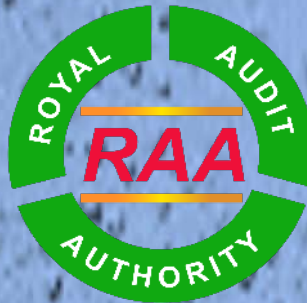


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Performance Audit Report on Provision of Drinking Water in Thimphu Municipality



August 2017



Reporting on Economy, Efficiency & Effectiveness in the use of Public Resources



**Performance Audit Report on Provision of Drinking Water in
Thimphu Municipality**

August 2017

DISCLAIMER NOTE

The audit was conducted in accordance with the International Standards of Supreme Audit Institutions (ISSAIs). The review was confined to provision of drinking water in Thimphu Municipality. The audit was based on the audit objectives and criteria determined in the audit plan and programme prepared by the Royal Audit Authority and the findings are based on the information and documents made available by the audited agencies.

This is also to certify that the auditors during the audit had neither yielded to pressure, nor dispensed any favor or resorted to any unethical means that would be considered as violation of the Royal Audit Authority's Oath of Good Conduct, Ethics and Secrecy.



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ROYAL AUDIT AUTHORITY
Bhutan Integrity House



Reporting on Economy, Efficiency & Effectiveness in the use of Public Resources

RAA/DPCA (TAD/2017-2018/02/ ༡༢༥༡)

14th August 2017

Dasho Thrompon
Thimphu Thromde
Thimphu

Subject: Performance Audit Report on 'Provision of Drinking-Water in Thimphu Municipality'

Sir,

Enclosed herewith please find the **Performance Audit Report on 'Provision of Drinking-Water in Thimphu Municipality'** covering the period from 2010 to 2016. The Royal Audit Authority (RAA) conducted the audit under the mandate bestowed by the Constitution of Kingdom of Bhutan and the Audit Act of Bhutan 2006. The audit is conducted as per the International Standards of Supreme Audit Institutions on performance auditing (ISSAI 3000). The overall objective of the audit was to ascertain the effectiveness of Thimphu Thromde in providing safe, adequate, reliable and equitable drinking water to its population.

The report has been prepared based on the records and information made available by the Thimphu Thromde, Ministry of Works and Human Settlement (MoWHS), National Environment Commission Secretariat (NECS) and Royal Centre for Disease Control (RCDC) and discussions held with relevant officials. The report contains positive initiatives, as well as shortcomings and deficiencies observed by the RAA.

The draft audit report was issued on 19th July 2017 to Thimphu Thromde, MoWHS, NECS and RCDC for factual confirmation, comments and feedbacks. Responses received from Thimphu Thromde have been incorporated and appended on this report as Appendix. The report also contains a set of recommendations, which are intended to help Thimphu Thromde in addressing the shortcomings and deficiencies thereby enhancing efficiency and effectiveness of Thimphu Thromde in provision of safe drinking water to its population.

In line with the directives of the Parliament, the RAA has instituted a system to fix the accountability on the officials responsible to implement recommendations provided in the Performance Audit Reports. Therefore, we would request Thimphu Thromde and other agencies responsible for implementation of each recommendation to submit duly completed and signed Accountability

*"Every individual must strive to be principled. And individuals in positions of responsibility must even strive harder."
-His Majesty the King Jigme Khesar Namgyel Wangchuck*

P.O. Box: 191, Kawajangsa, Thimphu: Bhutan. Tel: 322111 / 322833, Fax: 323491

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Statement (attached) to the RAA. **In the event of non-submission of the Accountability Statement, the RAA shall fix the responsibility for implementation of the recommendations on the Head of the Agency.** The RAA will follow up implementation of the recommendations based on the Accountability Statement and failure to comply will result in taking appropriate actions which may include suspending audit clearances to the accountable official(s).

The RAA would therefore appreciate receiving an Action Plan for implementation of audit recommendations with definite timeframe on or before 14th November 2017 along with the signed Accountability Statement.

We take this opportunity to acknowledge the officials of Thimphu Thromde, MoWHS, NECS and RCDC for rendering necessary support and co-operation extended during the audit.

Yours sincerely,

(Tshering Kezang)

Auditor General of Bhutan

Copy to:

1. Hon'ble Lyonchhen, Royal Government of Bhutan, Thimphu;
2. Hon'ble Gyalpoi Zimpon, Office of Gyalpoi Zimpon, Thimphu;
3. Hon'ble Speaker, National Assembly of Bhutan, Thimphu;
4. Hon'ble Chairperson, National Council of Bhutan, Thimphu;
5. Hon'ble Opposition Leader, National Assembly of Bhutan, Thimphu;
6. Hon'ble Chairperson, Public Accounts Committee, National Assembly of Bhutan, Thimphu (enclosed five copies);
7. Hon'ble Minister, Ministry of Health;
8. Hon'ble Minister, Ministry of Works and Human Settlement;
9. Hon'ble Secretary, Ministry of Health;
10. Hon'ble Secretary, Ministry of Works and Human Settlement;
11. Hon'ble Secretary, National Environment Commission Secretariat;
12. Dasho Thrompons, Thromdes, Gelephu, Phuentsholing and Samdrup Jongkhar (for information sharing);
13. Office copy; and
14. Guard file.

"Every individual must strive to be principled. And individuals in positions of responsibility must even strive harder."

-His Majesty the King Jigme Khesar Namgyel Wangchuck

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ACCOUNTABILITY STATEMENT

PERFORMANCE AUDIT ON PROVISION OF DRINKING WATER IN THIMPHU MUNICIPALITY

No.	Recommendations	Personal Accountability		Supervisory Accountability	
		Name & Desig.	EID No.	Name & Desig.	EID No.
4.1	Thimphu Thromde should provide reliable and equitable water supply to its population				
4.2	Thimphu Thromde should establish a robust system to monitor and supervise the water distribution network				
4.3	Thimphu Thromde should maintain and safeguard water distribution network				
4.4	Irregularities noted in water network system should be corrected				
4.5	Thimphu Thromde should develop comprehensive and accurate database on buildings and water meters				
4.6	Thimphu Thromde should develop clear job roles and responsibilities for the officials working in Water Supply Section				
4.7	Water meter needs to be installed for every water connection provided by Thromde and accordingly charged.				
4.8	Thimphu Thromde should provide adequate water supply in order to discontinue private and community connections				
4.9	Coordination amongst the relevant agencies and authorities should be strengthened				
4.10	The Ministry of Works and Human Settlement (MoWHS) should develop the master plan for drinking water supply				
4.11	The National Environment Commission Secretariat				

	(NECS) should finalize the Water Resources Inventory at the earliest				
4.12	Thimphu Thromde and the Royal Centre for Disease Control (RCDC) should ensure routine testing of the water quality				
4.13	Thimphu Thromde in collaboration with the Royal Centre for Disease Control (RCDC) should institute monitoring and reporting mechanism on water quality				
4.14	Thimphu Thromde should strengthen the storage facilities for water treatment chemicals				
4.15	Thromde should ensure that expiry and manufactured dates are labeled on the chemicals/ reagents and refrain from using expired chemicals				

(s/d)

Executive Secretary

Thimphu Thromde

TITLE SHEET

1. Title of the Report	:	Performance Audit on Provision of Drinking Water in Thimphu Municipality
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2. Audit Identification Number	:	14732
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3. Audited Entities	:	Thimphu Thromde, RCDC, Ministry of Health (MoH), Ministry of Works and Human Settlement (MoWHS) and National Environment Commission Secretariat (NECS)
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4. Schedule of Audit	:	1 st March 2017 – 10 th May 2017
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5. Audit Team	:	1. Sonam Wangmo, Deputy Chief Audit Officer 2. Tenzin Chhoedup, Sr. Audit officer 3. Sangay Thinley, Audit Officer 4. Samdrup Dolma, Audit Officer 5. Rinzin Choda, Sr. Auditor
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6. Direct Supervising Officer	:	1. Chandra Bdr. Gurung, Assistant Auditor General, Policy, Planning and Annual Audit Report Division 2. Sonam Delma, Offtg. Assistant Auditor General, Thematic Audit Division
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7. Overall Supervisor	:	Chimi Dorji, Deputy Auditor General, Department of Performance and Commercial Audit
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LIST OF ACRONYMS

CSC	:	Customer Service Center
CSD	:	Customer Service Division
ESP	:	Elementary Service Personnel
GDP	:	Gross Domestic Product
GNH	:	Gross National Happiness
G2C	:	Government to Citizen
HRMP	:	Human Resource Master Plan
LAP	:	Local Area Plan
MoH	:	Ministry of Health
MoWHS	:	Ministry of Works and Human Settlement
NEC	:	National Environment Commission
NECS	:	National Environment Commission Secretariat
NWRB	:	National Water Resources Board
O&M	:	Operation and Maintenance
RAA	:	Royal Audit Authority
RCDC	:	Royal Centre for Disease Control
RICB	:	Royal Insurance Corporation of Bhutan
SOP	:	Standard Operating Procedure
TAT	:	Turn Around Time
TSP	:	Thimphu Structural Plan
WaSIS	:	Water and Sanitation System
WSD	:	Water & Sanitation Division
WSP	:	Water Safety Plan

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EXECUTIVE SUMMARY

The Royal Audit Authority (RAA) had conducted the “Performance Audit on Provision of Drinking water in Thimphu Municipality” as mandated by the Constitution of the Kingdom of Bhutan and Audit Act of Bhutan 2006. The audit was conducted following Performance Audit Guidelines, which is in line with the International Standards of Supreme Audit Institutions (ISSAIs). The objective of the audit was to ascertain the efficiency and effectiveness of Thimphu Municipality in providing safe, adequate, reliable and equitable drinking water to the beneficiaries. To meet this objective, the RAA had adopted the following major researchable questions:

- i. Are drinking water sources identified and do the identified sources meet the demand of residents of Thimphu Municipality?
- ii. Are the residents of Thimphu Municipality provided with equitable and sufficient drinking water?
- iii. Is drinking water provided in Thimphu Municipality safe for human consumption?

The Performance Audit was conducted in the areas falling under the jurisdiction of Thimphu Thromde and the period covered was from 2010 to 2016. Although the principal agency was Thimphu Thromde, the audit team had also visited Ministry of Works and Human Settlement (MoWHS), National Environment Commission Secretariat (NECS) and Ministry of Health (MoH) for additional information. A survey on adequacy of water supply and efficiency of Thimphu Thromde in providing water related services was carried out with the residents of Thimphu Municipality.

In Bhutan, providing access to safe drinking water to all citizens is regarded as an important element not only because of abundant availability of water but also to achieve Bhutan’s goal of Gross National Happiness (GNH). It is also enshrined as an individual’s right in the Water Act of Bhutan 2011 stating, “Every individual shall have access to safe, affordable and sufficient water for basic human needs”.

Further, Thimphu, being the capital city of the country, has almost 20% of the country’s population and 90% of the population of Thimphu has piped water connection. Nevertheless, the rapid urbanization of the city and population growth pose challenges for efficient water supply system in the Municipality leading to inadequate and unequal distribution of water and huge wastage of water in the water distribution network system.

The positive accomplishments included the existence of the Water Act of Bhutan 2011, Water Regulation of Bhutan 2014, Bhutan Drinking Water Quality Standard 2016, and Water Safety Plan (WSP) to guide all relevant stakeholders in managing water resources efficiently and effectively at the National as well as local level.

Notwithstanding the positive accomplishments, some of the deficiencies and lapses are summarized below:

1. The water supply by zone shows that there is unequal distribution of water and water shortages at ground in certain areas.

2. Irregularities in water distribution network such as illegal tapping, water connection bypassing water meter, approval of water connection from transmission lines, provision of more than one water connection per dwelling, water supply diverted to community water tank were noted.
3. During the period 2010-2011 to 2015-2016 revenue amounting to Nu. 28.49 million were lost as a result of loss of water in the water distribution network system.
4. Water charges were never imposed and collected by the Thromde for the water supplied from Megaypang water treatment plant to Babesa, Lungtenphu and Olakha as of June 2017 causing a loss of revenue amounting to Nu. 20.37 million.
5. Many residents in Thimphu Municipality are still using water supply from private and community water sources, despite the Water Regulation of Bhutan 2014 requiring the Thromdes water supply system to be the only source of potable water supply system within the Municipality's jurisdiction unless this is technically not feasible.
6. Although presence of faecal coliform was noted during water quality testing, testing was not carried out on regular basis, which may result in outbreaks of water borne diseases. Moreover, Thimphu Thromde had never tested water quality in schools and institutes, though the nature of the consumer warrants so.
7. Despite significant lapse of time, the master plan for national drinking water is not yet formulated to identify available options to guarantee that there is sufficient quantity and quality of water for future generations.
8. Thimphu Thromde had not instituted monitoring system for supervision of the water network system. The absence of monitoring system had led to huge loss of water, water revenue and interruption in water supply.

Based on the audit findings, the RAA has provided 15 recommendations that are aimed at improving management of drinking water in Thimphu Municipality.

Despite having strong legal framework on water resources management and also adequate drinking water at source, the RAA observed several management deficiencies in the provision of drinking water in Thimphu Municipality, where improvements are desirable. Thimphu Thromde being the main agency in provision of drinking water in Thimphu Municipality should formulate appropriate strategies, make effective decisions and institute systems and processes to provide safe, adequate, reliable and equitable drinking water to its population.

CHAPTER 1: ABOUT THE AUDIT

Mandate

The Royal Audit Authority conducted the “Performance Audit on Provision of Drinking water in Thimphu Municipality” as mandated by the Constitution of the Kingdom of Bhutan and Audit Act of Bhutan 2006 under the following article and sections:

- i. Article 25 (1) of the Constitution of the Kingdom of Bhutan and Section 3 of the Audit Act of Bhutan 2006 provide that “*There shall be a Royal Audit Authority to audit and report on the economy, efficiency, and effectiveness in the use of public resources*”; and
- ii. Section 38 (b) of the Audit Act of Bhutan 2006, under the ‘functions of the Royal Audit Authority’ states, the Authority shall, “*Conduct Performance Audit to ascertain and report on the economy, efficiency and effectiveness of the operations of agencies audited*”.

Audit Standards

This audit was conducted in accordance with the International Standards of Supreme Audit Institutions on performance auditing (ISSAI 3000). The RAA followed audit procedures as prescribed under the RAA’s Performance Audit Guidelines to maintain uniformity and consistencies of approaches in auditing.

Audit Objectives

The audit was conducted with the objective to ascertain the efficiency and effectiveness of Thimphu Thromde in providing safe, adequate, reliable and equitable drinking water to the beneficiaries. Following are the three researchable questions considered to meet the audit objective:

- i. Are drinking water sources identified and do the identified sources meet the demand of residents of Thimphu Municipality?;
- ii. Are the residents of the Thimphu Municipality provided with equitable and sufficient drinking water?; and
- iii. Is the drinking water provided in Thimphu Municipality safe for human consumption?

Audit Scope

The audit on Provision of Drinking water in Thimphu Municipality covered the areas under the jurisdiction of Thimphu Thromde. The audit period covered was from 2010 to 2016. The audit team had also visited MoWHS, NECS and MoH for additional information. The audit was mainly conducted at the Thimphu Thromde, the principal agency for the provision of drinking water in Thimphu Municipality.

A survey was also carried out with the residents of Thimphu Municipality on adequacy of water supply and efficiency of the Thimphu Thromde in providing water related services.

Limitations

Non-availability of required data on numbers and details of water meters issued, water billing records, etc., with the Thimphu Thromde and unavailability of records on building inventory and population of the Municipality were some of the limitations to conduct analysis as planned. As such, the audit findings and opinions expressed in this report are limited only to those records and information made available to the RAA.

Audit Methodology

- i. Reviewed legislations, underlying rules and regulations, government policies that are directly related to water in the country, visited Thimphu Thromde office and interviewed relevant officials to understand the drinking water network system in Thimphu Municipality;
- ii. Visited MoWHS to obtain information on the master plan for drinking water and wastewater management system and also NECS for water resources inventory;
- iii. Activities carried out during the audit execution phase included:
 - a. Examination of Government to Citizen (G2C) system pertaining to water services, water billing system, and documents filed;
 - b. Data entry on water consumption by residents for three months from water bills and water production at four water treatment plants on sample basis;
 - c. Compiled records on complaints and water service delivery of Thimphu Thromde from G2C system, complaint register, excel record and complaint report forms;
 - d. Conducted interviews and discussions with key officials of the audited agencies;
 - e. Carried out joint physical inspection of all the four water treatment plants and all the water service tanks in the jurisdiction of Thimphu Municipality;
 - f. Collected water samples from water treatment plants and randomly selected reservoir tanks and tested the water quality;
 - g. Conducted joint physical inspection in critical water network areas to determine illegal tapping and proper and safe keeping of the water network;
 - h. Audit team jointly with Thromde officials visited car wash service providers in Thimphu Municipality to confirm their water sources and water meter connection;
 - i. Carried out survey of 910 beneficiaries residing in Thimphu Municipality through questionnaire administered by audit team; and
 - j. Carried out analysis of the survey responses using SPSS software; and
 - k. The beneficiaries' survey covered all the areas under the jurisdiction of Thimphu Municipality. Numbers of samples to be surveyed in each area were chosen based on the population and numbers of water meter connections in order to have a comprehensive and representative sample.

CHAPTER 2: INTRODUCTION

Background

Bhutan is a country, rich in natural resources. Relative to other nations, Bhutan has abundance of fresh water in terms of per-capita availability. With an average flow of 2,238 m³/s, Bhutan generates 70,572 million m³/annum, i.e. 94,500 m³ per person per year¹. Water plays an essential role in all four of Bhutan's major economic drivers- agriculture, hydropower, tourism and small-scale industry. Agriculture consumes over 90% of water resources used in Bhutan and employs half of the Bhutan's population contributing 15% of the country's GDP²(Gross Domestic Product). The energy sector in Bhutan, comprised almost wholly of hydropower, accounts for a fifth of the country's GDP.

Notwithstanding the importance of water for driving the economy, water is essential for living. Access to water, sanitation and hygiene is a human right, yet billions are still faced with daily challenges accessing even the most basic of services. Drinking water, also known as potable water or improved drinking water is water that is safe to drink or to use for food preparation, without risk to health.

In Bhutan, providing access to safe drinking water to all the citizens is regarded as an important element not only because the level of water availability is optimal but to achieve Bhutan's goal of GNH. It is also enshrined as an individual's right in the country's Constitution and is well supported with His Majesty's Royal Decree on Sanitation issued in 1992 declaring water and sanitation as a basic right of the people.

In Bhutan, drinking water is abstracted from various sources such as rivers, streams and springs. Groundwater and rainwater are rarely used. Safe, adequate and accessible supplies of drinking water combined with proper sanitation are the essential components of primary healthcare. Provision of in-sufficient safe drinking water is directly or indirectly related to spread of communicable diseases, increased health risk and environmental pollution. The National Health Survey of 2012 reports that the proportion of Bhutan's population with access to improved drinking water source is 97.7%. However, the report on a rapid assessment of rural drinking, water quality, which was carried out by the Royal Centre for Disease Control (RCDC) in 2012, showed that only 17% of stream water sources and 28% of spring water sources, were safe for use as drinking water. This implies that assurance of safe drinking water is a challenge in Bhutan.

Thimphu being the capital city of the country has a population of almost 20% of the country's population and more than 90% of the population in central area of Thimphu has piped water connection³. Nevertheless, the rapid urbanization of the city and population growth poses challenges for efficient water supply system in the Municipality.

¹ Water-Securing Bhutan's Future 2016, National Environment Commission.

² Water in Bhutan's Economy 2016, World Wildlife Fund & National Environment Commission.

³ Bhutan Urban Development Project II-AF, Environmental Impact Assessment and Management Plan 2013, Ministry of Works and Human Settlement.

Although, more than 90% of the population in central area of Thimphu has piped water connection, it was found that there still exist issues of inadequacy in management of water system and water infrastructure resulting in inadequate and unequal distribution of water and huge wastage of water in the water network system.

The economic impact of not investing in water and sanitation costs 4.3% of sub-Saharan African GDP⁴. The World Bank estimates that 6.4% of India's GDP is lost due to adverse economic impacts and costs of inadequate sanitation⁴. There is sufficient fresh water on the planet to achieve clean and accessible water for all. Nevertheless, due to poor infrastructure and management in place, millions of people continue to suffer. It is also the sixth goal of the Sustainable Development Goal (an agenda to improve the lives of people everywhere by transforming our world) to ensure access to water and sanitation for all.

Water management and distribution system

It is the responsibility of Water Supply Section under the Engineering Division, Thimphu Thromde to look after the water distribution system in the Municipality. The division is headed by Chief Engineer and functions under the Executive Secretary of the Thromde.

Water supply is one of the main services provided by Thimphu Thromde to its residents. Water supplied by the Thromde is intended for consumption, food preparation, bathing and laundry. The quality of the drinking water provided shall be in accordance with World Health Organization's (WHO) Guidelines for Drinking water Quality (4th Edition) and Bhutan Drinking Water Quality Standard 2016 with effect from 1st July 2017.

At present drinking water is supplied to the residents of Thimphu Municipality from the four established water treatment plants located at Motithang, Jungshina, Dechencholing and Changang or Megaypang and distributed from service tanks. The details on the water treatment plants and their distribution areas is tabulated in **Annexure A**.

Water services offered by Thimphu Thromde include water connections, disconnection, reconnection, upgradation, downsizing and replacement. Besides these services, the Thromde also attend to water complaints. The process map for availing Thimphu Thromde's water related services are shown in **Annexure B**.

The table below shows the structure of fees, the applicants are charged for availing water related services. No fees are charged for attending to complaints.

Water connection fees				
Sl. No.	Meter size	Meter charge (Nu.)	Connection fees (Nu.)	Total (Nu.)
1	15 mm	1,470.00	300.00	1,770.00
2	20 mm	2,285.00	300.00	2,585.00
3	25 mm	5,245.00	300.00	5,445.00
4	32 mm	7,455.00	300.00	7,355.00

Source: SOP of Thimphu Thromde

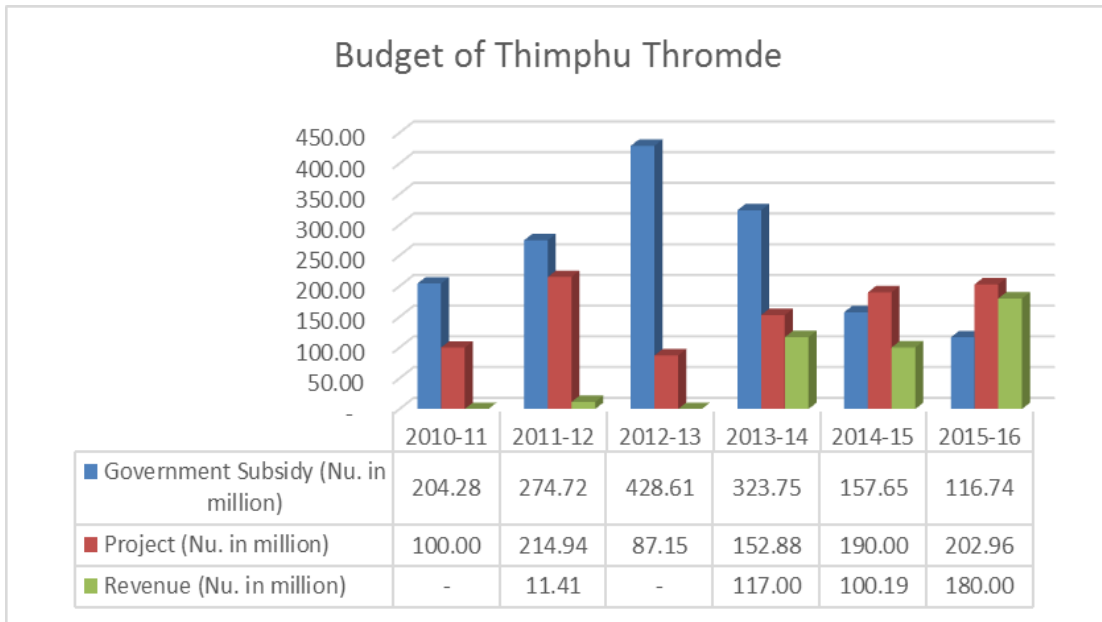
⁴ Clean Water & Sanitation: Why it matters, Sustainable Development Goals 2016, United Nations.

