completed in like manner, and in accordance with the manufacturer’s recommendations as regards maximum torque applied to bolts.   * 1. Valves      1. Valves in the Ground   Generally, DN 350mm and smaller valves shall be placed directly in the ground when not installed in chambers with larger valves.  The valves are provided with surface boxes and protection tubes, and shall be installed, and supported on a concrete block.   * + 1. Valves in chambers   Valves for installation in chambers shall be hand-wheel operated.   * 1. Thrust Blocks and Restraints   Bends, plugged ends, tees and tapers shall be well braced against undisturbed earth by the use of concrete thrust blocks.   * 1. External protection of joints   Mechanical couplings, flanged joints and saddle straps shall protected on site by the cold application of Densyl tape or similar approved material supplied by the Contractor.  Application of Densyl tape with Denso Primer, Densyl Mastic and Outerwraps shall be strictly in accordance with the manufacturer’s recommendations.   * 1. The level of an existing line shall be accurately ascertained by the Contractor and the exact details of all the materials and other requirements determined and listed in a detailed method statement to be submitted for the approval of Project Manager.   2. The Contractor must have the approval of the Project Manager and the Employer before any work is started and the Employer shall have made arrangements for the closing off of supplies as well as proposing the most appropriate time for the shut-down.   The Contractor must consider execution of such connections as early in the program as practicable, because the Employer will need to select a time when there will be least interference to the network and will not accept any requests for extensions of the Contractor period arising from delays in finding a suitable time for the connections. |
| 1. Service Connection Installation | * 1. General   The installation of service connections shall be in accordance with a standard design to be prepared by the Contractor and approved by the Project Manager. The diameter of the replaced service connection must not be less than the diameter of the existing service connection.  The Contractor shall prepare trenches for the service connections generally in accordance with the pipeline trenching requirements, and the reinstatement and compaction of the backfill follow the same procedure.  Trenchless technology is advisable to be used when possible.   * 1. Pipe Saddles   If possible, under pressure drilling should be carried out when installing pipe saddles on new or existing pipes.  The Contractor shall follow the detailed procedures of the manufacturer and supplier of the under-pressure pipe equipment to install and secure the pipe saddles and to connect the corporation stops to them. | |
| 1. Customer Meter Installation | * 1. General   The Contractor shall submit standard design drawings for large and small meter installation for the approval of the Project Manager.  All meters shall be installed in accordance to the meter manufacturer recommendations.   * 1. Large Meters   Large Meters, predominately for Industrial, Commercial and Institutional customers shall be installed in a suitable location taking the manufacturers recommendation for straight pipe length upstream and downstream of the meter into account. Also, if the meter selected is mechanical meter, upstream protective dirt box/strainer shall be installed.   * 1. Small meters   Small meters, predominately for domestic customers, shall be installed in protection cages (design to be approved by the Project Manager). Location of the cages shall be in easily accessible locations outside of private premises. | |
| 1. Leak Repair | | * 1. Leaks on Service Connections   Leaking service connections shall be completely replaced from and including the tapping point to the customer.  If possible, the new pipe saddle shall be placed over the existing hole and a new drilling shall be avoided. If not possible, the existing connecting point shall be sealed with a stainless steel repair clamp and a new hole shall be drilled.   * 1. Leaks on Main Pipes   Leaks on main pipelines shall be repaired by using stainless steel repair clamps. In case the damage is too large (e.g. longitudinal split) the damaged pipe shall be replaced by a new section of pipe, connected to the old pipe with flexible joints or flange adaptors.  Intrusion of ground water into the main pipe has to be avoided as far as possible. |
| 1. Repair/ Replacement of Leaking Appurtenances | | * 1. Sluice valves   Leaking sluice valves shall be replaced with new valves, even if only the stuffing box (gland) is leaking. Valves shall be installed complete with extension spindle, protecting tube and surface box or with had wheel if the valve is located in a chamber. |
| 1. Bulk Flow Meter Installation | | * 1. All bulk flow meters shall be installed in a chamber large enough to do Meter maintenance duties, meter dismantling and meter removal/replacement.   Chamber covers shall be lockable and might be either heavy duty cast iron covers or steel covers – depending on the location of the chamber in respect to heavy traffic. Chamber covers have to be approved by the Project Manager. Plastic heavy duty chamber covers might be safer against theft of metals, but heavy duty cast iron is suitable for location of the chambers in high traffic   * 1. The electromagnetic DMA flow meters shall be installed in a chamber large enough to perform flow meter maintenance and data management. Straight pipe length before and after the meter shall be according to the manufacturer’s specifications.   Meter battery back and converter/transmitter unit shall be placed in underground instrumentation box, inside the meter chamber. Cables from the meter to instrumentation box shall be well protected in a plastic conduit. Instrumentation box must be positioned high enough to prevent the damage especially during rainy season, where chambers sometimes got flooded |
