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Mapping the Water Market System in Maiduguri: Market Assessment Report and Recommendations for Pilot Activities

JERE AND MAIDUGURI METROPOLITAN COUNCIL LOCAL GOVERNMENT AREAS, MAIDUGURI, NORTH-EAST NIGERIA | NOVEMBER 2019

Cover: A pushcart seller fills jerry cans in Maiduguri.

Photo by CRS Assessment Team

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For any questions, comments or requests regarding this report, please contact Rolando Wallusche Saul at rolando.wallusche@crs.org and Jennifer Weatherall at jennifer.weatherall@crs.org

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Executive Summary

With more than 3.6 million people still in need of WASH services across north-eastern Nigeria's Borno, Adamawa and Yobe states, and continuing critical challenges faced among the WASH sector to effectively meet these needs at the scale required, CRS with funding from USAID's Office of Foreign Disaster Assistance (OFDA), has begun to implement operational research to identify more innovative and effective solutions to meet water supply needs. Implemented from July 2019 to April 2020, the operational research seeks to explore ways of engaging with private water providers to contribute to meeting water supply gaps as well as ensuring services provided meet minimum quality standards.

In order to identify feasible and appropriate interventions to pilot through the operational research, CRS conducted a market assessment of the water supply market in areas of Jere and MMC LGAs in Maiduguri town during October 2019. This report summarizes the methodology used and the key findings of this assessment and presents preliminary recommendations for pilot interventions that could be implemented in the short-term, while also providing a more detailed understanding of a previously unmapped largely informal market system.

The assessment used a mixed methods approach gathering both quantitative and qualitative data from a range of stakeholders including host and IDP households, community leaders, private water providers (including private borehole owners and private dam owners), pushcart water sellers, commercial water companies, water provider associations, government stakeholders, and representatives of local and international organizations implementing WASH interventions. Data was gathered through 472 household surveys; 46 water provider surveys; 96 surveys with pushcart sellers; 16 key informant interviews with private borehole owners, commercial water providers, government representatives, community leaders, pushcart owners and borehole owners' association; 6 FGDs with community representatives; and 2 FGDs with pushcart sellers. Although this assessment appears to be the most comprehensive study of the water market conducted to date in Maiduguri, there are still several areas to be explored as the operational research is implemented.

Overall, the assessment uncovered the following priority key findings:

- The **private water market**, including pushcart sellers and private boreholes, which is an informal and unregulated market, is a **key source of water** for many people, and in some neighborhoods, these are the only sources of water available. The number of private actors engaged in the provision of water has increased since the beginning of the crisis largely related to the increase in population and therefore demand.
- Alongside the increase in private water providers, there has also been an **increase in the unregulated establishment of boreholes and water points**. Where previously the Borno State Ministry of Water Resources (BSMoWR) had oversight of borehole construction, including providing geophysical and hydrogeological services to assess and plan construction, many of the boreholes used now are constructed spontaneously and are neither registered nor monitored by the government.
- Competition, cooperation and relatively stable water prices throughout the chain indicate a **relatively vibrant water market** playing a critical role in contributing to water needs in the town. However, in some areas pushcart sellers felt the market was saturated, particularly during the rainy season, and they were unable to expand their operations due to limitations in **a)** customers/demand, **b)** poor road conditions resulting in access difficulties, **c)** extending credit to regular customers, and **d)** having limited capital to invest (and therefore being reliant on cart owners for renting carts/jerrycans that were often in poor condition).
- Generally, the most critical issues identified in the communities assessed were around the **need to improve the quality of water and service delivery, rather than availability issues**. However, when government or INGO-supported water supply services are interrupted (e.g. due to malfunction, disrepair) there can be an increase in localized demand putting more pressure on the private water market. The areas of availability of water and capacity to deliver to end users among the private sector to meet

demand needs to be further explored during the operational research, though inaccurate and fluctuating population figures make accurate projections of water demand challenging.

- Household **incomes across host and IDP populations are severely constrained**, compounded by the crisis, with most of the people's basic income below the minimum threshold outlined in the draft Nigeria Minimum Expenditure Basket (MEB) Guidelines from October 2018. Despite this, affordability was not observed to be the most critical issue affecting water access. However, although water is a relatively small component of reported household expenditures overall, in areas where people are more or less solely reliant on the private water network (e.g. from pushcart sellers or private boreholes) the cost to access water can increase, posing a challenge particularly for the poorest households with the minimal or no income. Despite this, private borehole owners were found to be providing water free of charge or at minimal cost for those that were unable to afford it.
- **Despite widespread perceptions among pushcart sellers and end users that water is safe and treated, the reality is vastly different.** Very few private borehole owners were found to be treating their water despite that most boreholes access water from the upper aquifer, suspected to be at significant risk of contamination, particularly given the urban nature of Maiduguri which is exposed to poor sanitation and has no environmental control mechanisms to avoid contamination of the natural environment (soil, biota and water). Due to these commonly held beliefs that water is already treated, and is always safe, treatment practices at household level were relatively low.
- **Hygiene and water handing practices** along the water chain are also inconsistent and an area of concern. Private boreholes and dams were found to have poor drainage and sanitary conditions; some pushcart sellers had unclean and old jerrycans in poor condition, were using old cloths as filters when 'turning' water and were not practicing basic handwashing; while end users in some areas reported better handwashing practices, this was not the case in all locations assessed.
- Despite the coverage of the state water board water network in the city, there are still many areas that are uncovered. Default rates are high among those connected to the state water board, and there is limited capacity within the relevant departments of the BSMoWR to address pirate connections, and to reinforce a sustainable financing strategy and fee structure for end users. Additional challenges are posed by a general culture that water provided by the government should be free, and an unwillingness to pay. This limits the resources available for the government to reinvest in the system to improve services and expand network coverage. **Without systemic changes to the government water supply system, adequate resourcing and adjustments to the wider regulatory framework, private water providers will likely continue to play a key role in meeting the water needs of the population.** Therefore, efforts should be made to, at minimum, ensure the safety of the water availability and strengthen capacities of these private water providers to extend reliable and consistent services at affordable rates, particularly in areas with minimal coverage of other water supply interventions from NGOs and government.
- Humanitarian actors should consider **piloting interventions** that address the critical issues identified, engaging with actors throughout the market system. Pilot activities should be monitored and evaluated with learnings shared with the wider humanitarian community to inform future WASH implementation in Maiduguri and potentially other urban and peri-urban areas of north-east Nigeria. Preliminary recommendations for interventions are outlined at the end of this report.

Acronyms

AAH – Action Against Hunger

BAY – Borno, Adamawa, and Yobe States

BOSEPA – Borno State Environmental Protection Agency

BSMoE – Borno State Ministry of Environment

BSMoWR – Borno State Ministry of Water Resources

CBDA - Chad Basin Development Authority

CMWG – Cash and Markets Working Group

CRS – Catholic Relief Services

FGD – Focus Group Discussion

HH – Household

HNO – Humanitarian Needs Overview

IDP – Internally Displaced Person

IOM – International Organisation for Migration

KII – Key Informant Interview

LCDA – Lake Chad Development Authority

LCRI – Lake Chad Research Institute

LGA – Local Government Area

LPF – Lindi Peace Foundation

MBP – Market-Based Programming

MoWR – Ministry of Water Resources

NAFDAC – National Agency for Food and Drug Administration and Control

NRC – Norwegian Refugee Council

PHCN - Power Holding Company of Nigeria

RUWASSA – Rural Water Supply and Sanitation Agency

SAHEI – Sanitation and Hygiene Education Initiative

WASH – Water, Sanitation and Hygiene

WATCOMs – Water Committees

WB – World Bank

A. Background

Now in its tenth year, the crisis in north-east Nigeria shows no sign of abating. An estimated 7.1 million men, women, girls and boys remain in acute need of protection and humanitarian assistance in the most affected states of Borno, Adamawa, and Yobe (BAY), with more than 1.8 million people internally displaced[1]. The economic situation in north-east Nigeria has been severely disrupted, with serious impact on agricultural and income generating activities resulting in reduced purchasing power at the household level and in a reduced ability to meet basic food needs. Despite continued scale up in humanitarian assistance, significant gaps remain. In 2019, 3.6 million individuals were expected to be in urgent need of Water, Hygiene and Sanitation (WASH) support, 3.5 million in need of shelter assistance and 2.7 million in need of food and agriculture security support.[2] Insecurity and conflict continue to be the main driver of displacement, with Borno state alone hosting more than 1.4 million Internally Displaced Persons (IDPs)[3]. Continuing attacks along the Lake Chad border have forced IDPs south, specifically affecting Maiduguri Metropolitan Council (MMC), Nganzi, Monguno and Jere Local Government Areas (LGAs). Along with displacement, people are forced to abandon their agricultural land and livelihoods, add pressure to already insufficient water and sanitation infrastructure, lack adequate shelter, and do not have the means to meet household needs. The persistence of this crisis and continuing surges in displacement and returns demonstrate that humanitarian needs will continue for the foreseeable future. This requires humanitarian actors to adopt flexible approaches to emergency response that address immediate needs, respond to changing dynamics and maximize resources.

In terms of **Water, Sanitation and Hygiene** (WASH) needs, an estimated 3.6 million people require support across the BAY states. Historically low levels of access to WASH services prior to the crisis has exacerbated the situation, while ongoing protracted displacement continues to put additional stress on already existing and limited WASH services and facilities[4]. Water-borne diseases spread rapidly, and cholera outbreaks occur on an annual basis across several LGAs. In 2018, there were 4,250 reported cases of cholera across 18 LGAs, with 1.5 million people considered to be at risk of cholera[5]. Flooding, strong winds and sand storms have also caused significant damage to WASH infrastructure[6].

According to the 2019 Humanitarian Needs Overview (HNO), the WASH sector is facing critical challenges in effectively meeting the WASH needs of the affected population. This includes funding constraints, unanticipated emergency needs due to displacement and outbreaks, limited technical and operational capacities of WASH partners and communities, and significant access constraints[7].

To date, the WASH sector's water supply interventions have focused primarily on drilling and establishing new boreholes and rehabilitating nonfunctional ones in order to develop solar powered and hybrid water supply systems that meet demand in terms of quantity and quality. Other complementary activities around water supply have been well and hand pump rehabilitation and construction; overseeing the continuous operation and maintenance of water infrastructure in official camps and in some host communities; and finally, together with RUWASSA, conducting water treatment campaigns in times of cholera.

Most of these new established water supply systems, with the exception of those in official camps, have been mostly handed over to communities via Water or WASH Committees ('WATCOMS') where unfortunately

[1] Humanitarian Needs Overview (HNO): Nigeria, 2019, Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/01022019_ocha_nigeria_humanitarian_needs_overview.pdf
[2] UNOCHA, Humanitarian Response Strategy January 2019 – December 2021 Summary, December 2018.
[3] IOM, Displacement Tracking Matrix Round 26, March 2019.
[4] Humanitarian Needs Overview (HNO): Nigeria, 2019, Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/01022019_ocha_nigeria_humanitarian_needs_overview.pdf
[5] *Ibid.*
[6] *Ibid.*
[7] *Ibid.*

operation and maintenance managed by community-based structures have proven challenging to maintain and have required significant costs to ensure that quality standards and maintenance are met.

In addition to NGO interventions, there is an active private water market with a number of actors engaged in water provision for households. In the recently finalized WASH Sector Nigeria Emergency Technical Guidance (April 2019)[8], however, there is surprisingly no mention of the existing private sector service providers engaged in water supply, nor of interventions to improve their quality standards and capacity despite being an important water provider for both host and IDP populations.

It is within this context that CRS, with funding from USAID's Office of Foreign Disaster Assistance (OFDA), is conducting operational research which tries to identify more innovative and effective solutions to meet water supply needs in north-east Nigeria. The operational research is being implemented from June 2019 to April 2020 and seeks to explore ways of engaging with private water providers to contribute to meeting water supply gaps as well as ensuring services provided meet minimum quality standards. In order to do this, the first step for CRS was to understand and map the existing water supply system in Maiduguri, with a view to identifying feasible interventions that could be piloted with funding from USAID.

This report, therefore, summarizes the methodology used and the key findings of the water market assessment conducted in October 2019, and presents preliminary recommendations for pilot interventions.

The primary intention is for some of these recommendations to be piloted by CRS in 2019/20, closely monitored and evaluated, and learning shared with WASH actors comparing these activities with the more traditional water supply approaches implemented until now. However, it is also expected that this more detailed understanding of a previously unmapped largely informal market system, and the preliminary recommendations it includes, can also support other humanitarian actors to explore and pilot more market-based approaches alongside traditional water supply interventions to better meet the water needs of the most affected communities in north-east Nigeria as well as harness lessons that could be applicable in other contexts globally.

B. Assessment Methodology and Approach

B.1 Assessment Objectives

The main objective of the market assessment was to '*Map and analyse a representative sample of the water market system in north-east Nigeria to identify feasible recommendations and response options for addressing water supply needs.'*

As of October 2019, there appeared to have been no comprehensive assessments conducted to understand the role and operations of private vendors engaged in water supply in Maiduguri, despite the state water network not having full coverage, and evidence that many IDPs and host communities were reliant on private water vendors to meet their water needs. Some previous assessments, including the UNHCR Multi-Sector Rapid Assessment in 2017,[9] had done some preliminary data gathering on the water market to understand the main actors and some of the constraints faced in Maiduguri, however this assessment was light-touch and rapid, focused on a number of key goods and services (not only water), and highlighted the need for more comprehensive analysis particularly with regards to sustainability, water quality and general capacity and functioning of the market system.

This CRS-led assessment of the water market system therefore aimed to understand the functioning of the water market system in more depth, and from a holistic perspective, to answer the following key analytical questions:

- What are household's (end users and therefore the ultimate target population of humanitarian actors' interventions) knowledge, attitudes and practices in regard to safe water handling, sanitation and hygiene practices?

[8] https://reliefweb.int/sites/reliefweb.int/files/resources/nigeria_wash_sector_technical_guidance_second_revision_final.pdf
[9] https://www.unhcr.org/protection/operations/5a05b54d7/unhcr-multi-sector-market-assessment-nigeria-october-2017.html

- What are the constraints and barriers, if any, affecting accessibility and affordability of water services for the target population?
- What is the knowledge, interest and capacity of the water market system to cover people's needs in relation to access and quality?
- How can this water market system be used to facilitate access to critical water services?
- What are the short- and long-term options to improve and expand water access in terms of quality, quantity, and affordability through direct and/or indirect integrated market-based responses?

Ultimately the assessment aimed to gather data that would enable humanitarian and other water supply actors to:

1. Understand the business models, operational characteristics and roles of different actors engaged in water supply
2. Identify existing risks around quality issues, safety and public health, environmental degradation, over extraction, etc.
3. Understand how private water providers currently fit within or relate to the 2017 National Water Sector Reform Project
4. Inform CRS and other humanitarian and development WASH actors on potential intervention options to improve water access

B.2 Methodology

The assessment followed an adapted methodology, mostly informed by the general steps of the Emergency Market Mapping and Analysis (EMMA)[10], combined with water technical assessments and social assessments gathering information on household knowledge and practices, infrastructure, operations, and identification of risks related to quality issues, safety and health, environmental degradation and over extraction. Given the protracted nature of the crisis, the assessment focused on mapping and understanding the current status of the market system, the constraints and challenges faced, and the impact of the crisis, rather than developing both a baseline of the water market system prior to the crisis and an emergency market map.

The assessment began by reviewing available secondary information on the general WASH situation in Maiduguri; the economic situation; regulations, policies and strategies, from national and state government on supply and distribution of drinking water; market assessments conducted by other agencies related to water supply; and technical guidance and standards available from the WASH sector. Secondary information consulted includes:

1. Action Against Hunger (2019), '*Water, Sanitation and Hygiene Governance Report (DRAFT)*'
2. Federal Ministry of Water Resources (2016), '*Draft National Water Policy*'
3. REACH (2019), '*Nigeria Multi-Sector Needs Assessment*'[11]
4. Save the Children (2017), '*Basic Needs and Response Analysis Framework Report: Informal IDP Settlements in Borno State, Nigeria*'[12]
5. Save the Children (2017), '*Livelihoods and Food Security in Borno State, Nigeria: HEA Urban Baseline Report*[13]'
6. UNHCR (2017), '*Multi-Sector Market Assessment (MSMA) for Charcoal, water, low-income rental housing, and core-relief items in Maiduguri, Jere and Konduga*'[14]

[10] https://www.emma-toolkit.org/
[11] https://fscluster.org/nigeria/document/nigeria-2018-multi-sector-needs
[12] https://www.wfp.org/publications/nigeria-needs-response-analysis-assessment-informal-idps-settlements-borno-state-june-2017
[13] https://www.wfp.org/publications/nigeria-household-economic-approach-urban-baseline-borno-2017
[14] https://www.unhcr.org/protection/operations/5a05b54d7/unhcr-multi-sector-market-assessment-nigeria-october-2017.html

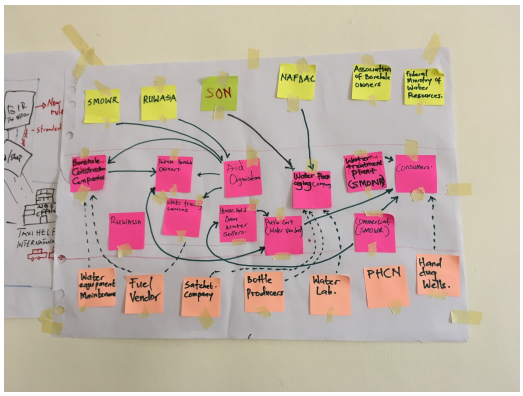
7. WASH Sector (2019), '*WASH Sector Nigeria Emergency Technical Guidance*'
8. World Bank (2017), '*Nigeria: National Water Sector Reform Project, Project Performance Assessment Report*'

Following initial secondary information review, key respondents were identified, and tools drafted and reviewed by WASH and Cash/Markets Technical Advisors and CRS' north-east Nigeria WASH team.

Prior to data collection, a 3-day workshop was held from 14-16 October 2019, facilitated in Maiduguri by CRS' Technical Advisor for WASH, and Technical Advisor for Cash and Markets from the CRS Humanitarian Department. The workshop invited partners from the WASH Sector and Cash and Markets Working Group (CMWG), with representatives from 11 different organizations participating[15]. The workshop provided an introduction to basic concepts on market-based programming, markets, market assessment and analysis and market mapping, and also introduced the objectives of the water market assessment, and the operational research. The participants drafted preliminary market maps of the water supply market system in Maiduguri and Jere LGAs, seasonal calendars and began to identify respondents for the assessment, information to be gathered and some of the critical challenges within the market system. Participants were also trained on the three main quantitative data collection tools that were used during the assessment, focusing on:

1. Household level data collection;
2. Private water providers such as borehole owners and dam owners; and
3. Pushcart sellers.

Tools were reviewed, tested by participants and revised during the workshop prior to the start of data collection.



Preliminary water system market map developed during the workshop (October 2019)

Group work on market mapping during the workshop in Maiduguri (October 2019)

The market assessment used a mixed-methods approach gathering quantitative data through surveys, and qualitative data through focus-group discussions, semi-structured interviews, and observations. Information was gathered from the following respondent types:

Table 1: Respondent Types

Method used	Respondent Type
Survey	- Host and IDP households - Water providers (private borehole and dam owners) - Pushcart sellers
Focus Group Discussion	- IDP and host community members – male and female - Pushcart sellers
Key Informant Interviews	- Community leaders (e.g. *bulamas*) - Water providers (private borehole owners) - Water providers (water packaging companies) - Water provider association (borehole owners)

[15] Christian Aid, CRS, FHI 360, IOM, Lindi Peace Foundation (LPF), Malteser International, NRC, Solidarites International, RUWASSA, SAHEI and ZOA

	- Pushcart owners - Government staff from State Ministry of Water Resources and RUWASSA
Direct Observations	- Water providers (borehole and dam owners) - Pushcart sellers - Host and IDP households

Data collected looked at the following general areas[16], across different respondent types:

- Economic situation of households, including expenditure patterns, income sources and coping strategies
- Water sources
- Quality of water and treatment practices
- Challenges and barriers faced in accessing water
- Water handling and storage practices and hygiene knowledge
- Current status/condition of water supply infrastructure (community, government, private etc.)
- Government policy, regulations, monitoring and role
- Pricing structures and trends
- Competition and market dynamics
- Seasonal trends in water access, prices and availability
- Impact of the crisis on water provider operations
- Capacity of water providers
- Constraints and challenges faced in operations of water providers
- Preferences
- Willingness to engage in potential interventions

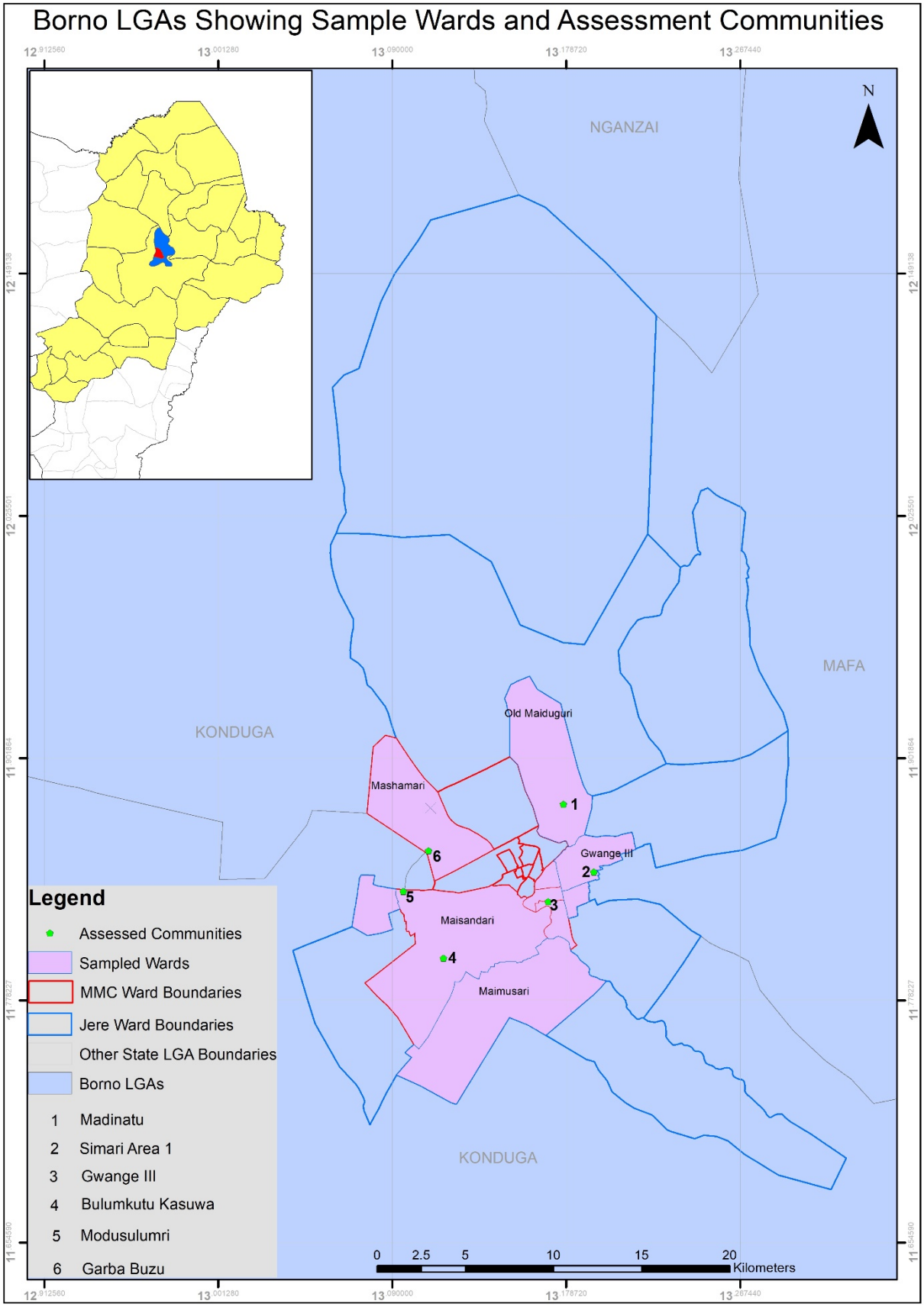
B.3 Geographic Selection and Sampling Size

Based on the CRS WASH team's knowledge of water supply activities from ongoing programming, and the high water demand in most peri-urban and urban areas of Maiduguri which are today mostly covered by a high number of private water providers engaged in the sourcing and sale of water, the operational research is focused on Jere and MMC LGAs. Given the focus of the operational research on piloting new interventions to improve access to water among host communities and IDPs affected by the crisis in north-east Nigeria, geographic areas within the two LGAs were provisionally selected based on the following criteria:

- Areas with a presence of both host and IDP populations
- Areas where people were known to be accessing water through purchase from private water providers
- Areas with an active operational private water market sector

During July to September 2019, the CRS WASH team visited various locations around Jere and MMC to build a preliminary understanding of the population makeup, water supply situation and to determine if populations there were relying on private water vendors. Based on the above criteria as potential target locations for the operational research a total of 13 communities were identified across 10 wards of Jere and MMC. In addition, CRS coordinated with its security focal point to ensure these areas could be accessed safely by CRS and partner teams.

[16] Assessment tools are available with the assessment team leads: rolando.wallusche@crs.org and jennifer.weatherall@crs.org



Map 1: MMC and Jere LGA showing sample wards and assessment communities

Table 2: Overview of Possible Target Areas for Operational Research

#	Community	Ward	LGA	Host Population (Est.)	IDP Population (Est.)	Total Population (Est.)	IDPs as % of population
1	Madinatu*	Old Maiduguri	Jere	7000	5000	12000	42%
2	Gwange I	Gwange 1	MMC	5000	1000	6000	17%
3	Gwange II	Gwange II	MMC	4000	800	4800	17%
4	Gwange III*	Gwange III	MMC	10000	4000	14000	29%
5	Simari Area 1*	Mashamari	Jere	5000	3000	8000	38%
6	Simari 2	Mashamari	Jere	10000	2000	12000	17%
7	Simari Area 3	Mashamari	Jere	5500	1500	7000	21%
8	Jiddari	Galtimari	Jere	80000	30000	110000	27%
9	Gomari	Gomari	Jere	10000	2000	12000	17%
10	Bulumkutu Kasuwa*	Maisandari	MMC	3000	1000	4000	25%
11	London chiki	Maimusari	Jere	4000	400	4400	9%
12	Garba buzu**	Bolori I	MMC	7000	3500	10500	33%
13	Modusulumri**	Maisandari	MMC	5600	TBC	5600	-

From these 13 locations, 2 communities (Garba Buzu and Modusulumri, indicated with '**' in Table 2) stood out as being distinct from the other 11 based on the way IDPs were being hosted. In these two areas, IDPs were more visible and recognizable by living in distinct shelters and compounds. In the other 11 communities, IDPs were more integrated in the community and were either renting houses or being hosted in houses of local residents and/or relatives.