Water meters are installed for every connection in order to account water usage and revenue. The table below shows water connection, water consumption, and revenue generated from water supply services.

Revenue from water meter connections, water consumption and water services for the years 2010 to 2016			
Year	Numbers of Meter connection (Cumulative figure)	Annual Consumption(m³)	Revenue (Nu.)
2010	3108	3,545,632	18,161,246.00
2011	3247	3,562,432	22,566,595.36
2012	3600	3,624,213	24,086,679.86
2013	3725	3,526,877	23,060,518.00
2014	3810	3,334,297	24,313,646.00
2015	4019	3,359,608	24,485,825.00

Source : Thimphu Thromde

The figure below represents the overall budget of the Thromde from 2010 to 2016.



CHAPTER 3: AUDIT FINDINGS

The chapter on audit findings is divided into two parts: **Part 1** highlights the positive achievements and **Part 2** highlights the shortcomings and deficiencies in provision of drinking water.

PART 1: INITIATIVES AND POSITIVE DEVELOPMENTS

While there were several deficiencies and shortcomings noted, the RAA also observed some significant initiatives and positive developments. These positive accomplishments are summarized below:

- i. The Water Act of Bhutan was enacted in 2011 applying to all issues related to water resources in the country with purposes to ensure that the water resources are protected, conserved and/or managed in an economically efficient, socially equitable and environmentally sustainable manner and also to establish institutions;
- ii. The Water Regulation of Bhutan was promulgated in 2014 to (a) enforce the objectives and purposes of the Water Act; (b) effectively implement and enforce the Water Act by the Competent Authorities; and (c) identify roles and responsibilities of designated Competent Authorities and other relevant organizations;
- iii. The NECS had developed the Bhutan Drinking Water Quality Standard in 2016 to ensure the safety of the drinking water supplies and the protection of public health. Task force members from all the relevant stakeholders have developed the standard. The standard will come into effect from 1st July 2017; Thimphu Thromde in collaboration with the MoWHS and MoH has developed the WSP as required under the Water Regulation of Bhutan 2014 for determining risk factors and their management. The WSP is a dynamic document and needs to be continuously reviewed and updated regularly by the WSP team depending on the risk factors;
- iv. In March 2013, the MoWHS and the Thimphu Thromde has secured Nu. 414 million from World Bank under Bhutan Urban Development Project-II for a centralized water supply from Dodena to augment the existing water supply and to meet future demand of Thimphu Municipality;
- v. Thimphu Thromde realizing the water supply shortage at Changzamtog area, an alternative provision of water supply to firefighting from Wangchhu, thereby saving about 600 m³ per day of drinking water being used for filling of the RBP fire tankers. Similarly, the firefighting water reserve tank near the Royal Insurance Corporation of Bhutan (RICB) office has been rehabilitated and water is pumped from Wangchhu; and
- vi. The new water & sewerage billing system was developed with the assistance of World Bank under Bhutan Urban Development Project-II and it was officially used from the 1st March 2017. The advantages of the new system include systematized payments and receipts and the provision to generate useful reports to facilitate decision making.

PART 2: SHORTCOMINGS AND DEFICIENCIES

The RAA's review and analysis of the available documents and information on provision of drinking water in Thimphu Municipality for the period 2010-2016 revealed various shortcomings and deficiencies. The audit findings are divided under three categories, i. Water distribution network controls, ii. Water Quality Management, and iii. Governance and Management as discussed below:

3.2.1 WATER DISTRIBUTION NETWORK CONTROLS

3.2.1.1 Inequitable supply of drinking water

Thimphu Thromde caters drinking water to an estimated population of 107,165 under its jurisdiction. Drinking water for Thimphu Municipality is supplied from four water treatment plants and two boreholes, which have total operating capacity of 21,100 m³ per day.

In the year 2016, water production of Thimphu Municipality was 20,036.21 m³ per day as against the required per capita water demand of 19,289.7 m³ per day. Thus, drinking water production was adequate considering the population and per capita water demand in Thimphu Municipality for the year 2016. Water production and calculated water demand for the year 2016 is shown in Table No. 1

Sl. No.	Total household as per the NSB	Average household size (as per Bhutan Living Standards Survey 2012 Report)	A: Population	B: Standard per capita requirement of water (l/c/d)	C: Requirement of Water supply for the population (l/c/d) (A*B)	D: Water production & requirement (in M ³ /day) (C/1000)	Water production & requirement (in M ³ /year) (D*365)
Production of water at treatment plants and bore wells						20,036.21	7,313,216.00
1	24,922.00	4.30	107,165	180.00	19,289,700.00	19,289.7	7,040,740.5
Surplus production						746.51	272,475.5

As depicted in the table, currently there is enough production of drinking water to meet the demand of the population of Thimphu Municipality. However, on the other hand, it was noted that a proportion of the population still do not get adequate drinking water despite sufficient production of water.

Despite having enough production of drinking water, residents do not get adequate drinking water.

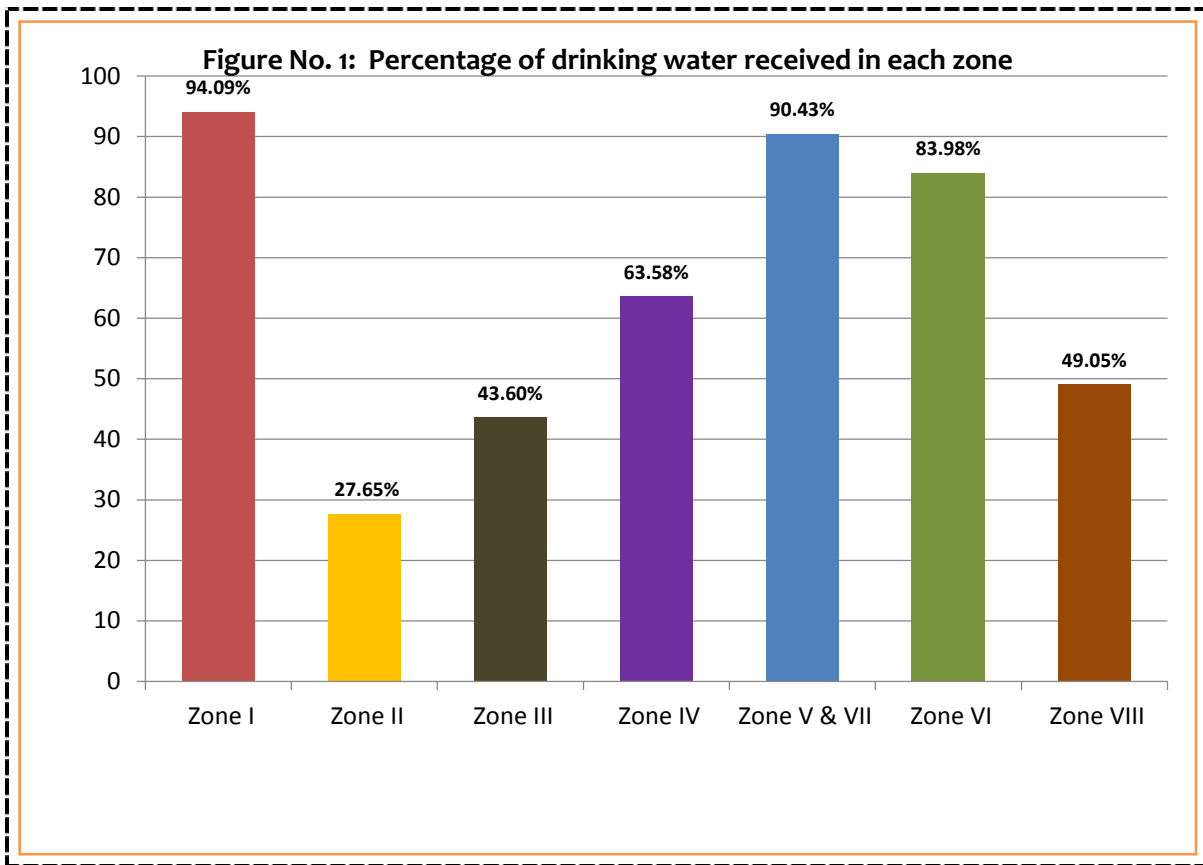
The jurisdiction of Thimphu Thromde is divided into eight zones for water supply. On comparison of the requirement of water with actual consumption for three months by zone in order to analyze equitable distribution of drinking water, it was found that some areas received drinking water to the extent of 94.09% while some areas received only 27.65% against the requirement. The summary result of analysis on water supply by zone is presented in Table No. 2 and detailed in **Annexure I** and **II**. The table shows unequal distribution of water and water shortages in some areas.

Zone	Name of Places	A: Population (Refer Annexure I)	B: Water requirement for Jan, April & June(m ³) ((A*180*91)/1000)	C: Water consumption as per water billing system for the month Jan, April & June 2016 (m ³)	D: Drinking water received (%) (C/B*100)
I	Upper and Lower Motithang	17,037	279,066.06	262,582.00	94.09
II	YHS and Lungtenzampa	10,389	170,171.82	47,055.00	27.65
	Kawangjansa and Zhilukha				
	Hejo, Dzong and High Court area				
	Langjophakha area				
III	Changzamtog above ring road and Changbangdu area	30,685	502,620.30	219,190.00	43.60
	Changzamtog, Hospital and Changgedaphu area				
	Changjiji pvt. Area				
	NPPF colony and above NPPF colony area				
IV	Sunday market and Chubachu area	6,575	107,698.50	68,483.00	63.58
V & VII	Below Doebum lam, IMTRAT and Hongkong Market area	5,053	82,768.14	39,340.00	90.43
				35,514.00	
Total				74,854.00	
VI	Core area along Norzin Lam	7,934	129,958.92	109,151.00	83.98
VIII	Changjiji (NHDC) Colony	3,122	51,138.36	25,085.00	49.05
Total		80,795	1,323,422.10	806,400.00	
Overall Percentage of drinking water supplied					60.93

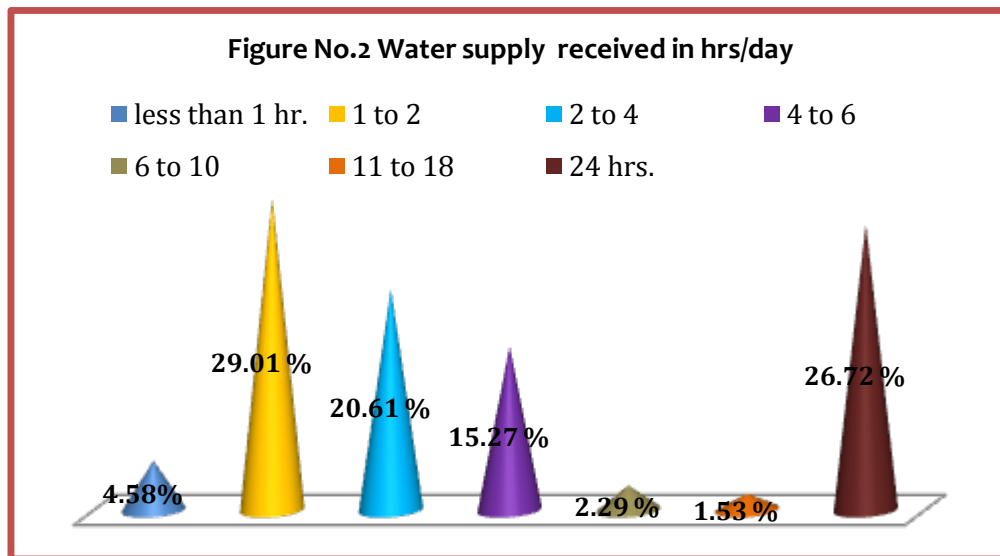
(Note: Average water consumption per person per day was taken as 180 liters based on World Bank funded project Bhutan Urban Development Project II Feasibility Study - Draft Investment Report Volume III)

The Table No. 2 depicts that Zone I –upper and lower Motithang received the highest amount of drinking water representing 94.09% of the quantity required and Zone II- YHS, Lungtenzampa, Kawangjansa, Zhilukha, Hejo, Dzong, High Court area, and Langjophakha area received the least quantity of drinking water representing 27.65 % of the quantity required.

On an average, the residents of the Thimphu Municipality received 60.93% of drinking water as against the required quantity.



From Figure No. 1, it can be concluded that there is inequity in distribution of drinking water. It was also noted that sizes of houses were not considered in provision of water supply. All the residents are given the same size of pipe and meter irrespective of number of units a house or building has defeating the principle of equity. Furthermore, the varying duration of water received by the beneficiaries gathered through the survey as depicted in Figure No. 2 also shows existence of inequity in distribution of drinking water.



All these are attributed by improper planning or non-consideration of the size of population, user group and the concept of equity while planning the water supply.

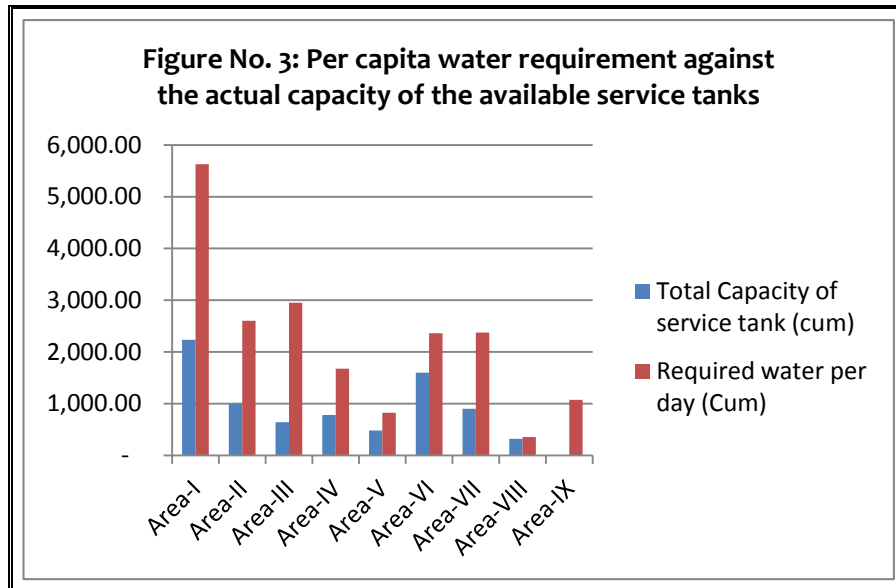
3.2.1.2 Inadequate storage capacity of service tanks to supply sufficient and reliable water to the residents

Service tanks are used to store water supplied from the water treatment plants to be distributed to the consumers. Thus, it is important to have service tanks with adequate capacity to cater to water requirement of the population. The RAA compared individual service tanks' storage capacity with the water requirement by area of distribution to ascertain whether the service tanks have the capacity to meet the water requirement. The comparison showed that service tanks were not constructed as per the water requirement by area. There was inequality in allocating service tanks wherein it was found that some areas were provided with adequate service tanks while some were not as worked out in Table No. 3. This has led to insufficient and inequitable distribution of drinking water.

Sl. No.	No x capacity of tank (m ³)	A: Total Capacity of service tank (m ³)	B:Water requirement per day (m ³) (Refer Annexure VI)	Percentage Coverage: (A/B *100)	Location of Service Tank	Areas water catered to	Area
1.	2x375	750	5,629.30	39.70	Babesa	Lungtenphu, Olakha, Simtokha & Babesa	Area-I
2.	1x735	735			Semtokha		
3.	2x375	750			Lungtenphu		
Total		2235					
4.	2x250	500	2,602.96	38.42	Changbangdu	Changjiji Pvt. Area, Changjiji (NHDC) Colony, Changzamtog above ring road & Changbangdu Area	Area-II
5.	2x100	200					
6.	2x150	300					
Total		1000					
7.	2x320	640	2,952.04	21.68	Dechencholing	Dechencholing Area and the service tanks are not provided in Dechenphodrang, Pamtsho, Taba	Area-III
8.	1x320	320	1,677.26	13.71	BCCI Office	Sunday Market & Chubachu Area, Core Area along Norzin Lam and Below Doebum Lam, Imtrat & Hongkong Market Area	Area-IV
9.	2x230	460			Swimming Pool		
Total		780					
10.	1x230	230	825.08	58.18	Langjuphaka	Hejo, Dzong & High Court Area and Langjophakha Area	Area-V
11.	1x250	250			TashiChho Dzong		
Total		480					
12.	2x320	640	2,361.47	67.75	Kuengachholing	Upper & Lower Motithang	Area-VI
13.	3x320	960			Motithang		
Total		1600					
14.	1x225	225	2,373.08	37.93	JDWNR Hospital	Changzamtog, hospital & Changgedaphu Area and NPPF colony & above NPPF colony	Area-VII
15.	1x125	125			-do-		
16.	1x320	320			RICB Colony		
17.	1x230	230			Changgedaphu		
Total		900					
18.	1x320	320	354.49	90.27	YHS area	YHS & Lungtenzampa Area and Samazingkha & Tandin Ngye	Area-VIII
19.	No service tanks		1,072.76	-	Kawajangsa & Zilukha Area	Kawajangsa & Zilukha Area	Area-IX

As depicted in the Table No. 3, out of the nine areas, only three areas have service tanks having capacity of more than 50% of the required water and five areas have service tanks of capacity less than 50% of required water while an area covering Zhilukha and Kawajangsa has no service tank at all.

It was found that the areas with adequate service tank coverage received sufficient drinking water and areas with lesser coverage received less drinking water thereby resulting into water shortages and un-equal distribution of water.



From Figure No. 3, it can be deduced that Thimphu Thromde has not considered the water requirement of the areas at the time of construction of service tanks, which has led to disproportionate allocation of service tanks as opposed to the water requirements.

3.2.1.3 Irregularities in water distribution network

As per the Water Act of Bhutan 2011, a person availing Thromde’s services shall pay a charge as prescribed and the competent authorities should impose and collect water supply service charges, waste-water disposal service charges, and other service fees.

In order to verify the water service charges imposed and paid by the beneficiaries, the RAA examined water bills and carried out joint physical verification of the water distribution network including water sources. In the process, following irregularities were noted:

3.2.1.3.1 Illegal water tapping

On joint physical verification of the water distribution network, the audit team observed instances of illegal tapping of drinking water at various places as depicted in Figure No. 4:

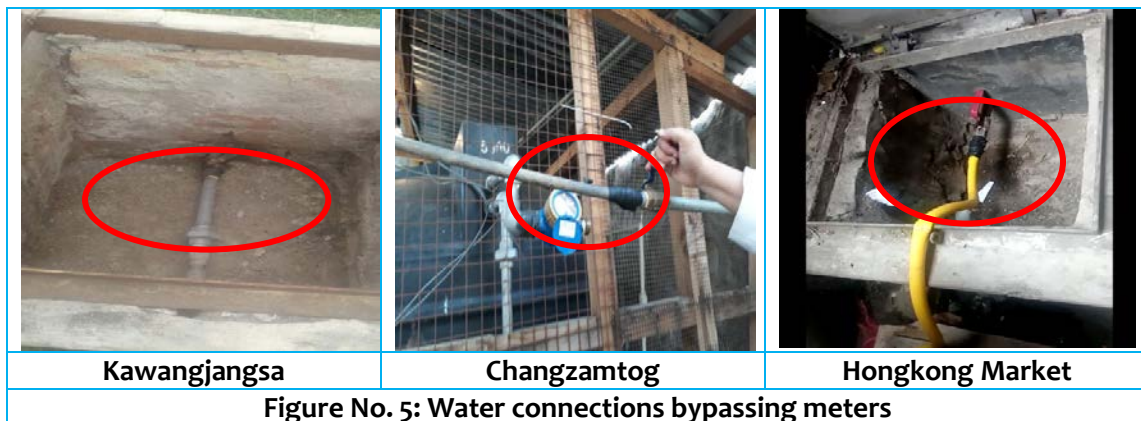


These water tapplings from distribution network were done without the consent of the Thimphu Thromde. For instance, in Hejo, drinking water was illegally tapped from the transmission line connected from Jungshina water treatment plant, which supplies water to the service tank at Bhutan Chamber for Commerce and Industry (BCCI) office for further distribution to Sunday Market and Chubachu area. It was surprising to note that the tapping was done from the transmission line made of Ductile Iron (DI) Pipe which is very strong and difficult to break. There were also cases where water tapplings were done from distribution lines.

Illegal water tapping is a fraudulent activity that deprives other beneficiaries from getting equitable distribution of drinking water.

3.2.1.3.2 Water connection bypassing water meter

During the joint physical verification of the water distribution network, instances of water connections bypassing the water meters were also observed wherein the beneficiaries have the advantage of not paying the water charges. Some of the cases are depicted in Figure 5.



3.2.1.3.3 Approval of water connection from transmission lines

The transmission lines were laid to supply water to service tanks from treatment plants. Drinking water is distributed to the beneficiaries from the service tanks with a control in supply time and quantity of flow. However, on reviewing the water distribution network, it was learnt that the Thimphu Thromde had approved several water connections from the transmission lines of Zhilukha, above RICB colony, Changjalu, Bhutan Youth Development Fund office area and Changgedaphu. As a result, the flow of water to the service tanks was substantially reduced. Moreover, there is no control exercised on the timing and flow of the water for those supplies connected from transmission lines thereby receiving water supply for 24 hours. A few incidences are depicted in Figure No. 6.



Granting approval to connect water supply from transmission lines is not rationally correct because the residents who receive water from transmission lines have 24 hours' water supply as compared to other residents and these connections disturb water flow and create inequity and injustice amongst the beneficiaries.

3.2.1.3.4 Provision of more than one water connection per house

Water resources and user rights under Water Act of Bhutan 2011 and Water Regulation of Bhutan 2014 stipulates "Every individual shall have access to safe, affordable and sufficient water for basic human and whether it is a traditional mode of determining water volume or a modern calibrated mode, water will be distributed amongst its users in a fair and equitable manner". As such, in order to uphold this principle, the Thromde in practice allows only one water supply connection per house, though it was not explicitly mentioned in any documents.

However, upon review of the records of water connections to ascertain number of water connections given per dwelling, it was noted that 136 houses were provided more than one water connections. Allowing 136 houses with more than one connection despite the practised norm of permitting only one connection per house is an undue favour rendered to those houses depriving water supply to other beneficiaries and creating inequity amongst the residents of Thimphu Municipality. Details are shown in **Annexure III**.

3.2.1.3.5 Water supply diverted to community water tank

The RAA observed that the residents of Changjalu are connected with both Community and Thromde's water supply. Community water supply is mainly obtained because of the erratic and inadequate water supply of the Thromde.

On physical verification, it was discovered that a pipe size of 80 mm was found connected to tap water from the Thromde's transmission line to Changjalu community tanks as depicted in Figure No. 7.



Figure: 7: Connection from transmission line (Changjalu community tank)

Although the diversion of Thromde's water supply to community water tank was approved by Thromde management, there is no water meter installed to levy water charges. Further, since it is diverted from the transmission line, there is no control over water timing and quantity of flow and more so, Thromde's treated water is mixed with the community's untreated water thus defeating the very purpose of water treatment. Such diversion causes loss of revenue, wastage of treated water, and inequity amongst the residents of Thimphu Municipality.