| 1. PRV Chamber Installation | | * 1. Pressure reducing valve and strainer shall be installed in a chamber large enough to do PRV maintenance duties, PRV dismantling and PRV removal/replacement.   Standard PRV chamber design shall be submitted to the Project Manager for approval.  Chamber covers shall be lockable and might be either heavy duty cast iron covers or steel covers – depending on the location of the chamber in respect to heavy traffic. Chamber covers have to be approved by the Project Manager.  PRV controller and pressure logger as well as and any other electronic or electrical parts shall be placed in the above ground instrumentation box of the DMA inflow meter. Cables from the meter to instrumentation box shall be well protected in a plastic conduit.  Pressure shall be measured upstream and downstream of the PRV. |

Annex 4 – Sample Bill of Quantities

| **Phase 1 - DMA establishment** | Unit | Quantity | Rate | Amount |
| --- | --- | --- | --- | --- |
| **District Metered Area (DMA)** establishment as per Technical Specifications: hydraulic modelling verification; all site investigations including boundary valves or zone dividers; zero pressure tests; preparation of as-built drawing; other documentation and miscellaneous works. Field measurements and baseline definitions. | No. |  |  |  |
| Allowance for **site investigations** (10 proving sites per DMA) - includes excavation, infrastructure proving, back-filling & surface reinstatement works. | No. |  |  |  |
| Boundary valve installations for identified **isolation points -** estimated 5 isolation points per DMA of different diameters, including: all labour; survey and excavations, complete boundary valve installation, valve marker and surface reinstatement works. |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Supply and installation of **DMA flow measurement** - different diameters, including: all labour; survey and excavations; underground chamber and all accessories; electromagnetic bulk meter, accessories and data transmission system; all necessary fittings and joints; back-filling and reinstatement of all surfaces; preparation of as-built drawing and other documentation. This includes laying of main pipelines up to a cumulated length of 20m. Quantities estimations are based on pre-assumptions that each DMA will require 1 measurement and pressure control point and 1 critical point. **Note:** meter installation and chamber design will allow future pressure control valve (PRV) installation and advance pressure management controller, to be defined in next phases. |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Supply and installation of **additional DMA flow measurement** - different diameters, including: all labour; survey and excavations; underground chamber and all accessories; electromagnetic bulk meter including accessories and data transmission system; all necessary fittings and joints; back-filling and reinstatement of all surfaces; preparation of as-built drawing and other documentation. Quantities estimations are based on pre-assumptions that every 2 DMAs it will be required an additional measurement and pressure control point. N**ote:** the meter installations and chambers design will allow future control valve (PRV) installation and advance pressure management controller. These installations will be defined in next project phases. |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| **Total DMA establishment** |  |  |  |  |

| **Phase 2A – Water Loss Reduction (first DMAs)** | Unit | Quantity | Rate | Amount |
| --- | --- | --- | --- | --- |
| **Mains, service connection and customer meters replacement. Pressure Management and Leaks repairs – ±30% of the project area** |  |  |  |  |
| Supply and installation of **water distribution pipelines** - different material & sizes, including: all labour; excavation, trench shoring support and drainage measures, safe and safety measures, laying & bedding, dewatering, fittings and connection to the network, pressure testing and disinfection, necessary thrust blocks, up to 2 meters depth as per technical specifications, detailed with as-built drawing; removal & proper disposal of old pipes; back-filling and reinstatement of all surfaces. |  |  |  |  |
| |  | | --- | | HDPE DN 50mm | | HDPE DN 75mm | | uPVC DN 100mm | | uPVC DN 150mm | | uPVC DN 200mm | | Extra-over item for pipelines to be installed in more than 2m depth | | M  M  M  M  M  M  M |  |  |  |
| Supply and installation of isolation valves, complete including chamber as per specifications, includes all fittings and materials, back-filling and reinstatement of all surfaces. |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Supply and installation of air valves on main pipe with diameter, including chamber, according to standards: |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Replacement of existing service connection (including water meter): disconnection at the customer metering point and the pipe saddle, installation of new HDPE service connection from (and including) the pipe saddle to metering point, complete as specified in the project specifications, including all materials, water meter, meter box, all fittings, excavation, laying with sand bedding, jointing, and proper backfilling, re-instatement of road, sidewalk or any other surface, including the supply of all materials up to a maximum pipe length of 10m. |  |  |  |  |