The remaining 11 communities were considered to be largely similar in terms of the integration of IDPs in the community, and the economic and livelihood situation in the area (according to the preliminary information the team had on each area). Consequently, the assessment focused on a sample of communities assuming that the situation would be reflective of the other communities.

The assessment gathered data across 6 communities, 2 in Jere and 4 in MMC. The 2 communities where IDPs lived in distinct 'camp-like' compounds, Garba Buzu and Modusulumri (indicated with '**' in Table 2), were covered during the assessment. In addition, 4 of the 11 remaining communities (2 in Jere and 2 in MMC) were also included based on those with the highest percentage of IDPs residing in the community, Madinatu, Simari Area I, Gwange III and Bulunkutu Kasuwa (indicated with '*' in Table 2).

In the absence of reliable government data, the figures used for the population estimates were received from the respective *Bulamas* (community leaders) of these communities.

Sampling frame for household surveys

In order to get a representative sample of the population in the targeted areas for the household survey, the sum of all individuals (sample frame) in the 6 assessment communities was used – 56,600 individuals. The sample size for the assessment was calculated thus:

$n=$

$$Z^{2X}P^{X}\,(1-P)/e^{2}$$

$$n1/(1+((n1-1)/N)$$

$$n^{X}D$$

$n^X R$ [17]

n= 477

n = minimum sample size required
N= Population size (56,600)
Z = confidence interval (95%)
P= prevalence (0.5)
e= margin of error (0.05)
D= design effect (1.0)
R= Expected response rate (0.8)

A total of 477 was therefore the number of actual responses needed to the stated level of accuracy (95%). This also considers any expected non-response. The sample size was then administered across the 6 communities based on their proportionality to the total population, giving a total sample size below for the household survey:

Table 3: Proposed Sample Size for Household Survey

Community Name	LGA	Total Population	Sample Size
Madinatu	Jere	12,000	101
Gwange III	MMC	14,000	118
Simari Area 1	Jere	8,000	67
Bulumkutu Kasuwa	MMC	4,000	34
Garba Buzu	MMC	10,500	88
Modusulumri	MMC	8,100	68
Total		**56,600**	**477**

Sampling frame for water provider surveys

Within each of the 6 communities, surveys with private water providers were also conducted. From the CRS team's preliminary mapping, a total of 51 private water providers (the majority borehole owners) were identified across the 6 communities. Due to the relatively lower sample frame for water providers, all available water providers were surveyed to make the sample exhaustive. Hence, across the 6 communities, all the identified private water providers were selected for surveys and observation visits. The break-down is as follows:

Table 4: Proposed Sample Size for Private Water Provider Surveys and Observation Visits

Community Name	LGA	Borehole Owner
Madinatu	Jere	10
Gwange III	MMC	12
Simari Area 1	Jere	10
Bulumkutu Kasuwa	MMC	5
Garba Buzu	MMC	7
Modusulumri	MMC	7
Total		**51**

[17] Slovin's Formula (Galero-Tejero, E. (2011). A Simplified Approach to Thesis and Dissertation Writing (pp. 43-44). Mandaluyong City: National Book Store)

Sampling frame for pushcart seller surveys

Because there was no available information on the number of water push cart sellers operating in each community it was not possible to calculate a sample size. Instead a minimum of 15 surveys were conducted in each community.

Table 5: Proposed Sample Size for Pushcart Seller Surveys

Community Name	LGA	Pushcart Sellers
Madinatu	Jere	15
Gwange III	MMC	15
Simari Area 1	Jere	15
Bulumkutu Kasuwa	MMC	15
Garba Buzu	MMC	15
Modusulumri	MMC	15
Total		**90**

In addition to the above quantitative surveys, a range of qualitative data was collected through focus groups and key informant interviews to triangulate information and obtain a more detailed understanding of the water supply system in the target areas (see below).

B.4 Data Collection and Analysis

The assessment team focused on data collection was composed of 8 staff and 18 enumerators from CRS, and staff from partner organizations including Christian Aid, IOM, LPF, NRC, RUWASSA, SAHEI, and ZOA. Data was collected over 6 days from 17th to 23rd October 2019. The three surveys for households, water providers and pushcart sellers were collected on phones using KoboCollect, while the qualitative data was collected on paper using standard questions.

Data was collected through 472 household surveys; 46 surveys with private water providers; 96 surveys with pushcart sellers; 16 key informant interviews with private borehole owners, commercial water providers, government representatives, community leaders, pushcart owners and borehole owners' association; 6 FGDs with community representatives; and 2 FGDs with pushcart sellers. These activities are summarized in the below table in more detail:

Table 6: Overview of Data Collected [17 - 23 Oct]

LGA:	Jere		MMC				Total
Ward:	Old Maiduguri	Mashamari	Bolori 1	Gwange III	Maisandari		
Community:	Madinatu	Simari Area 1	Garba Buzu	Gwange III	Bulumkutu Kasuwa	Modusulumri	
HH Survey	2 (M) 99 (F) = 101 (Total)	11 (M) 56 (F) = 67 (Total)	4 (M) 87 (F) = 91 (Total)	9 (M) 108 (F) =117 (Total)	4 (M) 32 (F) = 36 (Total)	0 (M) 60 (F) = 60 (Total)	30 (M) 442 (F) = 472 (Total)
Water Provider Survey	10	10	3	12	5	6	46
Pushcart Seller Survey	20	13	16	15	17	15	96

KII with Community Leaders	1	1	1	1	1	1	6
FGD with community members				1 Male (IDP/Host) 1 Female (IDP/Host) = 2 FGDs (Total)		1 Male (IDP) 1 Female (IDP) 1 Male (Host) 1 Female (Host) = 4 FGDs (Total)	6 FGDs
KII with borehole owners				1 KII		1 KII	2 KIIs
FGD with pushcart sellers				1 FGD		1 FGD	2 FGDs
KII with pushcart owner		1 KII					1 KII
KII with other stakeholders	3 X KIIs with government and NGO representatives 1 X KII with Gwange III borehole association 3 X KII with private water packaging companies 1 X KII with pushcart owner at Simari 1						8 KIIs

Following each day of data collection, the assessment team leads debriefed with the assessment team to understand challenges faced in data collection as well as their observations and impressions from their discussions with respondents. On 24th October, after completion of data collection, the assessment team were invited to a half-day debrief session. During this session, the assessment team revisited the water supply market map and noted changes and updates based on what they'd found in the assessment. Following this, the group discussed what the most critical issues and challenges they'd observed during the assessment in terms of the market's ability to provide enough and safe quality water to the general population and began to identify possible response options to address these issues.

Notes from qualitative data collection were entered into a pre-developed excel template, and the quantitative data was downloaded from KoboCollect, cleaned in excel and then fed into a PowerBI Dashboard for analysis.

B.5 Assessment Constraints, Limitations and Challenges

The following challenges and limitations were faced during the assessment, and therefore should be considered when interpreting the findings of the assessment:

- **Absence of accurate population figures for target locations:** Given the scale of the crisis and the continuous population movement in and out of the city, both due to conflict/insecurity and seasonal livelihood opportunities, there are no accurate population figures available on both host and IDP communities. This makes it challenging to obtain accurate projections of water needs to meet minimum standards in different geographic areas.
- **No registry or locations of private water sources available:** During the assessment, the teams gathering data from private water providers, particularly borehole owners, found it challenging to identify these water points as there is no existing mapping, and no registry of boreholes at the State Ministry of Water Resources (SMoWR) and no available data with logs or other parameters of drilled boreholes. So although the team aimed to visit all private water points in the assessment locations this may not have been the case. Similarly, neither the WASH Cluster nor the Ministry has a registry with the locations and numbers of boreholes and other water points constructed and/or rehabilitated by NGOs and other actors.
- **Reluctance of private water providers to share information:** Another challenge faced during the assessment was some reluctance and hesitance among water providers (including borehole owners and

pushcart sellers) to share information. This was likely related to the fact that these vendors are not currently registered or formally recognized by the government, and some (for example dam owners) are sourcing water from the state water board through connections that are intended for household use (not commercial use).

- **Time limitations for the assessment:** Overall there were only 2 weeks to finalize tools, train the team on the tools, complete the assessment data collection, and then begin analysis. While a lot of information was gathered, the timeframe available limited the opportunity for more iterative investigation. Nevertheless, as the operational research is implemented, the CRS team will continue to develop a more detailed understanding of the market system and the actors involved.
- **Use of water:** Given pre-assessment information that the general practice among poorer households is to not store water for different purposes separately (e.g. drinking, cleaning, washing clothes and dishes etc.) in many of the target areas, the assessment did not differentiate between drinking water and water for other uses. Instead, the assessment looked at overall water needs of the household. This is in line with the Nigeria WASH Sector Technical Standards of ensuring access to a minimum of 15 liters per person per day of water (for drinking, bathing/personal hygiene, clothes washing, and cooking)[18].
- **Recommendations of this assessment are provisional:** The assessment was intended to 1) map and understand the water market system and 2) identify preliminary recommendations that could be piloted to improve water access and quality. The pilot activities and operational research will provide more detailed evidence-based recommendations to take forward (anticipated to be available in April/May 2020).

B.6 General Situation in Target Areas

The total estimated population across the 13 communities is 210,300 of which around 54,200 are IDPs. In all the 13 communities considered for the operational research, internally displaced households mainly live among the host community with some camp-like settlements in some areas. Since the beginning of the crisis, there has been a progressive increase in the number of IDPs in these areas of Maiduguri. According to residents, displacement to these communities started as far back as 2009 as a result of increasing levels of insecurity elsewhere in Borno state. Reports from IOM's Displacement Tracking Mechanism (DTM) indicate both arrivals and departures of IDPs to and from these areas, with overall more arrivals than departures.

Communities like Gwange and Bulumkutu are planned government residential areas, while other communities in the target areas are unplanned residential areas that have spontaneously grown and consequently lack basic facilities such as drainage and access roads. Some communities, including Jidari, was once part of a forest reserve that has given way to residential use as a result of the large influx of people into Maiduguri. The preliminary areas of focus for the operational research, and therefore the assessment, are characterized by increasing population numbers, poor urban planning, poor building structures, poor drainage and high levels of poor environmental sanitation as a result of indiscriminate disposal of waste. Most access roads in the areas are usually submerged during the raining seasons making it difficult for passage in and out of the areas.

Residents of these 13 areas are engaged in various economic activities ranging from petty trade, occasional casual labour, local crafts, taxi services, food processing, and farming, and many are still without any source of income relying on relatives and aid organizations to meet their immediate needs. Due to the necessary security perimeter around the city, restrictions on movement and unavailability of land space within Maiduguri, most displaced people within the target areas are unable to farm, fish or sell their goods, leaving them entirely dependent on relatives and/or humanitarian assistance. Meanwhile, basic amenities and services are overstretched, water shortages are common, and sanitation is inadequate.

[18] https://reliefweb.int/sites/reliefweb.int/files/resources/nigeria_wash_sector_technical_guidance_second_revision_final.pdf

Water for domestic use is primarily sourced from boreholes constructed either by the state government, private individuals or non-governmental organizations. This includes hand pump and motorized boreholes, some with water storage facilities in tanks or reservoirs. Most privately drilled boreholes supply water to neighboring households through water pushcart sellers. Public (piped) water supply is available in some parts of the target areas that are captured under the water service zoning managed by the State Water Board under the Borno State Ministry of Water Resources (BSMoWR). Illicit connections to public water pipelines are common in these areas. Bottled/sachet water is sometimes used for drinking though only accessible to those who can afford it. Boreholes are also the primary source of water in IDP camps. However, camp residents report issues with the quality (both in terms of taste and incidents of illness) and quantity of water provided.

While the security situation in the target areas is stable, there are often curfews and restrictions on vehicular movement imposed, amended and lifted at short notice. Failure to comply with all curfews and movement restrictions can cause significant risk. Although there is evidence of humanitarian actors and aid provision in most of the 13 communities, except for Bulumkutu Kasuwa, services still remain insufficient.

C. Overview of the Water Market System

C.1 Water sources for the general population and water market sector

The population and therefore the water market sector of Maiduguri, including the assessed areas of Jere and MMC, obtains water from the following sources:

1. **Groundwater, exploited from three different aquifers:**
   Maiduguri derives its groundwater resources from the three-aquifer systems of the Chad formation, the youngest stratigraphic sequence in the Chad Basin, and to a lesser extent supplemented by the basement complex and the Fika shales.

   The upper Aquifer System
   Groundwater occurs both in confined and unconfined conditions in this system. It consists of at least three zones and these are referred to as A, B and C systems that are found at depths of 10- 40 m, 40-70 m and 78-99 m respectively. The yields from boreholes exploiting water in these systems range from 2-5 liters per second. Water levels in this aquifer system drops majorly during the dry season (November to May) as its recharge is related to vertical infiltration of rainfall.

   Middle Aquifer System
   The Middle aquifer system is the most widespread and best exploited confined aquifer within the study area. Its depths range from about 200 to 350 m. Recharge to this aquifer is reported to occur by horizontal inflow around the ridge of the rocky areas bridging the Chad basin and by vertical percolation from a ridge popularly referred to as the Bama ridge. Yields of boreholes tapping this aquifer range between 5 and 10 liters per second.

   The Lower Aquifer System
   The lower aquifer system is found at depths of 420-650 m, with varying yields according to location ranging from about 15 l/sec to as high as 30 l/sec. Initially it was thought that the aquifer was mainly confined to Maiduguri area, but geophysical investigation later indicates its presence beyond Maiduguri in the shores of Lake Chad in Baga LGA. Not much is known about the recharge to this aquifer, but it is believed to be at a far distance at the fringe of the basin away from Maiduguri.

2. **Surface water:**
   Lake Alau, an artificial dam constructed in conjunction with a Surface Water Treatment plant in Maiduguri funded by the World Bank (WB) in 1992, is co-administered by BSMoWR and Chad Basin Development Authority (CBDA). The dam serves the double function of a) feeding the Maiduguri Water Treatment plant

daily with a maximum capacity of 67,000 m3/day of raw water that is then treated and fed into the State Water Board water network in the city, and b) as source of water for agricultural irrigation around Maiduguri[19].

There are a few intermittent **streams** in and around Maiduguri and River **Naggda** which flows through the city center discharging its water into Alau lake. Alau dam receives water also from River Gombole and River Yedzram which meet at a confluent at Sambisa and flow as river Ngadda into Alau lake. The inflow to the lake depends mainly on the natural inflow of the Ngadda, which is seasonal, and to a less extent on runoff from the immediate surroundings.

3. **Rainwater harvesting:**
   Rainwater harvesting is a common method of obtaining free water used by many segments of the population during the rainy season. Like water from surface streams, harvested rainwater is not used typically by the water market sector as a source of water for sale.

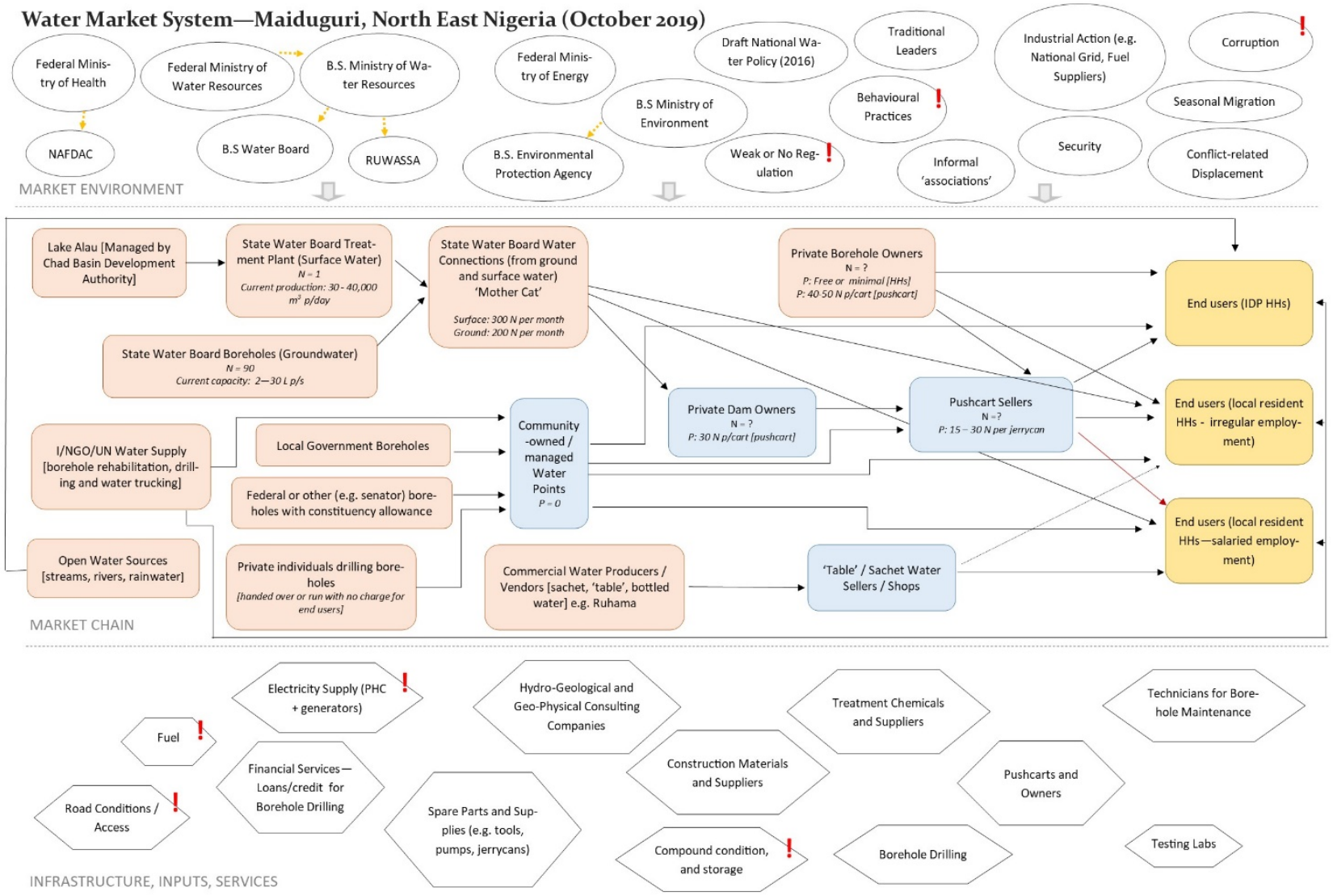
C.2 The Water Market System: Water Market Actors and Market Chain

A market system as defined by the EMMA Toolkit is *"a network of producers, suppliers, processors, traders, buyers, and consumers that are all involved in producing, exchanging, and consuming a particular item or service*" [20]. A Market System also includes the '*various forms of infrastructure, input providers, and services* [and] *operates within the context of rules and norms that shape this system's particular business environment*'.[21] For the CRS market assessment, and operational research in general, the critical market system of focus is ***water***. Given the agreed minimum standard among the Nigeria WASH Sector that the population should have access to 15 liters of water per person per day (for drinking, bathing/personal hygiene, clothes washing and cooking), the assessment looked at water supply for these needs, not only for drinking water.

The water market system includes various forms of infrastructure, inputs, and services required for it to function, as shown in the below map, and its' environment is shaped by numerous rules and norms. The various components of the water market system summarized in the market map are described in the following sections of the report.

[19] The assessment did not focus on determining the volumes of water that Lake Alau derives for irrigation purposes, on the surface of its catchment areas, nor whether irrigation systems are currently functional. Water for irrigation uses was not within the assessments scope.
[20] The Emergency Market Mapping and Analysis Toolkit, pg 4, available at: https://www.emma-toolkit.org/
[21] *Ibid.*

Figure 1: Water Market System Map for Maiduguri, North East Nigeria (October 2019)



The assessment identified the following market actors involved in the provision, and purchase, of water:

1. State Water Board
2. Local/International NGO (L/INGO) constructed boreholes/water points
3. Community owned managed boreholes/water points
4. Commercial water producers
5. Other water points
6. Private borehole owners
7. Private dam owners
8. Push cart sellers
9. End Users

C.2.1 State Water Board

The State Water Board is the main source of water for the city of Maiduguri, including parts of Jere and MMC LGAs, delivered through the state water network. As mentioned above, this water is sourced from 1) the water treatment plant in the city, and 2) a network of around 90 state-managed boreholes. The state water board connections have a set monthly fee, either 300 Naira for connections from the treatment plant or 200 Naira for connections from the borehole network. The state water service is also known locally as 'Mother Cat' which is linked to the construction company responsible for laying the piping and making the connections for households being linked to the network (CAT). See below section C.4.1.2 for more information. The state water network does not have coverage throughout the city, and there are some neighborhoods without the possibility of connecting to the network despite the BSMoWR claiming that connections can be made wherever required. For the assessment areas, Madinatu falls under Zone 1 of the BSMoWR coverage, and Gwange III under Zone 2. The other locations are in areas that currently do not have a functional distribution network from the BSMoWR.

C.2.2 L/INGO constructed boreholes/water points

Local and international NGOs, and UN agencies, are key actors in the constructing and maintenance of boreholes and water points in the city. Water is usually free of charge for end users, with committees established at community level for monitoring, management and reporting of any issues or challenges.

C.2.3 Community owned and/or managed boreholes/water points

For boreholes or water points established by NGOs, local government, or private individuals (see C.2.5) the community usually takes on the management of these points. Issues of operations and maintenance can be reported to the local government authorities or the BSMoWR Operations and Maintenance Department, or the NGO/individual who established the point, for action. Water from these water points is usually free of charge. Some committees collect contributions from the community when maintenance is required, while others charge a monthly rate (e.g. 20-50 Naira reported in Madinatu and Gwange III by *bulamas*).

C.2.4 Commercial Water Producers

Another source of water for the city of Maiduguri is that of commercial water producers – companies who source, treat and package water in sachets, drinking bottles and/or bottles for water coolers. This source of water is mainly used by economically better off groups in the community, and therefore is not a significant focus of the assessment. However, these water producers are registered with the Ministry of Health and regulated by guidelines from the National Agency for Food and Drug Administration and Control (NAFDAC). There is one producer with two boreholes in the assessment areas (in Maisandari), while most are in other parts of the city.

C.2.5 Other Water Points

There are also water points and boreholes established by private individuals and politicians, this includes those using their own individual financing (often to encourage political support among residents) and those who are working for the federal government who use their constituency allowance to construct water points. The assessment did not focus on these water points specifically as they are relatively small in number, and usually handed to the community for management as per C.2.3 above.

C.2.6 Private Borehole Owners

Although there are no accurate figures of private boreholes drilled and constructed by private individuals, this is reported as a significant source of water for the population of Maiduguri and for pushcart sellers that take the opportunity to sell this water directly to end users (see C.2.8). More recently, an increasing number of private boreholes are being constructed, with owners usually doing so without previously required surveys nor oversight from the government and there are no official records in terms of borehole logs, depths, etc. Alongside government boreholes and community/NGO boreholes, private boreholes are a major source of water for the communities assessed. Borehole owners often provide water free of charge to individual households who come to collect themselves, or charge whatever they can afford to pay. Otherwise, private borehole owners sell water to pushcart sellers for 30 to 50 Naira per cart of 14 jerry cans (approximately 280 Liters). If the borehole is powered by the national power grid pushcart sellers usually pay less (30-40 Naira per cart), and when the borehole is powered by a generator, pushcart sellers pay slightly more (40-50 Naira per cart). The assessment found varying conditions among private borehole owners (see section D.1 for more information).

C.2.7 Private Dam Owners

In some locations, there are private individuals who have constructed ground reservoirs. These reservoirs are usually connected to the state water board network and gather water which is then sold to pushcart sellers or collected by communities. Pushcart sellers usually pay 30-40 Naira to fill their cart of 14 jerry cans from these dams. There are no accurate figures on the number of private dams operating, but in some neighborhoods the assessment team observed this was a common source of water. Based on the assessment findings, these dams were often found to be uncovered, have very poor hygiene (with rubbish and animals inside) and no water treatment practices were observed (see section D.1 for more information).

C.2.8 Push Cart Sellers

Pushcart sellers are mainly from outside Maiduguri, either IDPs or seasonal economic migrants, who tend to rent a cart with 14-15 20L jerrycans and sell water to end-users. There are no accurate numbers of the total number of pushcart sellers, but most communities visited estimated there were between 30-100 pushcart sellers operating in each area. In some areas, pushcart sellers are the main source of water for end users given the intermittent and unreliable operations of government water supply or an absence of other water sources. Pushcart sellers collect water from a variety of sources including government and NGO boreholes (though this often entails long waiting times so is not as preferred), private boreholes and private dams. Pushcart sellers deliver directly to customers based on demand, usually charging a fairly consistent price irrespective of the water source. In the dry season a 20L jerry can is typically sold for 15 Naira, or a full cart for 200 Naira, the rest of the year a 20L jerry can is generally sold for 10 Naira or 150 naira for a whole cart. See Section D.2 for more information.

C.2.9 End Users

All community members are accessing water through the various actors in the market system, whether directly from the state water board, collecting from rainwater harvesting during rainy season, from I/LNGO water supply systems and handpumps, from private boreholes or from pushcart sellers. Although it's hard to categorize end

users into different sub-categories the assessment team felt it important to reflect differences between IDPs and host populations (with IDPs less likely to have access to state water board connections and with perhaps more limited economic options to purchase water) and also between host community residents who have regular or salaried income (e.g. government or NGO employees) and those with irregular and lower income. Within these groups, the sources of water vary, and also (though not easy to reflect on the market map above) the purpose of water use also varied. For example, those with more regular and higher income might rely on commercial water providers (e.g. bottled water) or state water board connections for drinking and cooking purposes, however they also purchase water from pushcart sellers for washing clothes. For lower income households, they may use water purchased from pushcart sellers for drinking and other purposes, including when free water is not available from other sources (e.g. due to water points drying up, temporary breakdown, long queues during periods of high demand etc). See Section D.3 for more information.

C.3 Infrastructure, services and inputs

The previously named market actors are the primary focus of this operational research. As direct service providers of water, their business models and the functioning of the overall water market system, rely on the existence of, and access to, other infrastructure, services and inputs. Therefore, it's important to understand these inputs and services, as well as the actors involved in their provision who are outlined in the lower third of the market map and can be separated in two categories:

1. Supplies and inputs, and the actors enabling access to these, and
2. Infrastructure and services

The below sections describe those that are the most critical for the whole system to work.