3.2.1.3.6 Water charges not levied to car-washing units

Currently there are 28 commercial car-washing units in Thimphu Municipality. Out of 28 units, nine are provided with Thromde's water supply and rest have their own private water connections. Thimphu Thromde provided drinking water connections to these car-washing units despite the fact that there are some areas with frequent drinking water shortages. On cross verification of water bills vis-à-vis meters found installed at the car-washing units during the site visit, out of nine, it was found out that the water charges for eight car-washing units were not levied till date of audit and the remaining one was found not metered. The car-washing units have been using treated drinking water for washing cars. Moreover, these units are charging people without paying any charges to the government. The details are shown in **Annexure IV**.

Even the Water Act of Bhutan 2011 prioritizes water use in the following order of priorities, No. 1 as most important and No. 6 as the least important:

1. Water for drinking and sanitation;
2. Water for agriculture;
3. Water for energy;
4. Water for industry;
5. Water for tourism and recreation; and
6. Water for other uses.

The provision of treated drinking water to the car-washing units not only deprives the intended beneficiaries but also contradicts the priority given in Water Act.

3.2.1.3.7 Water meters not installed in Babesa, Lungtenphu and Olakha (Nu.20.37 million)

Thimphu Thromde had constructed water treatment plant, service tanks, and distribution lines for Babesa, Lungtenphu LAP and Olakha under loan financed by Asian Development Bank Project. The water treatment plant is located at Chamgang known as Megaypang water treatment plant. The construction of the treatment plant and the water distribution network had incurred total expenditure of Nu. 338,320,312.29 pertaining to the following items mentioned in Table No. 4.

Sl. No.	Work Descriptions	Amount (Nu.)
1.	Water treatment plant	111,125,243.07
2.	Lungtenphu LAP tanks	9,763,443.83
3.	Simtokha & Babesa Tanks	17,975,185.57
4.	Changbangdu Tanks	8,871,530.51
5.	Water supply lines (main)	116,219,499.88
6.	Changbangdu distribution networks	12,524,118.60
7.	Lungtenphu distribution networks	16,671,148.94
8.	Simtokha distribution networks	16,479,756.41
9.	Babesa distribution networks	28,690,385.48
Total		338,320,312.29

The water supply system was commissioned on 23rd November 2014 and the water supply was provided to the residents of the designated areas since then. Although, the Water Act of Bhutan 2011 requires the Thromde to impose and collect water supply service charges, water disposal service charges and other service fees as prescribed, charges were never levied and collected from Babesa, Lungtenphu and Olakha as of date (June 2017).

As a result of not levying water and sewerage charges, there is a loss of government revenue amounting to Nu. 20.365 million calculated from 23rd November 2014 to 2017 based on production at the water treatment plant recorded as per bulk meter and the detailed work out is shown in **Annexure V**.

All above mentioned irregularities are mainly caused due to lack of monitoring system in regard to water distribution network and absence of proper mechanism to penalize the wrongdoers.

3.2.1.4 Loss of water in the water distribution network system amounting to Nu. 28.49 million

Thimphu Thromde has sufficient water production to meet per capita water demand of its population but there is still water shortages.

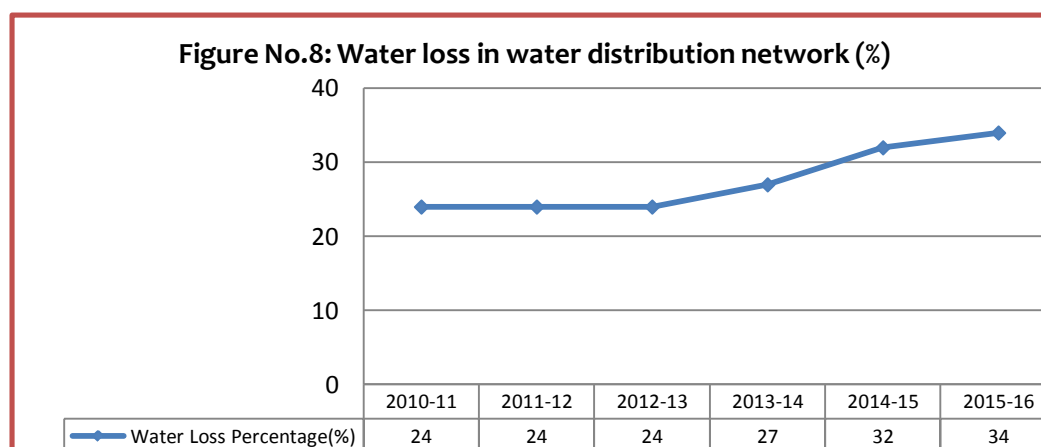
In order to quantify the water loss in the water distribution network, the RAA compared the quantity of water produced against the quantity of water consumed for six financial years from 2010-2011 to 2015-2016. The production and consumption statistics are based on records maintained at water treatment plants and revenue earned from water supply. The analysis showed substantial water loss of 7.96 million m³ amounting to Nu. 28.497 million. The details are shown in Table No. 5.

Table No. 5: Water loss in water distribution network

Financial Years	A: Production (m ³)	B: Consumption (m ³)	C: Water Loss (A-B) (m ³)	Water loss % as compared to production (C/A*100)	Water loss % as compared to consumption (C/B*100)	Water Loss CX3.58* (Nu.)
2010-11	4,653,929	3,545,632	1,108,292	23.81	31.26	3,967,685.36
2011-12	4,670,791	3,562,432	1,108,359	23.72	31.11	3,967,925.22
2012-13	4,763,533	3,624,213	1,139,320	23.91	31.44	4,078,765.60
2013-14	4,831,338	3,526,877	1,304,461	27.00	36.99	4,669,970.38
2014-15	4,903,378	3,334,297	1,569,081	32.00	47.06	5,617,309.98
2015-16	5,090,315	3,359,608	1,730,707	34.00	51.52	6,195,931.06
Total	28,913,284	20,953,059	7,960,220	27.53	37.99	28,497,587.60

*Water tariff rate considered is an average rate

As noted in the above table, the total water loss comes to 27.53 % of the total quantity of water produced and 37.99 % of the total quantity of water consumed. Further, there was an increasing trend in water loss over the period of 2010-2011 to 2015-2016 as depicted in the Figure No.8.



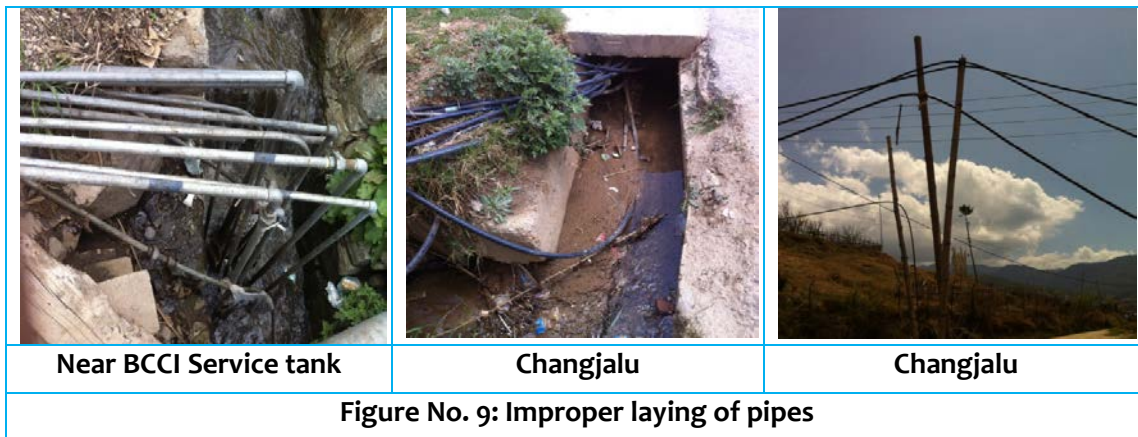
Besides several other causes, water loss was mainly caused due to water leakages at various locations from tanks and pipes. This has led to water shortages of 7.96 million m³ treated water valuing to Nu. 28.497 million causing revenue loss to the government.

3.2.1.5 Inadequacies in water network infrastructure

Water network infrastructure consists of structures that were built to pump, divert, transport, store, treat, and deliver safe drinking water. Regardless of the water source, water supply infrastructure must be designed and built to meet the anticipated demand of the intended beneficiaries. Thus for effective supply of water, it is important to have adequate water supply infrastructure and timely maintenance of the infrastructure. In order to ascertain the adequacies of Thimphu Thromde's water network infrastructures, the RAA carried out document review and joint physical verification of the water network infrastructure and noted the following lapses:

3.2.1.5.1 Inappropriate laying of water pipes

Thimphu Thromde does not have overall drawing and design or the blueprint on the pipes layout for the water distribution network. Upon joint physical verification, it was found that drinking water distribution pipes were laid improperly as shown in Figure No. 9. Water pipes were laid in drains, on side of roads and in the air over roads as depicted in the figure. Improper laying of pipes poses damage to the pipes leading to leakages and water contamination in case of pipe running in the drains. It also affects the aesthetic look of the city.

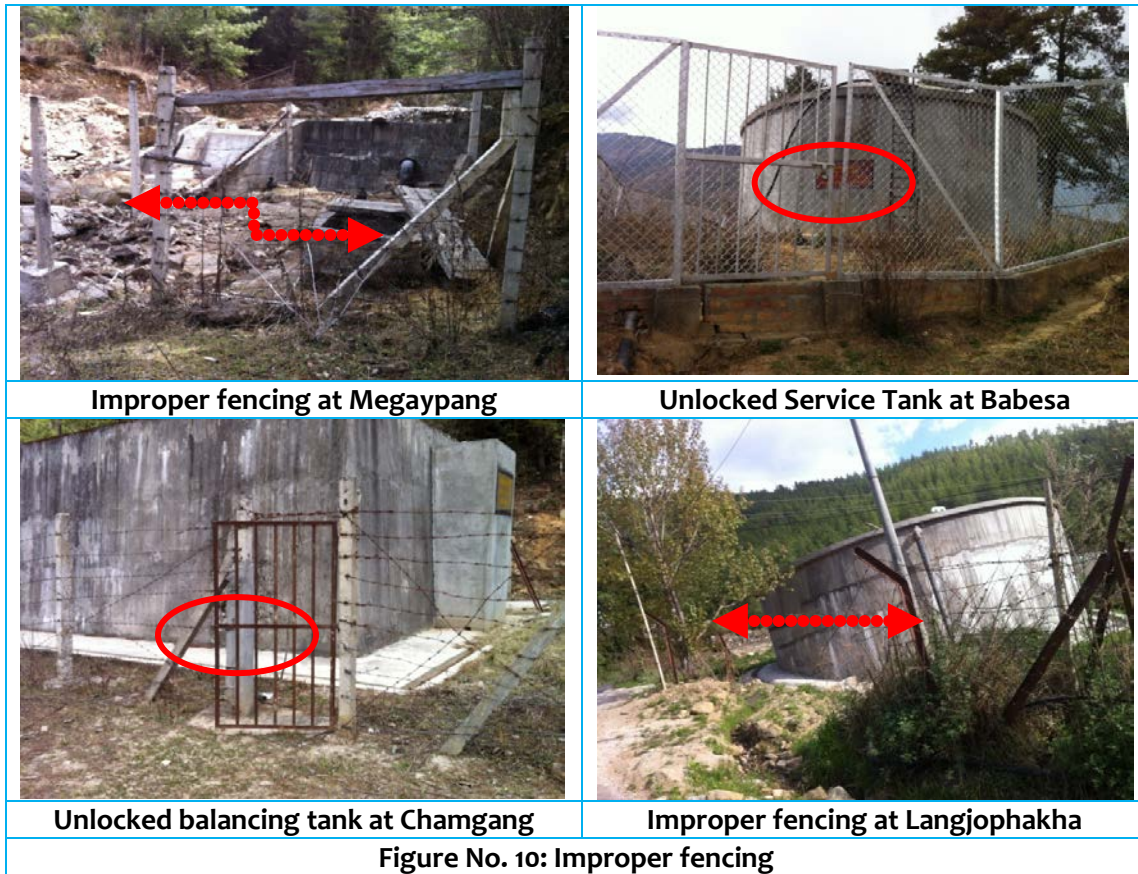


3.2.1.5.2 Improper fencing

As per the Water Regulation of Bhutan 2014, "A drinking water source will be protected from human and animal interferences". However, when no other known water source is available within its vicinity, the fencing of such water source will restrict congenial access to the wild animals that depend on the same water source.

On physical verification at water sources and service tanks, the RAA found that the fencing at source tapping (Megaypang water treatment plant) was not maintained properly as shown in Figure No. 10. Most of the service tanks at South Thimphu were kept open without having

proper lock and key. Unprotected drinking water infrastructure at source and through the distribution network poses high risk of intentional contamination and water theft.



Poor safeguard of the water infrastructures are mainly due to absence of monitoring system and lack of coordination between field staffs and the management.

3.2.1.5.3 Bulk meter not functioning

The bulk meters were installed in water treatment plants to record the actual production of drinking water from the water treatment plants to the service tanks. The bulk meters facilitate in calculating water revenue and water loss including non-revenue water. However, on site verification of water treatment plants, it was noted that the bulk meters at Motithang, Jungshina and Dechencholing were not functioning and the production at Motithang and Jungshina were measured manually. Although the production at Motithang was measured manually, the water production records were not maintained.

Non-functional bulk meter and improper record keeping impeded in getting the accurate figure on water production by treatment plants. The non-functional bulk meters are presented in Figure No. 11.

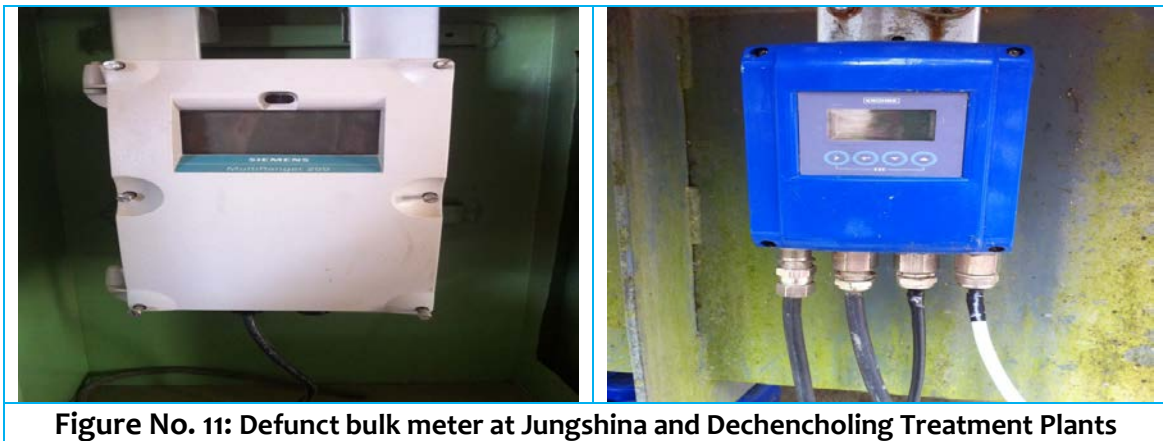


Figure No. 11: Defunct bulk meter at Jungshina and Dechencholing Treatment Plants

3.2.1.5.4 Non-maintenance of infrastructure

On physical verification, the RAA noted non-maintenance of water supply infrastructure leading to water leakages at various locations from tanks and pipes. Water leakage in water distribution network is one of the main causes of water shortage apart from other causes. Few instances of non-maintenance of infrastructure in the water system are depicted in Figure No. 12.

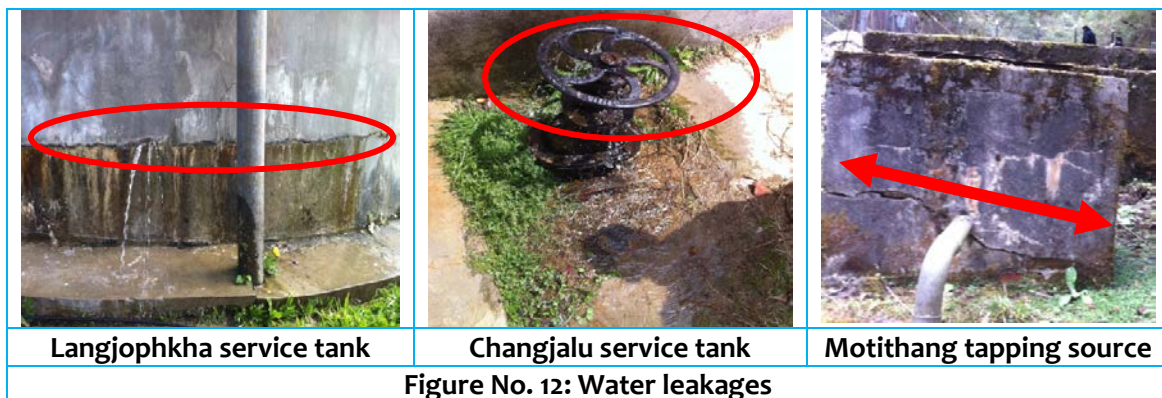


Figure No. 12: Water leakages

Water leakages in the water system have occurred due to lack of timely monitoring and periodical maintenance of tanks and water pipes.

3.2.1.5.5 Inappropriate installation of water meter

During the joint physical verification of water distribution network in Thimphu Municipality, the RAA noted that the water meters were not installed appropriately. Improper installation of meters not only poses high risk of damage to the equipment but also hinders in reading water meter correctly. Instances are shown in Figure No. 13.



Figure No. 13: Inappropriate water meter installation

Improper installations of water meters are mainly due to lack of guidelines and standards on water meter installation.

3.2.2 WATER QUALITY MANAGEMENT

3.2.2.1 Inadequacies in management of water quality

Water treatment is required to remove contaminants and undesirable components, destroy pathogenic microorganisms or reduce their concentration so that the water becomes fit for its desired end-use. Water treatment is a process that makes water more acceptable for drinking. Water treatment process adopted by Thimphu Thromde at Treatment Plants involves flocculation, sedimentation, rapid or pressure sand filtration and chlorination. Further, Alum is used for coagulation, lime for pH correction and chlorine for disinfection.

Operational monitoring of the control measures in the drinking water supply is of paramount importance in securing drinking water safety. Therefore, it is essential to set limits for parameters, monitor those limits and take corrective action in response to a detected deviation before the water becomes unsafe. The parameters of water quality testing and the frequency of the tests to be conducted are laid down in the WSP. Based on the World Health Organization (WHO) Guidelines for Drinking water Quality, the Thromde has derived numerical “guideline values” for each parameter of water quality testing as shown in the Table No.6.

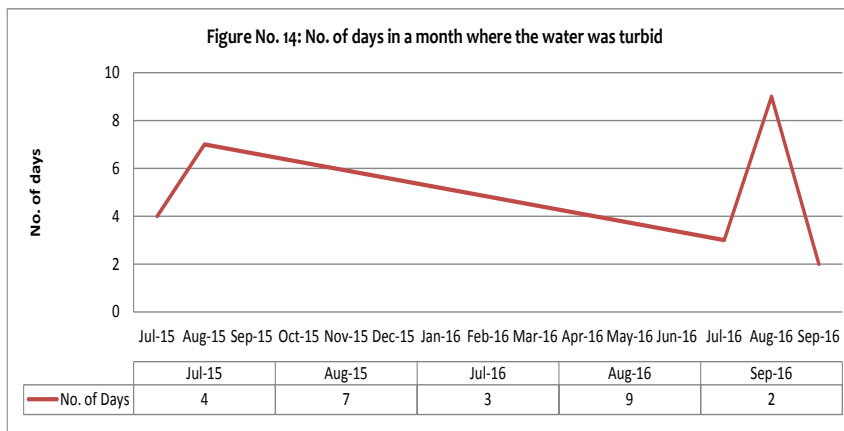
Sl. No.	Parameter	Guideline values	Remarks
1.	Conductivity	1400 μ	
2.	Hardness	500	
3.	Turbidity	<5NTU	
4.	pH	6.5 – 8.5	
5.	Residual Chlorine	0.2 ppm at service level	

6.	E. coli/faecal coliform	CFU/100ml	The term used for the coliform bacteria test conducted by the Thimphu Municipality is “faecal coliform” while the one RCDC used is “thermotolerant coliform”. The term "thermotolerant coliform" is more widely used and is gaining acceptance over "faecal coliform"
Source : Thimphu Thromde			

The RAA, while assessing the quality of drinking water, noted several inadequacies, which are discussed as follows:

3.2.2.1.1 Turbid water during the monsoon

As required by the WSP, the quality of the water at the water treatment plant has been monitored daily through four parameters namely conductivity, turbidity, pH and chlorine and also monthly through two parameters- hardness and E. coli. It was learnt from the records that all the daily parameters monitored were within the permissible limit adopted by the Thromde except for water from Motithang water treatment plant, which was found to be turbid during monsoon. The number of days in a month, which was found to be turbid even after the treatment ranges from two to nine days as represented in Figure No. 14.



The RAA was made known that the Motithang water treatment plant, which has an operating capacity of 6500 m³/day, has been operating beyond its capacity reaching upto 7500 m³/day, due to which, the water remains turbid even after addition of alum to treat the turbidity.

Although turbid water may have no direct health effects, the turbid water may not look palatable and may be regarded as unsafe by the consumers. Turbidity has a health risk in the long-run because it can interfere with disinfection and provide a medium for microbial growth. It also indicate the presence of disease-causing organisms including bacteria, viruses and

parasites that can cause symptoms such as nausea, cramps, diarrhea and associated headaches.

3.2.2.1.2 Presence of faecal coliform and high residual chlorine in water treatment plant and reservoir tanks

The monthly test for parameters such as E. coli, turbidity and pH is to be carried out at the sources (at intake chamber) as required by the WSP. However, it was noted that the water treatment plants at Dechencholing and Megaypang have not been tested. There were also no records of tests carried out at the distribution network, although WSP requires weekly monitoring of the water quality of three parameters i.e. pH, chlorine and turbidity and monthly monitoring of E. coli content in the water.

The great majority of evident water-related health problems are the result of microbial (bacterial, viral, protozoan or other biological) contamination- WHO Guidelines for Drinking-water Quality

Furthermore, chlorine, turbidity and pH at the outlet of the reservoir tanks are to be tested daily and E. coli monthly. While it was noted that faecal coliform tests has been carried out monthly at some of the reservoir tanks, the tests of the above three mentioned parameters were not carried out daily at the reservoir tanks rather it is being carried out once a month only. It was also noted that there were no tests carried out for the following listed reservoir tanks.

Sl. No.	Name of the Reservoir Tank
1.	Babesa Tank 1
2.	Babesa Tank 2
3.	Semtokha Tank
4.	Lungtenphu Tank 1
5.	Lungtenphu Tank 2
6.	Changjiji Tank
7.	Changjiji Tank (Borehole)
8.	Changbangdu Tank 1
9.	Changbangdu Tank 2
10.	Changbangdu Borehole Tank 1
11.	Changbangdu Borehole Tank 2 (above Hindu Temple)

The following case studies indicate that water tests were not carried out regularly in many tanks and in a few tanks, tests were never conducted. Some sample tests conducted jointly with Thromde showed presence of faecal coliform and high residual chlorine content.

Case 1: The sample of treated water collected from Megaypang water treatment plant on 30th March 2017 was tested for pH, conductivity and faecal coliform. While the tests revealed that pH and conductivity of the water were within the permissible limit, there was faecal coliform content of 437.4 in the water indicating that the water is grossly polluted.