| 1/2” service connection to be connected to main of diameter: | No. |  |  |  |
| DN 75-125mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Extra-over item for pipe length >10m | No. |  |  |  |
| 3/4” service connection to be connected to main of diameter: |  |  |  |  |
| DN 75-125mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Extra-over item for pipe length >10m | No. |  |  |  |
| High consumers service connections replacement |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Replacement of existing customers **water meters**: removal of old customer water; installation of new customer water meter according to technical specifications including meter box, all materials and labour. All removed customer water meters will be handed to AAWSA. |  |  |  |  |
| Dn 15mm | No. |  |  |  |
| Dn 20mm | No. |  |  |  |
| Dn 25mm | No. |  |  |  |
| Dn 50mm | No. |  |  |  |
| **Pressure Management:** Supply and installation pressure reducing valves (PRV) in existing flow meter chambers (see Schedule C.4) - different diameters, including: all labour, all necessary fittings and accessories; advance pressure management controller; preparation of as-built drawing and other documentation. Construction of the critical point pressure measuring point above ground instrumentation box, including supply of all required materials, fittings and equipment, as per the specifications. Important note: quantities estimations are based on pre-assumptions that each DMA will require 1 measurement and pressure control point and 1 critical point. |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Dn 150mm | No. |  |  |  |
| Dn 200mm | No. |  |  |  |
| Supply and installation of additional pressure control point in existing flow meter chambers (see Schedule C.5) - different diameters, including: all labour, all necessary fittings and accessories; advance pressure management controller; preparation of as-built drawing and other documentation. Construction of the critical point pressure measuring point above ground instrumentation box, including supply of all required materials, fittings and equipment, as per the specifications. Important note: quantities estimations are based on pre-assumptions that every 2 DMAs it will be required an additional measurement and pressure control point. |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Dn 150mm | No. |  |  |  |
| Main line leak repair including the supply of all materials and fittings, complete with road and sidewalk reinstatement (estimation of main line leaks at the DMA area) leak tagging – collecting all leak and leak repair information and updating the GIS |  |  |  |  |
| Up to DN 100mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Service connection leak repair including the supply of all materials and fittings, complete with road and sidewalk reinstatement (estimated number of leaks for the connections not replaced at the DMA area) of diameters: |  |  |  |  |
| Dn 15mm | No. |  |  |  |
| Dn 20mm | No. |  |  |  |
| Dn 25mm | No. |  |  |  |
| Dn 40mm | No. |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 80mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| **Totals** |  |  |  |  |

| **Phase 2B – Water Loss Reduction (first DMAs)** | Unit | Quantity | Rate | Amount |
| --- | --- | --- | --- | --- |
| **Mains, service connection and customer meters replacement. Pressure Management and Leaks repairs – ±70% of the project area** |  |  |  |  |
| Supply and installation of **water distribution pipelines** - different material & sizes, including: all labour; excavation, trench shoring support and drainage measures, safe and safety measures, laying & bedding, dewatering, fittings and connection to the network, pressure testing and disinfection, necessary thrust blocks, up to 2 meters depth as per technical specifications, detailed with as-built drawing; removal & proper disposal of old pipes; back-filling and reinstatement of all surfaces. |  |  |  |  |
| |  | | --- | | HDPE DN 50mm | | HDPE DN 75mm | | uPVC DN 100mm | | uPVC DN 150mm | | uPVC DN 200mm | | Extra-over item for pipelines to be installed in more than 2m depth | | M  M  M  M  M  M  M |  |  |  |
| Supply and installation of isolation valves, complete including chamber as per specifications, includes all fittings and materials, back-filling and reinstatement of all surfaces. |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Supply and installation of air valves on main pipe with diameter, including chamber, according to standards: |  |  |  |  |
| DN 50mm | No. |  |  |  |
| DN 75mm | No. |  |  |  |
| DN 100mm | No. |  |  |  |
| DN 150mm | No. |  |  |  |
| DN 200mm | No. |  |  |  |
| Replacement of existing service connection (including water meter): disconnection at the customer metering point and the pipe saddle, installation of new HDPE service connection from (and including) the pipe saddle to metering point, complete as specified in the project specifications, including all materials, water meter, meter box, all fittings, excavation, laying with sand bedding, jointing, and proper backfilling, re-instatement of road, sidewalk or any other surface, including the supply of all materials up to a maximum pipe length of 10m. |  |  |  |  |