C.3.1 **Supplies and inputs**

Spare parts, tools, equipment, and construction materials: Basic supplies required to collect and store water (e.g. jerry cans for pushcart sellers and end-users); tools, spare parts and construction materials required for construction of boreholes, dams, water networks and other water points; pumps (solar and/or electric) required for borehole operations; and generators used by a number of borehole operators and the State Treatment Plant to continue operations when there are interruptions in the national grid power supply. There were no critical issues reported around the availability of these materials, tools and spare parts and availability in Maiduguri had reportedly increased over the last 5 years (e.g. prior to the crisis equipment such as pumps had to be sourced from Abuja or other major cities, whereas now they are readily available in Maiduguri or nearby areas). For generators and pumps in particular, a number of borehole owners reported challenges in maintaining operations particularly in the dry season when temperatures and demand are significantly higher requiring equipment to run for longer and resulting in more frequent breakdowns.

Chemicals for water treatment: Chemicals and materials for water treatment such as chlorine, aluminum sulfate, and lime, are also required to ensure safety and quality of water for drinking. The State Water Board use these inputs for treating surface water from the Alau lake, along with NGOs, and Commercial Water Providers. Private borehole owners and private dam owners generally are not accessing materials for water treatment despite a need. At household level, materials for treating water such as aquatabs, Water Guard, and water filters are often needed – NGOs continue to provide treatment particularly during times when cholera risk is high, and also do some chlorine dosing at water points.

Fuel: For those borehole owners operating generators and the State Treatment Plant, fuel is required to maintain operations when electricity supply from the national grid is interrupted. Although fuel was generally available, issues of cost were frequently reported. For boreholes operated by the State Water Board, fuel is provided by the government but there were challenges reported around cost and sufficient supply.

C.3.2 Infrastructure and services

There are several services and infrastructure required for the functioning of the water supply system. These include:

Hydrogeological and geophysical surveys and drilling of boreholes: these services are only used (and affordable) by I/NGO's and government institutions. Private borehole owners do not use hydrogeological/geophysical surveys, instead they drill until a water bearing formation is reached. Previously companies engaged in drilling boreholes had to be registered and approved by the SMoWR with oversight maintained of their operations, however, now it was reported that there is less oversight and an increase in private individuals and companies drilling boreholes without the appropriate assessments, surveys and monitoring.

Financial services and loans: Financial services, particularly loans from banks and formal financial institutions appear to be only accessible to commercial providers and government agencies. Perhaps accessible to some private borehole owners, but many highlighted a lack of access to capital as a major constraint to improving their operations, compound, and replacing essential equipment.

Informal savings groups and access to micro credit: Particularly for pushcart sellers, savings groups and access to micro-credit were seen as essential to 1) support them through difficult periods when sales and income from selling water is reduced (e.g. due to illness), and 2) enable them to purchase their own cart and jerrycans reducing the need to rely on cart owners who may have carts in poor condition or high demand for rental of carts. It is not clear to what extent pushcart sellers have access to these services, though the assessment suggested it might not be widespread.

Laboratories: Laboratories seem only to be available through NAFDAC[22] and the laboratory at the water treatment plant that was recently equipped by ICRC. Referrals are made from RUWASSA to this laboratory and some NGOs are also using it[23]. I/NGOs have also access to simply bacteriological and physical field lab kits. Although RUWASSA does some testing of water samples among private boreholes this tends to be only when there are cholera outbreaks or in high risk areas. Commercial water companies also provide samples to the National Agency for Food and Drug Administration and Control (NAFDAC) for testing.

Electricity from National Grid: electricity is required for the operation of most pumps of private boreholes, government boreholes and the state water network. The national grid power supply is the main source of electricity, but provision can be intermittent, requiring many water providers to have generators as a back-up power supply which is more costly.

Road access: Road access and infrastructure is essential for pushcart sellers to be able to reach water sources and their customers. Road conditions can be particularly challenging in the rainy season making the work of pushcart sellers much harder. In some neighborhoods where roads are impassable pushcart sellers do not deliver water despite customer requests.

Pushcart and Jerrycan Rental: Most pushcart sellers rent their pushcarts from private individuals, these cart owners usually rent on a daily basis to pushcart sellers with rental inclusive of 14-15 jerrycans (20 L capacity) depending on the cart's capacity. In some areas, borehole owners were the main owners renting out pushcarts, while women were also reported to be renting out pushcarts as a source of income. New carts cost around 35,000

[22] As an agency under the Federal Ministry of Health, NAFDAC and while their mandate is on packaged water, they do also conduct water quality test for private individuals and organization based on request and with a charge. Some actors that make us of them include: Commercial Water Companies, borehole drilling companies (water quality report from NAFDAC is often required of them by clients) and NGOs.

[23] Donated by and installed in Water Treatment Plant by ICRC

Naira[24], while used carts can be bought for 15-18,000 Naira[25]. Pushcart sellers pay 100-150 Naira per day to rent a cart and set of jerrycans (price varies based on the condition of the cart).

C.4 Market Environment

When analyzing the water market environment, closer attention has been given to specific government actors that directly and/or indirectly influence the overall water market system (*see in Figure 1, top third of the market map*). These are significant players that, from a legal point of view, set rules and norms and are ultimately responsible to implement the institutional policies governing the water and environmental domains. In this case, the main institutions are the Borno State Ministry of Water Resources (BSMoWR) together with the Borno State Ministry of Environment (BSMoE) through the Borno State Environmental Protection Agency (BOSEPA). This report does not intend to provide a comprehensive and detailed overview of the institutions related to water supply and management, but only the most pertinent points. A detailed WASH Governance Review was conducted by Action Against Hunger (AAH) in July 2019 which provides a more comprehensive overview.[26]

Through the assessment, valuable information was also obtained on general trends and behaviors which helped form a more accurate understanding of the institutional strengths and the inherent gaps at an institutional level but also within the wider water supply system. To analyze the market environment, the **BSMoWR** is considered as a central player. Other state-level government institutions are either following the framework set by BSMoWR, being directly supervised by it, influenced by it, or work alongside BSMoWR as a peer, while others appear to be on the periphery with less strong links.

Aside from the governmental and institutional dynamics, there are also more informal and general trends and norms that play an influential role on the functioning and regulation of the market system, for example security, industrial action, population movements, seasonality and the role of traditional and community leaders.

The most critical relationships and mandates, between federal and state level ministries and agencies, and also more general trends and norms affecting the system, are outlined in the below description and analysis of the market environment.

C.4.1 Borno State Ministry of Water Resources (BSMoWR)

The primary role of the Federal Ministry of Water Resources is to allocate financial resources to state water ministries, approve loans, and draft and set national policies around water. By federal law a Water State Ministry, in this case the BSMoWR, has the mandate and responsibility to:

- Provide water to the whole population of Borno state[27]
- Regulate both the public and private extraction of ground and surface water
- Keep the main responsibility for water resource management planning (even though Borno State does not currently have any law relating to water resource management).[28]

Consequently, the BSMoWR provides water services to its constituents in Maiduguri through its agencies, directorates and departments whereas in rural LGAs and small towns the BSMoWR provides direct budget allocations to these as its agencies, directorates and department are not present outside Maiduguri. The reason for the centralization of BSMoWR in Maiduguri is partly due to the conflict but also due to budget restrictions before the conflict that forced ministry offices to close down in rural LGAs and small towns.

[24] Approximately 100 USD (1 USD = 355 Naira)
[25] Approximately 42 – 50 USD (1 USD = 355 Naira)
[26] This report was only available in draft form at the time of writing.
[27] Article 13 on the Right to health and health services form the 2003 Bill for an Act to Provide and Protect the Right of the Nigerian Child
[28] ACF WASH Governance Report 2019 Charrin, Lorne & Michoud

The BSMoWR is still the overall authority in Borno regarding water and supposedly should legislate and legally regulate any existing public or private water market system. However, this is far from the reality currently. There is a prevailing deregulated private water market system which the BSMoWR does not oversee nor control, and appears to have limited capacity, power and intention to do so. The only exceptions to this appear to be:

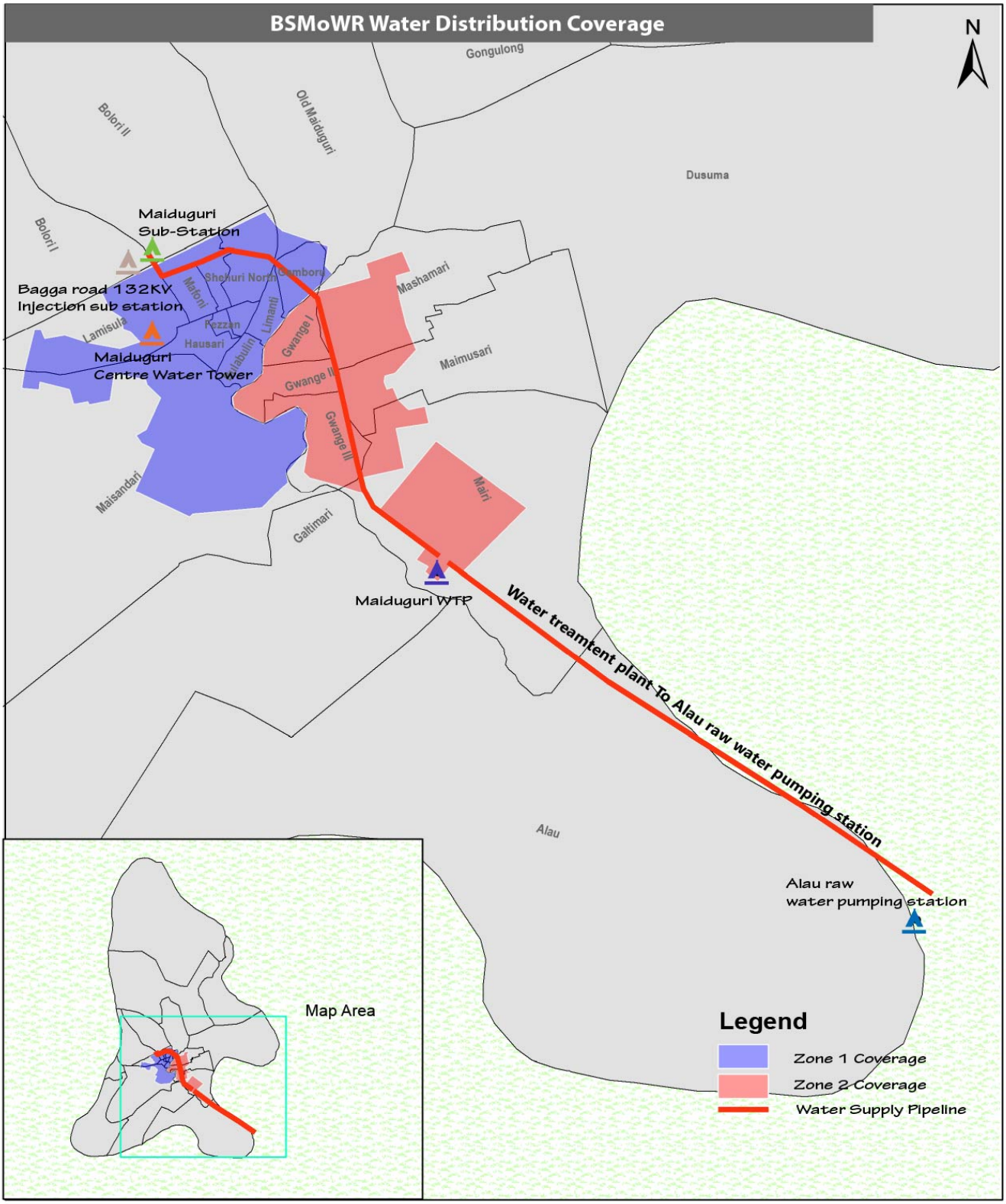
1. Commercial water producers in Maiduguri, which are legally registered companies regulated primarily by NAFDAC, an agency under the Ministry of Health, with the mandate of testing water quality and extending permits[29]; and
2. To a certain extent the public water domain – water provided by the government to the general population – through some of the BSMoWR own agencies, directorates and departments, these being:
    a. RUWASSA;
    b. The State Water Board;
    c. Its Commercial Department; and
    d. The Directorate of Operations and Maintenance

Before describing in more detail, the BSMoWR's four implementing branches and the relationship with the private deregulated water sector, it is of relevance to clarify and highlight that the BSMoWR manages two parallel networks supplying water to Maiduguri:

1. One coming from Water Board treatment plant; and
2. The other coming from approximately 90 State-managed boreholes in and around Maiduguri

These two networks are not integrated, and the Ministry has divided MMC and Jere in five distribution zones[30]. Zones 1 & 2 are served both by water delivered by the Treatment Plant and state-managed boreholes, whereas zones 3-5 are only supplied by the borehole network. It should be noted that there are still areas of both LGAs that currently have no access to state water connections (either from the treatment plant or state boreholes). Despite efforts, for example from the International Committee of the Red Cross and Red Crescent (ICRC) who established a network of new boreholes and treatment facilities to supplement an existing infrastructure built by BSMoWR to feed a local network covering Dala Alhamduri community in Maisandari ward of MMC[31], there are still other locations without access to the state water board supply.

[29] The role of BSMoWR in relation to these commercial water companies is not entirely clear.
[30] The BSMoWR was unable to provide a map of these zones.
[31] For more information about the ICRC please follow link: ICRC link map



*Map 2: MMC and Jere LGAs showing the public water distribution zones (only Gwange III and Madinatu from the assess areas are served by the distribution supply line)*C.4.1.1 ***RUWASSA (Rural Water Supply and Sanitation Agency)***

RUWASSA was established based on the directive of the Borno State House of Assembly in 2004 with the mandate of only providing infrastructure support to rural communities, not LGAs or small towns. They inherited all equipment such as drilling rigs, geophysical tools as well as qualified staff such as Engineers, Hydrogeologists/Geophysicists, Public Health experts and water laboratory with staff in order to implement their core mandate. RUWASSAs mandate is therefore only to:

- Drill boreholes
- Construct overhead tanks and distribution systems
- Construct toilets and sanitation facilities
- Distribute hygiene and other WASH-related NFIs
- Promote hygiene

Today Borno state government rely solely on RUWASSA for all drilling and construction of water supply systems. Because of the conflict, RUWASSA has started to operate as a contractor in LGAs, in Jere and MMC and where security allows in rural areas, given that they have access to the largest amount, and best quality, of drilling equipment. Due to security, RUWASSA has limited access to some areas of the state, and therefore has focused more on providing assessment and drilling services to government and other actors within Maiduguri town. For example, they have:

- drilled boreholes on behalf of the two local governments in Jere and MMC;
- signed MoUs to drill boreholes with INGO's and UN agencies (e.g. NRC, IRC, Oxfam, ACF, UNICEF);
- responded to requests from other state ministries to drill boreholes and construct water and sanitation infrastructure (for example in health facilities, schools and university);

Together with the Ministry of Health, RUWASSA also operates a rapid response team which is activated to respond when there are cholera outbreaks, providing hygiene promotion, disinfecting water points, both public and private, and taking water samples for testing in high risk areas. In one or two cases this has resulted in private boreholes being closed due to public health concerns but monitoring and testing only occurs during cholera outbreaks and only in high risk areas.

By law RUWASSA have no mandate nor responsibility in managing or overseeing any of the drilled boreholes or water supply systems implemented by them. As soon as a system is finalized it is handed over to the client. In those cases where the borehole or water supply system belongs to the Water Ministry it's handed over to the Directorate of Operations who is responsible for following up on operation and maintenance.

C.4.1.2 ***Water Board***

The Water Board oversees and manages the water treatment plant providing water to Maiduguri and releasing treated water to the city network. Originally this network, providing water to zones 1 and 2 of Maiduguri, was planned to reach all houses interested in getting connected. One condition of being connected to the network was that any connection should be metered for BSMoWR to calculate consumption, calculate applicable charges/fees and consolidate databases for future water demand projections.

When the treatment plant was established in 1992, it was designed to pump water 24/7 and meters were installed in each connected household. Originally BSMoWR planned to charge 5 Naira/m^3/month and started with 35,000 connections.

Unfortunately, the system had a flaw and the continuous pumping encountered problems when pump interruptions brought air into transmission lines and caused air to move through the piping system. This air in turn started moving the counters of the water meters rather than the water itself. This generated elevated and

inaccurate bill fees that were not reflective of people's actual water consumption. As the BSMoWR in its efforts to remediate the system flaw took too long the consequence was that within 2 years of installation the 35,000 consumers (clients) connected to the system had removed all water meters and payment based on quantity of water used was no longer possible.

The solution to resolve this problem taken by BSMoWR in 1995/96 was putting a flat rate price of 300 Naira per month for connections linked to the treatment plant, and 200 Naira for connections linked to the state-managed boreholes, for all water board consumers, irrespective of the volume they consume. These rates have not been revised since, and people still pay today the same amount set 24 years ago. There is also reportedly a high default rate, with BSoWR facing significant challenges in following up on outstanding payments. Even when connections are disconnected for non-payment, people simply reconnect to the network through a private plumber. The consequence is that there is no clear picture nor control of the number of consumers given the extreme high number of pirate connections.

The BSMoWR's initial plan of expanding coverage to zones 3, 4 and 5 became impossible as budget allocations neither from the fee collection nor from federal or central government are enough.

Today one of the greatest challenges for the Water Board is its dependence on diesel for its generators. The Power Holding Company of Nigeria (PHCN) is unreliable, and therefore the treatment plant, which operates 18 hours per day, has to rely on a mix of grid power and generators. There are days that 70-90% of the production runs on generators. As an example, running one generator takes around 220 litres of diesel / hour (each litre costs about 200 Naira).

C.4.1.3 ***Ministry Commercial Department***

The BSMoWR Commercial Department's responsibility is to:

1. Receive requests for new connections to the two Water Supply networks managed by the BSMoWR
2. Collect fees from population connected to the two Water Supply networks managed by BSMoWR
3. Disconnect users when they do not pay, and
4. Receive complaints if boreholes, or transmission lines are not providing water (these complaints are sent to the directorate of Operation and Maintenance for action)

A major challenge faced by the BSMoWR is to get people to pay. Water is seen as a social service and based on information gathered there is no consequence when clients don't pay. When the Commercial Department disconnects people just pay a private plumber and they reconnect illegally.

As mentioned above there are two flat rates that consumers pay:

1. 200 Nairas/month for water coming from state-managed boreholes
2. 300 Nairas/month for water coming from water board treatment plant

C.4.1.4 ***Ministry Directorate of Operations and Maintenance***

The Directorate of Operations and Maintenance oversees a total of 90 boreholes that supplies water to the Maiduguri borehole as well the borehole network and the network supplying water from the Water Board water treatment plant.

During the assessment there was limited information available about their work. The only information obtained was that the reliability of this Directorate was considered dubious by several of the communities interviewed. It was pointed out, for instance, that some communities had repeatedly reported non-functioning boreholes over a 2-year period but had lost hope to get their water points repaired as there had still been no action from the ministry and no visit from O/M staff.

C.4.2 National Water Policy

Currently, there is a draft national water policy developed in 2016 that provides some ambitions for improving governance and inter-department coordination on water provision. In particular, the draft policy also sets an objective to promote '*multi-stakeholder participation (governments, communities, civil societies and private sector) in the water sector development to rapidly meet the growing demand for domestic and industrial water supply, sanitation, irrigation and drainage'*[32], pointing to desire for more collaboration with private sector providers, including ambitions for '*creation of an enabling environment for private sector participation*[33]', though very little progress has been made. Most critically, the Water Policy remains in draft form, and is therefore not enforceable.

C.4.3 Informal trends, behaviors and norms affecting the water market system

Aside from the government and institutional environment, there are several other key trends that affect the functioning of the water market system. Some of the most critical are outlined here.

Weak or no regulation: As a result of the ongoing conflict, overstretched ministries, limited resources and large-scale displacement, the capacity of the BSMoWR to monitor and regulate private water providers is severely limited. Numerous respondents reported a significant increase in borehole drilling and establishing water points throughout the town with no oversight of the government. Even where previous regulations were in place requiring surveys and assessments, and government supervision prior to borehole construction, these are no longer enforced.

Population movements: Due to the population influx to Maiduguri as a result of the conflict the demand for water has increased significantly. This has put pressure on the overall water supply system, requiring higher quantities of water to meet needs, and has also contributed to the increase in informal and unregulated construction of water points. In addition, humanitarian actors have been engaged in construction and rehabilitation of boreholes and waterpoints, which is also not systematically coordinated and registered with the BSMoWR.

Behavioural Practices: assessments have continuously pointed out the need to address knowledge, attitudes and practices with regards to hygiene, water storage and treatment at household level, with many humanitarian WASH actors implementing software activities to address this over the past years. Perceptions that chlorinated water is not suitable for ablution, and that once water is treated it is safe (irrespective of when and how it was treated and subsequent transportation and storage conditions), reported during the assessment also indicate high risk that people are consuming contaminated water. Similarly, private borehole and dam owners consulted during the assessment were not treating water or maintaining minimum standards in their compounds/facilities required to protect water. Where some borehole owners had received chlorine to treat water from humanitarian organisations, they were not found to be using this consistently (only when distributed) and there was no evidence of their awareness or knowledge on appropriate treatment and dosing practices. In addition, pushcart sellers in some areas were collecting water from contaminated and uncovered dams and selling this to end-users. There appears to be limited awareness and demand for water that is treated or meets minimum quality standards from end-users.

Seasonality: Seasonality has a significant impact on water availability and demand. During the rainy season, demand from end-users tends to be lower as water is more available and people also source water from rainwater harvesting. In dry season, water is scarcer, with many boreholes closed as the upper aquifer usually dries up. Some pushcart sellers coming from outside Maiduguri town also migrate back to their areas of origin just before the

[32] Section 2.4 – 2016 Draft Water Policy
[33] Section 3.15 and 4.14 – 2016 Draft Water Policy

rainy season to tend to agricultural land, and then return to the town in the dry season when demand for their services is higher. Prices for water from private vendors, including pushcart sellers, also tend to be generally higher during the dry season. However, in some neighbourhoods where road access is extremely difficult during the rainy season this can also result in higher prices charged by pushcart sellers.

Industrial Action: Industrial action particularly affecting PHCN's national grid and fuel sector can cause temporary disruptions to operations in the water market system. A strike by PHCN workers in April 2019 lasted 7 days and caused disruption to all power supply in the city.

Informal Associations: Although the assessment found no evidence of formal registered unions or associations among the actors in the market system, for example private borehole owners and pushcart sellers, there were several reports of informal associations and cooperation between actors. For example, in Gwange III there is a borehole owners association established in 2009 with 30 members[34].

Traditional and Community Leaders: Community leaders, including *bulamas*, can play a critical role in managing water resources. For community-managed water points, community leaders can control access to water and operating hours. In some locations, community members reported that leaders would negotiate on behalf of the community during times of water crisis to have access to water or subsidised rates. In some locations, pushcart sellers are required to register their names with community leaders for security purposes.

Dishonest or fraudulent conduct: Although it was not possible to capture detailed information on the extent and levels of dishonest or fraudulent conduct, anecdotal information suggested that there were dynamics of fraudulent conduct at play within the market system. This includes private dam owners using state water board connections for commercial purposes, and officials being aware of this but not taking action.

Security: The ongoing security situation continues to impact the town through population influxes, inability of IDPs to return to their areas of origin, and lack of access of government to rural areas to oversee and ensure water services are provided. Security has also impacted the operations of commercial water providers, with distribution networks significantly reduced (one company reported supplying 27 LGAs in Borno State and Maiduguri with water before the crisis, while now due to restricted access they are only supplying to 3 LGAs and Maiduguri).

D. Key Findings

The following section of the report outlines more detailed information and analysis gathered from the assessment, with a focus on **1)** *Water providers, particularly private borehole owners*; **2)** *Water pushcart sellers*; and **3)** *End users.*

This is not a comprehensive overview of all data gathered, but rather a summary of the most pertinent points emerging from the data analysis done to date.

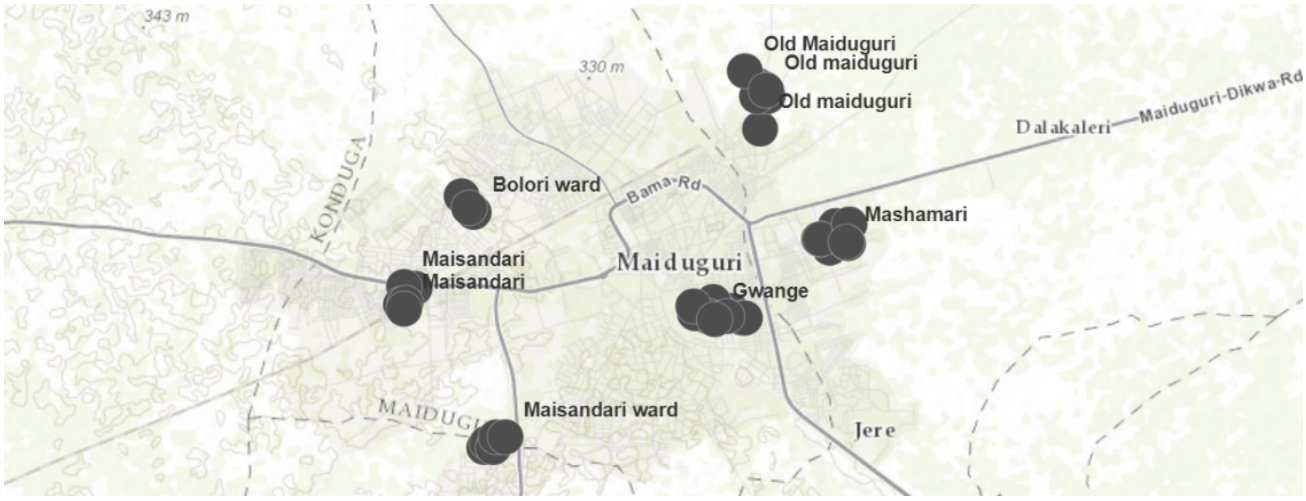
D.1 Water Providers

D.1.1 Overview of Water Providers Profiles

During the assessment, a total of 46 private water providers were surveyed across the 6 targeted neighborhoods. In addition, two (2) key informant interviews (KII) with private borehole owners and one (1) KII with the chairman of a private borehole association in Gwange III were conducted to triangulate information and obtain more accurate understanding of the private water provision market in Maiduguri.