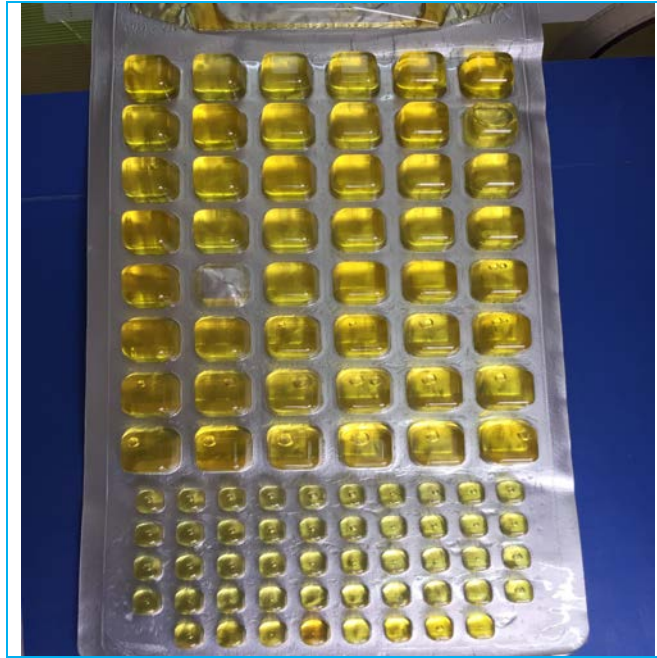


Figure No. 15: Water sample showing presence of faecal coliform

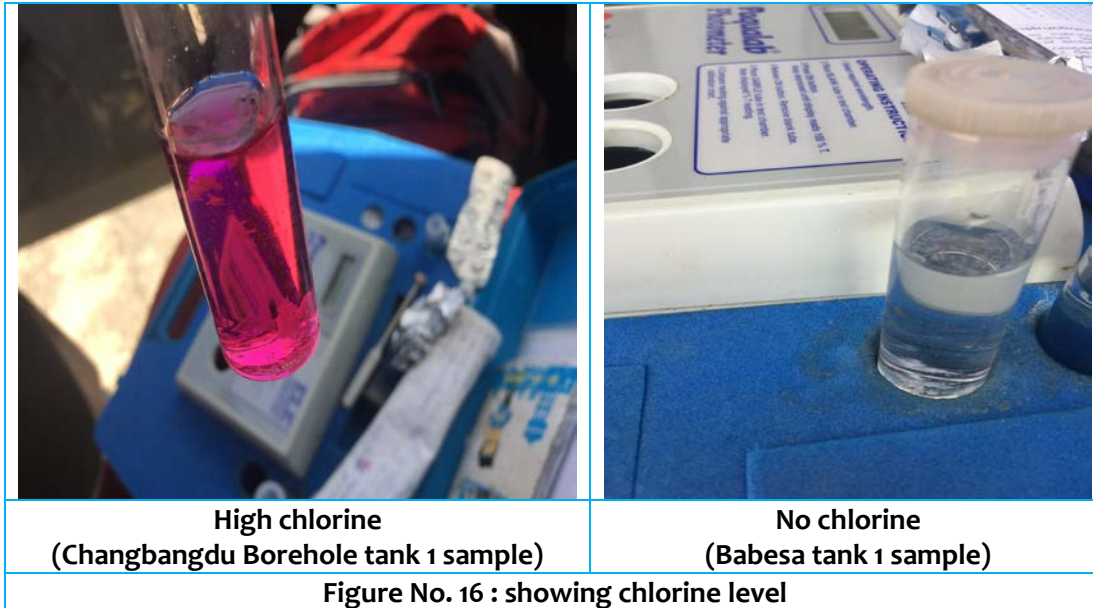
Case 2: To ascertain the residual chlorine and faecal coliform presence in the water, water samples from a few randomly selected reservoir tanks and also a few tanks where water testings were never conducted were collected on 25th April and 26th April 2017. Table No. 7 shows the result of residual chlorine and faecal coliform test.

Table No. 7 : Result of residual chlorine and faecal coliform test

Sl. No.	Date of collection	Sampling point	Faecal coliform (CFU/100ml)	Residual Chlorine (mg/l)
1.	25/4/2017	Langjophakha Tank (Jungshina WTP)	0	Not done
2.	25/4/2017	Dzong Tank (Jungshina WTP)	0	Not done
3.	25/4/2017	BCCI Tank (Jungshina WTP)	0	Not done
4.	25/4/2017	Swimming pool Tank (Jungshina WTP)	0	Not done
5.	26/4/2017	R1 Tank, Kuengacholing (Motithang WTP)	0	2.60 ppm
6.	26/4/2017	YHS Tank (Motithang WTP)	0	0.68 ppm
7.	26/4/2017	Luntenphu Tank (Megaypang WTP)	1	Nil
8.	26/4/2017	Simtokha Tank (Megaypang WTP)	2	Nil
9.	26/4/2017	Babesa Tank 1 (Megaypang WTP)	1	Nil
10.	26/4/2017	Babesa Tank 2 (Megaypang WTP)	5	Nil
11.	26/4/2017	Changbangdu Borehole Tank 1 (Borehole)	0	3 ppm
12.	26/4/2017	Changbangdu Borehole Tank 2 (Borehole)	1	Nil
13.	26/4/2017	Changgedaphu Tank (Motithang WTP)	0	0.26 ppm
14.	26/4/2017	Changjiji Tank (Borehole)	1	Nil

As evident from the table above, water samples collected from reservoir tanks of Motithang water treatment plant and Jungshina water treatment plant revealed non-presence of faecal coliform in the water. However, water supplied to southern part of the Thromde from Megaypang water treatment plant revealed presence of faecal coliform whose values ranged from **One to Five**, which is also attributed by disinfection not carried out at the Megaypang water treatment plant and reservoir tanks.

Case 2 continued: The test also revealed presence of residual chlorine in two reservoir tanks i.e. R1 Kuengacholing tank and Changbangdu Borehole Tank 1 with 2.60 ppm and 3 ppm respectively, which were found to be extremely high. The Technician of Motithang Water treatment plant explained that since the water supplied from R1 Kuengacholing tank is for the far-flung places, the amount of chlorine dosage is high due to the fact that chlorine has the tendency of losing its strength quickly. It was informed that high content of residual chlorine in the Changbangdu Borehole Tank 1 could be because the disinfection of the tank was done by its caretaker like in the case of most reservoir tanks.



Similarly, test conducted by RCDC for the Changjiji Colony reservoir tank also revealed presence of thermotolerant coliform as shown in Table No. 8.

Sampling point	Thermotolerant coliform (per 100 ml)	Sample Analysis Date
Changjiji Colony reservoir Tank	1	16-09-15
Changjiji Colony reservoir Tank	6	19-10-15
Changjiji Colony reservoir Tank	3	25-11-15
Changjiji Colony reservoir Tank	3	19-01-16
Changjiji Colony reservoir Tank	3	27-07-16
Changjiji Colony reservoir Tank	4	09-08-16
Changjiji Colony reservoir Tank	1	19-10-16

The Thromde had not carried out water quality test at the Changjiji reservoir tank since January 2014.

The presence of faecal coliform in the water indicates microbial risks, which are associated with increasing disease risks due to ingestion of water that is contaminated with faeces from humans or animals. It may also trigger outbreak of water-borne diseases such as typhoid, cholera, etc.

Studies have shown that the attempts to prevent illness by adding chlorine in the water have contributed to another problem i.e. increase of cancer and heart disease. Thus, getting the chlorine levels right is important because too much of it causes unpleasant side effects while insufficient does not make the water very safe.

3.2.2.1.3 Non-conduct of water quality test at the schools and institutes by Thromde

It is of utmost importance to confirm that water quality is being achieved and maintained in places like schools, institutes and hospitals. Particular attention should be directed to monitor the quality of water consistently ensuring safe drinking water for young children and patients, thereby protecting public health. Furthermore, safe drinking water for school children should be given high priority because of the positive impact on child's physical health, cognitive development and subsequent enhanced learning abilities and also the effects of exposure to pathogens are not the same for all individuals. The young, the elderly, pregnant and immunocompromised are considered to be vulnerable to risk of water borne illness. Thus, routine water quality tests should be conducted in schools, hospitals and institutes.

The RAA noted that the Thromde had tested the water samples from the Hospital reservoir tanks regularly but the water quality in the schools was never tested except for Jigme Namgyel Middle Secondary School.

Nevertheless, the RCDC had conducted tests of water quality in the schools and found that the water in some schools was grossly polluted.

The thermotolerant coliform tests conducted by the RCDC for six months i.e. June 2016 to November 2016 are presented in Figure No. 17. As evident from the figure, the test values for thermotolerant coliform presence in the water had hit as high as 200 in case of Jigme Losel Primary School in the month of September, followed by Yangchenphug Higher Secondary School with 100 in June.

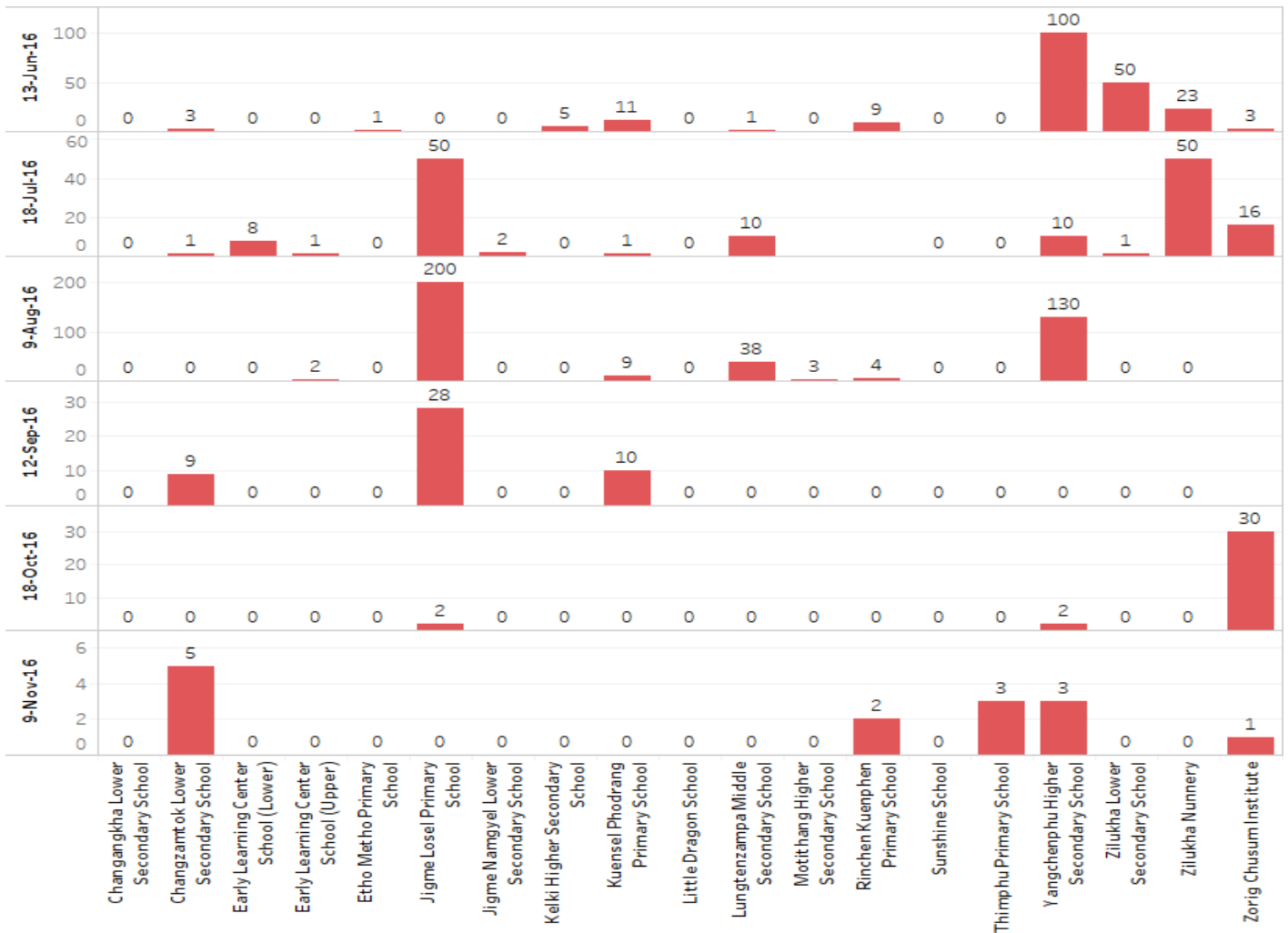


Figure No. 17 : Thermotolerant coliform tests conducted in schools having Thromde water connection

Although, monitoring of the quality of water is not carried out by the Thromde for private and community connections, the RCDC had carried out monthly monitoring of the quality of water in the schools irrespective of its connection. The Figure No. 18 shows the result of tests conducted by the RCDC of schools and institutes having private water connections.

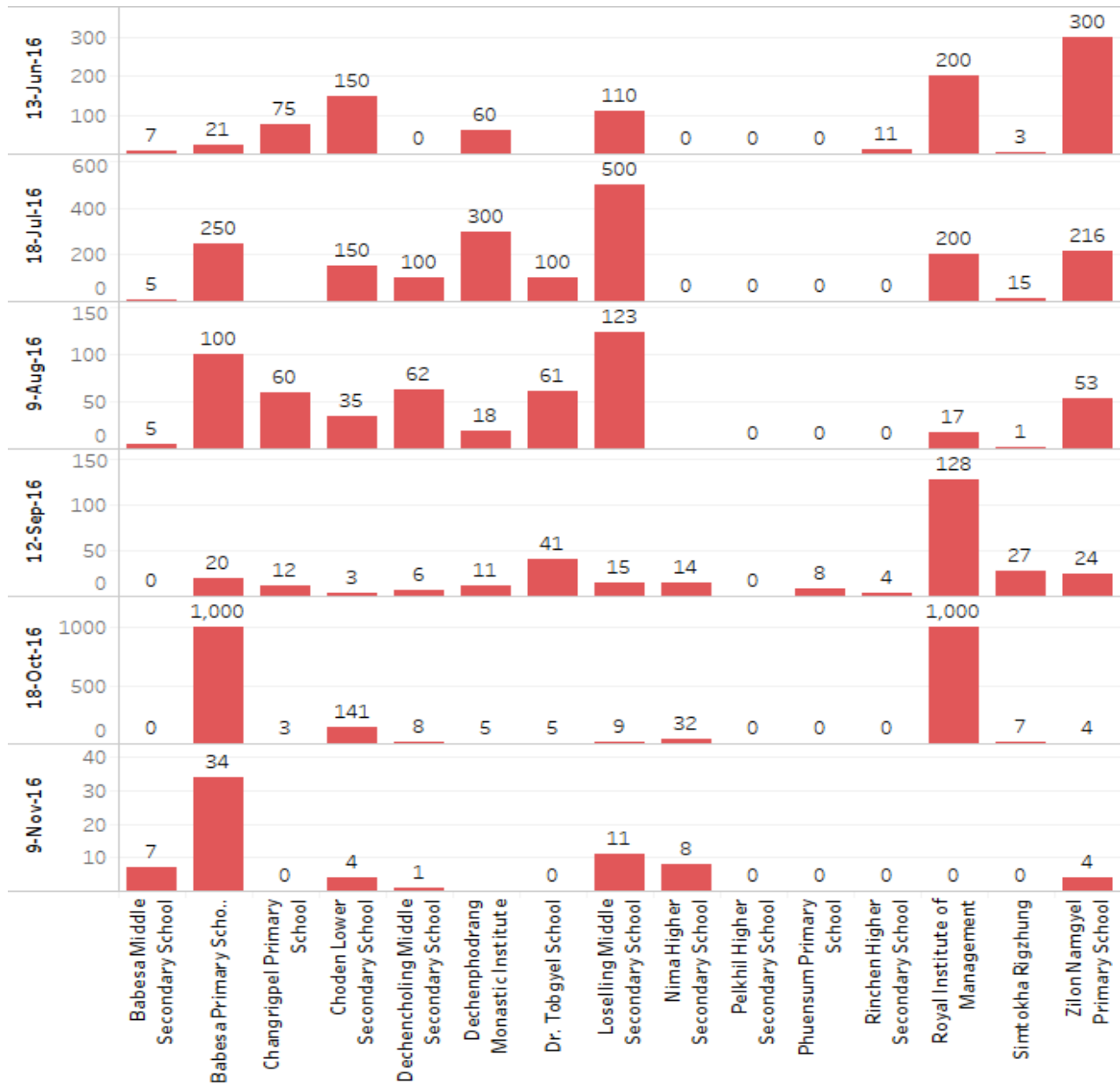


Figure No. 18: Thermotolerant coliform tests conducted in schools having Private water connection

As evident from the figure, the contamination level in the water was more in the case of those having private connections as compared to those having Thromde’s connection (Figure No. 17 vs. Figure No. 18). The values for thermotolerant coliform tests in the case of Royal Institute of Management (RIM) and Babesa Middle Secondary School were 1000, which was alarming indicating the water is totally polluted. Thus, it is worrying to note such situation because there are many residents having private and community water connections.

Short water supply from Thromde has forced the residents to have alternative drinking water sources (private and community connections) that are not treated properly and may pose risk to their health.

Unsafe or polluted drinking water exposes the community to the risk of outbreaks of intestinal and other waterborne disease diseases.

3.2.2.2 Difference in water quality tests results conducted by Thromde versus RCDC

On cross verification of the faecal coliform test conducted by the Thromde and the RCDC within the same month, the RAA noted discrepancies in the results.

As evident from Figure No. 19, the test results of the Thromde revealed no presence of faecal coliform in the Hospital tank for three consecutive months, i.e. July 2015, August 2015, September 2015, and January 2016. On the other hand, the RCDC test results showed presence of thermotolerant coliform in the water ranging from 1 to 35 for the same months as shown below.

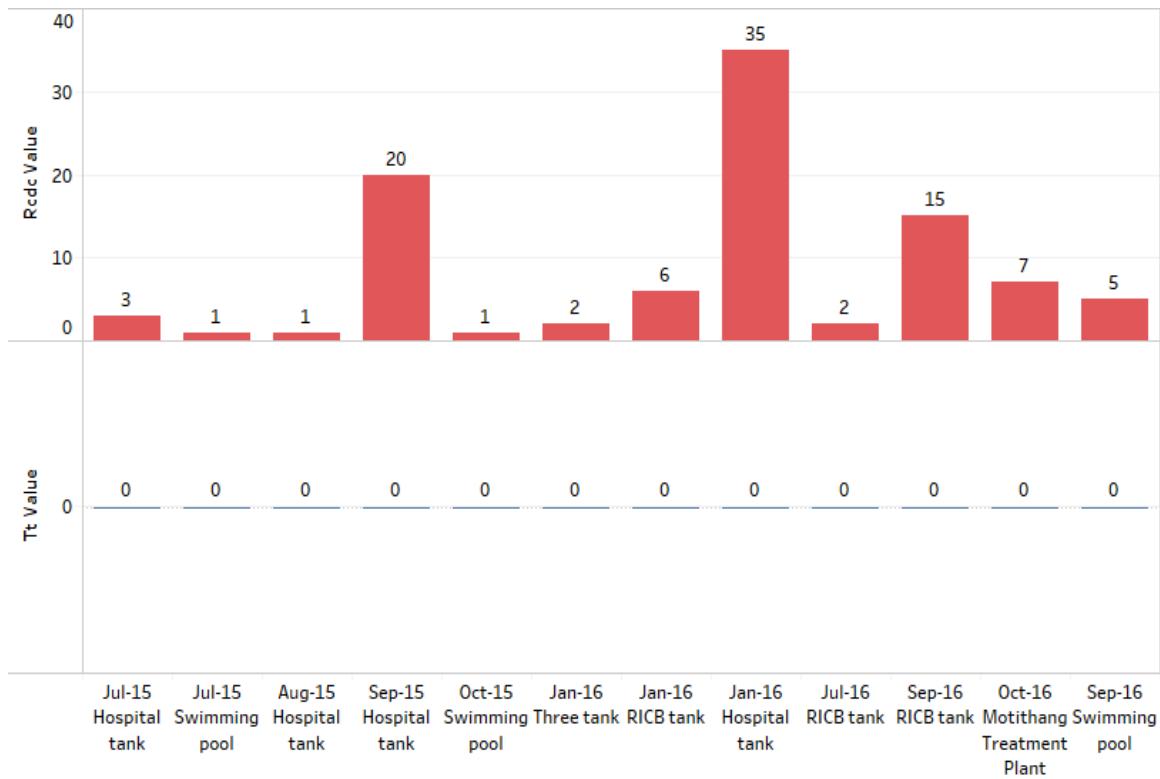


Figure No. 19: Faecal coliform test conducted by the Thromde and the RCDC

The RAA also noted that till date of audit there was no documented processes in place to be followed if any deviation from the standards is observed. Moreover, there was no specific action to be taken if the deviation is repeated for a number of consecutive months as noted in the current scenario.

The test results of the RCDC were shared with the Thromde, although in an inconsistent manner. However, there was neither any remedial action taken by the Thromde nor was there any follow-up done by RCDC. There is no persuasive means of encouraging compliance to drinking water quality standards.

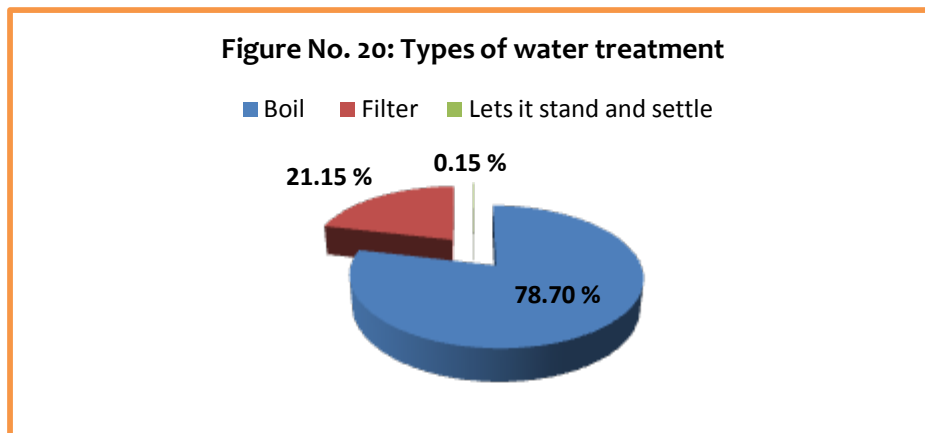
3.2.2.3 Lack of monitoring and reporting mechanism on the water quality tests

It is imperative that appropriate monitoring and reporting mechanisms to be established. Municipality to review and monitor of the quality of drinking water so that timely appropriate actions can be taken if the water is contaminated. Also to inform the relevant stakeholders on the quality of the water being supplied.

There is, however, no systematic monitoring and reporting system in place to review the water quality tests conducted by the technicians deputed at the various water treatment plants. The reports of these tests carried out are neither reviewed nor submitted for review. During the audit, the RAA noted that the Thromde had incorporated the water quality test reports in the WaSIS (Water and Sanitation System) of MoWHS but the reports were found to be incomplete. Further, the reports incorporated were only from January 2016 to June 2016.

In addition, timely and clear communication with the consumers is a vital for successful handling of drinking water problems and emergencies. The consumers have rights to information on the safety of their drinking water. Moreover, they play an important role in ensuring safe drinking water by carrying out necessary measures at the household level such as boiling their drinking water. Nevertheless, the consumers have not been informed on the quality of drinking water supplied to their houses.

Although the consumers were not informed on the quality of water, the survey result showed that almost all of the consumers treat their drinking water as depicted in Figure No. 20.



Not having monitoring and reporting mechanism in place could impede in providing safe drinking water to the public and also hinder in taking timely action if the water is contaminated. It will also deprive the relevant stakeholders from knowing how safe their drinking water is.