| 1/2” service connection to be connected to main of diameter: | No. |  |  |  |
| DN 75-125mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Extra-over item for pipe length >10m | No. |  |  |  |
| 3/4” service connection to be connected to main of diameter: |  |  |  |  |
| DN 75-125mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Extra-over item for pipe length >10m | No. |  |  |  |
| High consumers service connections replacement |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Replacement of existing customers **water meters**: removal of old customer water; installation of new customer water meter according to technical specifications including meter box, all materials and labour. All removed customer water meters will be handed to AAWSA. |  |  |  |  |
| Dn 15mm | No. |  |  |  |
| Dn 20mm | No. |  |  |  |
| Dn 25mm | No. |  |  |  |
| Dn 50mm | No. |  |  |  |
| **Pressure Management:** Supply and installation pressure reducing valves (PRV) in existing flow meter chambers (see Schedule C.4) - different diameters, including: all labour, all necessary fittings and accessories; advance pressure management controller; preparation of as-built drawing and other documentation. Construction of the critical point pressure measuring point above ground instrumentation box, including supply of all required materials, fittings and equipment, as per the specifications. Important note: quantities estimations are based on pre-assumptions that each DMA will require 1 measurement and pressure control point and 1 critical point. |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Dn 150mm | No. |  |  |  |
| Dn 200mm | No. |  |  |  |
| Supply and installation of additional pressure control point in existing flow meter chambers (see Schedule C.5) - different diameters, including: all labour, all necessary fittings and accessories; advance pressure management controller; preparation of as-built drawing and other documentation. Construction of the critical point pressure measuring point above ground instrumentation box, including supply of all required materials, fittings and equipment, as per the specifications. Important note: quantities estimations are based on pre-assumptions that every 2 DMAs it will be required an additional measurement and pressure control point. |  |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 75mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| Dn 150mm | No. |  |  |  |
| Main line leak repair including the supply of all materials and fittings, complete with road and sidewalk reinstatement (estimation of main line leaks at the DMA area) leak tagging – collecting all leak and leak repair information and updating the GIS |  |  |  |  |
| Up to DN 100mm | No. |  |  |  |
| DN 150-250mm | No. |  |  |  |
| DN >250mm | No. |  |  |  |
| Service connection leak repair including the supply of all materials and fittings, complete with road and sidewalk reinstatement (estimated number of leaks for the connections not replaced at the DMA area) of diameters: |  |  |  |  |
| Dn 15mm | No. |  |  |  |
| Dn 20mm | No. |  |  |  |
| Dn 25mm | No. |  |  |  |
| Dn 40mm | No. |  |  |  |
| Dn 50mm | No. |  |  |  |
| Dn 80mm | No. |  |  |  |
| Dn 100mm | No. |  |  |  |
| **Totals** |  |  |  |  |

| **Phase 3 – Maintenance** | Unit | Quantity | Rate | Amount |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| **Totals** |  |  |  |  |

1. A DMA is a discrete area of water distribution networks usually created by ring-fencing the section with boundary valves. Their establishment is a critical step towards being able to diagnose, identify and monitor water loss. [↑](#footnote-ref-2)
2. The bidding documents will specify a protocol for determining the water loss baseline and achievement, which may comprise the comparison of inflow, pressure and consumption measurement over an agreed number of days (such as 7 days) between the baseline and verification period, complemented by minimum night flow measurements (MNF). [↑](#footnote-ref-3)
3. This is likely to mean starting with those DMAs nearest the input to the distribution system and proceeding from there to the extremes of the network. [↑](#footnote-ref-4)
4. This might be completion at the individual DMA level, a “batch” of DMAs (see next footnote) or all DMAs. The target will be separately specified per DMA for Phase II A and for Phase II B as a whole. [↑](#footnote-ref-5)
5. The end dates for each period and for the Contract as a whole (Phase I/II/III) would be given in the bid document but would be subject to adjustment at the time of negotiating Phase II A and Phase II B, and/or for claims by the Contractor for events outside their control – as for any contract.. [↑](#footnote-ref-6)
6. The maintenance period will end one year after the DMAs have met the performance standard and will commence for each phase separately on completion of Phase II A DMAs and later all Phase II B DMAs of Phase II B. [↑](#footnote-ref-7)
7. Water Loss Reduction is identified as a part of Non-Revenue Water and consists of apparent and real losses. It does not address metered and unmetered unbilled authorised consumption which is also part of WLR [↑](#footnote-ref-8)
8. To be adjusted in line with the overview of the BOQ [↑](#footnote-ref-9)
9. A zero pressure test is procedure to test whether a DMA is hydraulically discrete. [↑](#footnote-ref-10)