[34] For more information on the water provider association in Gwange III see section D.1.2

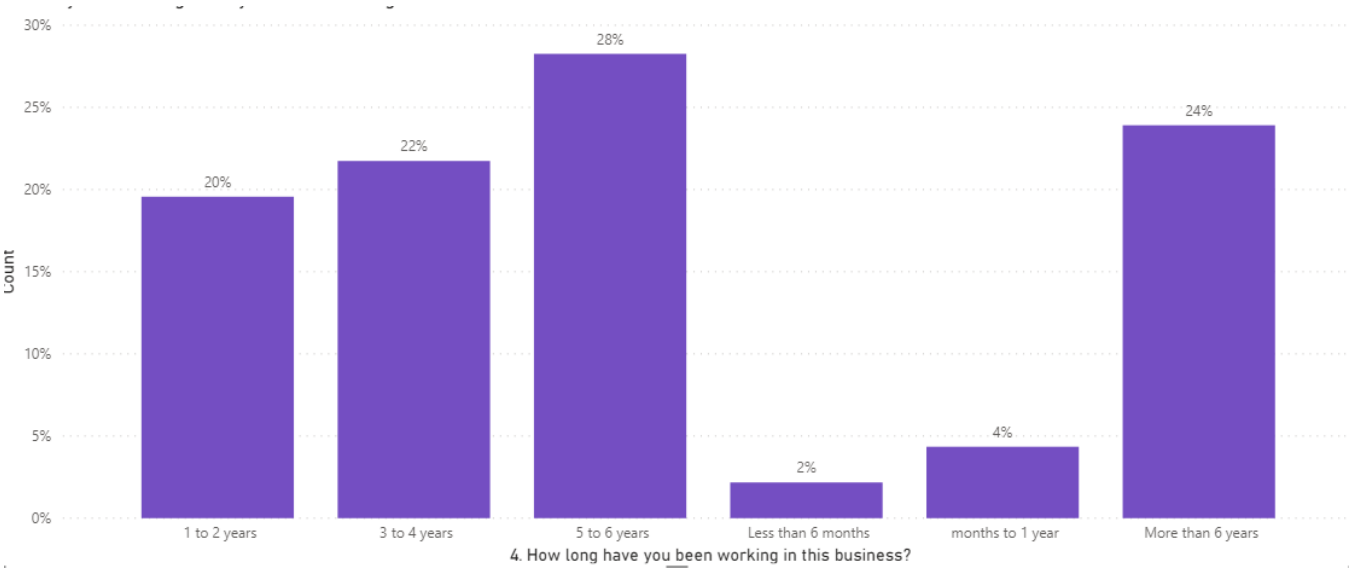
Map 3: Locations of assessed water providers in Maiduguri Town



Of the 46 water providers that were assessed 38 where private borehole owners and 8 were owners of so-called 'dams', which pump water from the Ministry (Water Board) water network to underground reservoir tanks (estimated to be between 10 and 42 m^3 in size). CRS also completed three (3) key informant interviews with commercial water providers that sell bottled and sachet water[35].

As shown in the below in Figure 2 Maiduguri has seen an increase in private water providers of 76% since 2013 in the assessed areas.

Figure 2: Years since private water providers started their business

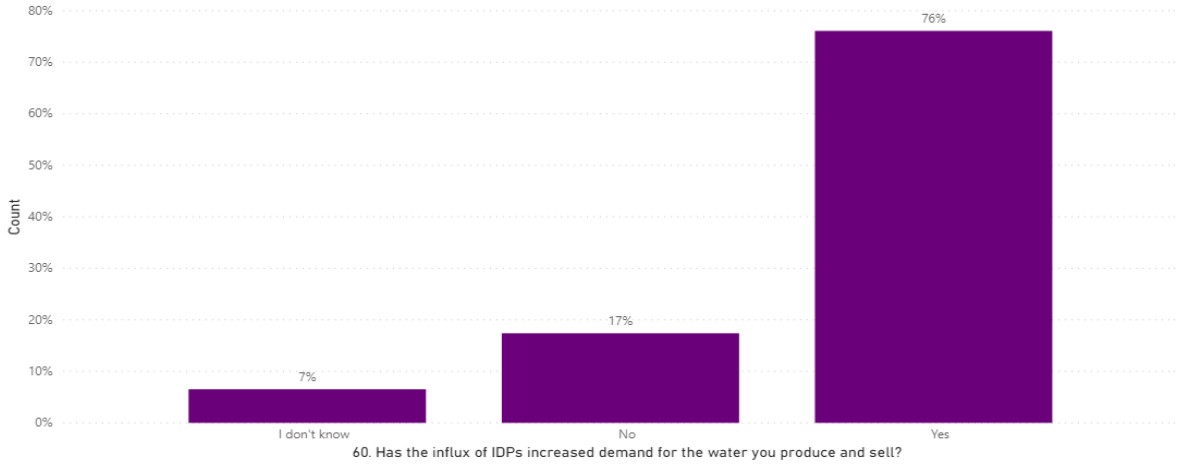


According to the assessment findings the first major increase of private water providers occurred in 2015 in the Simari area, which saw a 40% rise, followed by Madinatu with a 30% rise, and Gwange III with a 25% rise.

[35] Because the clientele of commercial water providers tends to be better-off households, private sector and NGOs which are not our target population of end users the assessment did not focus on these market actors.

Nevertheless, the greatest growths occurred between 2017 and 2018 in Bulumkutu Kasuwa with a 60% increase followed by a 33% increase in water providers in Garba Buzu and Modusulmri.

Figure 3: Responses of private water providers for how the influx of IDPs is perceived as a factor increasing demand for water

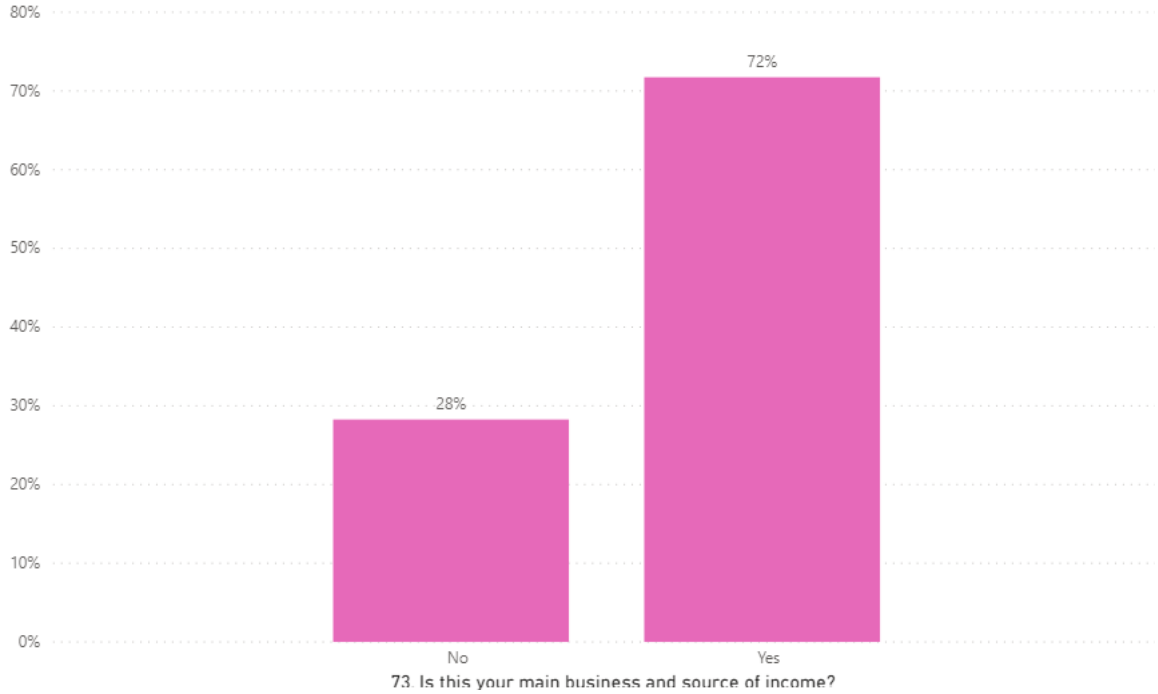


This upsurge is thought to be directly associated with an increase in the number of IDPs (and therefore population) in these areas as a result of the ongoing crisis. As shown in the graph above 76% of all surveyed water providers indicated that the presence of more IDPs has increased the demand for water.

The same trend was observed across most of the geographic areas covered in the assessment, with 100% of water providers in Madinatu confirming the same, followed by 83% in Gwange III, 70% in Simari, 67% in Modusulmri and 60% in Bulumkutu Kasuwa. Garba Buzu saw the lowest response with only 33%.

For 72% of the water providers assessed, water provision is their main livelihood. In Garba Buzu, less water providers (33%) reported making a living out of the water business alone. In the other areas, the % was higher starting with Gwange III with 92%, Bulumkutu Kasuwa 80%, Simari 70%, Modusulmri 67% and Madinatu 60%.

Figure 4: % of water providers that make their living out of the water business



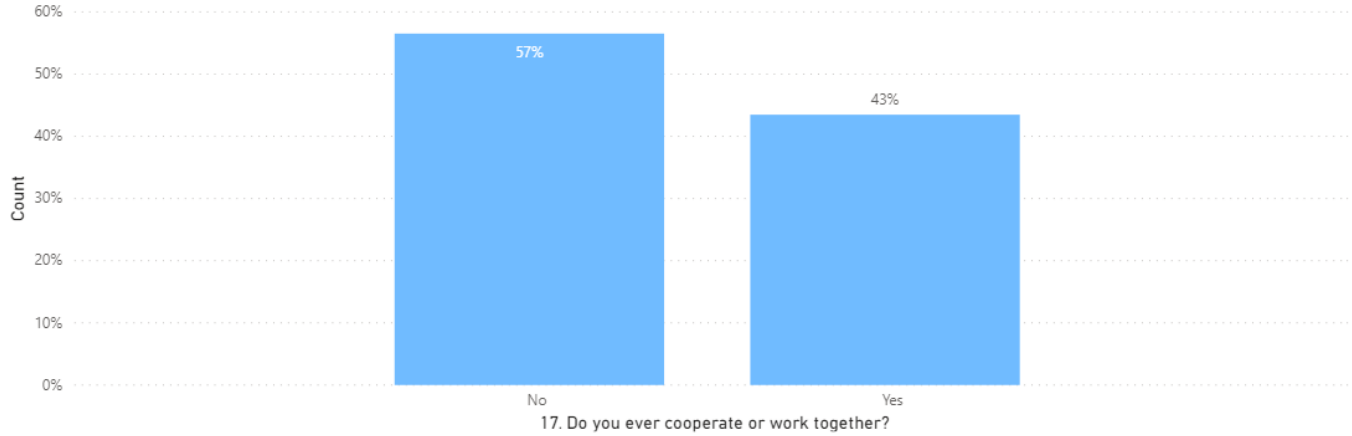
Many of those water providers that combine the water business with other jobs or livelihoods responded that they are engaged in their own commercial shops and a minority responded that they farm or drive a taxi. Others use the water for production of bricks, which is a significant source of income. For those who are reliant on the water business as their main source of income, this was not only related to provision of drinking water or water for household use.

D.1.2 Market Competition, Cooperation, Associations and Government Regulation

Market Competition and Collaboration

Market competition seems to be fair and cooperation among water providers is not insignificant. Even if 57% of respondents said they never cooperate or work together, with Simari having the highest response (100%) and Bulumkutu Kasuwa and Madinatu the second highest (80%), 43% of water providers still answered throughout the 6 assessment areas that collaboration indeed occurs.

Figure 5: Cooperation among private water providers



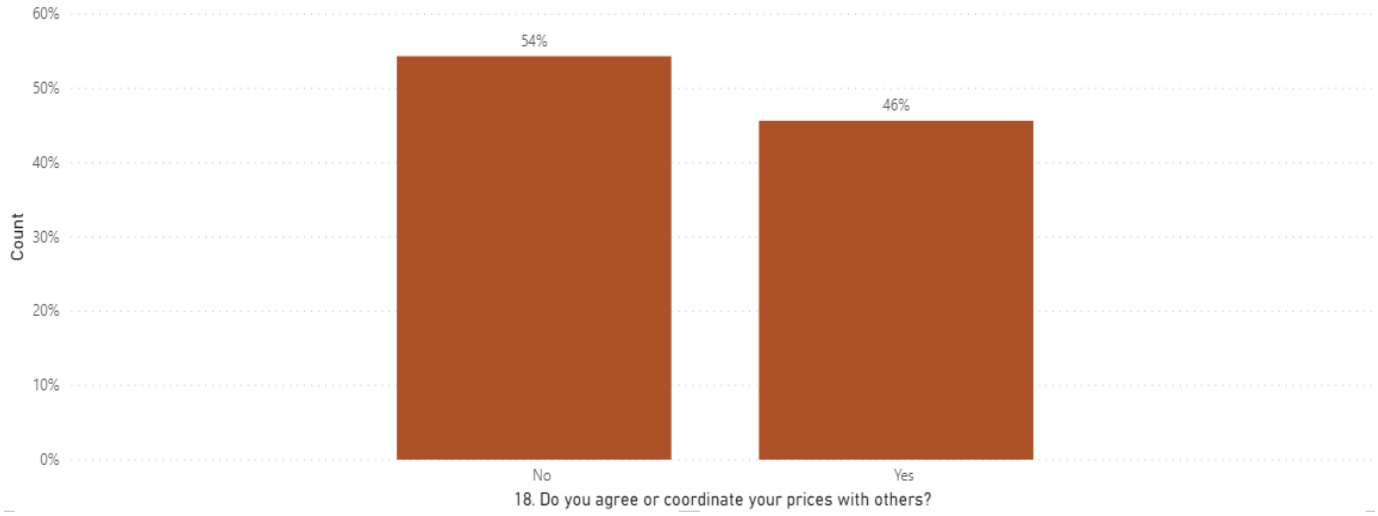
Of this 43%, water providers in Modusulmri had the highest rates of cooperation, with 100% of respondents indicating collaboration, followed by Gwange III with 83% and Garba Buzu with 43%.

These numbers need to be further investigated, but especially in Gwange III, this seems accurate given that this neighborhood had the only proven private borehole owner associations found during the assessment.

Price Setting

In line with the levels of collaboration reported among private water providers, 54% responded that they do not set prices with one another, however 46% responded that they do coordinate when setting prices, see Figure 6 below.

Figure 6: % of respondents across 6 assessed areas who agree or coordinate price setting



Price setting follows a very similar pattern to the percentage of private water providers reporting collaboration. However, although collaboration was reported to be highest in Modusulmri, water providers in Gwange III reported the highest levels of price setting with 92%, followed by Modusulmri with 83%, Garba Buzu with 67% and Bulumkutu Kasuwa and Madinatu with 20%.

The reason that Gwange III has such an elevated number of private borehole owners coordinating prices is likely related to the presence of a highly developed water association among private borehole owners that exists in that neighborhood.

Associations

During the assessment, only one association was identified and interviewed. This association is in Gwange III and was formed in 2009. It is not registered under any government agency. However, in 2017 it joined a government registered state-level association but withdrew participation one year later due to issues of mistrust. The association was initially formed to assist borehole owners to regulate and harmonize the growing cost of operations and in setting prices of water for pushcarts sellers and other vendors. However, the mandate subsequently expanded to include assisting each other operationally. Members meet regularly once or twice a month depending on the urgency of information to be shared. The association consists of 25 active members and 5 less active members. Members are all water service providers with private boreholes. The association covers more than 30 private boreholes under its umbrella as some members have more than one borehole. The association consists of the leadership structure, i.e. chairman, vice-chairman, secretary and the members, and membership is open to all interested private borehole owners in the three Gwange wards.

The main criteria for membership are that the borehole owner must be located in Gwange district, this is in order to ensure easy management. The other four conditions are that members:

- must be a community member i.e. lives in the community
- must be vouched for by the community leader or a respected community member
- must have a borehole or be in the process of constructing one
- must inform the association of plans to drill new boreholes and demonstrate their financial capacity to do so

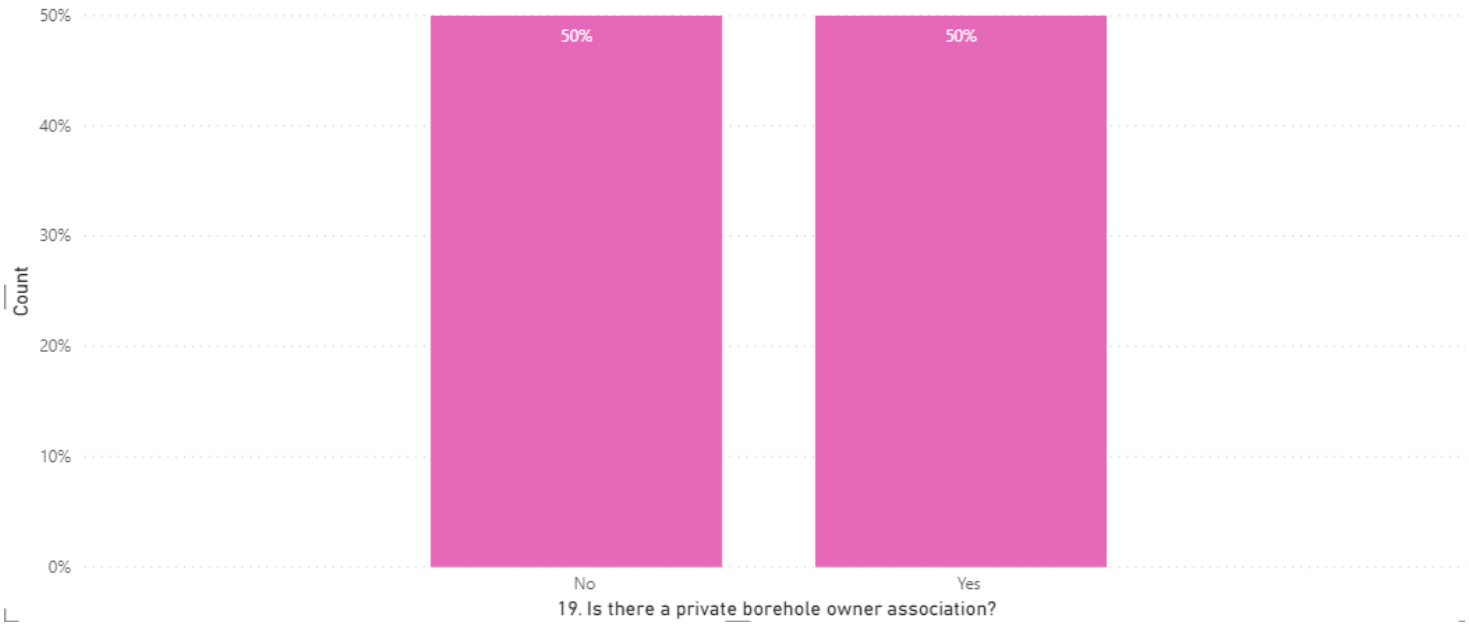
The association is involved in:

- Building capacity of members on minor repairs for generators
- Providing technical guidance/assistance to members seeking to drill new boreholes
- Providing domestic borehole owners, thus boreholes owners that do not sell water, with minor repair services free of charge
- Providing referrals to members in terms of service providers for major repair or installations
- Renting of pumping system parts to members at a subsidized rate
- Regulating the activities of pushcart sellers (that are customers) e.g. the association ensures that pushcart operators clean their jerry cans regularly. Services will not be provided to pushcarts with dirty jerry cans.

Gwange III has the largest number of private borehole owners compared with the other communities assessed - a total of 12. According to the data collected, Gwange III is also the area out of the 6 assessed with the highest density of private water providers and with the water providers there reporting no presence of I/NGOs working in the area of water provision[36]. However, 6% of households surveyed in Gwange III did report using NGO boreholes to access water, and pushcart sellers also reported accessing water from INGO boreholes, however they could be travelling to water points located outside of the area.

Despite Gwange III having a high density of private water providers and an active water provider association, only 50% of water providers in Gwange III reported being aware of the existence of this association.

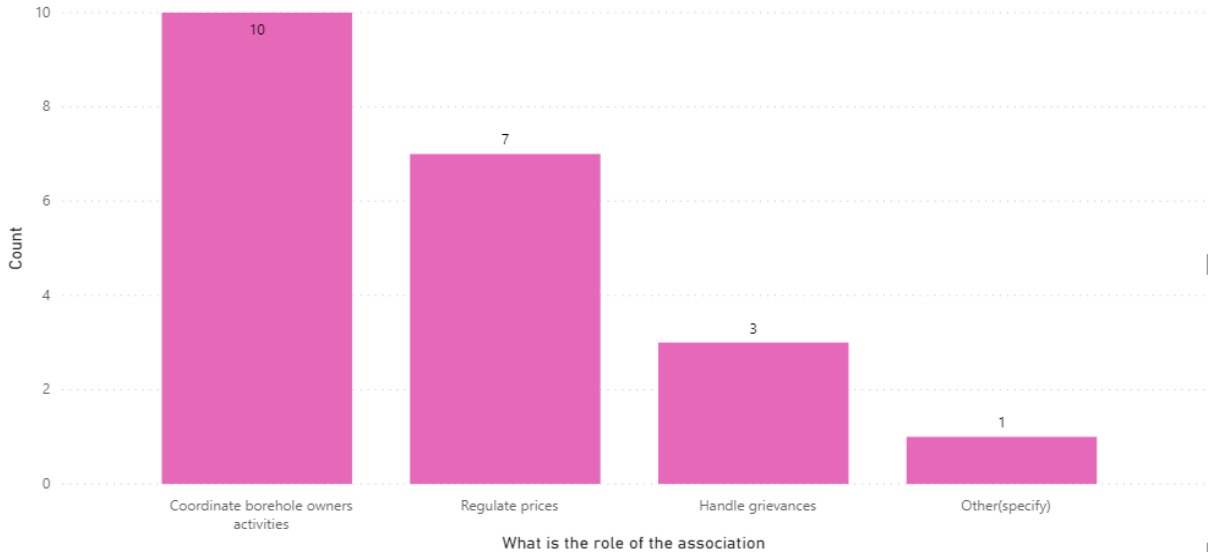
Figure 7: Knowledge among Gwange III water providers on the existence of water association



Aside from Simari where respondents reported no presence whatsoever of associations and in Madinatu where 50% reported no presence and 50% didn't know, 67% of respondents in Garba Buzu and 20% in Bulumkutu Kasuwa reported the existence of water associations. Despite attempts to find out about the existence of borehole associations, it was not easy to identify contacts in all areas where associations exist – it is also not clear to what extent these associations are formalized, or if they are registered with the authorities.

[36] Gwange is composed of three neighbourhoods: Gwange I, II and III and it's not clear if water providers meant there are no INGOs working in Gwange III only or in the wider Gwange area.

Figure 8: Respondent perceptions of roles of water associations



Of all the surveyed borehole owners across the 6 areas 38% of them reported being members of an association, 16% in Gwange III, 8% in Modusulmri, and 3% each in Garba Buzu and Bulumkutu Kasuwa. According to these 38% involved in an association, the roles of the association are as indicated in the above Figure

Seven (7) respondents indicated no membership fees however one (1) specified a fee of 50 Naira, two (2) a fee of 500 Naira and another one a fee of 1000 Naira. It is unclear whether the costs reported are accurate, but all mentioned that they are paid on a monthly basis.

Of the 12 surveyed borehole owners who were asked "how many other individuals or groups are doing the same business in the area" (see above table), borehole owners provided mixed responses.

50% responded in line with the number of boreholes that the assessment team had identified, however the remaining responses reflected that borehole owners were largely unaware of other boreholes operating in the area.

Table 7: Knowledge among Gwange III water providers of number of other similar businesses

Reported # of other private boreholes in the area [by private borehole respondents]	# of responses
21 to 30 other boreholes in the area	1 borehole owner responded
31 to 40 other boreholes in the area	1 borehole owner responded
11 to 20 other boreholes in the area	4 borehole owners responded
Less than 5 other boreholes in the area	3 borehole owners responded
5 to 10 other boreholes in the area	3 borehole owners responded

Finally, there is no contact whatsoever between private water providers and the BSMoWR's different operational branches (e.g. Commercial Department, Operations and Maintenance Department, RUWASSA, State Water Board etc.). All survey respondents and KII, except for the three (3) interviewed commercial water providers[37],

[37] Even though all three commercial water providers responded that they pay state taxes and that NAFDAC is the only state and Federal agency they work with, regarding permission and water quality, we decided at this stage to not focus on these commercial water providers as main water actors in the market system given that their main customers are not at this stage the main focus for this Operational Research

responded that no permits were extended by BSMoWR and there is neither any communication nor sharing of water extraction volumes to BSMoWR.

It is remarkable, and perhaps unlikely, that in Madinatu with 80% of surveyed water points being fed by the State Water Board network, that the commercial department of BSMoWR is not aware of their operations, though in practice their operations are illegal.

D.1.3 Water Availability, Customers and Source Pricing

It has been confirmed by several sources that water is mostly available throughout Maiduguri. When asked about whether yield drops during the year, 72% of private water providers responded that no drops in yields had occurred, however 28% responded that they had experienced drops. Regarding the 72% these confirmations are very much based on boreholes owners' own perceptions, yields may indeed be dropping but it would be difficult for them to notice the difference due to the following:

1. Most boreholes, pumping water from the upper and middle aquifers are relatively new, no more than 6 years old, and ground water levels may have been reducing but because the dropdown levels are negligible this goes unnoticed; and
2. The assessment team observed that no record keeping of extracted volumes nor measurement of groundwater table depth was being done at all at any private boreholes.

Of the 28% that answered that yield had dropped, the highest occurrence was found in the Madinatu and Simari areas with 40%, followed by Garba Buzu and Modusulmrii with 33%, and Gwange III with 17%. There were no reported yield drops in Bulumkutu Kasuwa.

The 28% experiencing yield drops during the dry season own all boreholes in the range of depths between 50-100 m which means they pump water from the upper aquifer which goes dry during the dry season. As for Madinatu, who is among the 28% the reason is most likely because 80% of the surveyed water points are dams fed by the State Water Board network and, as pointed out earlier, the water treatment plant suffers from power issues that combined with leaks in transmission lines and pirate connections results in intermittent flows to its customers.

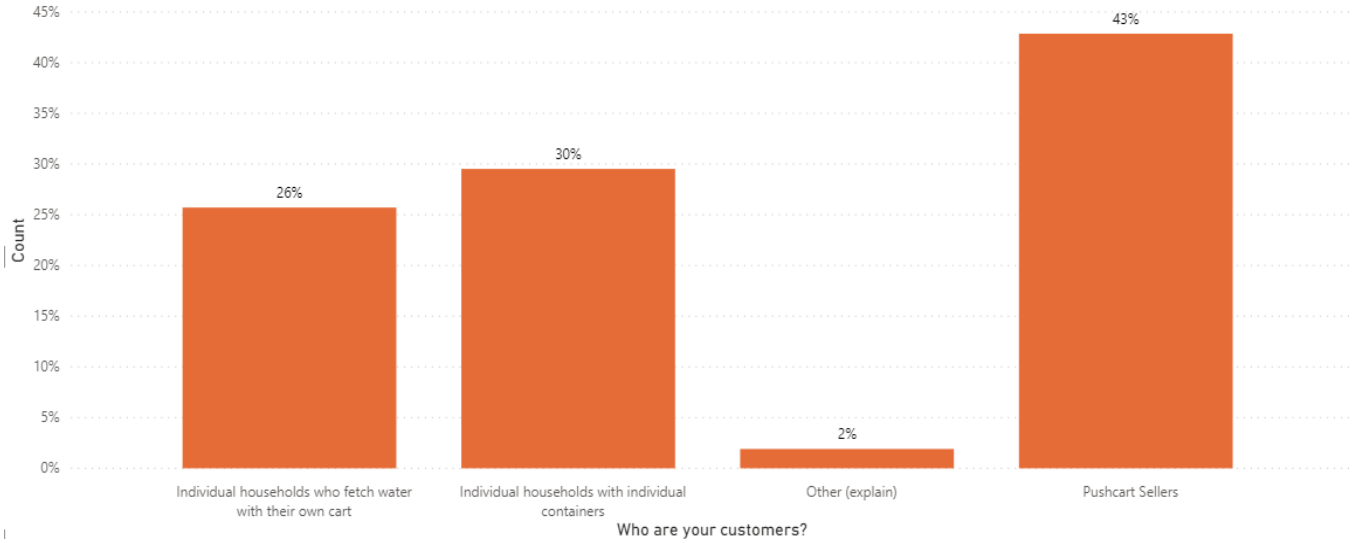
In terms of water availability, the opinion of RUWASSA's Deputy Director for Groundwater Resources is that no over-extraction of deeper aquifers is thought to be happening as there are few operational wells reaching those depths (450 - 650 m). But, given that BSMoWR has no water management plans for the state and there is no data series on aquifer fluctuations, this statement is more of an assumption than a fact based on evidence.