3.2.2.4 Absence of proper storage for water treatment chemicals

It is very crucial to safely store bleaching powder and liquid chlorine in a cool, dry and adequately ventilated place to ensure effective stability and to prevent fire and explosion hazards. Since chlorine exhibits oxidation properties, it can be highly reactive and capable of generating high temperatures as well as releasing toxic vapors if not properly handled or

stored. Also storing the bleach outside and exposing it to direct sunlight could cause the bleach to lose its effectiveness and degrade more rapidly.

Nevertheless, during the field visits to the water treatment plants and reservoir tanks, the RAA found that the Thromde did not have proper and safe storage to store bleaching powder and liquid chlorine. For instance, the jerry cans containing liquid chlorine in Dechencholing water treatment plant were kept outside due to lack of storage space. Likewise, Megaypang water treatment plant has converted a staff quarter into a storage place to keep the liquid chlorine. Due to improper handling, there were leakages from the jerry cans of liquid chlorine as shown in Figure No. 21. Some bleaching powder was also found lying unattended at the care takers' houses risking the lives of their families.



3.2.2.5 Use of chemicals without expiration dates and expired chemicals

All chemicals have certain shelf life, after which it loses its chemical stability or undergo chemical or physical changes. Similarly, the disinfectants such as bleaching powder and liquid chlorine and other chemicals used for conducting water quality tests should also have shelf life in terms of expiration dates.

Nonetheless, the RAA found that some of the chemicals and disinfectants used by the Thromde for the water treatment and conducting various water quality tests did not have expiry dates as depicted in Figure No. 22. Furthermore, it was also observed that “manufactured dates” were also not provided on them.

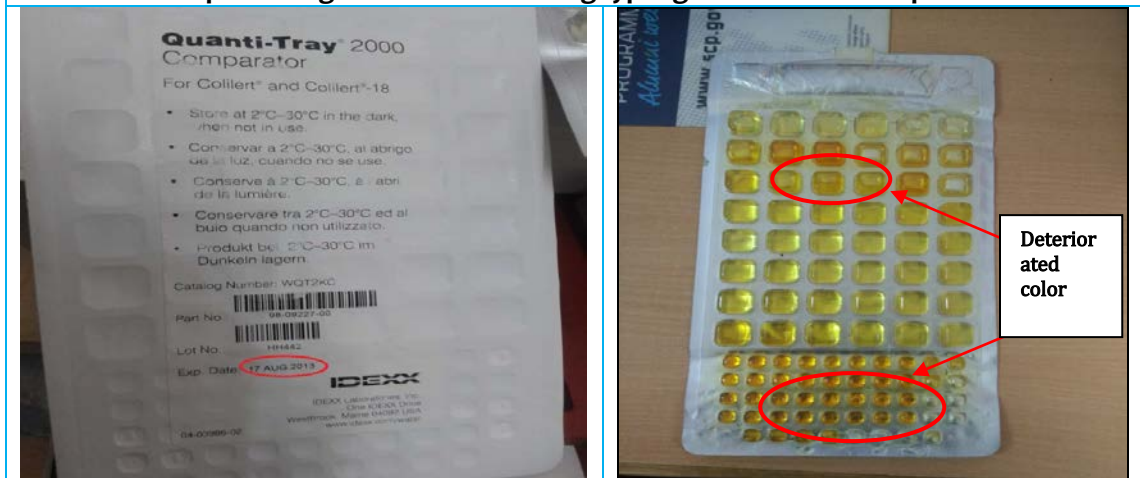


In absence of such dates, the officials concerned cannot ascertain the exact date of manufacturing and also cannot identify those chemicals nearing expiry dates or even those that have crossed expiry dates. The expired bleach may not have the potency to disinfect the water properly or disinfection efficacy may be unsatisfactory against microbial contamination.

The RAA, particularly in the case of Megaypang water treatment plant, noted that some of the reagents used for the water quality testing were expired as shown in Figure No. 23.



Expired reagents used at the Megaypang water treatment plant



Expired comparator for faecal coliform test

Figure No. 23 : Expired chemicals and reagents

Since the water treatment plant is still under the operation and maintenance period and the chemicals were procured by the contractor, the management should monitor the kind of reagents used for water testing because it is likely that using expired reagents could lead to generation of wrong tests reports.

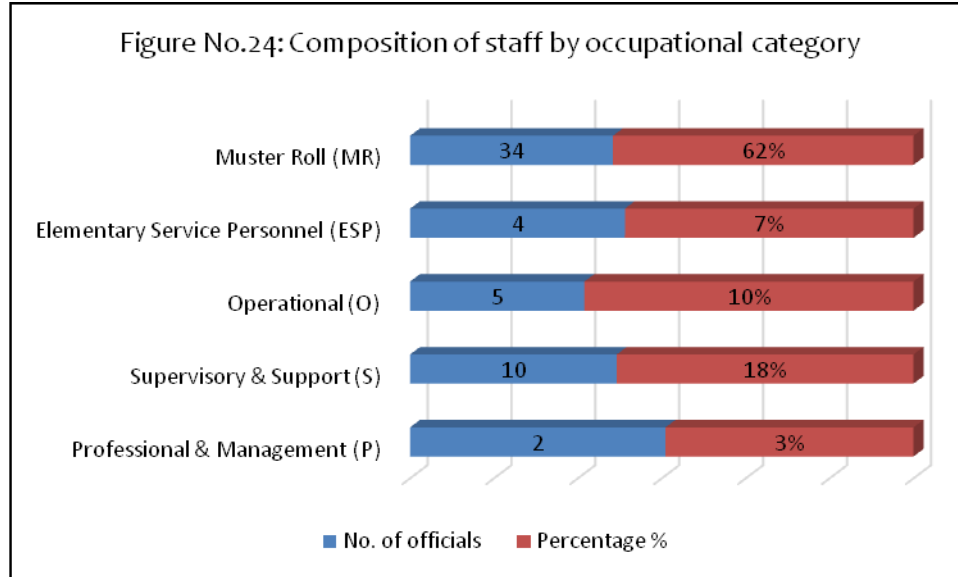
3.2.3 GOVERNANCE AND MANAGEMENT

3.2.3.1. Human Resource Management

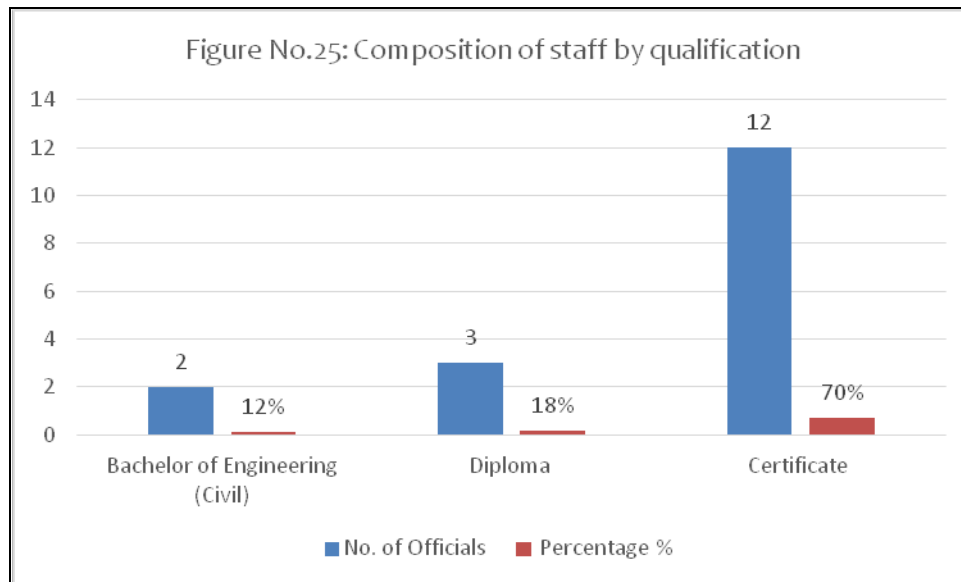
Adequacy of human resource in terms of both number and proficiency is vital for delivering efficient and effective professional services in any field. Nevertheless, the RAA observed that Thimphu Thromde is constraint of proficient officials in the Water Supply Section, Engineering Division.

As of May 2017, Water Supply Section has 55 employees, providing water services to approximately 107,164 persons and 7,614 buildings in Thimphu Municipality.

As depicted in Figure No. 24, the Water Supply Section has staff strength of 55 comprising of two in professional & management category, 10 in supervisory & support category, five in operational category, four as Elementary Service Personnel (ESP) & 34 causal laborers as compared to the other occupational category. The muster roll staff constitutes 62% of the workforce and the regular employees constitute 31% of the workforce totaling to 17 persons.



Further, out of the 17 regular employees, 12 employees representing 70% have qualification of certificate level. Only two employees, representing 12% have bachelor’s degree and three employees, representing 18% have diploma as shown in Figure No. 25.

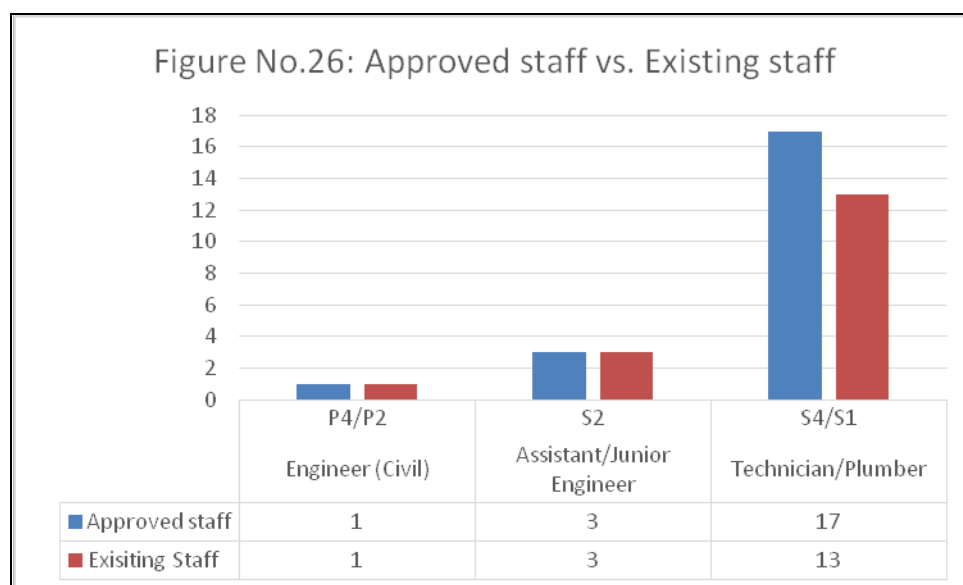


As evident from the figure, there is no employee having professional qualification in the field of water engineering. Currently, the Thimphu Thromde lacks expertise and proficient work force in water engineering in terms of strategic thinking, developing strategic direction, and carrying out high-end analytical task related to water network & its infrastructure.

Water treatment plants are staffed with certificate holders supported by muster roll staff. The distribution of staff in different areas of work by qualification is detailed in Table No. 9.

Sl. No.	Current responsibility & Area	Bachelor	Diploma	Certificate	Class IX & below	Muster roll	Total
1.	Water Supply Capital Works only	-	2	-	-	-	2
2.	Operation & Maintenance (O&M)Core & North, Thimphu	1	1	-	3	26	31
3.	O & M Water, South, Thimphu	1	-	-	-	7	8
4.	Network	-	-	4	-	-	4
5.	Motithang water treatment plant	-	-	2	-	-	2
6.	Jungzhina water treatment plant	-	-	2	-	-	2
7.	Dechencholing water treatment plant	-	-	2	-	-	2
8.	Megaypang water treatment plant	-	-	1	-	-	1
9.	Water Supply Store	-	-	1	-	-	1
10.	Customer Service Center	-	-	1	-	1	2
Total		2	3	13	3	34	55

On the adequacy in terms of number of employees, the RAA compared the existing number of employees with that of the approved number of employees in 11th Five Year Plan for Water Supply Section and found the differences as represented in the Figure No. 26.



As transpired from the figure, as against the approved staff strength of 21, Water Supply Section has staff strength of 17 with a shortfall of four persons. However, the RAA noted that these four positions were filled with ESP instead of trained technician.

Furthermore, the Organization Development (OD) Exercise conducted by Royal Civil Service Commission in 2015 reported that the Thimphu Thromde did not have a comprehensive Human

Resource Master Plan (HRMP) developed and the RAA also noted that this plan is still not developed.

The gap in human resource between the actual requirement and the existing human resource both in terms of strength and qualification may have detrimental effects in the effective and timely delivery of services. Moreover, the absence of HRMP would inevitably impede optimal recruitment policy particularly in strategic and key areas having direct impact on effective water administration. Competence of employees in terms of educational qualification and trainings are of utmost importance in water services that requires professionalism.

3.2.3.2 Lack of delineated roles and responsibilities within the Water Supply Section

Good practice of governance in the organization is of paramount importance and good internal governance helps in realizing organizational visions and missions through a culture of transparency and sustaining a motivated workforce in the organization. To ensure employees work as efficiently as possible, it is important to have clearly defined job roles and responsibilities. This is particularly important in large firms to ensure that no part of the workload is overlooked. Clear job descriptions enable workers to focus on their job-specific tasks reducing the possibility of work duplication.

However, in the current scenario, the Water Supply Section of the Engineering Division lacks delineated roles and responsibilities of the employees. Due to which, some employees were overburdened with unnecessary works or tasks while others were left with no work. Such scenarios exist because work done cannot be accounted and assessed in absence of clearly defined roles and responsibilities. Moreover, there is a risk of not achieving management's aspiration.

Lack of defined roles and responsibilities of the employees in Water Supply Section had affected the water services delivery to the beneficiaries by not being able to respond to complaints promptly.

3.2.3.3 Absence of the monitoring system for water sources and distribution network

Supply of reliable and safe drinking water is a lot more complex today due to rapid economic development and increasing risk of contamination of the source of drinking water. Thus, stringent institution of monitoring system on the water supply system is very critical to ensure adequate and safe water supply.

Recognizing the importance of effective monitoring in water supply system, the section 89 (d) of the Water Regulation of Bhutan 2014 stipulates as "The Thromdes in collaboration with MoWHS shall establish an effective monitoring and evaluation system and report to concerned Competent Authorities for drinking water systems".

However, upon review, it was observed that Thimphu Thromde has no mechanism institutionalized for monitoring of water sources and the distribution networks. In addition, there is also no system in place to report to the competent authority on the water supply system as required by the water regulation.

Using the following tool, the RAA assessed the system of monitoring and supervision. The corresponding results are shown in the Table No. 10.

Sl. No.	Component	Parameter (s)		
		Monitoring/ inspection team	Monitoring/ supervision schedule	Monitoring & supervision reports
1.	Motithang Water Sources & Distribution network	xxx	xxx	xxx
2.	Jungzhina Water Sources & Distribution network	xxx	xxx	xxx
3.	Dechencholing Water Sources & Distribution network	xxx	xxx	xxx
4.	Megaypang Water Sources & Distribution network	xxx	xxx	xxx
5.	Changbangdu Bore Holes	xxx	xxx	xxx
6.	Changjiji Bore Holes	xxx	xxx	xxx
	√= Yes	xxx = No		

It is evident from the table that the Thromde has not carried out monitoring and supervision of its water supply network resulting into several instances of inadequacies and irregularities as highlighted in the report.

3.2.3.4 Lack of effective coordination amongst stakeholders in the water management

Provision of drinking water, being a cross-cutting task requires cooperation and coordination of various agencies in implementing water management activities to provide reliable and safe drinking water to the beneficiaries and also to ensure sustainable development and management of water resources in the country. The Water Act of Bhutan 2011 envisions the holistic management of water resources requiring collaboration and cooperation of all key stakeholders for making informed decisions on water and its development.

In cognizance to the fact that effective collaboration, cooperation & institutional linkages of all key stakeholders are vital for making harmonized decision on water and its development, the 32nd National Environment Commission meeting held on 21st June 2011 had approved the formation of a National Water Resources Board (NWRB). In pursuant to the approval, the executive order no.C-2/277 of 8th September 2011 of the Prime Minister's Office constituted the NWRB comprising the following:

Sl. No.	Stakeholder Agencies	Board Members
1.	National Environment Commission Secretariat	1. Secretary as Chair 2. Head, Water Resources Co-ordination Division as member Secretary
2.	Ministry of Economic Affairs	1. Director General, Department of Energy 2. Head, Department of Geology and Mines
3.	Thimphu Thromde	Thrompon
4.	Ministry of Health	Director, Department of Public Health
5.	Ministry of Home and Cultural Affairs	Director, Department of Local Governance
6.	Royal Society for Protection of Nature	Executive Director
7.	Ministry of Works and Human Settlement	Director, Department of Urban Development and Engineering Services
8.	Ministry of Agriculture and Forests	1. Director, Department of Agriculture 2. Director, Council for Renewable Natural Resources Research 3. Head, Watershed Management Division 4. Head, Water Department, Ugyen Wangchuk Institute Conservation for Environment

As per the Terms of Reference of the Board Members, “The board members shall meet at least quarterly and also when necessary”. However, the Board had convened only four meetings so far since the inception in 2011. The first board meeting was held on 6th April, 2012. The second & third board meeting were held on 29th January, 2013 & 16th December, 2013. The last one was conducted from 13th to 14th January 2014.

Meeting of the Board is important because Board represents important stakeholders in the water management and board meetings provide appropriate platform to discuss cross cutting water issues, provide direction in water management and take stock of situations of water preparedness at various levels. In contrary, no board meetings were convened after 2014, indicating apathy in water management in the country by all parties concerned. This in turn resulted into working in isolation inhibiting the overall outcome in provision of reliable and safe drinking water to the beneficiaries.

For instance, the water quality reports of Thromde were not shared with any of the competent authorities. The RCDC, as an independent surveillance body, also conducts water quality testing and shares test reports with relevant agencies on irregular basis. The Thromde office does not take any action on the test results received since there is no stipulated requirement.

An another example is non-pursuant on the recommendations from MoWHS (study report on the existing water supply system of Thimphu Thromde) by Thimphu Thromde as detailed in Para No. 3.2.3.5.

3.2.3.5 Non-implementation of recommendations of the MoWHS

Clause 9 (a) of the Water Regulation of Bhutan 2014 stipulates that the MoWHS should “Review the existing status of drinking water supply systems in Thromde and determine its strengths and shortfalls for their maintenance and remedial measures”.

In pursuant to the above provisions, Water & Sanitation Division (WSD), MoWHS had under taken an independent study with an objective to assess the existing drinking water services of the Thimphu Thromde and issued a report in March 2016. The study exclusively reported on area wise water service coverage, accessibility of water supply, duration of supply, adequacy & reliability of water supply, affordability of water supply, household treatment, water scarcity, water saving practices, customer satisfaction, willingness to pay and usage for non-drinking purpose.

Based on the study, the MoWHS had provided many important recommendations to the Thimphu Thromde:

- ✓ To connect Dechencholing, Babesa, Simtokha & Lungtenphu areas to Thromde’s water supply service since the water supply system for these Local Area Plans (LAP) are already in place;
- ✓ To ensure equitable distribution of water to all the Thromde residents;
- ✓ To improve in the water infrastructures;
- ✓ To reduce the non-revenue water;
- ✓ To institutionalize appropriate measures to overcome water scarcity;
- ✓ To create public awareness on water conservation;
- ✓ To explore alternatives water for non-drinking purposes;
- ✓ To improve & create awareness of Customer Care Service;
- ✓ To implement WSP; and
- ✓ To explore outsourcing of water supply services (Public Private Partnership modalities).

Further, the WSD, MoWHS presented the study report to the Thimphu Thromde on 11th April 2016. The minutes of meeting was drawn and circulated vide office memo no.30/TT/ID/WS/2015-2016/1338 dated 11/04/2016 to implement the recommendations.

Despite issuance of pertinent recommendations by the MoWHS, Thimphu Thromde did not take any action. The inaction from the side of Thimphu indicates lack of seriousness, which has inevitably impeded in providing reliable water supply to its beneficiaries.

3.2.3.6 Lack of master plan for drinking water

Master Plan for drinking water forms an integral part of the overall Water Supply Strategy. The objective of master plan for drinking water is to identify available options to guarantee that there is sufficient quality and quantity of water for future generations.

Recognizing the importance, need for development of a master plan for the national drinking water and waste water management system for Thromde in consultation with local government was explicitly mentioned in the Water Regulation of Bhutan 2014 under section 9

(b) as a function of MoWHS. However, the master plan for national drinking water is not yet formulated.

The absence of master plan for drinking water could be one of the causes leading to inefficiencies and ineffectiveness in provision of reliable and equitable drinking water in Thimphu Municipality.

3.2.3.7 Inadequate maintenance of building inventory and database on water meters

Maintaining a comprehensive and up to date inventory on buildings and water meters within the Thromde's jurisdiction is very crucial for the authority to levy correct property taxes and other levies such as water charges as mandated by law.

The building inventory maintained by the Thromde was in a form of Maps from Geographical Information System(GIS). The RAA noted that Thimphu Thromde had failed to maintain adequate building inventory, despite audit observations raised in previous audit report bearing Audit Identification Number (AIN) 12608.

Furthermore, the management had allocated and expended Nu. 1.5 million for conducting building inventory without producing building inventory/database. In addition, Thimphu Thromde does not have database maintained for procurement and issuance of water meters. Currently, the procurement and issuance of water meter records are maintained in stock register like any other equipment or items. The register records are found to be incomplete and not up-to-date and also it does not capture important aspects of the consumer such as consumer Citizenship Identity number, proper address including thram number and building number, etc.

As a result, the actual number of water meters installed and buildings existing in Thimphu Municipality cannot be determined thereby inhibiting in ascertaining the sources of revenue (local taxes and fees) as well as the water connections provided.

3.2.3.8 Draft Water Resources Inventory still not finalized

Water Resources Inventory is the study carried out on the availability of water from different sources and also captures the quality aspects of water sources. Having water resources inventory would help in providing information for proper allocation of water from various sources to meet the current and future water demands.

As per the Water Act of Bhutan 2011, the NECS is responsible for conducting inventory on water resources and the work was awarded to a consultant at the cost of USD 8,784 in 2015. However, during the audit, the RAA observed that the inventory on water resources was still in the draft form even though the Water Act of Bhutan was enacted in 2011.

Finalization of the inventory on water resources would be of particular relevance for identifying and prioritizing the water sources given the current lack of reliable information on water availability. Lack of such information would impede the decision making process in identification of reliable water sources for drinking water, for example, it would be difficult to determine and assess whether water sources meet the increasing water demands.

In absence of inventory on water resources, one of the vital functions of the NECS has been defeated wherein the Secretariat is required to monitor the state of water resources, compile, analyze, and disseminate information thereon.

3.2.3.9 Non-identification of the water sources for LAPs

A LAP sets out a strategy for the proper planning and sustainable development of a specific area within a local authority and for a timescale as specified by the authority. As per Thimphu Structure Plan (TSP) and LAPs since 2002-An Update, 14 LAPs were prepared, consulted and approved for implementation by 2007.

The LAP concept should include at least the basic amenities necessary for the residents including water supply, electricity, sewerage, and roads. Upon review of the LAP and water sources to ascertain whether water sources have been identified for each LAP, it was noted that there was no document showing such allocation or study. However, the review of the existing water connections in each LAP showed that a few of the LAPs have no Thromde's drinking water connection.

