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RESEARCH REPORT

NON-REVENUE WATER (NRW): STRATEGY ON REDUCING AND MANAGING WATER LOSSES IN LUNDU

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CHAPTER 1 – INTRODUCTION

1.1. Introduction

Water supply system, infrastructure for the collection, transmission, treatment, storage, and distribution of water for homes, commercial establishments, industry, and irrigation, as well as for such public needs as firefighting and street flushing. Of all Government services in Lundu District, provision of potable water is perhaps the most vital. People depend on water for drinking, cooking, washing, carrying away waste, and other domestic needs. Water supply systems must also meet requirements for public, commercial, and industrial activities. In all cases, the water must fulfill both quality and quantity requirements.

In addition to quantity of supply, water quality is also of concern. Even the ancients had an appreciation for the importance of water purity. Sanskrit writings from as early as 2000 BCE tell how to purify foul water by boiling and filtering. But it was not until the middle of the 19th century that a direct link between polluted water and disease (cholera) was proved, and it was not until the end of that same century that the German bacteriologist Robert Koch proved the germ theory of disease, establishing a scientific basis for the treatment and sanitation of drinking water.

Water treatment is the alteration of a water source to achieve a quality that meets specified goals. At the end of the 19th century and the beginning of the 20th, the main goal was elimination of deadly waterborne diseases. The treatment of public drinking water to remove pathogenic, or disease-causing, microorganisms began about that time. Treatment methods included sand filtration as well as the use of chlorine for disinfection. The virtual elimination of diseases such as cholera and typhoid in developed countries proved the success of this water-treatment technology. In developing countries, waterborne disease is still the principal water quality concern.

In industrialized countries, concern has shifted to the chronic health effects related to chemical contamination. For example, trace amounts of certain synthetic organic substances in drinking water are suspected of causing cancer in humans. Lead in drinking water, usually leached from corroded lead pipes, can result in gradual lead poisoning and may cause developmental delays in children. The added goal of reducing such health risks is seen in the continually increasing number of factors included in drinking-water standards.

Lundu District has one of the high rates in population access to tap water. Based on 2017 data, Lundu extracts 14.5 million litres of raw water per day for treated water supply alone.

CHAPTER 2 - LITERATURE REVIEW & CONCEPTUAL FRAMEWORK

2.1 Introduction & Literature Review

An annual water balance is normally used to assess Non-Revenue Water (NRW) and its components. Unfortunately, because of the wide diversity of formats and definitions used for such calculations, previous attempts at national and international comparisons of performance in NRW management and performance have been open to considerable doubt.

<table>
<tr><td rowspan="2">Volume from Own Sources</td><td rowspan="10">System Input Volume (corrected for known errors)</td><td>Water Exported</td><td rowspan="5">Authorised Consumption (includes Water Exported)</td><td>Water Exported</td><td>Billed Water Exported</td><td rowspan="3">Revenue Water</td></tr>
<tr><td rowspan="9">Water Supplied</td><td rowspan="2">Other Billed Authorised Consumption</td><td>Billed Metered Consumption</td></tr>
<tr><td rowspan="8">Water Imported</td><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="7">Non-Revenue Water</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorised Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Mains</td></tr>
<tr><td>Leakage and Overflows at Storages</td></tr>
<tr><td>Leakage on Service Connections up to point of customer metering</td></tr>
</table>

Figure 2.1 Shows IWA Water Loss Task Force Standard Water Balance Practive for NRW indicators

IWA Task Forces recently produced an international 'best practice' standard approach for water balance calculations (Figure 1), with definitions of all terms involved, as the essential first step in practical management of water losses (Hirner and Lambert, 2000; Alegre et al, 2000). Abbreviated definitions of the principal components of Figure 1 are:

a) System Input Volume: the annual input to a defined part of the water supply system
b) Authorized Consumption: the annual volume of metered and/or non-metered water taken by registered customers, the water supplier and others implicitly or explicitly authorized to do so. It includes water exported, and leaks and overflows after the point of customer metering.
c) Non-Revenue Water (NRW): the difference between System Input Volume and Billed Authorized Consumption.
d) NRW consists of Unbilled Authorized Consumption and Water Losses Water Losses: the difference between System Input Volume and Authorized Consumption, consisting of Apparent Losses and Real Losses
e) Apparent Losses consists of Unauthorized Consumption and Metering Inaccuracies

CHAPTER 3 - RESEARCH METHOD

3.1 Introduction

The methodologies deployed for this research are concerned with the use of preliminary and secondary data. Hence it is crucial to adapt to the precautionary parameter that we set unto this research as a case study based on historical facts instead of in-depth technical process. The design control strategy for NRW will help to understand more regarding policy design, planning, implementation, and monitoring of the problems in cases where it may be typical for the NRW situation for example, water system provision, socioeconomic and the size of the population.

3.2 Research Design

The section of the analysis is divided into 4 sections. First, passive control strategy is especially defined as the domain of policy, administrative function, and implementation of infrastructural and it's agencies by the government to design a program and their targeted audience.

Second in the more technical domain is active leakage control. There are a lot of active leakage control strategies that are being used to control the leakage flow of the pipe system and detection in the situation of failure. For example, enhanced hydraulic modelling considering pressure dependent components of the demands such as burst leaks, background leakages, customer demands in pressure deficient conditions, etc. The WDNetXL Leakage Control module provides a collection of functions entailing a structured approach to supporting water utilities for burst detection and localization. (Giustolisi, 2016)

Third, active control is defined as the systematic method of assessing, identifying, implementing, and evaluating all the technical, policies and audience/customer cooperation compared to the measured/perceived effectiveness of the control program.

Fourth, active leakage monitoring is also one of the technical aspects in the NRW control strategy. There are a lot of methods that can be deployed such as the DMA is the area of a distribution network which is specifically defined (usually by the closure of valves) and in which the quantities of water entering and leaving the area are metered (Brothers, 2003). The flow is analyzed to determine the level of leakage within the area to enable the engineers to determine the locations where it is most beneficial to search for leaks. (Li et al., 2011).