Even though water currently appears to be abundant there are regional patterns related to climate change showing that groundwater is likely to become scarcer in a not so far future[38]. This is due to increasing desertification around Lake Chad and its Basin which is the watershed feeding Borno's deeper aquifers.

When it comes to pricing, private water providers' answers were in line with the information obtained through surveys, FGDs, and KIIs with end users and push cart sellers. As seen in the below table, borehole owners' core customers are pushcart sellers. The % of water providers reporting customer trends is very similar throughout the 6 assessed areas.

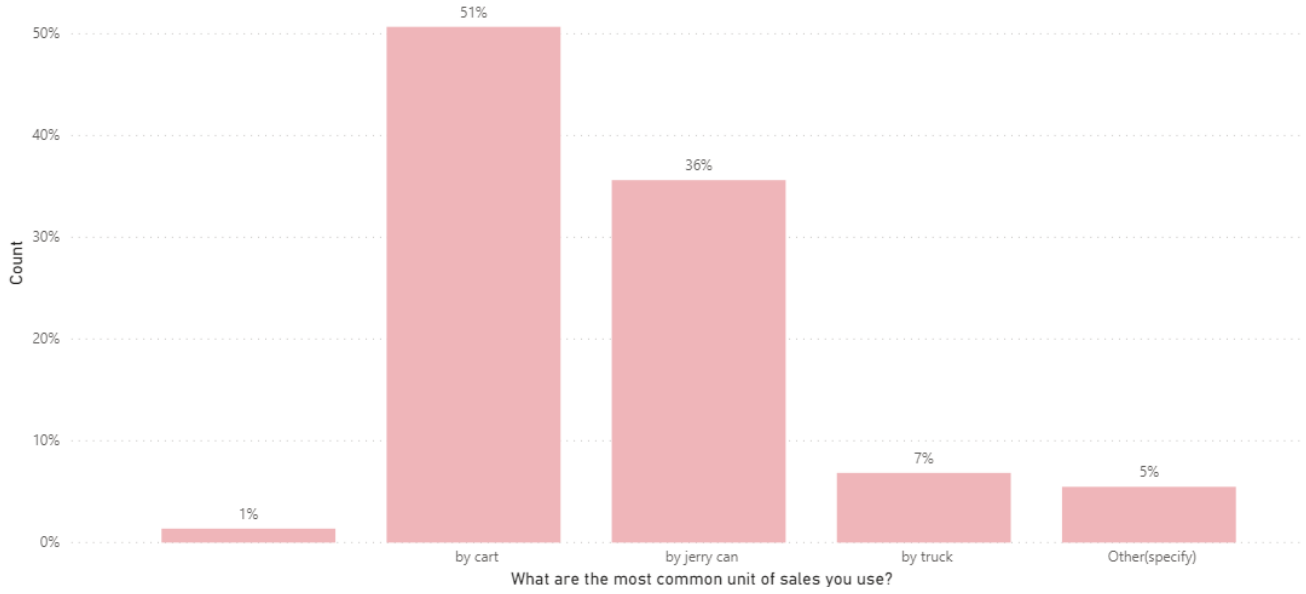
[38] In recent decades, the open water surface of Lake Chad has reduced from approximately 25 000 km2 in 1963, to less than 2 000 km2 in the 1990s heavily impacting the Basin's economic activities and food security. The shrinkage of the Lake has been driven by both global and local causes: climate change and vastly increased competing demands on the Lake and its surrounding land have accelerated its shrinkage over the past years. http://www.fao.org/fileadmin/user_upload/faowater/docs/ChadWWW09.pdf

Figure 9: Principle customers of private water providers



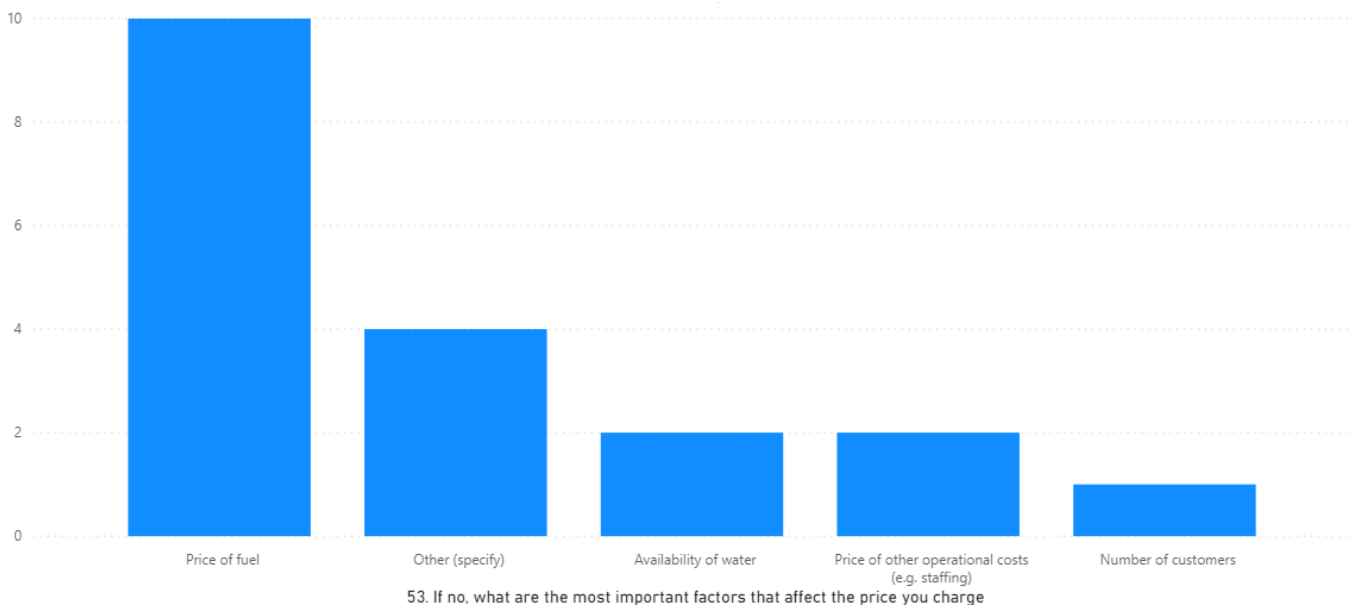
The most common units of sale among water providers are carts; thus, push cart sellers and families owning their own carts. This is followed by people coming with one or two jerrycans and trucks. As for trucks, earlier CRS assessments from 2017 showed that most water carried by trucks are for construction sites rather than for drinking purposes. Trucked water was sold mostly in Gwange that reported an 18% occurrence and in Modusulmri and Bulumkutu Kasuwa with 9% of sales each to trucks. However recently water trucking for drinking purposes was reported by some parners but not within the assessed locations.

Figure 10: Most common units of sale among private water providers



Prices of water fluctuate depending on several variables. A key driver is fuel price as PHCN is unreliable and most private water providers must depend on generators. The second most important reason is shown in the table below and indicated as “other” which refers in this case to seasonality. The highest prices charged are during the dry season and the lowest during the wet season. Variations in the number of customers and water availability are also important variables.

Figure 11: Main factors affecting prices of private water providers



Price ranges are also set based on the volume or capacity of the carts, for example there are different prices for carts of 6, 12 or 14 jerrycans. Below Figures highlight average yearly ranges throughout the 6 areas for different cart sizes.

Figure 12: Average charge for cart of 6 jerrycans

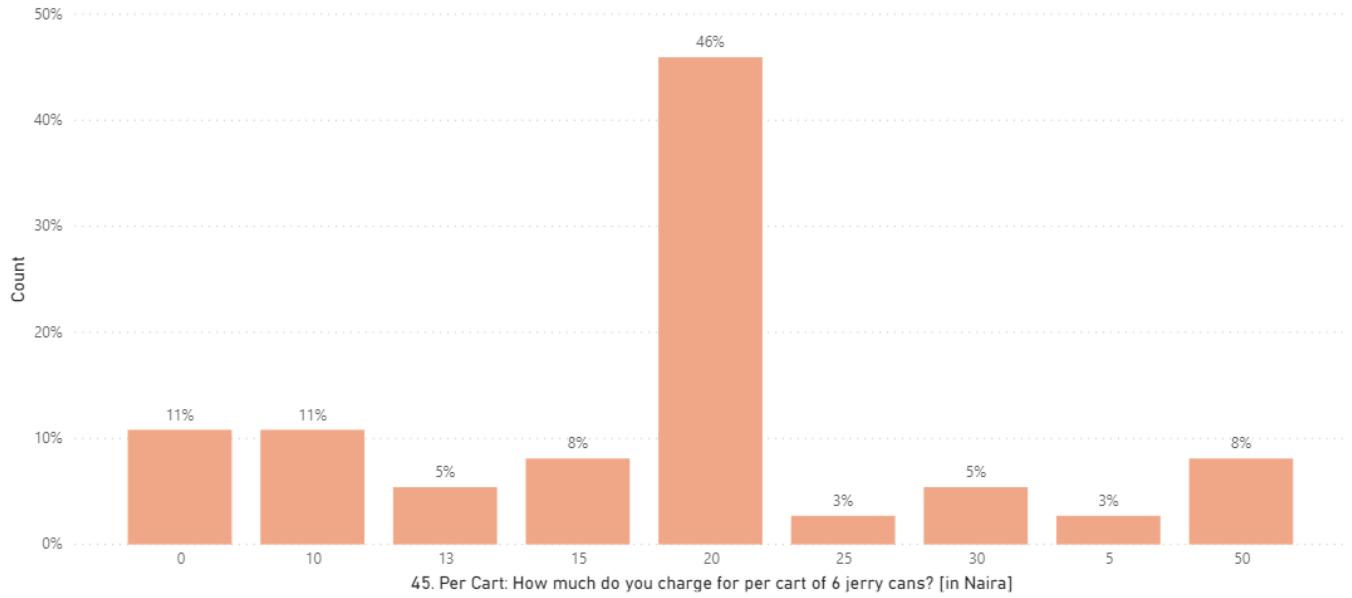


Figure 13: Average charge for cart of 12 jerrycans

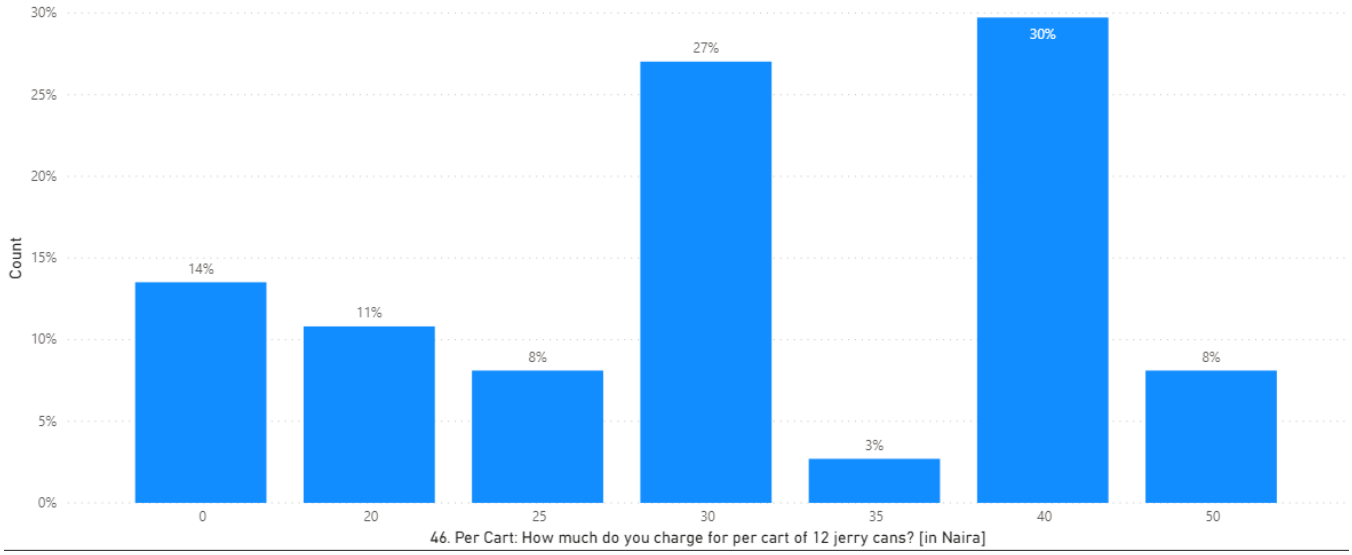
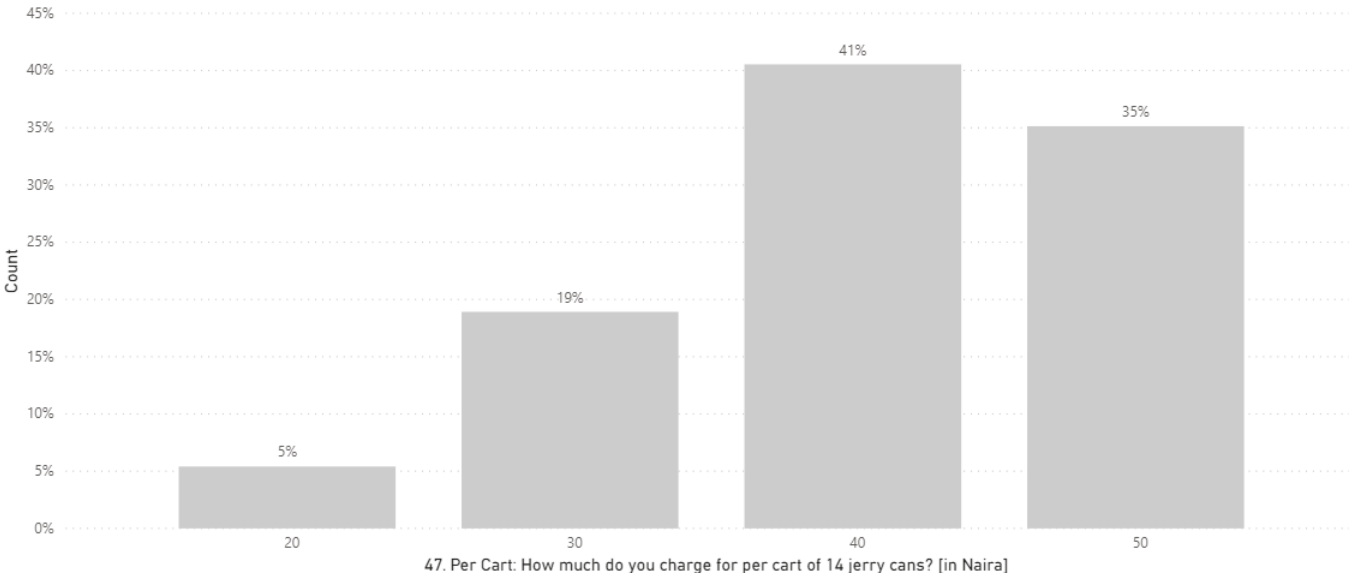
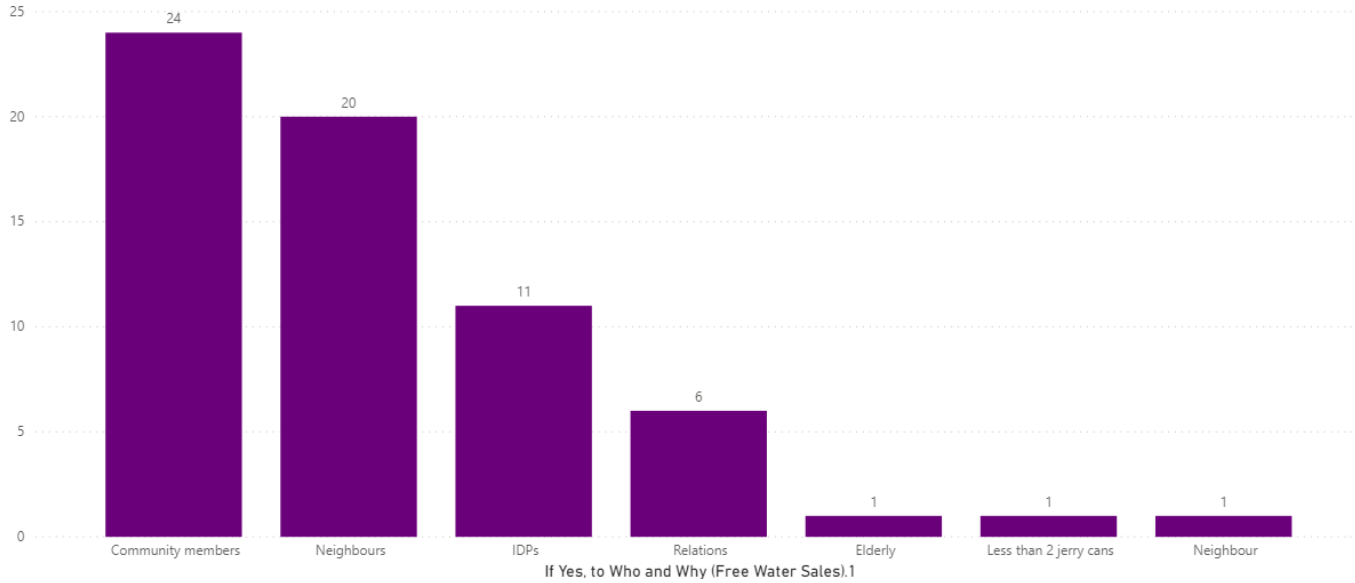


Figure 14: Average charge for cart of 14 jerrycans



All water providers said they offer water free of charge to poor families coming to the water point with one or two jerrycans, to those that can't afford to pay and to those with smaller water containers, in some cases they ask for a small contribution. The below table provides a sample of the different community members and reasons why they are given free water by private water providers.

Figure 15: Recipients of free water from Private Water Providers



Despite the factors affecting prices, and the range of prices charged across water providers, 67% of respondents indicated that their prices stay the same throughout the year.

Finally, a very common phenomena is the extension of credit to consumers and clients. 85% said they provide water on credit. For example, in Gwange III 100% of respondents provide credit, followed by Madinatu and Simari with 90% each, Modulsumri with 83%, Bulumkutu Kasuwa with 60% and lowest Garba Buzu with 33%. Credit is extended mostly to community members buying water and to pushcart sellers.

D.1.4 Operations and Compound/Facility Conditions

As a business there are running costs water providers must cover regularly (including fuel, maintenance and repairs). 65% of respondents reported that they do make investments to improve their system, with the most common reported being expenditures on generators, followed by pump repairs.

Pump repairs are mostly conducted on a yearly basis whereas generator repairs are more likely to occur on a monthly basis. The average investment in pump repairs was calculated to be around 35,000 Naira/year and 32,000 Naira/year for generators.

A minority reported investments in compound improvement, this was confirmed as a critical issue by the assessment teams' observations. Most compounds (though not all) were found to have significant drainage issues and therefore stagnant water, water handling was found to be substandard, limited storage (or uncovered storage conditions), and in some cases boreholes were found to be very close to latrines. None of the boreholes visited were keeping any measurements or logs of extraction volumes or other data.

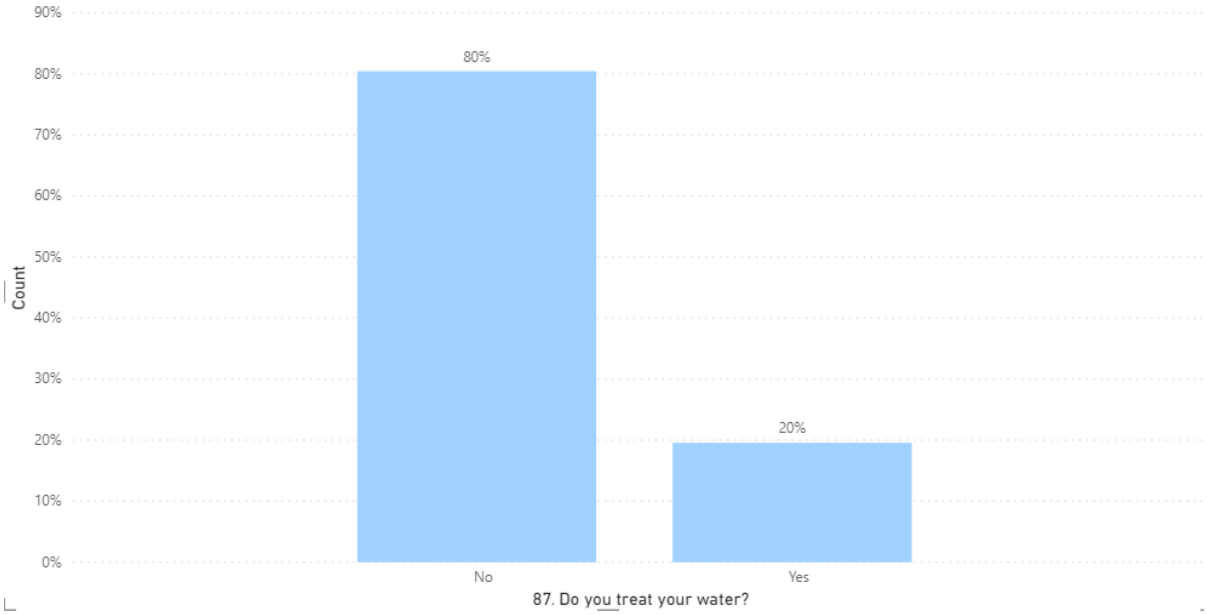
D.1.5 Water Treatment, behaviors, practices and general observations

80% of water providers indicated they do no treat the water. For the 20% of those reporting treating it, chlorine is obtained from INGOs, although one respondent in Gwange III mention the market as the source. It is not clear how often they receive chlorine, how often they chlorinate their water, and even if dosing practices are correct. Some borehole owners were not aware of water treatment at all.

The highest percentage of water providers treating their water were found in Garba Buzu with 67%, followed by Bulumkutu Kasuwa and Madinatu with 20%, Gwange III and Modusulmri with 17% and Simari with 10%.

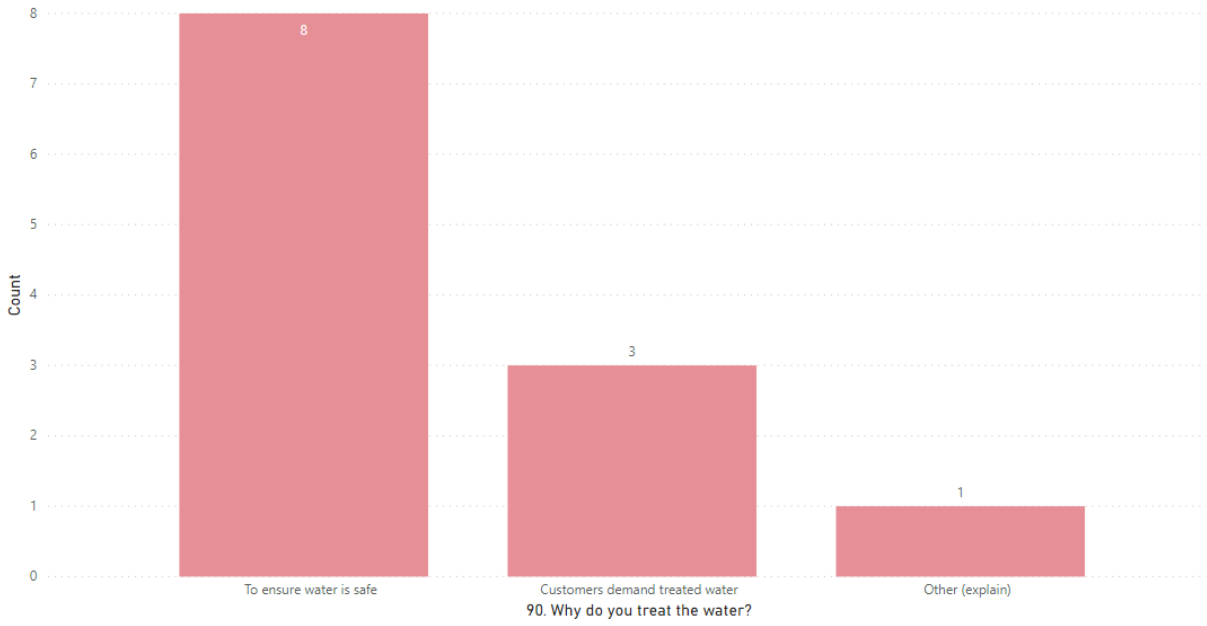
At this stage we are not able to establish a clear understanding of why Garba Buzu has such an elevated number of water providers chlorinating their water, this may be related to a presence of INGOs in the area, though needs to be investigated further. The same can be said of Modusulmri but inversely. Modusulmri has the highest number of INGO's providing water services but the lowest water treatment percentages of the 6 assessed areas. This could be perhaps be related to the fact that NGOs have not prioritized interventions targeting private water providers yet.

Figure 16: Percentage of water providers treating their water



66% out of the 20% who treat water said they do it "*to ensure water is safe*". Even if this highlights a solid knowledge, it is still an extremely low part of those surveyed and indicates a need to target water providers in water treatment and handling practices.

Figure 17: Number of water providers answering why they treat their water



25% out of the 20% who reported that they treat water indicated that this was due to "*customers demand treated water*".

Finally, 89% of the private water providers do not test and have never tested the water they sell. If we consider that 1) Maiduguri is located on top of sandy deposits and 2) most boreholes extract water from the upper aquifer where water is found at depths of 50-100m, it is easy to see that groundwater is exposed to critical pollution risks. It is not only that water may be or is biologically contaminated, but the risks of heavy chemical pollution is highly likely and therefore a critical public health issue with longer term consequences.