Sl. No.	Name of the LAPs	Existing water connection
1.	Serbithang	Chamgang
2.	Babesa	Chamgang
3.	Lungtenphu	Chamgang
4.	Semtokha	Chamgang
5.	Changbangdu	Chamgang
6.	Changzamtog (middle)	Motithang/Boreholes
7.	Changzamtog (upper & lower)	Motithang/Boreholes
8.	Hejo-Samtenling –(Hejo)	Jungshina
	Hejo-Samtenling –(Samtenling)	No Thromde water connection
9.	Jungshina-Pamtsho	No Thromde water connection
10.	Dechencholing	No Thromde water connection
11.	Langjuphakha	Jungshina
12.	Taba	No Thromde water connection
13.	Semtokha workshop area (old)	Chamgang
14.	Zilukha	Motithang/Jungshina

There were four LAPs namely Hejo-Samtenling, Pamtsho, Dechencholing, and Taba, where Thromde's water connections were not provided as indicated in Table No.7. due to which, the residents of these LAPs still depend on the Private and Community water connections.

3.2.3.10 Delay in providing water related services

Thimphu Thromde provides water related services such as new line connection, reconnection, upgradation of connection, meter shifting, mains shifting, and domestic connection shifting. The applicant/customer care operator initiates these services by submitting application to the Thromde. The dealing official in the Customer Service Center forward the applications to the respective section for further verification & final approval to avail the services.

Upon review of the actual time taken against standard timeframe for providing above mentioned water related services through G2C web online system from July 2015 to March 2017, the RAA noted that Thimphu Thromde has considerably delayed in the delivery of its services.

The RAA carried out the analysis on the Turn Around Time (TAT) for processing each type of services and results of the analysis are shown in Table No. 12.

Sl. No.	Type of Services	No. of applications received	TAT allowed (days)	Applications processed within allowed TAT (Nos.)	Applications taking more than the allowed TAT (Nos.)	Percentage of applications delayed	Average time taken (days)	Minimum time taken (days)	Maximum time taken (days)
1.	New water line connection	666	3 to 7	142	524	79%	43	1	443
2.	Reconnection	6	3 to 7	4	2	33%	10	1	41
3.	Upgradation of connection	8	3 to 7	7	1	13%	2	1	8
4.	Meter Shifting	134	3 to 7	103	31	23%	6	1	50
5.	Mains Shifting	5	3 to 7	3	2	40%	26	1	65
6.	Domestic Connection Shifting	44	3 to 7	28	16	36%	15	1	98
Total		863		287	576				

As evident from Table No. 12, out of 863 applications, 287 applications representing 33% of the total applications were processed within the TAT, which is three to seven days for all the services and 576 applications representing 67% had taken more than TAT. Some applications were processed within a day, while some applications took considerable time in case of new water connection, where the maximum time taken was 443 days.

Amongst the various services catered by the Thromde, providing new connection & main line shifting took considerably longer time with an average of 43 days and 26 days respectively.

Some applications were processed within a day, while some applications took maximum of 443 days

It was observed that applications for water related services mainly pertained to new water connection with 666 applications out of the total applications of 863 representing 77%. The Thromde had not been efficient in providing this main service with 79% of applications being delayed, which also represented the highest percentage for delayed application processing.

According to the Thromde, the delay in application processing is happening because the officials who are dealing with application processing in the G2C system are most of the time at the site attending to water problems and other administrative works. They also indicated that delayed response from the applicants as one of the causes for delaying water related services.

The delay in providing water related services not only depicts the inefficiency of the Thromde but also affects supply of water to the applicants.

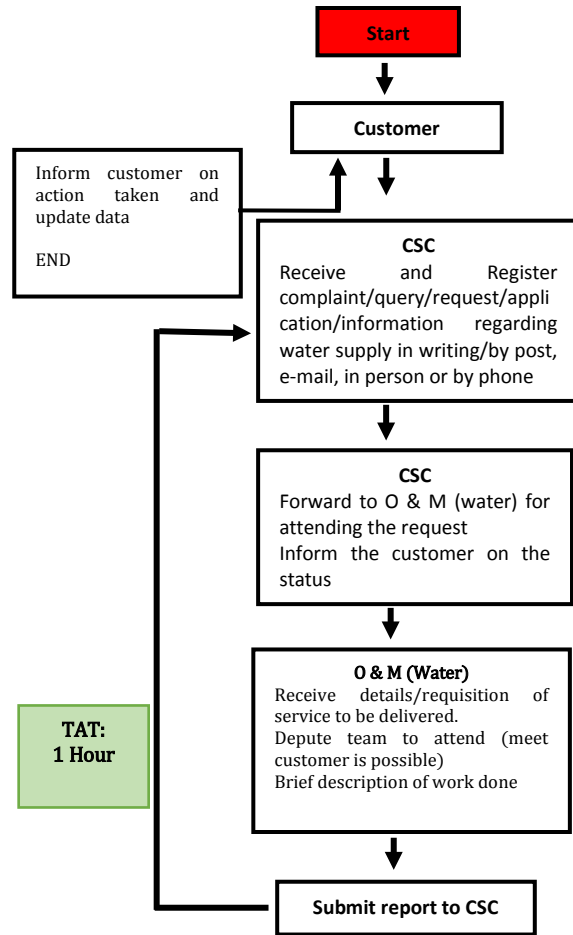
3.2.3.11 Inefficiency in addressing complaints

Water complaints are submitted to the Thromde through G2C online web portal or by dialing the helpline services from 9 AM to 8 PM. Complaints lodged via helpline are further divided as during office hours and after office hours.

The G2C operator in the Customer Service Center forwards applications initiated through G2C online web portal to the Operation and Maintenance (O&M) Unit, Water Supply Section. The O&M, Water Supply Section then deputs a team to attend complaints and submits the report to Customer Service Center.

In case of applications initiated through helpline during the office hours, the Customer Service Center maintains ‘register of complaints’ to record complaints received from the public on various water issues. Immediately after the registration, Customer Service Center operator contacts the plumbers of the respective jurisdiction to attend the complaint by providing details. On the same day of the complaint, the operator makes call to the customers to obtain feedback on whether the complaint was attended or not.

Flow Chart for Registration and Attending Water Complaints



Applications initiated through helpline after office hours are taken care by a team, formed to address complaints for that particular time. The team is paid overtime for off-hour service. The team records the complaint on the complaint record form and then attend complaints in the field. Upon completion, the team submits the complaint record form to O & M, Water Supply Section for verification.

The RAA carried out the assessment of TAT against standard timeframe allowed as per Standard Operating Procedure (SOP) for resolving complaints. The assessment included both processed through G2C web online system (July 2015 to January 2017) and helpline (July 2016 to December 2016). The result of the assessment showed staggering delays in resolving the complaints as depicted in Table No. 13.

Type of complaint lodged	No. of complaints lodged	Minimum time taken	Maximum time taken	Average time taken
G2C online complaint services)	324.00	1 day	67 days	4 days
Hotline services from 9 AM to 5 PM)	232.00	1 day	97 days	3 days
Hotline services from 5 PM to 8 PM)	336.00	5 minutes	18 hours	59 minutes

As depicted in the Table No.13, analysis of 324 complaints registered with Thromde through G2C web portal showed the average time taken to attend to a complaint was four days. There were also cases wherein a maximum of 67 days were taken to attend complaints against the standard TAT of 1 hour. Nevertheless, most of the complaints were resolved within a day and 145 complaints representing 45% of the total were processed within the standard TAT.

In case of complaints lodged through helpline during office hours, the TAT taken for processing the complaints were considerably longer. Analysis of 232 complaints showed that the average time taken to attend a complaint was three days. While some complaints were attended in 1 day, some have taken a maximum of 97 days. Out of the total of 232 complaints, 137 complaints (59% of the total) were not resolved within the specified TAT of 1 hour.

On analysis of complaints lodged through helpline after office hours, it was observed that the average time taken to attend a complaint was 59 minutes, which is less than the expected TAT of one hour. 208 complaints representing 61% of the total were attended within one hour, 128 complaints representing 38% had taken longer than the expected TAT of one hour and four complaints representing 1% of the total was unattended.

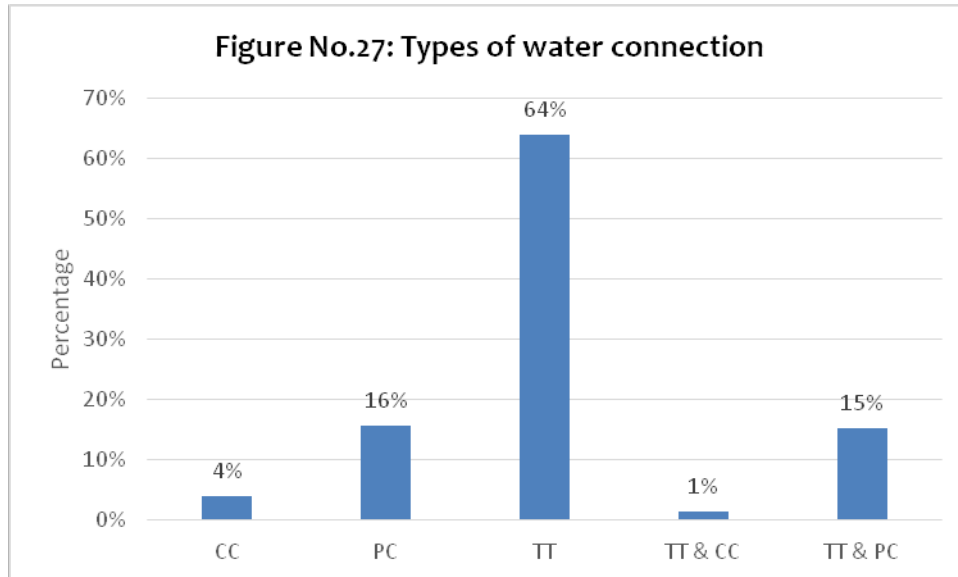
Complaints lodged through helpline after office hours with overtime payments were addressed promptly

The nature of complaints, which sometimes needs more time, attributed to delay in addressing the complaints. In addition, the dedicated G2C dealing officials were assigned with other administrative works thus losing momentum and focus in addressing complaints on timely basis. Even the standard TAT of 1 hour is too ambitious which also aggregated to huge deviation from standard.

It was also noted that the complaints lodged through helpline after office hours with overtime payment were addressed promptly as compared to other complaints. Untimely action against complaints shows ineffective public service delivery of the Thromde and causes inconveniences to the customers.

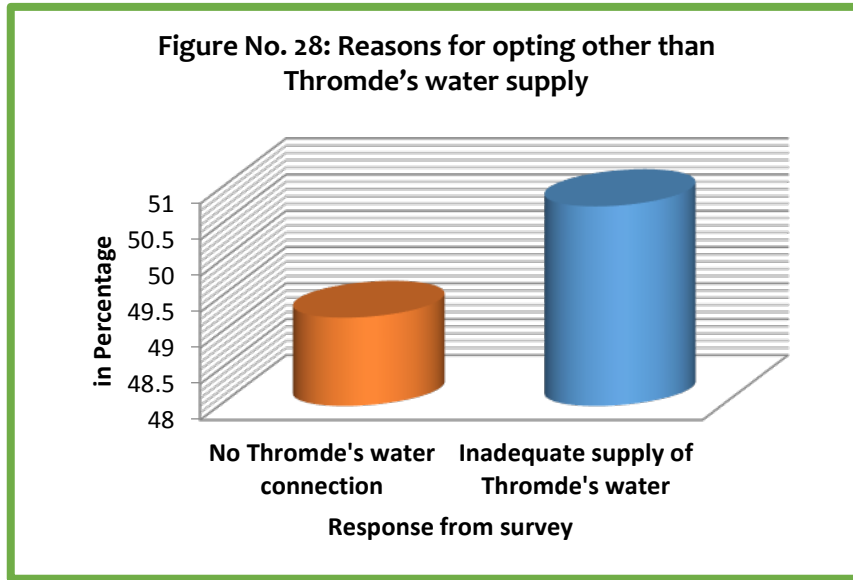
3.2.3.12 Prevalence of drinking water connections from private and community obtained sources

The residents in Thimphu Municipality currently get water supply from three sources viz. Thromde's water supply, privately and community obtained water supply. Some residents just have one of the three water connections while the others have combination of either two or all three connections as depicted in Figure No. 27.



The Section 90 of the Water Regulation of Bhutan 2014 stipulates, “The Thromde water supply system will be the only source of potable water supply system within Thromde’s jurisdiction unless this is technically not feasible. All other water supply connections will be discontinued when the Thromde supplies adequate water”.

This provision underscores Thimphu Thromde to provide adequate water supply to its population in order to discontinue private and community water connections. However, the RAA noted that the Thimphu Thromde was not able to provide adequate water supply in several areas of the Municipality and could not supply water in Dechencholling, Taba, Samtenling and Pamtsho. For these reasons, people continue to have private and community water supply connections and for the same reasons, the Thromde’s management is not able to discontinue private and community water connections. Even the survey conducted by the RAA among the residents in Thimphu Municipality indicated inadequacy of Thromde’s water supply as the main reason for having private and community water connections as depicted in Figure No. 28.



Although it is important for the Thromde to phase out the private and community water supply in a systematic and planned manner, the Thromde had not carried out any study and developed plan on how and when to discontinue private and community water sources. Without such plan, it would be difficult to completely phase out private and community water connections.

On the other hand, allowing private and community water connections will further encourage new aspirants leading to more inequity in water supply, low quality drinking water and loss of revenue from water services.

CHAPTER 4: RECOMMENDATIONS

Based on the deficiencies and lapses pointed out in chapter 3, and notwithstanding the initiatives being undertaken through the World Bank funded project for a centralized water supply from Dodena, the RAA has formulated the following recommendations which are aimed at enhancing economy, efficiency and effectiveness in provision of drinking water in Thimphu Municipality.

4.1 Thimphu Thromde should provide reliable and equitable water supply to its population

Analyzing the water received in each zone of Thimphu Municipality as against the required amount, it was noted that the zones received varying amount of drinking water ranging from 28% to 94% of the requirement depicting inequity in water supply. Further, some areas do not have Thromde's water connection at all despite having enough water produced to meet the required amount of water. The RAA also noted inadequate storage capacity of service tanks leading to water shortages in certain areas.

Therefore, Thimphu Thromde should develop a strategic water distribution plan considering the size and density of population, area and different user groups to ascertain the amount of water supply required for each zone in order to ensure reliable and equitable drinking water. Thromde should also construct adequate numbers of service tanks proportionate to water requirement.

4.2 Thimphu Thromde should establish a robust system to monitor and supervise the water distribution network

Absence of monitoring system for water sources and the distribution network has led to huge loss of water, water revenue and interruption in water supply.

To ensure quality and reliable supply of drinking water and also to control water loss in the water distribution network, there should be robust monitoring system established for water distribution networks. The Thromde should come up with components of monitoring system such as monitoring standards and protocol, formation of monitoring team, schedule and reporting, etc. to have established system in place.

4.3 Thimphu Thromde should maintain and safeguard water distribution network

Several inadequacies were noted in the water distribution network relating to infrastructure and water protection such as inappropriate laying of water distribution pipes and Installation of water meters , improper fencing at water source and service tanks and non-functional bulk meters .

In order to address the inadequacies noted, Thimphu Thromde should develop blue print of water network system, conduct periodic maintenance of water distribution network infrastructure and develop guidelines on water meter installation.

4.4 Irregularities noted in water network system should be corrected

Instances of irregularities such as unauthorized tapping of water, water connection bypassing meters, water connection from transmission lines, allowing more than one connection per dwelling and diversion of water supply to community tanks were noted in the process of audit.

Thimphu Thromde should further investigate and take appropriate action immediately. In addition, the Thromde should also institute corrective measures in order to prevent such cases in the future.

4.5 Thimphu Thromde should develop comprehensive and accurate database on buildings and water meters

Maintaining a comprehensive and up to date database on property holdings and issuance of water meters within the Municipality's jurisdiction is very crucial for the Thromde to levy correct property taxes and water charges as mandated by law.

Maintaining comprehensive and accurate database will not only help Thimphu Thromde to determine the actual number of water meters connected and those buildings that need to be connected. In addition, it will also help in assessing Thromde's water coverage and proper accounting of water consumption and water revenue. This in turn would help the Thromde in effective planning and decision making in water supply management. Thus Thimphu Thromde should develop comprehensive and accurate database on building and water meters.

4.6 Thimphu Thromde should develop clear job roles and responsibilities for the officials working in Water Supply Section

To ensure efficient and effective delivery of mandates of organization, divisions and sections should clearly understand their roles and responsibilities. There should be formal instructions for all units in the organization on how businesses are to be conducted. It shall be the collective responsibility of officials in the organization to facilitate achievement of organizational goal.

Thimphu Thromde should develop clear job roles and responsibilities for each position in Water Supply Section with accountability to address many inadequacies noted in this audit such as ineffective monitoring of the water network system, delay in providing water related services, inefficiency in addressing complaints, inadequacies in monitoring of water quality, etc.

4.7 Water meter needs to be installed for every water connection provided by Thromde and accordingly charged

Thromde's drinking water supplied to Babesa, Lungtenphu and Olakha from Megaypang water treatment plant since November 2014 was never charged. Furthermore, commercial car washing units did not have water meters installed despite having Thromde's water supply. As a result, there was a loss of government revenue amounting to Nu. 20.37 million.

Thimphu Thromde should ensure to install water meter for every water connection provided and also justify for the forgone revenue.

4.8 Thimphu Thromde should provide adequate water supply in order to discontinue private and community connections

The residents in Thimphu Thromde currently gets water supply from three sources viz. Thromde's water supply, privately and community obtained water supply. Some residents just have one of the three water connections while the others have combination of two or all three of them.

As per the section 90 of the Water Regulation of Bhutan 2014, Thromde's water supply should be the only source of portable water supply and all other water supply should be discontinued when Thromde supplies adequate water. Therefore, the Thromde should have plans to provide adequate water supply to all and eventually discontinue the private and community water supply connections. Further, quality of drinking water from the private and community source are grossly polluted, thus the concerns for human health also warrant discontinuation.

4.9 Coordination amongst the relevant agencies and authorities should be strengthened

The Water Act of Bhutan 2011 envisions the holistic management of water resources requiring collaboration and cooperation of all key stakeholders for making informed decision on water and its development. The main agencies involved in provision of drinking water in Thimphu Municipality include Ministry of Works and Human Settlement (MoWHS), Ministry of Health (MoH), National Environment Commission Secretariat (NECS), and Thimphu Thromde.

Recognizing the importance of effective coordination, National Environment Commission formed the National Water Resources Board (NWRB) comprising of all the stakeholders. Since NWRB was inactive from 2014, the NECS should initiate to revive the NWRB and ensure they function as per the Water Regulation of Bhutan 2014.

4.10 The Ministry of Works and Human Settlement (MoWHS) should develop the master plan for drinking water supply

As required by the Water Regulation of Bhutan 2014, the MoWHS should develop master plan for the national drinking water and waste water management system for Thromde in consultation with local government in order to identify available options to ensure sufficient water for future generations. The plan would also provide clear strategic direction and holistic approach in the management of water supply system in the country.

4.11 The National Environment Commission Secretariat (NECS) should finalize the Water Resources Inventory at the earliest

Water Resources Inventory is the study carried out on the availability of water from different sources and its quality aspects. Having water resources inventory would help in providing information in proper allocation of water from various sources to meet the current and future water needs. Till the date of audit, the inventory on water resources conducted by the NECS was found to be in the draft form. Thus, the NECS should immediately finalize the Water Resources Inventory.

4.12 Thimphu Thromde and the Royal Centre for Disease Control (RCDC) should ensure routine testing of the water quality

The Thromde does not carry out the water quality tests on regularly basis especially in the south Thimphu. Further, there was no test conducted for the private and community water supply by the Thromde, except for few tests in schools and institutes by Royal Centre for Disease Control (RCDC). Absence of regular testing could lead to provision of unsafe drinking water which in turn could trigger outbreak of water-borne diseases.

Therefore, the Thromde and the RCDC should institute system to conduct water quality testing regularly as required by the WSP to ensure that the water supplied is safe at all times. Special attention should be given to test the water quality of schools, institutes and hospitals irrespective of the water supply source.

4.13 Thimphu Thromde in collaboration with the Royal Centre for Disease Control (RCDC) should institute monitoring and reporting mechanism on water quality

The report on the water quality tests conducted by technicians was neither monitored nor the result was submitted for review. Furthermore, there was no action taken on the test results despite showing high presence of faecal coliform and residual chlorine. In absence of monitoring and reporting mechanism, appropriate treatment and timely actions cannot be taken if the water is contaminated.

Therefore, Thromde in collaboration with RCDC should institute proper monitoring and reporting mechanism on water quality.

4.14 Thimphu Thromde should strengthen the storage facilities for water treatment chemicals

It was observed there was lack of proper storage facilities for the chemicals used for water treatment, thereby deteriorating the chemical stability by exposing to direct sunlight. In some cases, it was also found stored at Caretakers' house posing risks to the families' of the caretakers.

Therefore, Thimphu Thromde should have appropriate storage facilities for the chemicals.

4.15 Thromde should ensure that expiry and manufactured dates are labeled on the chemicals/reagents and refrain from using expired chemicals

It was observed that most disinfectants and chemicals used for water treatment and quality testing were not labeled with expiry and manufactured dates. In the case of Megaypang WTP, expired reagents were used for water quality testing. The expired reagents could lead to generation of wrong reports and it may not have the intended potency to affect the level of contamination in the water.

Therefore, the Thromde should ensure that the expiry and manufactured dates are labeled on the disinfectants and reagents and refrain from using expired reagents.

CHAPTER 5: CONCLUSION

There are strong legal frameworks governing water resources in the country. The Water Act of Bhutan 2011, Water Regulation of Bhutan 2014 and Bhutan Drinking Water Quality Standard 2016 require and guide all the relevant stakeholders in managing water resources efficiently and effectively at the National as well as local level.

Despite having strong legal framework on water resources management and explicitly stating, “every individual shall have access to safe, affordable and sufficient water for basic human needs” in the Water Act of Bhutan 2011, the RAA observed several management deficiencies in managing the water network system in Thimphu Municipality, where improvements are desirable. Thimphu Thromde being the main agency in provision of drinking water in Thimphu Municipality, the observations mostly pertain to Thimphu Thromde.

The assessment and analysis of water sources showed that currently there is enough water produced from water treatment plants and Bore-wells to meet the water demand of the residents of Thimphu Municipality. Nevertheless, the residents do not receive safe, adequate, reliable and equitable drinking water due to inefficiencies and ineffectiveness of Thimphu Thromde and other relevant agencies in the field of governance and management of drinking water.

There was weak coordination amongst the agencies involved in water management and the National Water Resource Board (NWRB) steering coordination amongst relevant agencies was not functional. There was no water supply master plan and water resources inventory developed to guarantee sustainable water in future. There was no adequate building inventory or required details on the consumers to ascertain the number of beneficiaries and validate water revenue earned. Further, there were several irregularities observed in management of water distribution and water quality due to absence of defined roles and responsibilities of the employees working in Water Section, lack of monitoring and supervision of the water distribution network and inadequacies in the water supply network infrastructure. The RAA also observed that water supplied by Thimphu Thromde was not adequate in most of the areas and few areas under the jurisdiction of Thimphu Thromde did not even have Thromde’s water connection creating inequity amongst the residents. As a result, these people have resorted to community and privately obtained water supply connections.