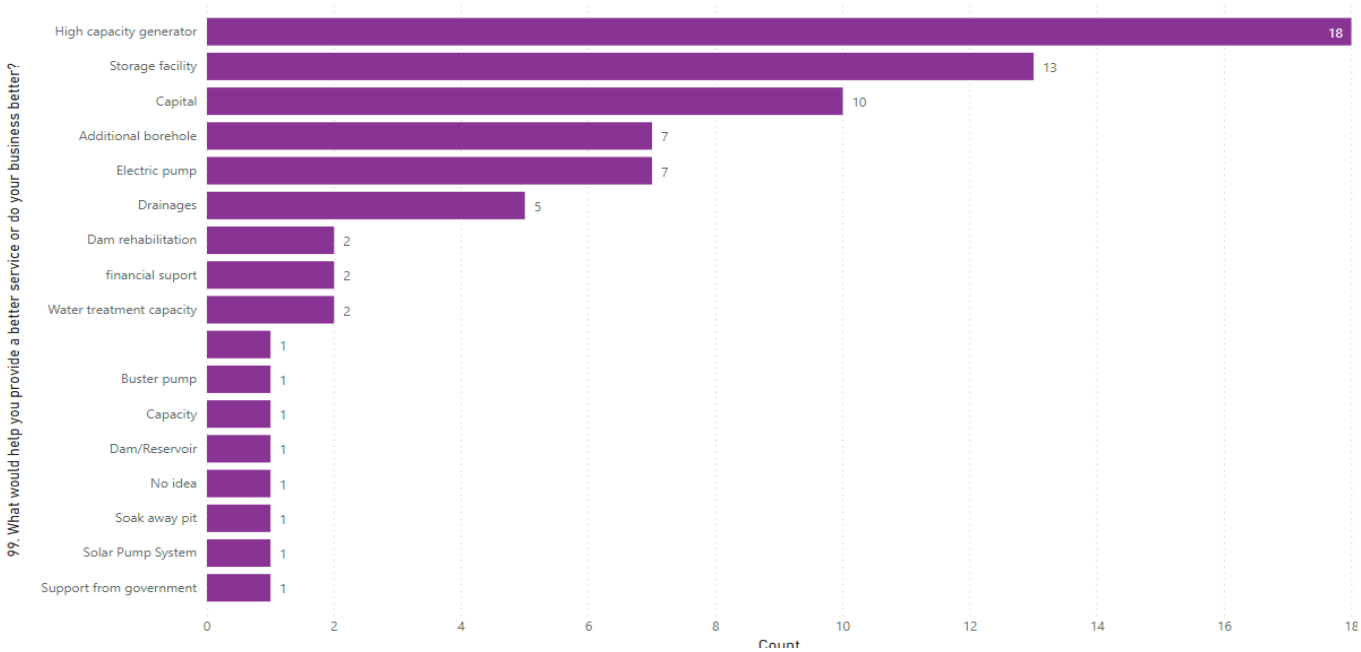
D.1.6 Challenges, constraints and priorities

There were many challenges reported by water providers. The most critical can be summarized around:

1. Failure of equipment such as generators and pumps
2. Lack of drainage: (in the compound) which clearly highlights issues around the health and safety mentioned earlier and resulting in an unsanitary environment
3. Poor accessibility: Due to bad road conditions (mostly during the rainy season) that does not allow push cart sellers to reach the site
4. Not enough water: During the dry season
5. Unreliable electricity supply
6. High running costs, and
7. No access to loans or financial support

When asked "*what would help you provide a better service or do your business better?*" the main answers where related to: "*help with provision of a high capacity generator*"; "*more storage facilities*"; "*capital*"; "*additional boreholes*"; and "*electrical pumps and drainages*". Remarkably "*water treatment capacity"* came very low on the list of priorities. This is certainly an example highlighting the limited knowledge on the importance of water safety and water treatment, and the related risks around untreated water.

Figure 18: Priorities of water providers highlighted as being key to improving their business



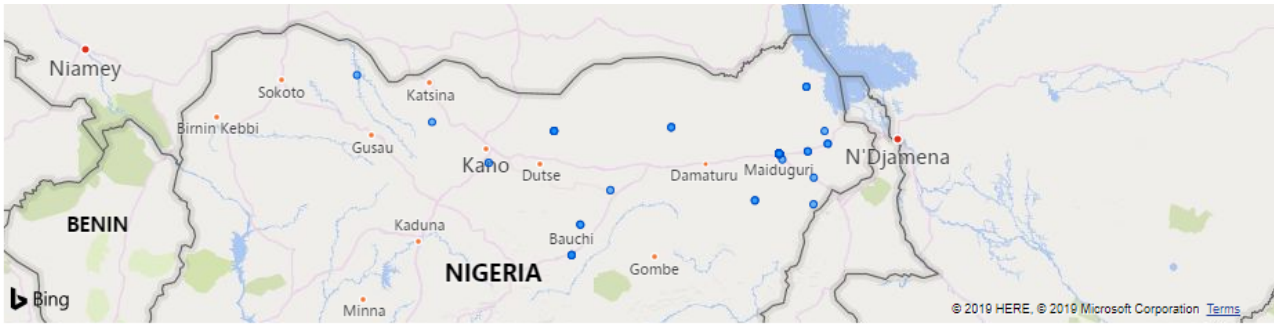
D.2 Pushcart Sellers

D.2.1 Overview of Pushcart Seller Profiles

During the assessment, a total of 96 surveys with pushcart sellers were completed across the 6 targeted communities. In addition, a key informant interview with a pushcart seller, and two FGDs with pushcart sellers were conducted to triangulate information and get a more detailed understanding of the situation.

Most pushcart sellers are not originally from the areas where they are currently living and working, though they are mostly from within Borno State. 82% of the pushcart sellers surveyed are not from the LGA where they are currently living and working; 25% were from other states, while 75% were originally from Borno State. Of these, only 11% were originally from MMC LGA, and only 6% were originally from Jere LGA. Although it appears that most pushcart sellers are not from Maiduguri town, the causes of migration were not captured in the survey. The FGDs and surveys uncovered that the majority of pushcart sellers were IDPs, but some are economic migrants who travel to the city during the dry season (and peak of demand) from areas that are affected by the conflict to work as pushcart sellers, and then return back to their areas of origin to farm and cultivate agricultural land prior to the rainy season.

Map 2: Locations of Origin Reported by Pushcart Sellers Operating in Maiduguri Town



81% of pushcart sellers have been working as a water seller for 2 years or more, with 18% having been doing this business for less than a year. This means that 86% of pushcart sellers began their business in the last 5 years, showing a large increase in the number of water sellers operating in these areas (likely, as noted above for water providers, related to increases in population and therefore demand, and IDPs looking for income generation activities).

Table 8: Length of Time Working as Pushcart Seller

How long have you been doing this job?	% of Respondents
Less than 6 months	5.21%
6 months to 1 year	13.54%
2-3 years	36.46%
4-5 years	31.25%
6 years or more	13.54%

87% of pushcart sellers are involved in selling water throughout the year, while 10% only sell water during the dry season, and the remaining 3% are involved in other livelihoods activities. For 86% it is the only source of income they have.

D.2.2 Market Competition and Cooperation

There are no accurate numbers for pushcart sellers operating in the neighborhoods assessed. However, the following are estimates from community leaders and pushcart sellers themselves:

Table 9: Approximate Number of Pushcart Sellers by Neighbourhood

Community Name	Estimated Number of Pushcart Sellers Operating in the area
Bulumkutu Kasuwa	> 100
Garba Buzu	20 - 40
Gwange III	350 - 700
Madinatu	> 40
Modusulmri	50 - 80
Simari Area 1	> 70

68% of pushcart sellers reported that the number of pushcart sellers has increased in the previous year, particularly in Madinatu, Modusulmri, and Simari 1. In FGDs with pushcart sellers, they explained this was largely related to the influx of IDPs and limited job opportunities available in the city. However, people also pointed to the influx of IDPs increasing demand for water and so there being more opportunity for pushcart sellers to work. 84% of pushcart sellers reported operating only in the neighborhood they live (mainly those living in Bulumkutu Kasuwa, Gwange III and Modusulmri), while the remaining serve customers both within the neighborhood they live and in other neighborhoods.

The market among pushcart sellers seems to be highly competitive in all areas, though the situation did vary from one neighborhood to another. For example, in Madinatu, there appeared to be a high-level of saturation in the market with pushcart sellers reporting having to travel outside of their neighbourhood in search of customers. In addition, pushcart sellers complained of the poor condition of carts they were renting and found it difficult to demand better condition carts from cart owners as cart owners can easily find other people to rent to because of the high demand for pushcart rental. Some pushcart sellers in Madinatu reported that being a pushcart seller was one of the only livelihood options they had and some (8%) mentioned a preference for capital to start a different business rather than support to improve their current business selling water.

In areas such as Gwange III and Modusulmri, however, pushcart sellers reported high levels of competition, with major challenges more around the condition of carts and jerrycans available with renters and challenging access road conditions rather than market saturation. In these locations, pushcart sellers requested capital to purchase their own carts and jerrycans and reduce the reliance on cart owners.

The high level of competition among pushcart sellers has resulted in fairly stable prices over the last 5 years. Almost all pushcart sellers reported selling one 20 L jerry can for 10 Naira as standard. Prices can increase in the dry season and also in the rainy season depending on the road condition and distance to a customer's home, but generally prices have remained stable (see section D.2.4 for more information).

Although there was no evidence of formal associations or unions coordinating pushcart sellers, there were a number of examples provided where pushcart sellers informally worked together and supported one another. During FGDs, pushcart sellers in Gwange III and Modusulmri reported that they support one another in times of need, for example if someone is unable to work due to illness, or if they need additional money for life events such as weddings or funerals. They also cover basic rental costs of the cart if someone doesn't have sufficient customers to cover the costs on a particular day. This appears to be mainly groups of pushcart sellers who know each other, and it was almost impossible to tell how many pushcart sellers have access to such mechanisms. However, only 21% of pushcart sellers reported that there were associations, so it is assumed that such informal

organization and social support networks currently only cover a minimal number of pushcart sellers but offer important support.

Table 10: Existence of Pushcart Association

Is there an association of pushcart sellers?	% of respondents (n = 96)
Yes	21%
No	78%
I don't know	1%

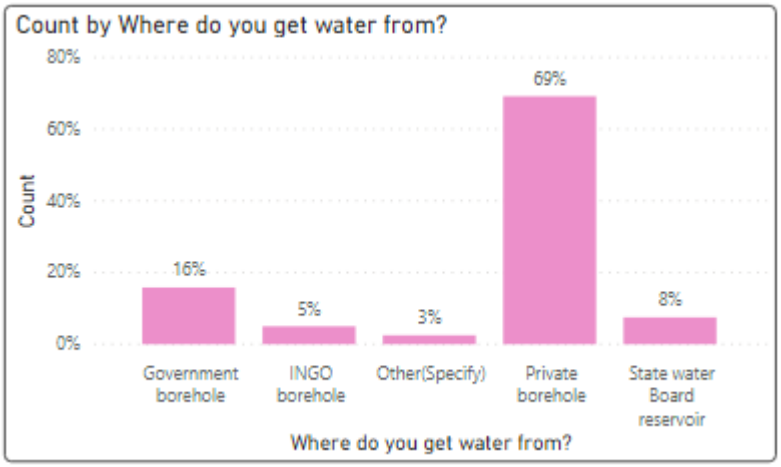
Table 11: Benefits of Pushcart Association

What are the benefits of being in an association?	% of respondents (n = 33)
Can get help in terms of challenges	45%
Help in regulating pushcart business	18%
Help in savings	18%
I don't know	6%
Other	12%

D.2.3 Water Sources, Availability and Source Price

69% of pushcart sellers surveyed source at least some of the water they sell from private boreholes, followed by 16% from Government boreholes, 11% from private reservoirs or dams filled from state water board connections, and 5% from INGO boreholes. The sources used by pushcart sellers differ between the geographic areas assessed. In some locations, namely Garba Buzu and Simari Area 1, pushcart sellers reported only sourcing water from private boreholes (no other water sources). 78% of pushcart sellers surveyed reported only one type of water source where they collect water.

Figure 19: Sources of Water for Pushcart Sellers



The most commonly reported reasons for pushcart sellers choosing a particular water source is proximity, either to the communities they sell in (58% of respondents reported this as one of the reasons), or proximity to where they live (57%), and the quality of the water (34%). For those reporting buying from private boreholes, proximity, and perception on the quality of water were the primary reasons for choosing a particular source (though as explained above, there is currently no quality testing of water, minimal water traetment and questionable conditions in private borehole compounds meaning water is likely contaminated and therefore water 'quality' is more related to perceptions rather than verified). 66% of pushcart sellers always collect water from the same water points, while 34% do not – mainly due to availability and queuing times.

Water from Private Boreholes

Water from private boreholes is always purchased by the cart (or per trip) and the most common cart size holds 14 or 15 jerry cans of 20 litres (depending how the cart is packed). There were mixed responses from pushcart sellers in different geographic areas on whether water prices stay the same throughout the year. 66% reported that prices remain the same throughout the year, however in some locations – particularly Gwange III and Madinatu – more pushcart sellers reported that prices they pay for water change during the year (see below).

Table 12: Price Information for Private Borehole Water by Location

Location	Price paid by pushcart sellers per cart (from Private Boreholes)	Does the price you pay for water from private boreholes stay the same throughout the year?		Critical factors affecting price of water from private boreholes
		Yes	No	
Bulumkutu Kasuwa	40-50 N	85%	15%	N/A Price is stable
Garba Buzu	50 N	88%	13%	- Availability of water - Particularly in dry season
Gwange III	30 – 40 N (30 N for NEPA, and 40 N for generator pumped water)	46%	54%	- Availability of water - Demand for water - Seasonality - Borehole owner's price adjustments
Madinatu	10 – 50 N	11%	89%	- Availability of water (most critical) - Demand - Seasonality - Borehole owner's price adjustments
Modusulmri	40 – 50 N (40 N for NEPA, and 50 N for generator)	67%	33%	- Availability of water - Borehole owner's price adjustments
Simari Area 1	40 – 50 N	54%	46%	- Availability of water - Borehole owner's price adjustments - Availability of power - Price of diesel

Generally, there is no major issue of availability of water from private boreholes for pushcart sellers to purchase, with 77% saying there was always sufficient water available to purchase from private boreholes, with the exception of Madinatu. Madinatu appears to have the most issues in terms of availability as 53% of pushcart sellers there reported that there is not always sufficient water available from private boreholes. This is probably linked to the fact that 80% of the supplied water in Madinatu is obtained from water dams fed by the state water board network which experiences regular cuts in supply.

Table 13: Availability of Water for Purchase with Private Borehole Owners

Location	Is there always sufficient water available for you to buy?	
	Yes	No
Overall	**77%**	**23%**
Bulumkutu Kasuwa	92%	8%
Garba Buzu	81%	19%
Gwange III	92%	8%
Madinatu	47%	53%

Modusulmri	100%	0
Simari Area 1	69%	31%

State water board reservoirs 'Mother Cat' and Private Dams

Pushcart sellers reported buying water either by full or half cart from dams and reservoirs containing water from the state water board network. Prices varied from 20 – 50 N per cart (or 'trip' as most pushcart sellers refer to it). Prices change during the year, and there is not always sufficient water available for purchase from these reservoirs and dams.

INGO Boreholes

Pushcart sellers do not pay for water collected from INGO boreholes. However, 100% of pushcart sellers reporting using INGO boreholes as a water source reported that there was not always sufficient water available at INGO boreholes. Gwange III and Madinatu were the only locations where pushcart sellers reported collecting water from INGO boreholes and selling it on to households (though this may be happening elsewhere and not being reported). In discussions, pushcart sellers reported that they preferred to pay for water from private boreholes than using free INGO boreholes because of the limited operating hours of INGO boreholes and long queues – challenges not generally faced at private boreholes.

Government Boreholes

Pushcart sellers also reported sourcing water from Government boreholes. Pushcart sellers normally pay 30 - 50 Naira per cart from Government boreholes with 100% reporting that the price stays the same throughout the year. 84% of pushcart sellers sourcing water from Government boreholes reported that there is always sufficient water available to buy from Government boreholes (with only those in Bulumkutu Kasuwa reporting that there isn't always sufficient water to buy from Government boreholes).

D.2.4 Prices for End Users

Prices charged to households by pushcart sellers are consistent irrespective of the source of water, with most pushcart sellers reporting that the price they charge is similar across pushcart sellers. If the price they charge varies this is usually because of a) low availability of water (resulting in charging a higher price); b) customer's negotiating, and c) distance travelled to the customer's house (resulting in higher prices for further/more difficult to access customers).

- ***Pushcart sellers selling Private Borehole Water:*** water is sold either by the jerrycan or by the cart to their customers. The majority sell for 10 N per jerrycan (20L), and this rises to 15 N per jerrycan in the dry season. In Garba Buzu, prices can reach 20 N per jerry can. Few pushcart sellers sell by the cart, but when they do this is usually sold at 150 N per cart and 200 N in the dry season.
- ***Pushcart sellers selling INGO Borehole Water:*** water it sold by the jerrycan for 10 N per jerrycan (20L) normally, and sometimes for 15 N per jerrycan in the dry season.
- ***Pushcart sellers selling water from Dams and Reservoirs with State Water Board:*** water is sold for 10 – 15 N per jerry can (20L).
- ***Pushcart sellers selling Government Borehole Water[39]:*** water is always sold at 10 N per jerrycan to households.

There appears to be no price regulation by government or communities for the water sold by pushcart sellers, rather prices are kept consistent based on the competitiveness of the market. During focus groups with pushcart

[39] In the assessment 'government boreholes' were not differentiated by which department or ministry constructed them. It is assumed that these 'government boreholes' are either constructed and managed by the BSMoWR or by local government authorities.

sellers, they reported that the prices they pay for and charge end users have been more or less consistent over the last 5 years.

D.2.5 Customers and Demand

Pushcart sellers are selling to both host and IDP communities, with around 35% reporting they serve the same customer base throughout the year, while the majority, 65%, serve different customers based on demand. For those with a regular customer base, this was mainly due to familiarity, reliability of purchasing, and them being in the same neighborhood. Interestingly, many preferred not to sell to regular customers as they found that with regular customers there was a greater expectation to extend credit and therefore pushcart sellers found themselves more likely to face delays in payments and risk of making less profit. 91% of pushcart sellers reported selling water to at least some customers on credit.

Pushcart sellers reported serving between 3 and 50 customers per day, with the overall average of 11 customers per day (or around 80 per week).

Table 14: Number of Customers per Day (Pushcart Sellers)

# of customers per day	#	%
3 to 6	20	21%
7 to 10	47	49%
11 to 14	7	7%
15 to 20	17	18%
21 to 30	3	3%
31 to 50	2	2%
Total	96	100%

On average, pushcart sellers reported selling between 5 and 840 jerrycans per day, with an average of 138 jerrycans of water sold per day. Demand among households to purchase water from pushcart sellers is always highest during the dry season.

64% of pushcart sellers reported being able to meet an increase in demand of 50%, with 3% reporting that they would likely never find themselves having to increase supplies to meet demand given the high number of pushcart sellers operating in the area (this was mentioned by pushcart sellers in Gwange III and Modusulumri). For the majority of those that reported being able to meet increased demand they mentioned that they would do this by either a) increasing their capacity, either through rent of an additional pushcart (15%), getting help from family/friends to sell water or paying someone to help sell water (45%), and/or b) increasing the number of hours they work in a day (26%). 84% said that prices would stay the same if demand increased.

For those that reported not being able to meet demand, this was mainly due to a) lack of finance to increase capacity in terms of jerrycans/carts, b) lack of water available to purchase, c) time taken to refill jerry cans limiting the number of customers they can serve per day, d) due to the energy/demands of the job, and e) due to queues at collection points.

D.2.6 Operations

Most pushcart sellers (83%) rent the pushcart they are using. Rental usually includes the cart and a set of jerrycans. Most pushcart sellers pay 100 N per day for cart and jerrycan rental, with some paying 150 N per day (for newer carts).

The average income of a pushcart seller from selling water is approximately 30,160 N per month (or approx. 85 USD).

Table 15: Estimated Basic Income for Pushcart Sellers

Average # of customers per day	11
Average # of jerry cans sold per day	138
Price paid per cart of water (14 jerrycans)	10 N
Average # of carts filled by Pushcart sellers per day (14 cans per trip)	10
Sales price for one jerry can	10 N
A) Total paid per day to buy water (N)	100 N
B) Total paid per day to cart and jerrycan rental by Pushcart seller (N)	120 N
C) Total sales per day (N)	1,380 N
D) Approximate Income per day (N) [C minus (A+B)]	1,160 N (approx. 3.2 USD)
Income per month (N)* **** Assuming 6 day working week = 26 days per month***	30,160 N (approx. 85 USD)

Pushcart sellers tend to empty water from their jerrycans into the customer's container rather than swapping full jerry cans for empty ones. Some pushcart owners require pushcart sellers to clean and maintain the jerrycans when rented, while others don't. Some pushcart sellers reported paying 100 N for someone to clean the whole set of jerry cans (usually with sand).

There is no oversight of pushcart sellers and their operations by the government or other authorities. 95% of pushcart sellers reported not needing any permission to sell water from the government, community or otherwise. For those that reported needing permission to buy water, this was from the local community (e.g. *bulama* – for security reasons) or their local association of pushcart sellers. There is no requirement of licensing from the government to be able to operate or sell water. Almost all (92%) reported no interaction with government or relevant departments that have responsibility for water provision or water quality. Some pushcart sellers did report that they had been visited by someone who inspected the condition of their jerrycans, but they were unclear who or where these people were from, though they were accompanied by the community *bulama*[40].

D.2.6 Water Treatment, Storage and General Observations

The condition of the jerrycans used by the pushcart sellers was generally found to be quite poor. 63% of pushcart sellers were found to be transporting water in jerrycans with lids, while 37% were using at least some jerrycans that had no lids increasing the risk of contamination and raising concerns on the safety of water sold. From the assessment team's observations, the condition of the jerrycans was found to be quite poor:

- 73% of pushcart sellers were using jerrycans with visible algae growth
- 53% of pushcart sellers were using leaking or damaged jerrycans
- 67% of pushcart sellers were using jerrycans that were not clean inside
- 38% of pushcart sellers were observed to have poor personal hygiene (e.g. no evidence of handwashing)

Sale of treated water was found to be very uncommon among pushcart sellers. Although 53% of pushcart sellers said that the water they source is treated when they buy it, as outlined in the above section on water providers, this is not necessarily the case. Furthermore, 30% said they knew the water they sold was not treated at all, and 17% didn't know if it was treated or not. For those that reported that water is treated, none of them treat the water themselves.

[40] This may have been NGOs conducting monitoring during times of cholera risk and/or outbreaks, but this is not confirmed

For those that reported that their water is not treated pushcart sellers reported that this was primarily because a) they cannot afford to treat water or do not know where to get water treatment materials from, b) because customers do not request treated water, or c) because they felt that treating water doesn't make a difference.

D.2.7 Behaviors and Practices

61% of pushcart sellers reported not receiving any previous training or hygiene messages. For those that reported being trained previously, this training was provided by NGOs or government and the majority reported that this was within the last 1 year (there were no significant differences across the 6 geographic areas in terms of training coverage). 89% of pushcart sellers reported that they wash their hands before handling water (though observations suggested this might not have been the case).

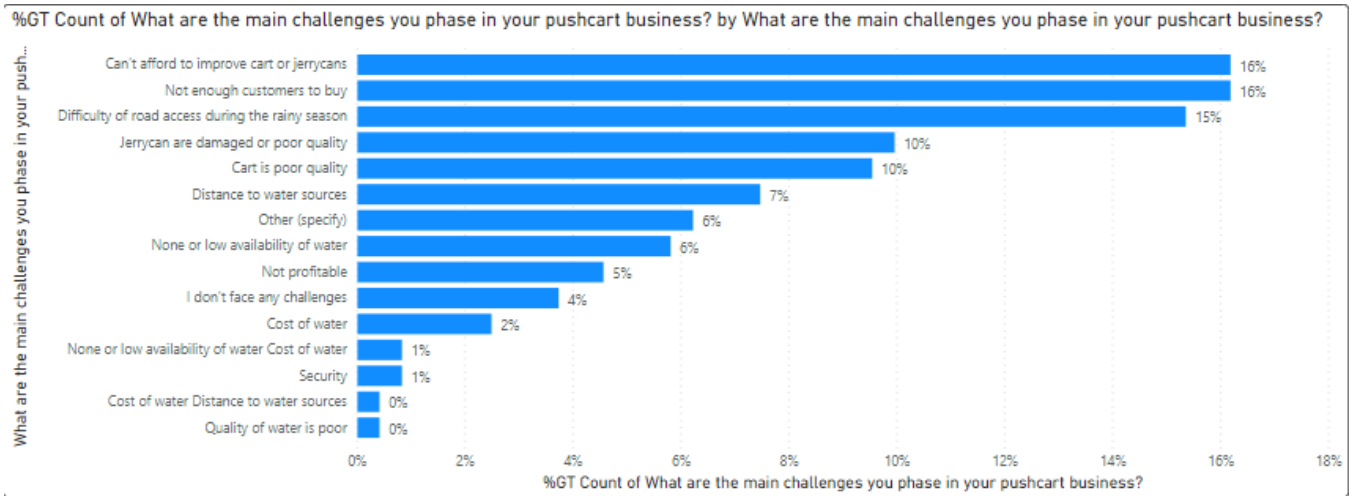
Almost all (99%) pushcart sellers reported cleaning their jerrycans, though the majority (60%) cleaned them with sand or small gravel. 39% reported cleaning their jerrycans with detergent. Some pushcart sellers were observed to be using old cloth as a filter when transferring water from the water source to their own jerry cans.

D.2.8 Challenges and constraints

96% of pushcart sellers reported facing some challenges or constraints in running their pushcart business. The most common challenges reported by pushcart sellers were related to:

- Not being able to afford to improve the condition of their cart or jerrycans
- Not having enough customers to sell water to
- Road access challenges during rainy season
- Poor quality or damaged jerrycans and/or carts
- Limited availability of water

Figure 20: Main challenges faced in pushcart business



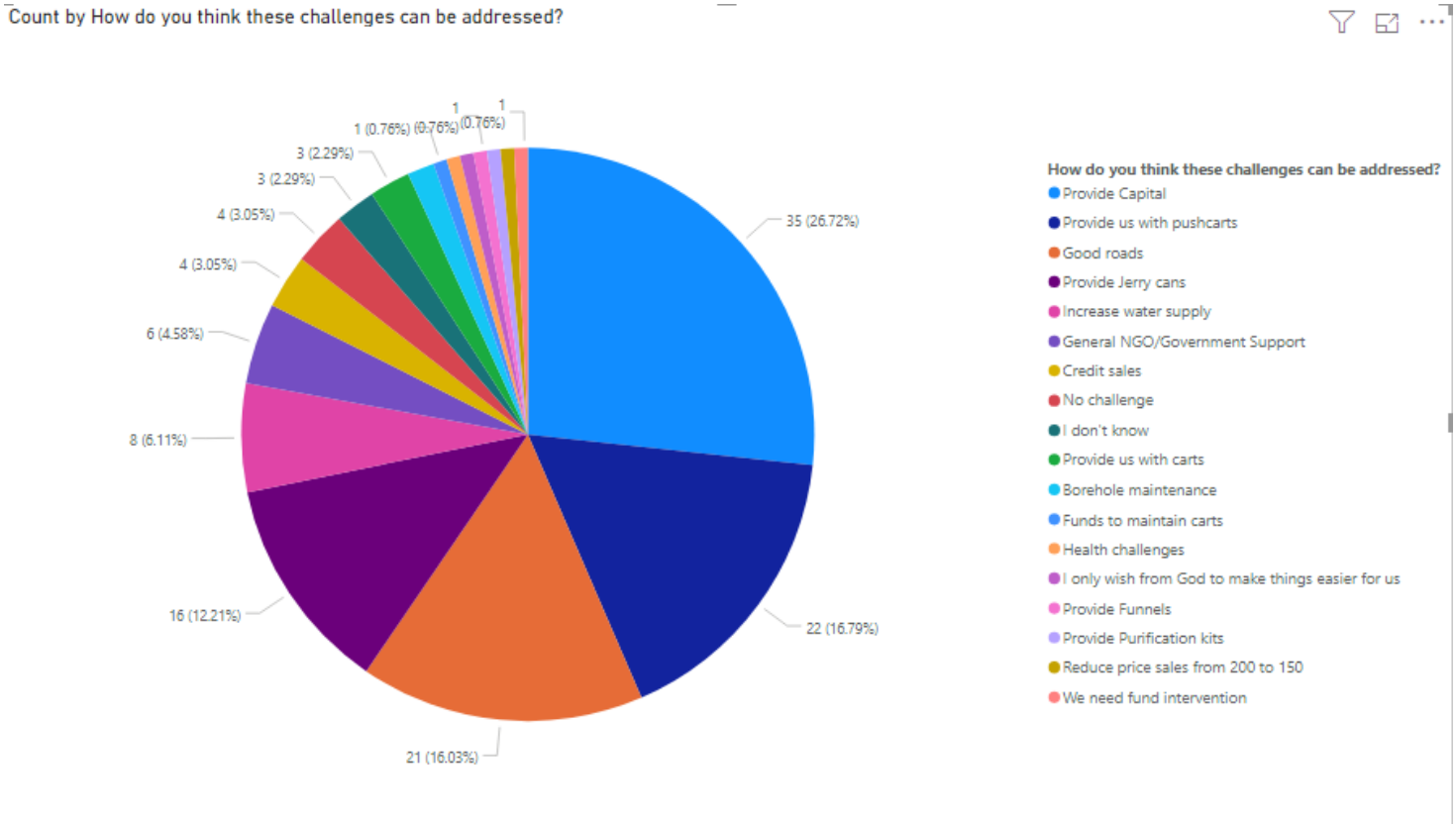
30% of pushcart sellers also reported that the interventions of humanitarian agencies had had an impact on their business by reducing the number of customers through the supply of free water.

D.2.9 Priorities

When push cart sellers were asked what their priorities would be for government, private sector and/or humanitarian organization interventions, 63% recommended capital injections to buy their own pushcart and jerrycans, followed by 23% recommending improvements to road conditions, 7% recommended repairing

boreholes to increase water supply, and 7% indicated that providing capital for another livelihood or business would be preferred.

Figure 21: Solutions for current problems faced by pushcart sellers as identified by pushcart sellers



D.3 End Users

D.3.1 General livelihoods profile of end users

The information from this section is largely based on the household surveys and FGDs conducted during the assessment. A total of 472 household surveys were conducted, majority (94%) were with female respondents. Although there was a high percentage of female respondents, 73% of households surveyed were male headed households while the remaining 27% were female headed. 62% of the respondents were IDPs, while 38% were members of the local community.

According to the survey data, the average household size of all respondents was 7.8 [average of 8.2 individuals per household for host and 7.6 for IDPs]. 70% of respondents were aged 18-40, with 28% aged 41-59 and the remaining 3% over 60 years old.

Host community households tend to live in permanent (brick/concrete) houses (96%) with very few (3%) living in temporary shelters made from mud/metal sheets/wood. However, as can be expected, IDP housing structures were considerably different, with 56% living in temporary shelters made from mud/metal sheets/wood, 9% in huts made from straw/grass/mud, while 35% lived in permanent (brick/concrete) buildings.

Income sources:

The population in the assessed areas rely on a diverse range of livelihood options to generate income. Most commonly, 50% of respondents generate income from small-scale petty trade, 17% from artisan trades (e.g. tailoring, sewing, repairs), 16% from agricultural labour, 15% from casual work such as construction labour, followed by other activities including agricultural production, livestock sales, paid domestic work, NGO/government employment, remittances and other activities (see below table). Among the other activities mentioned, some households reported selling water (i.e. pushcart seller) as a source of income.

Table 16: Income sources reported by household respondents

Incomes Sources	% of Respondents (n = 472)
Agricultural Labour	16%
Agricultural production	8%
Livestock sales (livestock or products)	9%
Other casual labour (e.g. construction)	15%
Paid domestic work	8%
Salaried employment (e.g. government or NGO)	7%
Remittances	5%
Collection and sale of wild foods or fuel	3%
Trade - petty trade (small-scale)	50%
Trade (large scale)	3%
Artisans (e.g. tailoring; sewing; hairdressing; repairs; services etc.)	17%
Other	8%

For both IDPs and host, 68% of households reported that their income doesn't change during the year. For the remaining, seasonality, insecurity and market instability are key determinants for varying income levels among the target communities.

90% of households reported an average monthly income of less than 45,000 Naira. As per the Nigeria Cash Working Group Draft Minimum Expenditure Basket (MEB) Guidelines from October 2018, the value of the MEB across Jere, MMC and Konduga LGAs was set at 44,139 Naira per month.

Considering this, the reported income levels of households during the survey highlight the constraints they are under in terms of financial resources. 90% of households reported an average monthly income of less than the draft Minimum Expenditure Basket (amount required for survival;even if some households may have under-reported their income level during the assessment this still highlights significant constraints in purchasing power). IDPs appear to face greater challenges in terms of monthly income, with 87% of IDPs earning less than 30,000 N per month, compared with 58% of host community families. In line with this, only 18% of respondents reported that their income adequately covered their household needs (15% of IDP households, and 23% of host community households).

Table 17: Average Monthly Income reported by Households in Assessment Locations

What is your average monthly household income? (N)	% of Respondents (Overall)	% of Respondents (IDP)	% of Respondents (Host)
< 5,000	11%	15%	4%
5,000 – 15,000	30%	37%	20%
15,000 – 30,000	35%	35%	34%
30,000 – 45,000	15%	12%	20%
45,000 – 60,000	7%	2%	14%
60,000 – 75,000	2%	0	4%
75,000 – 100,000	1%	0	3%
> 100,000	0	0	0

Expenditures:

Unsurprisingly the most significant expenditure of households surveyed in the target areas is on food (reported by 98% of respondents at an average of 12,020 Naira per month). 62% of respondents reported spending on water on a monthly basis, at an average of 1,542 Naira per month. Only 7% of respondents reported expenditures on water purification materials at an average of 68 Naira per month. Overall, the average monthly expenditures for a household were reported to be 26,279 N.

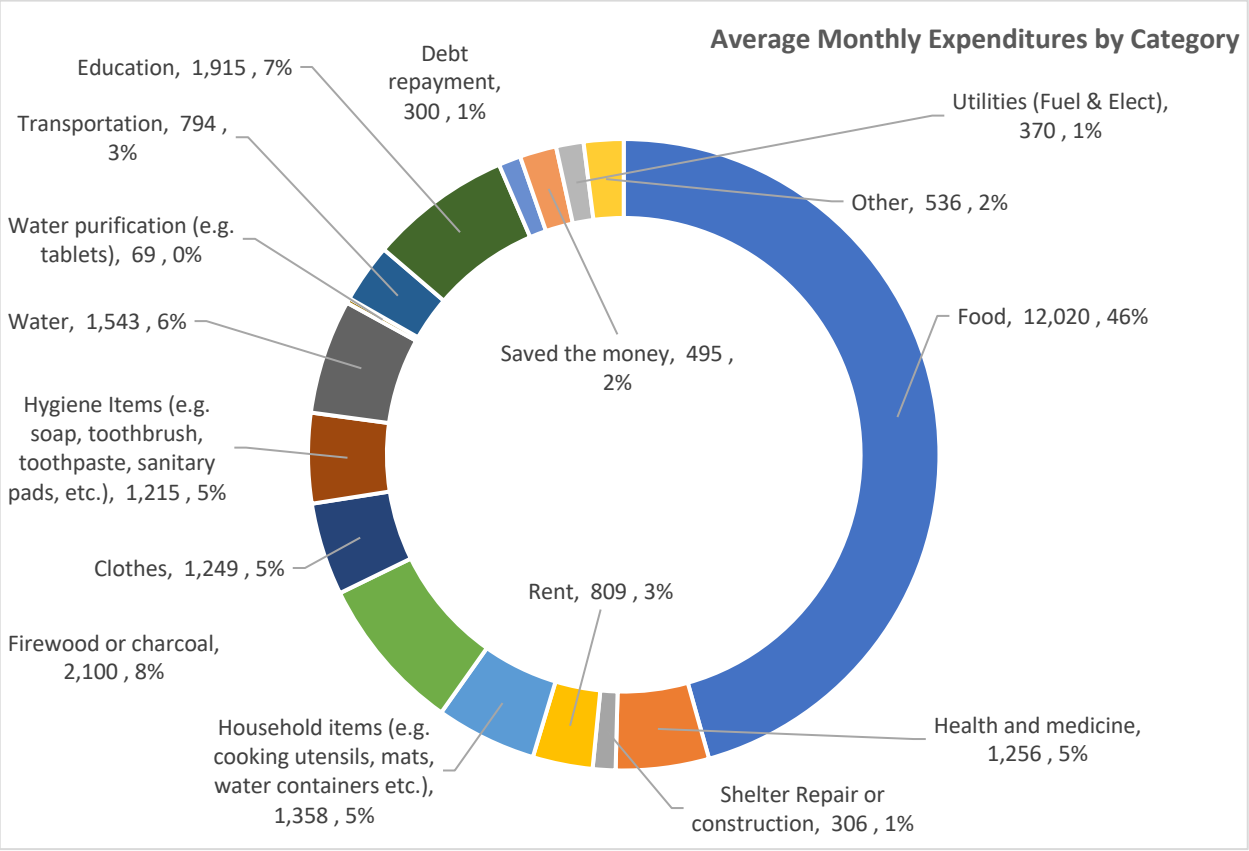
Table 18: Average Monthly Household Expenditures

How much do you usually spend on things you mentioned each month?	% of Respondents Reporting Monthly Expenditure on that Item	Average Monthly Expenditure (N) across all respondents
Food	98%	12,020.4
Firewood or charcoal	95%	2,100.32
Hygiene Items (e.g. soap, toothbrush, toothpaste, sanitary pads, etc.)	88%	1,215.43
Household items (e.g. cooking utensils, mats, water containers etc.)	63%	1,358.26
Water	62%	1,542.99
Education	38%	1,914.83
Health and medicine	59%	1,255.83
Clothes	35%	1,248.52
Rent	26%	809.26

Transportation	53%	793.86
Other	17%	536.44
Saved the money	12%	494.70
Utilities (Fuel & Elect)	12%	370.34
Shelter Repair or construction	15%	306.36
Debt repayment	10%	299.58
Water purification (e.g. tablets)	7%	68.54
Total average monthly expenditure per household		***26,279.97***

The below graph shows the proportion of monthly expenditures by category, reflecting the biggest share of expenditures is on food (average of 46% of expenditures), followed by firewood or charcoal (8%), and remaining expenditures such as education (7%), water (6%), clothes (5%), hygiene items (5%), household items (5%), health and medicine (5%) etc. This suggests that average expenditure on water is not currently a significant share of household expenditures[41]. Based on a rough estimation, a household of 7 would need around 157 jerry cans (20L) per month to cover the minimum of 15 litres of water per person per day. This would cost around 1,570 N per month during times of year when water prices are lowest (e.g. 10 N per jerry can from pushcart sellers). However, expenditures on water would likely increase during the peak of the dry season when water availability is lower and prices increase.

Figure 22: % of Average Monthly Expenditures by Category

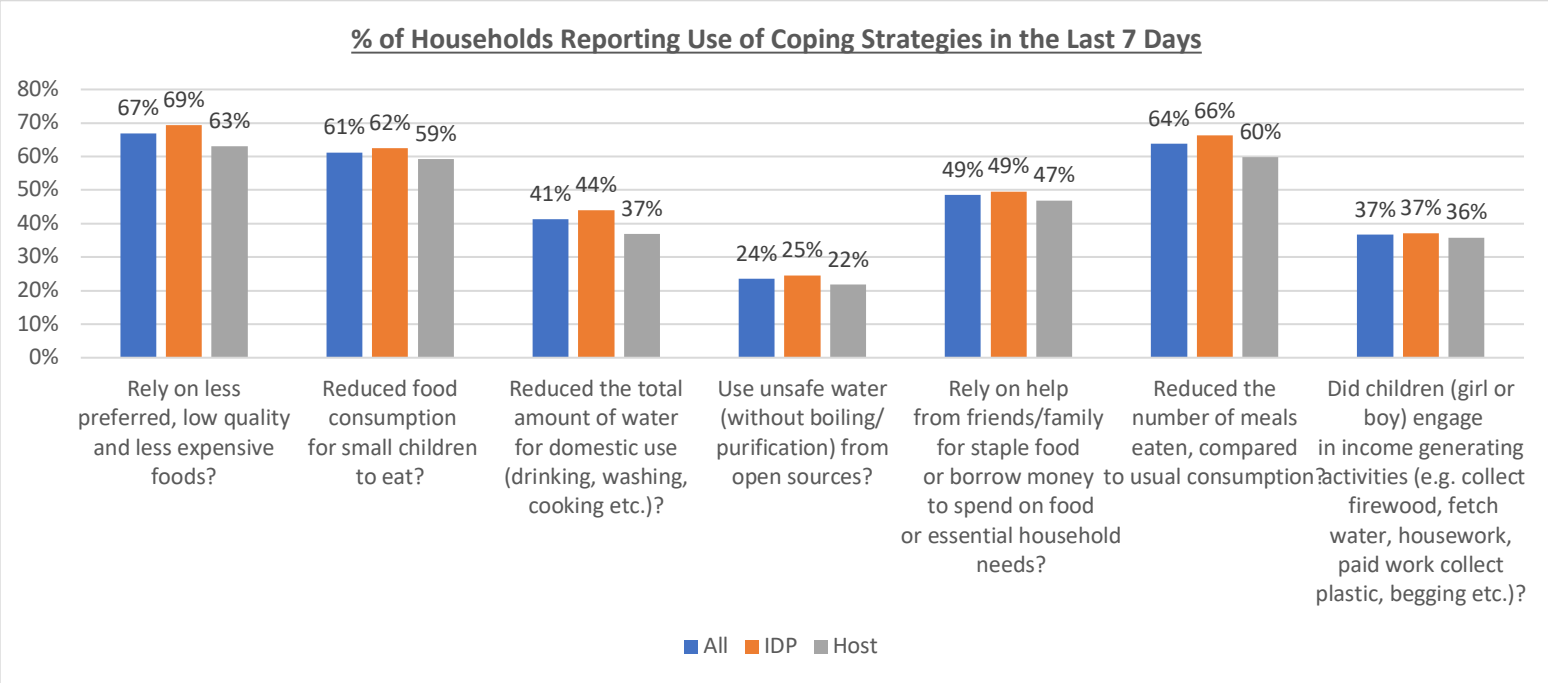


[41] The data needs to be further analyzed to understand if there are certain neighborhoods where expenditure on water is higher than others.

Coping Strategies:

The assessment also tried to understand the coping strategies currently employed by households to understand constraints in terms of access to income at household level. There were no significant differences among IDP and host families in terms of the % of households reporting use of different coping strategies in the last 7 days. 41% of households reported reducing the total amount of water for domestic use at least once in the last 7 days, while 24% reported using unsafe water from open sources. The most common coping strategies employed by households were mainly related to food consumption – 67% had relied on less preferred, low quality or less expensive food, 64% had reduced the number of meals eaten, and 61% had reduced consumption for small children to eat. 37% of households reported children engaging in income generating activities in the previous 7 days. 46% of IDP households and 40% of host households reported borrowing money in the last three months, which reflects a reliance on debt to compensate for limited income among some households.

Figure 23: Coping Strategies Reported by Households in the last 7 days



D.3.2 Access to Water:

67% of households reported buying water for household use. A higher proportion of host community households reported buying water than IDPs, with 75% of host households buying water compared with 63% of IDP households. 58% of households reported buying water throughout the year, while 42% only bought water at certain times of the year (likely in the dry season when water is scarce, and some boreholes pumping water from the upper aquifer dry up). For those that purchase drinking water throughout the year, 97% reported that they are always able to afford drinking water, while 3% could not (all mentioned lack of access to income as the reason why)[42]. Some water providers (e.g. private borehole owners) mentioned providing water free of charge (or for a minimal cost) for those that cannot afford to pay and come to the borehole with their own containers. This may explain why such a high percentage of households reported always being able to afford drinking water (e.g. they have options to buy for free when they cannot afford it in most locations).

[42] Note, in the survey this question was only asked from those who buy water throughout the year, therefore does not reflect if purchasing power is a reason why people do not buy water all year round.

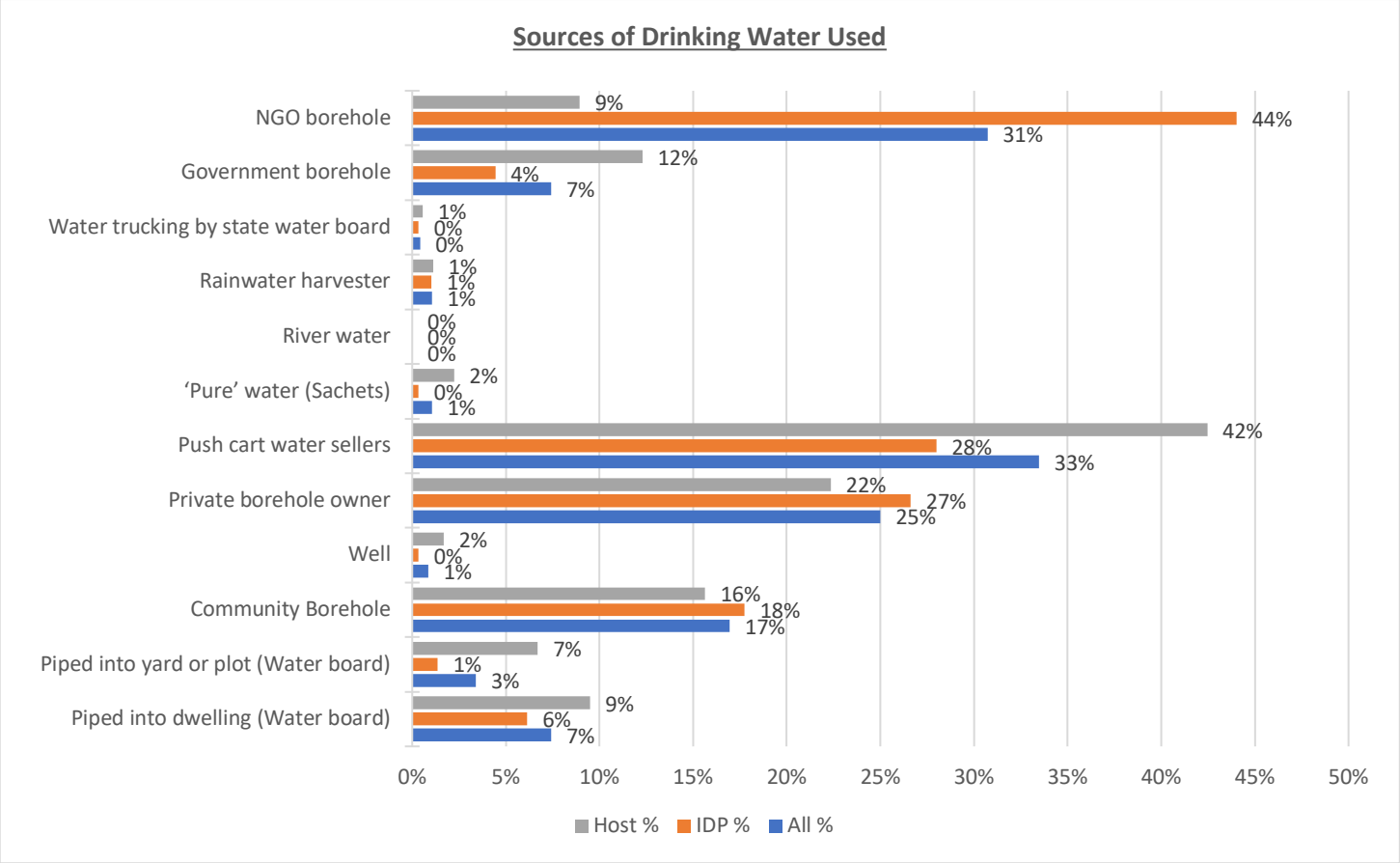
For those buying water, 10% purchase twice a day, 64% purchase once a day, 13% purchase two to three times a week, 9% purchase once a week, and the remaining 4% purchase once a month or less.

Less than 1% of households reported paying transportation costs to get to/from the water collection or purchase point, with those that pay paying 120-140 Naira per return journey (those paying transport costs were residing in Gwange III and Madinatu).

Water Sources:

76% of households reported only one type of water source being used to access water, with 24% reporting two or more sources for water. The types of water sources used by households varied by geographic area. Across all households, 33% reported accessing drinking water from pushcart sellers, followed by 31% from NGO boreholes, 25% from private boreholes, and 17% from community boreholes. Other less common water sources reported were water board connections either piped into the dwelling (7%) or yard (3%), government boreholes (7%) and rainwater harvesting (1%).

Figure 24: % of Households Reporting Use of Source for Drinking Water



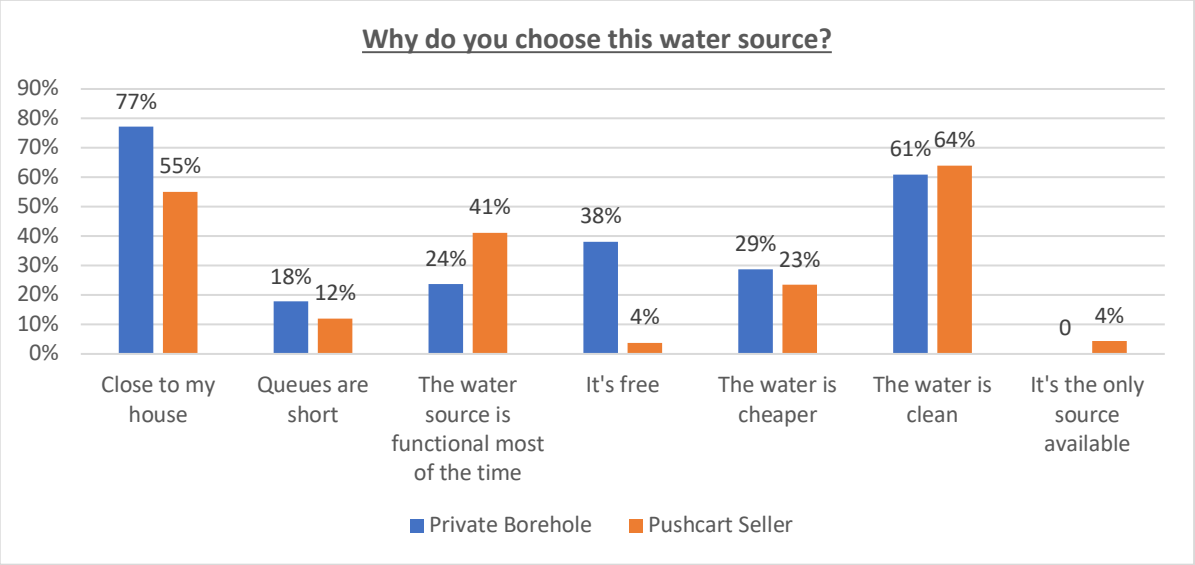
The main reasons that households reported opting to access water from private boreholes was related to proximity and perceptions of cleanliness of water. 77% of those accessing water from private boreholes preferred this source because it was close to their house, 61% felt the water was clean, and 38% accessed because it was free[43]. For households accessing water from pushcart sellers, 64% did so because they felt the water was clean, 55% because it was close to their house, and 41% because it was somewhat reliable (i.e. available most of the

[43] As per the assessment findings, if households go directly to some private borehole owners they can collect for free or for a minimal fee based on what they can afford.

time). 4% of households reported that they used pushcart sellers because it was the only water source available to them. Despite these perceptions on cleanliness of water, the findings from both borehole owners and pushcart sellers highlighted minimal treatment practices, so the reality is quite different.

Perceptions on Water Safety:

Figure 25: Reasons for choosing Private Boreholes and Pushcart Sellers to Access Water



Among households reporting that they accessed these water sources, the following perceptions on water being safe from that source were found:

- 99% of households felt water from **the water board piped either in to the yard or dwelling** was safe
- 94% of households felt water from **community boreholes** was safe. For the remaining 6% they felt it wasn't safe because it had a bad taste or didn't think it was treated.
- 75% of households felt water from **wells** was safe.
- 96% of households felt water from **private boreholes** was safe.
- 95% of households felt water from **pushcart sellers** is safe to drink.
- 80% of households felt water from **rainwater harvesting** was safe to drink.
- 100% of households felt water from **Government boreholes** was safe to drink.
- 93% of households felt water from NGO boreholes was safe to drink.

These perceptions, particularly around water from private boreholes and pushcart sellers, are somewhat misplaced given the findings outlined above around treatment practices, hygiene practices and compound conditions of private water providers.