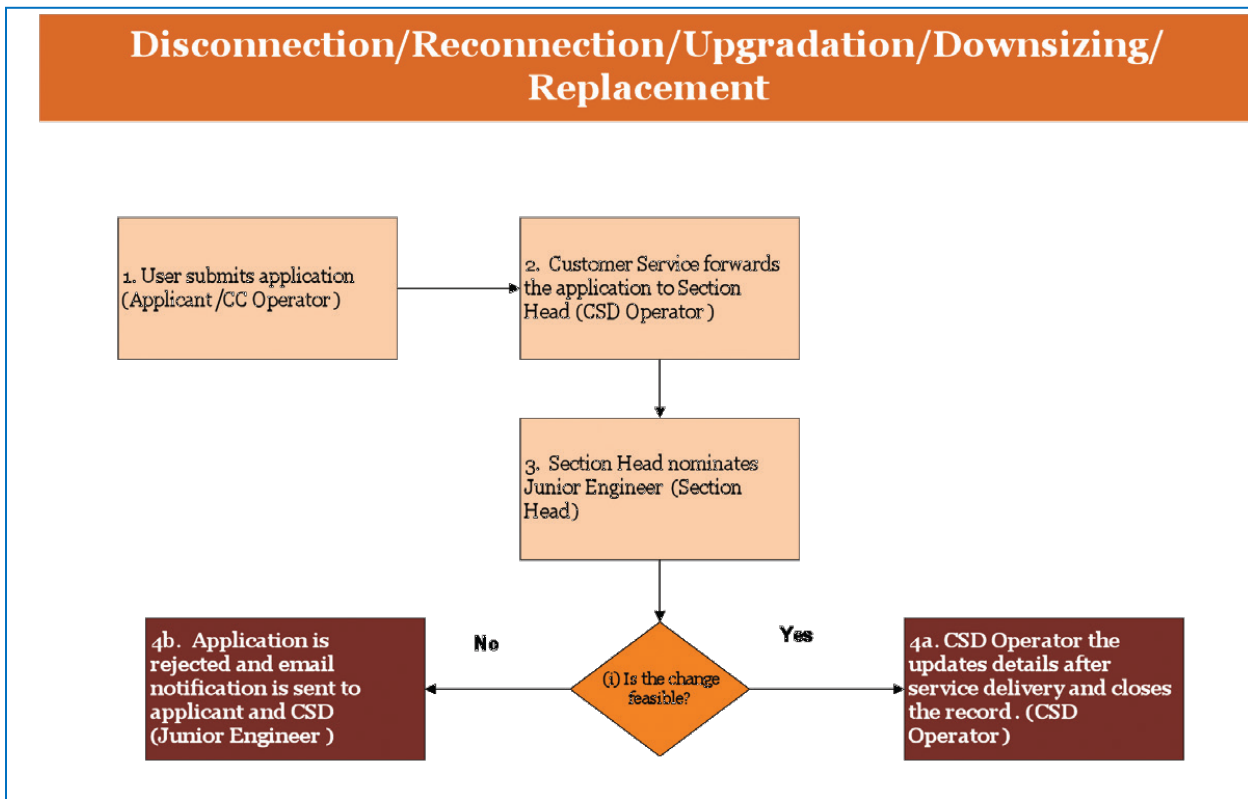
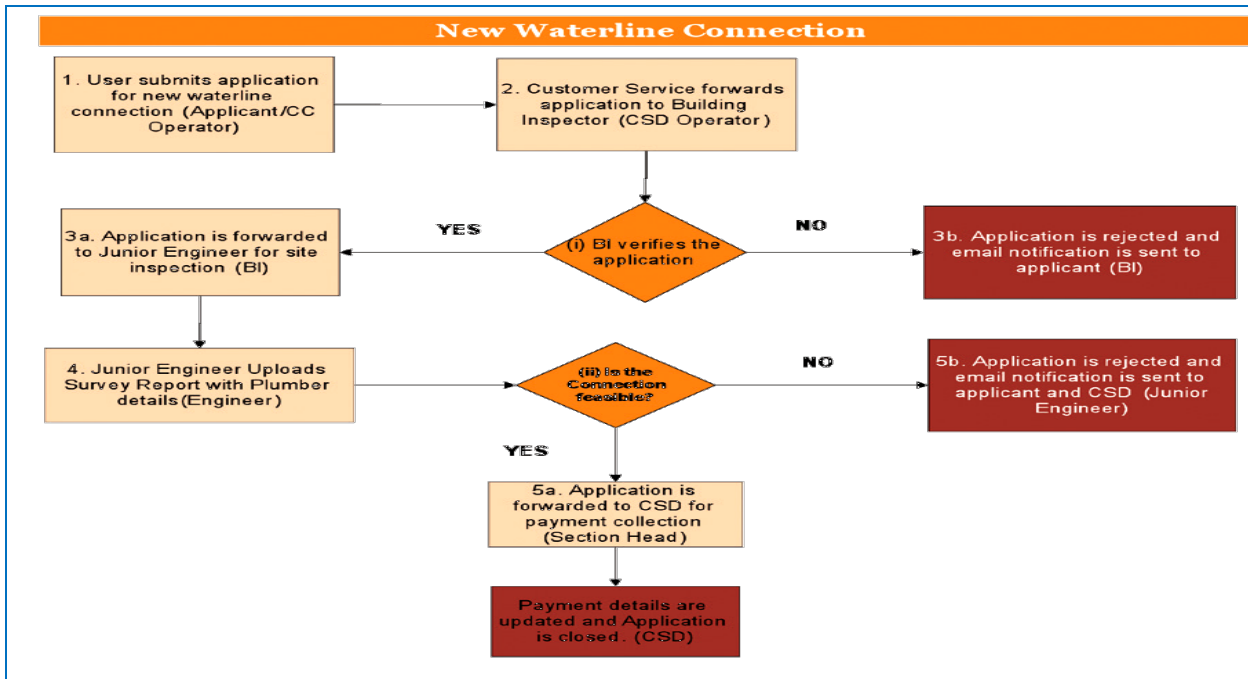
Although, there were problems with regard to water quality of the Thromde’s water supply, the quality of the water supplied by Thromde was far better than community and privately obtained water supply. Low water quality of the community and privately obtained water is a serious issue considering the fact that there is a huge chunk of Thimphu Municipality’s population drinking community and privately obtained water.

Although, the irregularities and inadequacies in the management and implementation of tasks related to provision of drinking water in Thimphu Municipality has led to serious issues, the RAA hopes that Thimphu Thromde and related stakeholders will enhance efficiency and effectiveness considering the fact that lapses are fixable.

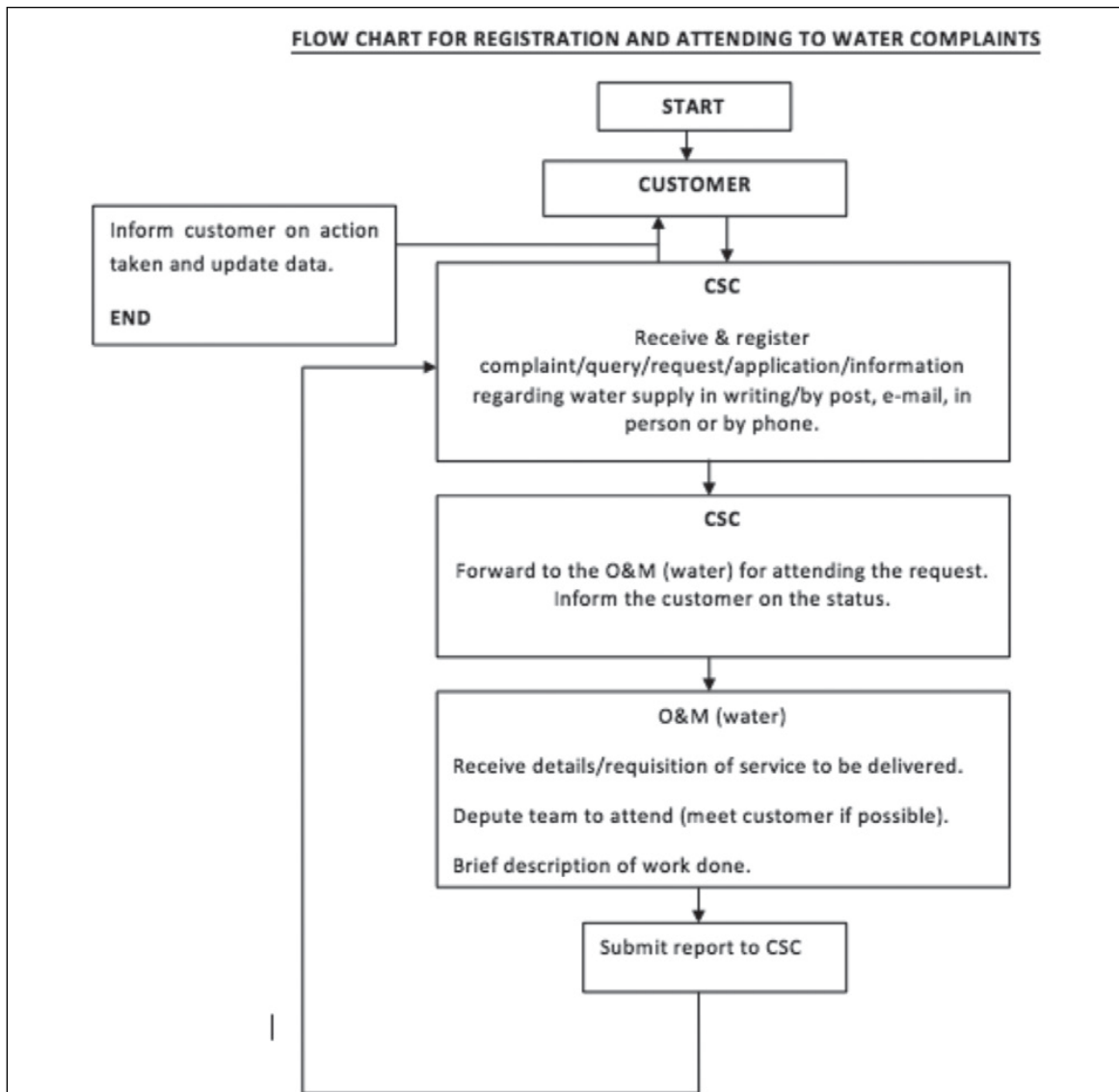
ANNEXURES

Water treatment plants and areas receiving water supplies from Thimphu Thromde

Sl. No.	Name of the water treatment plant & its capacity	No. of service tanks x capacity (m ³)	Total capacity of the service tanks (m ³)	Location of service tank	Areas of water distribution
1	Megaypang water treatment plant: 6,500 m ³ /day of actual capacity and operating capacity. Borehole: Actual capacity is 500 m ³ /day and operating capacity is 350 m ³ /day	2x375	750	Babesa	Babesa LAP
		1x735	735	Semtokha	Semtokha LAP
		2x375	750	Lungtenphu	Lungtenphu LAP
		2x250	500	Changbangdu	Changbangdu LAP
		2x100	200		Upper & Lower Changzamtok
Total			2,935		
2	Dechencholing water treatment plant : Actual capacity is 1400 m ³ /day and operating capacity is 640 m ³ /day	2x320	640	Dechencholing	Dechencholing LAP
Total			640		
3	Jungshina water treatment plant with 5,000 m ³ /day actual capacity and also operating capacity & Borehole : Actual capacity is 500 m ³ /day and operating capacity is 750 m ³ /day	2x150	300	Changjiji	Changjiji
		1x320	320	BCCI Office	Sunday Market & Chubachu
		1x230	230	Langjophaka	Upper and Lower Langjophaka
		1x250	250	TashiChho Dzong (Zhilukha)	Dzong Area, RCSC Secretariat and Hejo, Crematorium
		2x230	460	Swimming Pool	Changjiji, Hongkong Market, Norzin Lam and Chang Lam
Total			1,560		
4	Motithang water treatment plant :Actual capacity is 6,500 m ³ /day and operating capacity is 7,500 m ³ /day	2x320	640	Kuengachholing	Balancing Tanks including Kawajangsa
		3x320	960	Motithang	RICBL Tank, Hospital Tank, Changangkha and area above Noebum Lam
		1x225	225	JDWNR Hospital	Hospital
		1x125	125	JDWNR Hospital	Hospital and parts of Changzamtok
		1x320	320	RICB Colony	TT office area, Norzin Lam and HongKong Market
		1x230	230	Changgedaphu	Changgedaphu and Changzamtok
		1x320	320	YHS area	YHS area
			2,820		
Total from service tanks			7,955		



Note: The standard Turn Around Time (TAT) for services is 3 to 7 working days



Note: The standard Turn Around Time (TAT) for addressing complaint is 1 hour.

Detailed workout of population by Zone

Zone	Places	Total household as per the NSB	Average household size (as per Bhutan Living Standards Survey 2012 Report)	Population
I	Upper and Lower Motithang	3,962	4.30	17,037
II	YHS and Lungtenzampa	2,416	4.30	10,389
	Kawangjansa and Zhilukha			
	Hejo, Dzong and High Court area			
	Langjophakha area			
III	Changzamtog above ring road and Changbangdo area	7,136	4.30	30,685
	Changzamtog, Hospital and Changgedaphu area			
	Changjiji pvt. Area			
	NPPF colony and above NPPF colony area			
IV	Sunday market and Chubachu area	1,529	4.30	6,575
V & VII	Below Doebum lam, IMTRAT and Hongkong Market area	1,175	4.30	5,053
VI	Core area along Norzin Lam	1,845	4.30	7,934
VIII	Changjiji (NHDC) Colony	726	4.30	3,122
Grand Total		18,789	4.30	80,793

Note: Population considered is only those connected with Thimphu Thromde's drinking water

*Annexure II***The workout on water consumption for selected months in year 2016**

Zone	Months	Qty. (m3)	Qty. (m3)
I	January	79,166.00	262,582.00
	April	96,905.00	
	June	86,511.00	
II	January	23,916.00	47,055.00
	April	1,839.00	
	June	21,300.00	
III	January	116,163.00	219,190.00
	April	44,048.00	
	June	58,979.00	
IV	January	25,524.00	68,483.00
	April	20,304.00	
	June	22,655.00	
V	January	16,029.00	39,340.00
	April	10,970.00	
	June	12,341.00	
VI	January	41,651.00	109,151.00
	April	38,876.00	
	June	28,624.00	
VII	January	12,852.00	35,514.00
	April	12,307.00	
	June	10,355.00	
VIII	January	-	25,085.00
	April	25,085.00	
	June	-	
Grand Total			806,400.00

**List of dwelling having more than one Thromde's water connection:
YHS and Agriculture Colony**

Sl. No.	Account No.	Name	Meter No.	Remarks
1	Z2-126	Tenzin Dem	87688964	Same building
	Z2-513	Karma Tshering	140715000015	
2	Z2-87	Kunga Namgay	5380435	Same building
	Z2-89	Kinley Yangden	452006013	
3	Z5-7	Karma Dolkar	B07N006268	Same building
	Z5-14	Jamba	140715000162	
	Z5-241	Jamphal	B08N003478	
4	Z5-80	Aum Sangchung	A05N17625	
	Z5-81	Aum Sangchung/Pasang Dorji	87685719	
5	Z5-82	Phub Bidha	B07N006300	
	Z5-83	Phub Bidha	87688455	
6	Z5-107	Tshering Yangki	B07N006191	
	Z5-252	Tshering Yangki	5380250	
Honkong Market and Indian House				
Sl. No.	Account No.	Name	Meter No.	Remarks
7	Z7-1	Dema	40169458	
	Z7-41	Dema	B07N006134	
8	Z7-36	Chimi Wangmo	B05N002210	Same building
	Z7-37	Choden	B05N002209	
9	Z7-42	Sportless	B05N002176	Same building
	Z7-81	Kinga Tshering	B05N102066	
10	Z7-44	Yedzeen Guest House	B08N003433	Same building
	Z7-66	Chimi Wangmo	87692044	
11	Z7-59	Kinley Tshering	5380016	Same building
	Z7-94	Thuji Dorji	87685577	
	Z7-161	Deki Wangmo	B07N006343	
12	Z7-78	Kipchu Tshering	87686180	
	Z7-87	Kipchu Tshering	87688423	
	Z7-177	Kipchu Tshering	4838426	
13	Z7-82	Ngawang Choden	87688997	
	Z7-158	Ugyen Pelden & Ngawang Choden	452001986	
14	Z7-89	Dechen Zam	B0N7006249	
	Z7-97	Dechen Zam	87684407	
15	Z7-92	Gyeltshen Tobgay	87686026	
	Z7-93	Gyeltshen Tobgay	87689118	
	Z7-142	Gyeltshen Tobgay	538031	
16	Z7-123	Lhamo	A0905053	
	Z7-180	Lhamo	5380459	
17	Z7-126	Bhutan Hotel Pvt. Ltd	5380403	
	Z7-175	Bhutan Hotel Pvt. Ltd	1219220023	

18	Z7-102	Dorji	128018658	Same building
	Z7-104	Gawa Dorji	87686147	
19	Z7-108	Dasho Nob Tshering	87686176	
	Z7-165	Dasho Nob Tshering	87689329	
20	Z7-127	Tshering Sherpa	87688992	
	Z7-128	Tshering Sherpa	86785778	
21	Z7-131	Pem Zam	23960309	
	Z7-132	Pem Zam	23960370	
	Z7-133	Pem Zam	31915872	
	Z7-134	Pem Zam	31915875	
	Z7-135	Pem Zam	31915873	
	Z7-136	Pem Zam	31915874	
	Z7-137	Pem Zam	05A110808	
22	Z7-144	Nim Pem	87691686	
	Z7-150	Nim Pem	452001900	
23	Z2-143	Dasho Ugyen Dorji	87690030	
	Z2-258	Dasho Ugyen Dorji	87685171	
24	Z2-368	Hotel River View	37102656	
	Z2-171	Hotel River View	87686174	
25	Z2-266	Wangchuk Namgyel	B011N002201	Same building
	Z2-494	Sakila Chhetri	B11N002246	

Above NPPF Colony

Sl. No.	Account No.	Name	Meter No.	Remarks
26	Z3-211	Dr. Tandin Dorji	87692110	
	Z3-212	Dr. Tandin Dorji	87692175	
	Z3-213	Dr. Tandin Dorji	87692175	
	Z3-214	Dr. Tandin Dorji	87691196	
	Z3-215	Dr. Tandin Dorji	87690342	
	Z3-216	Dr. Tandin Dorji	87690337	
	Z3-217	Dr. Tandin Dorji	78691149	
	Z3-218	Dr. Tandin Dorji	87691134	
27	Z3-312	Mr. Gyeltshen	87691131	
	Z3-313	Mr. Gyeltshen	87691137	
	Z3-314	Mr. Gyeltshen	87691120	
	Z3-315	Mr. Gyeltshen	78691147	

Core Area and Norzin Lam

Sl. No.	Account No.	Name	Meter No.	Remarks
28	Z6-03	Jamyang Choden	452001987	
	Z6-22	Jamyang Choden	45200189	
29	Z6-04	Aum Nima Om	451005956	
	Z6-142	Aum Nima Om	B11N02210	
30	Z6-27	Tarayana Handicraft	87689102	
	Z6-17	Tarayana Handicraft	87689270	

31	Z6-28	Y.D.F	8768447	
	Z6-31	Y.D.F	87688893	
32	Z6-40	Mr. Lham	87684158	
	Z6-108	Mr. Lham	451006088	
34	Z6-54	Pemaling Hotel	14071500001	Same building
	Z6-55	Thinley Tshering	87690278	
Changzamtok and Changbandu				
Sl. No.	Account No.	Name	Meter No.	Remarks
35	Z3-2416	Deki Pelden	5380429	Same building
	Z3-396	Chimi Dema	5380711	
	Z3-416	Deki Pelden		
	Z3-416	Deki Pelden	5380714	
	Z3-605	Deki Pelden	140715000109	
36	Z3-598	Mani Gyeltshen	A0906028	
	Z3-377	Mani Gyeltshen	3772181	
37	Z3-405	Kaly Tshering	3770379	
	Z3-527	Kaly Tshering	451005986	
38	Z3-882	Zeko	B07N006207	Same building
	Z3-974	Dochu	3710035	
	Z3-2363	Dochu	2012A2147192	
	Z3-820	Dochu	B05N002235	
39	Z3-181	Tshering Pem	B07N006159	
	Z3-182	Tshering Pem	A0906099	
	Z3-925	Tshering Pem	B08N003623	
40	Z3-172	Mr. Dorji	5380264	Same building
	Z3-175	Aansari	5380361	
41	Z3-828	Karma Dorji	B07N006124	
	Z3-870	Karma Dorji	A06N036953	
42	Z3-883	Tshering Lhamo	140715000222	
	Z3-760	Tshering Lhamo	A06N003988	
43	Z3-466	Yeshey Bidha	3710192	Same building
	Z3-857	Pem Zangmo	A0905023	
44	Z3-620	Chencho Pem	B05N002206	Same building
	Z3-874	SoNAM zam	3710133	
45	Z3-541	Gangchuk Drukpa	A06N036989	
	Z3-807	Gangchuk Drukpa	B05N002019	
46	Z3-412	Lotoe	87690422	Same building
	Z3-439	Dago Tshering	8613946	
	Z3-915	Thinley Gem	A10N623492	
47	Z3-427	Tashi	140715000186	Same building
	Z3-428	Sonam Zangmo	87686094	
48	Z3-421	Namgye Nidup	87690820	
	Z3-953	Namgye Nidup	B08N003592	

49	Z3-383	Nark Kamo	87691683	Same building
	Z3-604	Tshering Dorji	451005960	
50	Z3-979	Kinley Gyeltshen	3710359	Same building
	Z3-2395	Pelden	5380247	
51	Z3-324	Namgay Lhamo	B07N006089	same building
	Z3-1057	Dorji	B11N002206	
52	Z3-864	Aum Rinzin	3710450	
	Z3-926	Aum Rinzin	B07N006336	
	Z3-2115	Aum Rinzin	5380192	
53	Z3-37	Tshering Tenzin	B05N001961	
	Z3-2340	Tshering Tenzin	4638268	
54	Z3-832	Tenzin Dema	A06N036991	
	Z3-2117	Tenzin Dema	A10N623545	
55	Z3-470	Tashi Mo	3710220	
	Z3-787	Tashi Mo	B05N00195	
56	Z3-376	Chador Wangdi	5380118	
	Z3-1019	Chador Wangdi	A0905049	
57	Z3-400	Tshering Lhamo	B05N002093	Same building
	Z3-2335	Tashi Lhamo	3710146	
58	Z3-414	Tashi Dorji	87691085	
	Z3-2381	Tashi Dorji	14071000149	
59	Z3-389	Dawa Gyelmo	87690418	
	Z3-603	Dawa Gyelmo	B08N004004	
60	Z3-403	Chencho Dorji	452002033	
	Z3-658	Chencho Dorji	B08N003564	
	Z3-796	Chencho Dorji	B05N002247	
61	Z3-332	BT Dorji	B07N006209	
	Z3-437	BT Dorji	A06N037266	
62	Z3-374	Ugyen Dema	B07N006164	Same building
	Z3-814	Kezang Yuden	B05N001976	
63	Z3-443	Aum Gyem	140715000026	Same building
	Z3-542	AP chendra	5380244	
64	Z3-970	Dr. Tashi	A10N623488	
	Z3-2331	Dr. Tashi	3710141	
	Z3-2332	Dr. Tashi	3710144	
65	Z3-415	Chencho Wangdi	B07N006167	
	Z3-840	Chencho Wangdi	A05N176685	
66	Z3-839	TSHI gyeltshen	4638425	
	Z3-881	TSHI gyeltshen	B07N006116	
67	Z3-623	Rinchen DORJI	B07N006064	Same building
	Z3-822	Thinley Dorji	3710056	
68	Z3-1032	Dawa Lhamo	A0906014	Same building
	Z3-2425	Karma Dolkar	5380049	
69	Z3-325	Lam Taki	B06N003619	Same building