Issues related to Water Sources:

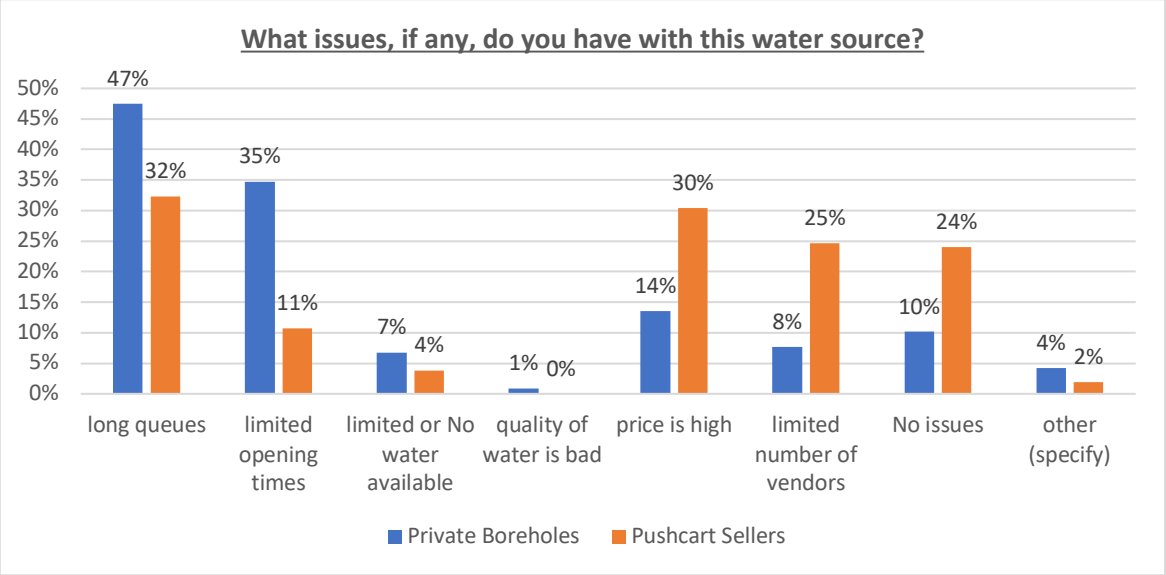
The main issues reported by households accessing water from private borehole owners were as follows: 47% of households reported issues related to long queues, 35% reported limited opening times, 14% reported high prices and 10% reported no issues.

For those accessing water from pushcart sellers, 32% of households reported issues of long waiting times, 30% that the price is high, 25% that there is a limited number of vendors, with 24% reporting no major issues.

Households reported a limited number of vendors (mainly pushcart sellers, but in some areas also private boreholes) were located across all the 6 target communities, so despite perceptions among pushcart sellers that

the market is saturated in some locations such as Madinatu, this is not necessarily the perception among the 33% of households who buy water from pushcart sellers.

Figure 26: Issues with Private Borehole and Pushcart Sellers as a source of water



For households buying water from pushcart sellers, 89% reported that they were able to get all the water they need from them indicating that there may not be any significant challenges in terms of availability. However, even in areas that appeared to have a high number of pushcart sellers and a highly saturated market in terms of the number of pushcart sellers operating, such as Madinatu, there were still 21% of households in the area that reported they were not able to get all the water they needed from pushcart sellers.

Table 19: Capacity of Pushcart Sellers to Supply Needed Water

Location	Are you able to get all the water you need from push cart sellers?	
	Yes	No
Overall	89%	11%
Bulumkutu Kasuwa	92%	8%
Garba Buzu	75%	25%
Gwange III	98%	2%
Madinatu	79%	21%
Modusulmri	100%	0
Simari Area 1	93%	7%

100% of households reported that they do not face any risks or feel unsafe when travelling to access water.

Water use:

64% of households reported using 5 or more jerry cans per day, thus 100 litres, for all household water needs (including washing). 5.2 jerrycans of 20L is equivalent to the WASH Sector standard of 15 Litres per person per day for an average household size of 7. The remaining 36% of households reported using less than the minimum standard of water per day. Water usage was lower among IDPs than host community households, with 59% of IDP households using 5 or more jerry cans per day, while 73% of host community households did.

Cost of Water:

The price of water for households varied depending on the water source. The below table shows the range of prices reported during household surveys, FGDs and key informant interviews with key informants.

Table 20: Price of Water for Households by Source

How much do you pay for a 20L jerry can of water from the following sources…	Price per 20 L jerry can in Naira (N)
Pushcart Sellers	10 - 20 Naira
Private Boreholes	5 - 20 Naira
Government Boreholes	10 - 30 Naira
Community water source	Free, or 5 - 10 Naira

D.3.3 Knowledge, Behaviours and Practices

63% of households reported that they do not treat their drinking water, while 37% reported that they did. A higher % of host community households reported not treating their drinking water (77%), compared to IDP households (55%), perhaps related to most INGO interventions targeting IDPs rather than host community populations. Water treatment prevalence varied across communities, with the majority of people treating their drinking water found in Garba Buzu (71% of the respondents).

Table 21: % of households treating drinking water by location

Location	Do you treat your drinking water	
	Yes	No
Overall	37%	63%
Bulumkutu Kasuwa	25%	75%
Garba Buzu	71%	29%
Gwange III	15%	85%
Madinatu	35%	65%
Modusulmri	25%	75%
Simari Area 1	46%	54%

The main reason people provided for not treating their drinking water was related to availability of products to purchase (53%), belief that the water is already treated (41%), belief that the water is always safe from water points (12%), and there being no affordable treatment products (12%).

Table 22: Reasons for not treating drinking water

Reason for not treating drinking water	% of Respondents
No treatment products available to purchase	53%
No affordable treatment products	12%
Dislike smell of treatment products	1%
Dislike taste of treatment products	0%
The water is already treated	41%
All piped water is always safe	4%
All water from water points is always safe	12%
Other (specify)	0%

For those that do treat their drinking water before consuming it, 60% reported using aqua tabs to treat, 31% use water guard[44], 20% use a water filter, 8% use cloth, and the remaining either boil or use bleach.

Table 23: Method of treatment for drinking water

Method of treatment	% of Respondents
Boil	2%
Water guard	31%
Bleach	1%
Aqua Tabs	60%
Use a water filter	20%
Use of cloth	8%
Other	2%

65% of households who reported treating their drinking water said they do not pay anything as it is free or distributed by NGOs (most of these – 56% – were in Garba Buzu, 22% in Simari 1, 12% in Madinatu, 6% in Gwange III, 2% in Modusulumri, and <1% in Bulumkutu Kasuwa). 93% of those reporting that they treat their water said they didn't face any challenges accessing the materials needed for treatment, and the remaining 7% reported facing challenges in not being able to afford it and/or it not being available. For those reporting not being able to afford it, these households were in Bulumkutu Kasuwa (1%), Madinatu (1%) and Modusulumri (5%).

34% of households who reported treating their water said they only received treatment materials in rainy season, 32% said they received it monthly, 21% said they received it weekly, and 10% received it only during an outbreak.

87% of households reported usually using water and soap to wash their hands, 7% use water and ash, 3% use water only, and 2% use water and sand/leaves. 78% of households had no hand washing facilities around their home. 72% of households were observed to have clean water storage containers.

Table 24: Households with no available handwashing facilities and unclean water storage containers

Location	% of Households with no available hand hashing facility near the home	% of Households where water storage containers were not clean
Overall	78%	28%
Bulumkutu Kasuwa	50%	22%
Garba Buzu	77%	30%
Gwange III	82%	27%
Madinatu	62%	30%
Modusulmri	100%	37%
Simari Area 1	93%	19%

52% of households reported having received training in water safety over the last 3 months, however, there were some differences across the different geographic areas (see table below).

Table 25: Training on Water Safety in Last 3 Months

Location	Have you received training on water safety in the last 3 months?	
	Yes	No

[44] Both aquatabs and water guard are commonly distributed by NGOs

Overall	52%	48%
Bulumkutu Kasuwa	11%	89%
Garba Buzu	84%	16%
Gwange III	73%	27%
Madinatu	55%	45%
Modusulmri	53%	47%
Simari Area 1	66%	34%

D.4 *General Conclusions*

Although the assessment gathered a considerable amount of data, and there is more detailed analysis that could still be done, the following are the priority key findings observed from the analysis included in this report. Overall, the assessment uncovered the following priority key findings:

1. The **private water market**, including pushcart sellers and private boreholes, which is an informal and unregulated market, is a **key source of water** for many people, and in some neighborhoods, this are the only sources of water available. The number of private actors engaged in the provision of water has increased since the beginning of the crisis largely related to the increase in population and therefore demand.

2. Alongside the increase in private water providers, there has also been an **increase in the unregulated establishment of boreholes and water points**. Where previously the Borno State Ministry of Water Resources (BSMoWR) had oversight of borehole construction, including providing geophysical and hydrological services to assess and plan construction, many of the boreholes used now are constructed spontaneously and are neither registered nor monitored by the government.

3. Competition, cooperation and relatively stable water prices throughout the chain indicate a **relatively vibrant water market** playing a critical role in contributing to water needs in the town. However, in some areas pushcart sellers felt the market was saturated, particularly during the rainy season, and they were unable to expand their operations due to limitations in **a)** customers/demand, **b)** poor road conditions resulting in access difficulties, **c)** extending credit to regular customers, and **d)** having limited capital to invest (and therefore being reliant on cart owners for renting carts/jerrycans that were often in poor condition).

4. Generally, the most critical issues identified in the communities assessed were around the **need to improve the quality of water and service delivery, rather than availability issues**. However, when government or INGO-supported water supply services are interrupted (e.g. due to malfunction, disrepair) there can be an increase in localized demand putting more pressure on the private water market. The areas of availability of water and capacity to deliver to end users among the private sector to meet demand needs to be further explored during the operational research, though inaccurate and fluctuating population figures make accurate projections of water demand challenging.

5. Household **incomes across host and IDP populations are severely constrained**, compounded by the crisis, with most of the people's basic income below the minimum threshold outlined in the draft Nigeria Minimum Expenditure Basket (MEB). Despite this, affordability was not observed to be the most critical issue affecting water access. However, although water is a relatively small component of reported household expenditures overall, in areas where people are more or less solely reliant on the private water network (e.g. from pushcart sellers or private boreholes) the cost to access water can increase, posing a challenge particularly for the poorest households with the minimal or no income. Despite this, private borehole owners were found to be providing water free of charge or at minimal cost for those that were unable to afford it.

6. **Despite widespread perceptions among pushcart sellers and end users that water is safe and treated, the reality is vastly different.** Very few private borehole owners were found to be treating their water despite that most boreholes access water from the upper aquifer, suspected to be at significant risk of contamination, particularly given the urban nature of Maiduguri which is exposed to poor sanitation and has no environmental control mechanisms to avoid contamination of the natural environment (soil, biota and water). Due to these commonly held beliefs that water is already treated, and is always safe, treatment practices at household level were relatively low.

7. **Hygiene and water handing practices** along the water chain are also inconsistent and an area of concern. Private boreholes and dams were found to have poor drainage and sanitary conditions; some pushcart sellers had unclean and old jerrycans in poor condition, were using old cloths as filters when 'turning' water and were not practicing basic handwashing; while end users in some areas reported better handwashing practices, this was not the case in all locations assessed.

8. Despite the coverage of the state water board water network in the city, there are still many areas that are uncovered. Default rates are high among those connected to the state water board, and there is limited capacity (and possibly disinterest) within the relevant departments of the BSMoWR to address pirate connections, and to reinforce a sustainable financing strategy and fee structure for end users. Additional challenges are posed by a general culture that water provided by the government should be free, and an unwillingness to pay. This limits the resources available for the government to reinvest in the system to improve services and expand network coverage. **Without systemic changes to the government water supply system, adequate resourcing and adjustments to the wider regulatory framework, private water providers will likely continue to play a key role in meeting the water needs of the population.** Therefore, efforts should be made to at minimum ensure the safety of the water availability and strengthen capacities of these private water providers to extend reliable and consistent services at affordable rates, particularly in areas with minimal coverage of other water supply interventions from NGOs and government.

9. Humanitarian actors should consider **piloting interventions** that address the critical issues identified, engaging with actors throughout the market system. Pilot activities should be monitored and evaluated with learnings shared with the wider humanitarian community to inform future WASH implementation in Maiduguri and potentially other urban and peri-urban areas of north-east Nigeria. Preliminary recommendations for interventions are outlined at the end of this report.

E. Initial Recommendations

This section highlights the initial recommendations from the findings of the assessment. It should be noted that these are preliminary recommendations and should be piloted and tested before being taken to scale. The short-term pilot interventions are possible activities that could be implemented by CRS as part of the operational research from November 2019 until April 2020. Final pilot activities and the approaches that will be used to implement these interventions will be identified by the CRS Nigeria team based on feasibility, budget available, timeframe and government and stakeholder buy in.

Possible Short-term [6 months or less] Pilot Interventions, targeting the following stakeholders:

1. **General:**

Interventions should be comprehensive and target multiple actors in the market chain: Any interventions implemented should be comprehensive and targeted in the same geographic areas (neighborhoods assessed) to ensure a complementary approach. For example, any interventions targeting hygiene promotion knowledge and practices of end users should focus on the catchment areas of private borehole owners that are also being targeted. Without this holistic approach, the challenges identified will not be addressed effectively.

Prioritize geographic areas for pilot activities: Based on the assessment findings, some critical challenges have been identified. Although there were differences from one neighborhood to another, these overarching challenges are assumed to be fairly representative of other neighborhoods in the targeted wards. Therefore, prior to beginning any target interventions, geographic locations should be prioritized. Possible criteria for prioritizing specific areas for intervention might include: **1)** where private boreholes and/or push cart sellers are the main (or only) source of water in the areas; **2)** where critical public health risks related to private boreholes have been observed; **3)** areas that have received minimal interventions from NGOs or UN agencies previously (particularly focused on hygiene promotion, water treatment, and any activities targeting private sector actors); and **4)** where there is a high concentration of IDPs .

2. **Water providers:**

Targeting water providers should be approached through a package of activities composed of several parallel interventions that are complementary to one another (see below proposed activities 1-5).

When identifying the priority water providers to engage with, focus should be on identifying private borehole owners in areas where there are IDPs and few or no other water source options, and those posing the most critical public health risks.

Selected borehole owners should be committed to collaborating with organizations and to improving their practices, as well as being willing to make their own contributions[45]. Interventions should focus primarily on borehole owners, given that private dam owners are operating illegally and are reducing the water available for legitimate users connected to the state water network. Specific targeting criteria and approach for selecting borehole owners to target should be developed further based on the context.

A crosscutting and fundamental idea behind the different approaches suggested, is that these pilot interventions should offer an opportunity to ***build relationships with key private borehole owners*** for continuing collaboration beyond the pilots of the operational research and lay the foundations for longer-term interventions.

[45] It's important to identify borehole owners that are truly interested in improving its business both from an economical and a water quality point of view without compromising affordability for end users;

In addition, it would also be valuable to identify some borehole owners that are already demonstrating good practices as they could be engaged in the project as a way of demonstrating good practice to the targeted borehole owners, and also be involved in encouraging replication and spreading this knowledge with other water providers in their areas as well as in other neighborhoods.

A package of five (5) complementary activities and two (2) influencing activities are suggested.

The five (5) complementary activities recommended are:

1. ***Improve compound conditions of private borehole owners:*** Improve drainage within and outside borehole compounds, for example with soak pits and appropriate buried piping, prioritizing borehole owners with the most critical need, and encouraging contributions from the owner towards improvements (either financially, through labor etc.).
2. ***In collaboration with borehole owners, develop solutions to minimize pollution and contamination within the compound:*** In partnership with targeted water providers, explore solutions to completely avoid spillages of chemicals (e.g. oil and fuel) into surrounding soil.
3. ***Improve health and safety procedures, and practices for handling water, chemicals and electricity:*** Work with private borehole owners to orient them on key health and safety risks, and work with them to identify specific risks in their own compound and priority solutions/action plan to improve practices.
4. ***Work with borehole owners to establish monitoring and record keeping procedures to track extracted volumes:*** Explore installation of water meters to measure extraction volumes and provide orientation and training to monitor and keep records daily by introducing log books.
5. ***Training on the importance of water treatment and how to treat water:*** Trainings on water treatment, and provision of IEC material on procedures for a longer-term impact (ensuring appropriate chlorine doses are maintained, reservoir tanks clean, etc.). Also provide training on basic water storage and handling and encourage water providers to demonstrate these practices and share messages with pushcart sellers collecting at their water points.

The two (2) 'influencing' activities recommended are:

1. ***Link private borehole owners with RUWASSA (and potentially other actors) to access water disinfectants supplies:*** In parallel to the above package of activities, it would be beneficial to link selected borehole owners with RUWASSA (or other NGOs and/or UN agencies) to provide water treatment supplies. In the short-term, if no actors can provide supplies, explore cost sharing with borehole owners and provide chlorine directly. In parallel ensure that certain market vendors have available chlorine to supply the private water market sector as the various pilot interventions are likely to stimulate demand for water treatment.
2. ***Advocate with NGOs operating in Madinatu to encourage private dam owners to improve hygiene and safety practices:*** Significant risks are posed by uncovered dams/reservoirs that are tapping the state water board network. In Madinatu neighborhood, this is a significant source of water, so the public health risks are critical. If CRS does not engage in Madinatu for the pilot, then other actors already operating in Madinatu should be encouraged to provide training to dam owners on health risks, water storage and handling, water treatment and encourage them to work together with dam owners so they regularly clean the dam and improve the unsanitary conditions of these compounds.

Monitoring

Continuous monitoring will be fundamental when targeting private borehole owners, throughout implementation and beyond the completion of interventions, in order to observe if compound conditions, and if/how improved behaviors, practices and attitudes have been implemented. It is therefore recommended that relevant baseline information is collected from each borehole owner selected for the pilot interventions. A baseline assessment

should be conducted with each targeted borehole owner to gather information on the current status of their compound; identify key risks around pollution, contamination, and handling of water, chemicals and electricity; and in relation to their behaviors, general knowledge and attitudes. This baseline information can then be used to compare the situation at the end of implementation to gauge improvements.

3. **Push cart sellers:**

Improve knowledge and practices around safe water storage and handling: Training and hygiene messages for pushcart sellers (and potentially cart owners) specifically covering: **a)** improved methods for cleaning and maintaining jerry cans; **b)** water handling practices and safe storage; **c)** handwashing and personal hygiene; **d)** water safety and risks with different water sources; and **e)** importance and effective methods of water treatment.

Improve access to, and conditions of, carts and jerry cans: pilot the provision of capital for pushcart sellers to purchase their own cart and jerry cans[46]. This 'start-up' support should initially target pushcart sellers based on vulnerability considering those that only have this as a livelihood (e.g. no other income source for their household, no access to savings or other financial support), and should be provided in combination with the above-mentioned training. Carts and jerrycans are readily available in Maiduguri based on assessment findings, so cash grants could be feasible provided there is a safe and accessible mechanism to delivery cash to recipients. When refining selection criteria and modality for this intervention, explore the ability of pushcart sellers to make a small contribution or 'match fund' and consider basic training on cart and jerry can maintenance if required. Use this pilot as an opportunity to better understand the household economy, savings and financial management practices of pushcart sellers, and begin the design of an appropriate curriculum and plan for improving/promoting improved savings practices under longer-term interventions.

Baseline and regular monitoring of water storage, handling and general hygiene practices among pushcart sellers: Design and conduct a baseline assessment for targeted pushcart sellers to understand their current knowledge, attitudes and practices and to enable comparison and gauge improvements during monitoring activities. Conduct regular monitoring of pushcart sellers targeted under the project to understand if practices, knowledge and attitudes have improved as a result of interventions.

4. **Households:**

Hygiene promotion to improve practices around safe water storage and handling: hygiene promotion interventions should focus on end users in the catchment areas of targeted private borehole owners and pushcart sellers. Priority should be given to both host and IDP households, and to those who have not previously been covered by other NGO hygiene promotion and training interventions. Activities should focus on: **a)** improving knowledge of safe water storage and handling practices; **b)** understanding of water treatment (and how to recognize if water is already treated; c) water treatment methods (including local and low-cost solutions for water treatment); **d)** encourage end users to demand treated water and good hygiene among water vendors (both pushcart sellers and private borehole and dam owners)

Work with the Cash Working Group to ensure water costs are adequately reflected in the Minimum Expenditure Basket (MEB) and therefore as part of multi-purpose cash transfer programmes: Although the draft MEB developed in October 2018 included water components, the content of this should be updated based on current market prices and trends. In addition, seasonal adjustments considering higher demand and higher cost of water during the dry season should be reflected in the MEB. Actors providing multi-purpose cash interventions should

[46] A new full set of jerry cans (14 X 20L jerrycans) would cost approximately 9,800 Naira (27 USD) and a new cart is around 30,000 Naira (85 USD)

be encouraged to consider water expenditures as part of their transfer value calculations to help increase the purchasing power of households to access water.

Collect baseline data among targeted end users and monitor changes: Conduct baseline assessment with a sample of end users in the areas targeted for hygiene promotion activities. Regularly monitor the knowledge, attitudes and practices of end users in areas of water storage and handling; water treatment; and preferences/demand for treated water and hygiene practices among water vendors. Baseline assessment should enable the implementation teams to gauge changes as a result of the interventions.

5. **Government:**

Engage RUWASSA in support of pilot activities, including hygiene promotion components and providing chlorine to water service providers (e.g. private borehole and dam owners): RUWASSA is reportedly able to provide chlorine supplies on request, and, as part of its mandate, engages in hygiene promotion. There is potential to therefore engage RUWASSA (and other departments of BSMoWR as relevant) in providing support to private boreholes, and pushcart sellers through hygiene promotion, which may also encourage more collaboration between government and private sector counterparts.

Encourage Government to conduct road improvements in areas most affected during the rainy season: using the assessment data gathered, work with local "*bulamas*" and government authorities to identify the most problematic neighborhoods and access routes to see how road conditions can be improved in advance of the rainy season. Areas with no access to the state water board network and limited other drinking sources should be prioritized.

6. **Other:**

Gather more information to better understand how current associations are functioning and potential areas of support and collaboration (for both private borehole owners and pushcart sellers): The assessment uncovered that there may be several associations (even if not registered) among private borehole owners and pushcart sellers. More information needs to be gathered to understand the role of these associations, and the potential for their engagement and support in implementing activities that will improve the market system on the longer term.

Pilot the above recommendations to generate evidence on the most effective approaches to improving water access in Maiduguri: CRS already has some funding to implement pilot interventions and will be monitoring and sharing the outcomes of these pilots with other actors. Other actors who implement interventions that work with the private water market or target any of the actors identified in this report are encouraged to proactively share lessons learnt and evidence with CRS and other WASH actors in north-east Nigeria through the WASH sector.

Possible Longer-term [1 year or more] Interventions, targeting:

1. **Water providers**

Explore options to improve reliability of water supply for specific targeted borehole owners: given challenges with consistent power supply from the national grid and high running costs of generators, explore mechanisms to provide access to hybrid systems for selected borehole owners.

Based on a more complete understanding of current borehole associations, engage with borehole associations to address water treatment knowledge and explore ways of sharing this knowledge in other locations/areas: Borehole associations in Gwange III are already playing a role in providing technical support, operations support and coordination among private borehole owners. These associations have potential to contribute to reaching

more private borehole providers with critical messages, and also support improved organization and collaboration in other areas where associations do not exist.

2. Push cart sellers

Promote savings groups and support organization among pushcart sellers: there is potential to leverage the informal networks among pushcart sellers to improve dissemination and reinforcement of critical water handling practices. In addition, some informal associations have already established savings mechanisms for pushcart sellers to pay into and access support when they face difficulties. These savings groups should be further explored and understood, with a view to strengthening and replicating if effective. By promoting and supporting savings groups, pushcart sellers could access capital required to purchase their own carts/jerrycans, cover cleaning and maintenance costs, and/or invest in diversifying their livelihoods. Models such as CRS' Savings and Internal Lending Communities (SILC)[47] could be explored.

Find sustainable mechanisms to maintain and replace jerry cans: Ideally with the support of organized groups of pushcart sellers, explore options to establish a scheme that would enable pushcart sellers to replace damaged or leaking jerry cans for new jerrycans at affordable costs. Potential to explore recycling of old jerrycans (e.g. through plastic recycling and therefore earning a minimal fee) in order to reinvest and subsidize the cost of new jerrycans. A specific exploratory study would need to be conducted to understand the potential and viability of such a scheme.

3. Households

Create demand for better water quality and hygienic conditions among pushcart sellers: Explore opportunities to stimulate demand for clean, treated water and improved hygiene conditions from water vendors (e.g. boreholes and pushcart sellers).

Create livelihoods opportunities among end users to produce local chlorine: This could be sourced among private borehole owners and others water actors in Maiduguri.

[47] More information here: https://www.crs.org/publication-tags/silc

Annexes

Annex 1: Seasonal Calendar for Maiduguri, North East Nigeria

Month	January	February	March	April	May	June	July	August	September	October	November	December
Dry Season	'Cold'' Dry Season	'Hot'' Dry Season	'Hot'' Dry Season	'Hot'' Dry Season						'Cold'' Dry Season	'Cold'' Dry Season	'Cold'' Dry Season
High winds, dust, risk of infrastructure damage												
Rainy Season					Lower rainfall	Medium rainfall	High rainfall	Highest rainfall	High rainfall	Lower rainfall		
Agricultural and Livestock Activiites*		Land Preparation			Planting		Weeding		Main Harvest			
				Off season harvest								
			Livestock Migration* (Host and IDP population in Maiduguri not reliant on pastoralism, but Fulani community move outside of Maiduguri city during this time)									
Lean Season*							Lean Season					
Flooding risks							Peak Flooding Risks					
Cholera risk							Peak Cholera Risk					
Power supply (electricity)	More regular power/electricity supply				High interruption to electricity supply					More regular power/electricity supply		
Road access					Partial Disruption	Partial Disruption	Severe disruption	Severe disruption	Severe disruption			
Water sources	Less avaiability. Less diversity in water sources. Travel longer distance to access water. Higher demand for purchasing water				More availability and more diverse water source options (including river and rain water catchment). Less purchase of water.					Less availability. Less diversity in water sources. Travel longer distance to access water. Higher demand for purchasing water		
Water contamination risks						People using stagnant water, open sources, river resources						
Aquifer recharge	Lower				Higher					Lower		
Water prices (General)	Higher water prices (demand higher, water sellers going further to fetch water)				Generally lower prices (water available, fewer people need to buy) ***Prices can be higher in areas that become inaccessible as pushcart sellers charge more to reach inaccessible areas***						Higher water prices (demand higher, water sellers going further to fetch water)	
Income sources	Normal income levels (still some availability of food, prices stable, trade not disrupted by rainfall)			Lower income (rain disrupting petty trade and markets, lower purchasing power among population as food prices are higher, people have consumed food stocks, people spending on agricultural inputs and cultivation)					Higher income levels (more petty trade, lower food prices, more food availability, more purchasing power as people get income from harvest)			
Migration	Pastoralist migration outside of the city to look for pasture for livestock Agriculturalists migrate to the city to look for other income opportunities (e.g. pushcart sellers)				Agriculturalists migrate from the city to where they have land for planting and cutivation (including some pushcart sellers)						Pastoralist migration outside of the city to look for pasture for livestock Agriculturalists migrate to the city to look for other income opportunities (e.g. pushcart sellers)	
Security	Security risks throughout, conflict-related displacement unpredictable											