69	Z3-847	Penjore	B08N003612	Same building
70	Z3-327	Tshering Zam	5380258	Same building
	Z3-916	Pema Khandu	b07n00658	
71	Z3-609	Phub Dendup	140715000265	Same building
	Z3-966	Dawa Tshering	B08N003456	
72	Z3-854	Kinzang Lhamo	87685159	Same building
	Z3-914	Desang Dorji	3710425	
	Z3-1035	Tshering Dema	B11N002150	
73	Z3-119	Tshering Tshom	B07N006189	
	Z3-1031	Tshering Tshom	B11N002180	
74	Z3-526	Karchung Dorji	B08N004001	
	Z3-786	Karchung Dorji	B05N002230	
75	Z3-790	Karma Chko	B05N002249	Same building
	Z3-791	karma peki	B05N002250	
76	Z3-661	Chimi Wangm	B05N002061	
	Z3-951	Chimi Wangm	B07N006261	
77	Z3-632	Aum Pem Zam	B07N006331	
	Z3-948	Aum Pem Zam	B05N002020	
78	Z3-431	Chegay Penjire	B07N006200	
	Z3-831	Chegay Penjire	B05N002271	
79	Z3-681	Dago Bidha	B05N002137	
	Z3-994	Dago Bidha	B08N003486	
80	Z3-756	Sangay Tenzin	B07N006165	Same building
	Z3-1047	Sonam Dorji	B11N002272	
81	Z3-649	Chador Wangdi	3710264	
	Z3-2400	Chador Wangdi	5380538	
82	Z3-78	Dawa Gyelmo	3710188	
	Z3-1029	Dawa Gyelmo	3710286	
83	Z3-6	Dendup	5380304	
	Z3-665	Dendup	B11N002333	
84	Z3-617	Karma dema	3710444	
	Z3-2353	Karma dema	4638402	
85	Z3-784	Tshering Yangzom	147185	
	Z3-2426	Tshering Yangzom	5380046	
86	Z3-834	Ngawang Dorji	B05N002050	
	Z3-2354	Ngawang Dorji	147131	
87	Z3-766	Tashi Wangchuk	3710010	
	Z3-843	Tashi Wangchuk	3710008	
88	Z3-863	Choki	3710424	Same building
	Z3-1045	Ugyen Norzang	B11N002269	
89	Z3-1030	Jabla	B11N002366	
	Z3-2402	Jabla	5380532	
	Z3-2418	Jabla	5380674	

Chubachu, Sunday Market and RAPA

Sl. No.	Account No.	Name	Meter No.	Remarks
90	Z4-29	Yeshe Lham	451006146	
	Z4-475	Yeshe Lham	87686008	
91	Z4-10	Aum Dechen Choden Dorji	8768126	
	Z4-959	Aum Dechen Choden Dorji	BO7N006273	
92	Z4-8	Anday Kam	87690080	
	Z4-456	Anday Kam	87688718	
93	Z4-14	Dasho Sangay Rinzin	87685970	Same building
	Z4-473	Dasho Sangay Rinzin	87688930	
	Z4-80	Sonam Deki	87691124	
94	Z4-33	Chim Pwangdi	BO7N006113	Same building
	Z4-389	Tshering Wangdi	87688116	
95	Z4-33	Namgay Wangchuk	3710442	
	Z4-77	Namgay Wangchuk	BO7N006193	
96	Z4-41	Zaw Kuenga	87688597	
	Z4-504	Zaw Kuenga	5380018	
97	Z4-48	C.F.M	BO8N003637	
	Z4-964	C.F.M	3710352	
98	Z4-54	Pempa Gyektshn	BO5N002003	Same building
	Z4-491	Lyonpo Dawa Tshering	87686046	
99	Z4-55	Dasho Ugyen Dorji	B11N002152	
	Z4-973	Dasho Ugyen Dorji	140715000230	
100	Z4-78	Muesum BDG	B11N002172	Same building
	Z4-974	School BDG	B11N002298	
101	Z4-81	Dophu & Lhamo	3710247	Same building
	Z4-481	Ap Dophu Drukpa	BO8N004000	
102	Z4-393	Deki Wangmo	BO5N002215	
	Z4-394	Deki Wangmo	87685806	
103	Z4-409	Natu Tenxin	87684322	Same building
	Z4-997	Tenzin Norbu	140715000010	
104	Z4-458	Yuden Dorji	87691966	
	Z4-459	Yuden Dorji	87684064	
105	Z4-470	Sangay	87685721	
	Z4-07	Sangay	87680080	
106	Z4-471	Gyem Dorji	451006138	
	Z4-972	Gyem Dorji	B11N002170	
107	Z4-474	Tandin Dorji	87684645	Same building
	Z4-989	Sangay Wangmo	3710096	
108	Z4-482	Am Nidup	AO905037	
	Z4-483	Am Nidup	AO905099	
109	Z4-487	Dorji Gyeltshen	3710270	
	Z4-995	Dorji Gyeltshen	5380193	
	Z4-492	Kencho Tshering	451006036	

110	Z4-993	Ugyen Wangchuk	46384822	Same building
111	Z4-505	Tshering Bidha	87688416	Same building
	Z4-986	Tandin Dorji	147158	
112	Z4-511	Ugyen Pem	B11N002161	
	Z4-30	Ugyen Pem	87685639	
113	Z4-951	Sonam	87685967	Same building
	Z4-502	Aum Mindu	87689066	
114	Z4-994	Samdrup Norbu	5380245	
	Z4-1005	Samdrup Norbu	5380372	
115	Z4-15	C. Tshering	BO5N002106	Same building
	Z4-391	C. Lhamo & C. Gemo	87684190	
116	Z4-22	Karma Gelay	452001909	
	Z4-23	Karma Gelay	452001906	
117	Z4-56	Ngajor Gomdey	5380259	
	Z4-990	Ngajor Gomdey	3710190	
118	Z4-61	Kuenzang	B05N002082	Same building
	Z4-98	App Jaga	87686087	
119	Z4-74	Dophu Tshering	BO7N006101	Same building
	Z4-421	Dasho Dophu	87688923	
120	Z4-419	Dago	5380613	
	Z4-1007	Dago	53806011	
121	Z4-472	Jatuu Sawmil	5429590	Same building
	Z4-998	Jattu Drukpa	5380200	

Upper and Lower Motithang

Sl. No.	Account No.	Name	Meter No.	Remarks
122	Z1-57	Dasho Sonam Tobgay	87689000	
	Z1-58	Dasho Sonam Tobgay	87686129	
123	Z1-2037	Rinzin Wangmo	5193260497	Same building
	Z1-560	Dasho Tashog Phuntsho	87685686	
124	Z1-144	Kezang Choejoe	AO7N006255	
	Z1-143	Kezang Choejoe	87685440	
	Z1-307	Kezang Choejoe	87685177	
125	Z1-2385	Karma Yonten	147138	
	Z1-2386	Karma Yonten	147130	
	Z1-2387	Karma Yonten	147143	
126	Z1-4	Mrs. Chimi Dema	87685349	
	Z1-5	Mrs. Chimi Dema	3710377	
127	Z1-17	Mrs. Sonam Choden	87684424	
	Z1-426	Mrs. Sonam Choden	87686599	
128	Z1-355	Karma Galley & Karma Yuden	B07N006105	
	Z1-562	Karma Galley & Karma Yuden	BO5N001946	
129	Z1-251	Tshering Tobgay	87688523	
	Z1-2389	Tshering Tobgay	146362	

130	Z1-513	Lham Nidup	451005998
	Z1-514	Lham Nidup	451005994
	Z1-515	Lham Nidup	451005999
	Z1-516	Lham Nidup	451005992
131	Z1-484	Kinzang Namgay	87685131
	Z1-2421	Kinzang Namgay	5380422
132	4 & 5	Chimi Dem	87685349
		Chimi Dem	3710377
133	22 & 23	Lyonpo Om Pradhan	87685213
		Lyonpo Om Pradhan	87685315
134	175 & 136	Dorji Gyeltshen	130714006076
		Dorji Gyeltshen	87691064
135	533 & 409	Ugyen Dorji	380691
		Ugyen Dorji	30913589
136	97 & 111	Bartsham Mani Dorji	3710199
		Bartsham Mani Dorji	3710200

Annexure IV

List of car washing units and their water connections

Sl. No.	Name of Establishment	Name of Area	Type of water connection	Water Meter No.	Water meter connection date	Remarks
1	Lotus Car Wash	Babesa	Thromde and Private Connection	No meter connected	Nil	based on license issued date.
2	Penchu Car Wash	Babesa	Thromde and Private Connection	3710140	17.03.2014	Issued in name of Ms. Namgay Om
3	Passang Water Servicing & Spa	Babesa	Thromde and Private Connection	5380327	03.10.2015	
4	Yarkhal Car Wash	Babesa	Thromde and Private Connection	5380248	19.06.2015	
5	Honda Car Wash	Babesa	Thromde and Private Connection	5380199	12.05.2015	
6	Dargyaling Car Wash/ Carzsps	Babesa	Thromde Connection	140715000096	04.05.2015	
				5380198	19.05.2015	
7	ST Car Wash	Babesa	Thromde and Private Connection	2012A2/1471194	07.08.2014	
8	Xpress Car Wash	Bebasa	Thromde and Private Connection	5380324	01.10.2015	
9	Jungshep Car Wash service	Hejo	Thromde and Private Connection	5380697	10.09.2015	
10	M/s Wangmo Car Wash	Hejo	Private Connection			
11	Dee Tee Car Washing & tyre Services	Babesa	Private Connection			
12	Taba Car-Service	Taba	Private Connection			
13	Kuenphen Car Wash	Bebasa	Private Connection			
14	Dagap Automobile	Olarongchu	Private Connection			
15	U.J Automobile	Olarongchu	Private Connection			
16	Yangki Automobile	Olarongchu	Private Connection			
17	Jangchuk Automobile	Olarongchu	Private Connection			
18	STCBL service	Olarongchu	Private Connection			
19	Car Care Service	Olarongchu	Private Connection			
20	Tachog Automobile	Olarongchu	Private Connection			
21	K. Norphel Automobile	Olarongchu	Private Connection			
22	Haap Automobile	Olarongchu	Private Connection			
23	Drukgyal Automobile	Olarongchu	Private Connection			

24	Lungten Automobile	Olarongchu	Private Connection			
25	BMW Automobile	Olarongchu	Private Connection			
26	Kuenga Automobile	Olarongchu	Private Connection			
27	Autyer Automobile	Olarongchu	Private Connection			
28	Bhutan Eco Automobile	Olarongchu	Private Connection			

Detailed workout on revenue loss as a result of not levying water and sewerage charges

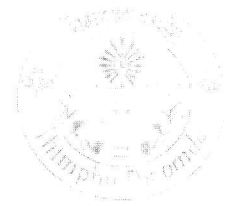
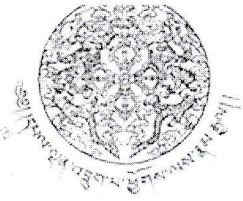
Year	Month	Previous reading	Present reading	Qty supplied (m3)- A	Revenue loss (in Nu.) A * 3.58- Applied domestic average tariff rate	Remarks
2015	January	17,918.00	211,168.00	193,250.00	691,835.00	
	February	211,168.00	379,438.00	168,270.00	602,406.60	
	March	379,438.00	567,691.00	188,253.00	673,945.74	
	April	567,691.00	758,191.00	190,500.00	681,990.00	
	May	758,191.00	957,420.00	199,229.00	713,239.82	
	June	957,420.00	1,148,179.00	190,759.00	682,917.22	
	July	1,148,179.00	1,354,341.00	206,162.00	738,059.96	
	August	1,354,341.00	1,548,684.00	194,343.00	695,747.94	
	September	1,548,684.00	1,750,303.00	201,619.00	721,796.02	
	October	1,750,303.00	1,946,967.00	196,664.00	704,057.12	
	November	1,948,527.00	2,122,227.00	173,700.00	621,846.00	
	December	2,122,227.00	2,316,403.00	194,176.00	695,150.08	
Total		12,764,087.00	15,061,012.00	2,296,925.00	8,222,991.50	
2016	January	2,316,403.00	2,518,932.00	202,529.00	725,053.82	
	February	2,518,932.00	2,693,566.00	174,634.00	625,189.72	
	March	2,693,566.00	2,803,002.00	109,436.00	391,780.88	
	April	2,803,002.00	2,882,827.00	79,825.00	285,773.50	
	May	2,883,373.00	2,974,938.00	91,565.00	327,802.70	
	June	2,974,938.00	3,089,060.00	114,122.00	408,556.76	
	July	3,091,350.00	3,278,813.00	187,463.00	671,117.54	
	August	3,278,813.00	3,407,668.00	128,855.00	461,300.90	
	September	-	-	-	-	
	October	3,558,239.00	3,605,475.00	47,236.00	169,104.88	
	November	3,605,475.00	3,780,141.00	174,666.00	625,304.28	
	December	3,790,243.00	3,975,401.00	185,158.00	662,865.64	
Total		33,514,334.00	35,009,823.00	1,495,489.00	5,353,850.62	
Grand Total		46,278,421.00	50,070,835.00	3,792,414.00	13,576,842.12	
Swerage charges					6,788,421.06	50% on water bills
Total revenue loss					20,365,263.18	

Annexure VI

Statement showing water requirement per day (m³)

Area	Location of service tanks	Areas water catered to	A: No. of households in the Area	B: Average household size (as per Bhutan Living Standards Survey 2012)	C: Population of the Area (A*B)	D: Water requirement per day per person (litres)	E: Water requirement for the Area (litres) (C*D)	F: Water requirement per day (m ³) (E/1000)
Area-I	Babesa	Lungtenphu, Olakha, Simtokha & Babesa	7273	4.30	31,274	180	5,629,302.00	5,629.30
	Semtokha							
	Lungtenphu							
Area-II	Changbangdu	Changjiji Pvt. Area, Changjiji (NHDC) Colony	3363	4.30	14,461	180	2,602,962.00	2,602.96
		Changzamtog above ring road & Changbangdu Area						
Area-III	Dechencholing	Dechencholing Area and the service tanks are not provided in Dechenphodrang, Pamtsho, Taba	3814	4.30	16,400	180	2,952,036.00	2,952.04
Area-IV	BCCI Office	Sunday Market & Chubachu Area, Core Area along Norzin Lam	2167	4.30	9,318	180	1,677,258.00	1,677.26
	Swimming Pool							
Area-V	Langjuphaka	Hejo, Dzong & High Court Area and Langjophakha Area	1066	4.30	4,584	180	825,084.00	825.08
	TashiChho Dzong							
Area-VI	Kuengachholing Motithang	Upper & Lower Motithang	3051	4.30	13,119	180	2,361,474.00	2,361.47
Area-VII	JDWNR Hospital	Changzamtog, hospital & Changgedaphu Area and NPPF colony & above NPPF colony	3066	4.30	13,184	180	2,373,084.00	2,373.08
	-do- RICB Colony							
	Changgedaphu							
Area-VIII	YHS area	YHS & Lungtenzampa Area and Samazingkha & Tandin Ngye	458	4.30	1,969	180	354,492.00	354.49
Area-IX	Kawajangsa & Zilukha Area		1386	4.30	5,960	180	1,072,764.00	1,072.76

APPENDIX



TT/ID/WSS/2017-2018

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7/8/2017

The Deputy Auditor General,
Department of Performance and Commercial Audit,
Royal Audit Authority,
Thimphu

Sub: Submission of response on Draft Performance Audit Report on 'Provision of Drinking Water in Thimphu Municipality'

Sir,

Thimphu Thromde is pleased to submit the audit response on Draft Performance Audit Report on 'Provision of Drinking Water in Thimphu Municipality'.

Yours Sincerely

(Passang Dorji)
Executive Secretary

1

Cc:

1. Thrompon, TT for kind information
2. Chief Engineer, ID for information
3. Principal Engineer, WSS/ID for information
4. Engineers, O&M WSS/ID for information and na
5. GF

① TAG, DAD
For u.a.
8/7/17

Response on the recommendations of Performance Audit Report

4.1 For area - IX: Thimphu Thromde has already initiated the construction of adequate number of service tanks in the following locations which are in conformation with RAA's findings and recommendations. NIT has been floated for construction of a 230cum capacity tank at Zilukha. Kawajangsa is already supplied from tank located at Kuengacohling and additionally, there is already an existing 50cum tank for Kawajangsa which is fed from Dzong tank by pumping.

Area -VII: Process for construction of 230 cum tank at Changedaphu and 100 cum tank at Changzamtog has already been initiated. Two tanks have been recently constructed for Changzamtog and Changedaphu located at Karisha above old RICB colony and at Changedaphu. The capacities are 100 and 50cum respectively.

Area - V: A new 230cum tank has been constructed at Langjuphaka under the World Bank funding. Further enhancement of the storage capacity by another 230cum for the whole Langjuphaka area is included in the scope of the ongoing central water supply project.

Area - IV: A 100cum tank is being constructed which will be located at Sunday market to enhance the service tank storage capacity.

Area - II: A 230cum service tank is being constructed at Changjiji to increase the existing storage capacity.

Thimphu Thromde is in the process of implementing the work of providing extended new distribution pipelines in Changzamtog, Yangchenphu, Zilukha, in the core city areas of Changlam, Norzinlam including old pipe replacement works covering the areas of Changzamtog, Changangkha and Kawajangsa.

4.2 Thromde appreciates and recognizes the need for a robust water supply distribution monitoring system. Realizing this, Thromde has already requested and discussed with the World Bank mission in July 2017 to conduct a diagnostic study of Thromde water services. Based on the outcome result of the diagnostic study, necessary monitoring system shall be set up which shall include all aspects of water supply distribution monitoring components with appropriate institutional setup, standards and protocol, monitoring teams, schedules, implementation, reporting on a sustainable basis.

4.3 The proposal for diagnostic study of Thromde water services include all the components mentioned under recommendation 4.3 that Thromde should maintain and safeguard water distribution network. The specific issues to be considered are developing geo-coordinated network data of the water distribution system for use in GIS, metering of all the water production outlets from water treatment plants, service tanks including metering all service connections to monitor and take remedial measures to reduce the non-revenue water and to facilitate water audit. Fencing of intake/intake structures, service tank compounds including compound lightings to ensure water safety shall be implemented on priority. Active leak detection system, monitoring of distribution network based on the best practices, standard operating procedures, guidelines on water meter installations shall be developed and implemented. The need to make provision of facilities such as meter test bench for testing and calibration of water meters, meter repairing workshop etc. the need to set up a dedicated workshop for operation and maintenance of water supply infrastructure are being considered.

4.4 Actions have already been initiated by the customer service centre to streamline the deficiencies in line with the water regulation of Bhutan 2014. It has already been discussed that a separate rules and regulations need to be prepared specific to Thromde based on the water regulation to address the irregularities and institute corrective measures with regard to water connections and metering.

4.5 Development of accurate database on buildings is long overdue and is being considered for a detailed survey. Development of comprehensive and accurate data with regard to water meters shall be addressed as recommended. The proposed diagnostic study on water services to be conducted by the World Bank BUDP II shall include the data development on metering, monitoring of operation and maintenance aspects. The data shall facilitate in strengthening the planning and decision making process in the management of water supply.

4.6 One of the components identified in the proposed diagnostic study of Thromde water services is to review the institutional capacity. In particular, the human resource requirement to enable effective, efficient and professional delivery of water supply services. Thromde management shall seriously review the issue of the need to develop clear job roles and responsibilities. Assess and review the existing capacity of human resource with emphasis on the qualification and experience of Thromde engineers, technicians, operators, plumbers and other staff engaged in the management, operation and maintenance of water supply. The available strength of existing technical staff under Thromde shall be reviewed and necessary changes shall be implemented to ensure effective delivery of water services.

4.7 The water metering has been completed and the bills have been raised for Babesa, Lungtenphu and Olakha areas. Meters have been installed for commercial car washing units having Thromde water supply and bills are raised.

4.8 Implementation process has already been initiated to facilitate gradual discontinuation of private and community water connections through provision of adequate water supply by Thromde.

a. Improvement in system input include the ongoing central water supply scheme funded by world Bank, enhancement of existing storage capacities through construction of tanks, network extension for coverage and replacement of pipelines including rehabilitation of existing water infrastructure.

b. Improvement in demand management such as monitoring of distribution network, connections, active leak detection, waste control and metering water supplied from the water treatment plants and service tanks and ensuring 100% metering all connections.

c. Ensuring the quality of drinking water supply through enhanced coordination with RCDC which include taking prompt actions to remedy and minimize the risk and hazards associated with contamination of water supplies.

4.9 Thromde shall initiate and coordinate the revival of National Water Resource Board (NWRB) comprising MoWHS, NECS, MoH and Thimphu Thromde for making informed decision on water and its development.

4.10 Thimphu Thromde has prepared a draft water master for Thimphu Thromde water supply. Since the Ministry of Works And Human Settlement is mandated to develop the national drinking water

management system for Thromde in consultation with local government, Thimphu Thromde shall make an official request to the Ministry to develop the drinking water master plan for Thimphu Thromde.

4.11 The National Environment Commission Secretariat shall be officially requested to finalize the water resource inventory for Thimphu Thromde. Thimphu Thromde is prepared to render all necessary inputs that may be required for finalizing the water resource inventory.

4.12 Thromde carries out regular water quality tests at the water treatment plants for raw as well as treated water and at the service tanks. Although water quality tests are done at the Megaypang/Chamgang water treatment plant, there is no water quality testing done at the service tanks under this treatment plant as mentioned in the findings. The RCDC has been testing the water quality for schools and institutions and the reports are shared with Thimphu Thromde. Thimphu Thromde shall pursue in institutionalizing and enhancing the existing coverage of water quality testing for water supplied by Thromde including schools and institutions within its jurisdiction. Schools and institutions which do not have access to Thromde water supply are being reviewed for actions to be taken to ensure safety of drinking water supply for which, Thromde Education Office shall be spearheading the necessary actions to be taken in collaboration with operation and maintenance of water supply. The water tests shall then be conducted regularly as required by the Bhutan Drinking Water Quality Standard 2016. Thimphu Thromde shall also increase and establish water sampling stations within the water distribution system to monitor water quality. Besides, these sampling stations shall facilitate RCDC to carry out their surveillance effectively. Implementation of activities identified in the water safety plan shall be carried out on priority.

4.13 There was no institutionalized system of reporting and action taken reports on the water quality test results conducted by RCDC. However, the water service providers are required to comply with the Bhutan Drinking Water Quality Standards 2016 with effect from July 2017. Monitoring and reporting system shall be implemented as required by the standard.

4.14 Storage facilities have been provided for chemicals at Motithang, Jungshina and at Megaypang/Chamgang water treatment plants. However, the storage facility provided at Dechencholing treatment plant is inadequate. The provision of necessary facilities shall be made for safe storage of chemicals at the treatment plants. In addition to the above, it is required to develop adequate space for conducting laboratory tests including safe storage of laboratory equipment where necessary.

4.15 Regarding the manufacturing and expiry dates of the chemicals and reagents for disinfection and testing of water quality, Thromde has already taken initiative to ensure that the quality of chemicals and reagents being purchased are verified and thoroughly checked. The requisitions placed by the water treatment plant must provide the specification of chemicals and reagents to be used for treatment of water. The procurement section has been requested to include clear specifications and the quality standards to be met in the bidding document and ensure that these are complied before taking over the goods from suppliers. The RCDC being the regulating authority shall certify the quality of chemicals and reagents to be used in the treatment and monitoring of water quality. Thromde has noted that henceforth it shall refrain from using expired chemicals and reagents and ensure that the quality of chemicals and reagents are as per the specifications.

4.16 The contractor has been informed to deposit the money amounting to Nu.190,400.00 but consider retaining the money with Thimphu Thromde to purchase the chemical for operation and maintenance of the same plant.



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