Challenges and Issues of Access to Water and Sanitation in Refugee Camps in Eastern Chad

Gassina Pierre[1], Kadessou Djarmatna[2], Abdelkerim Tchinsou[3] , Akoilet Joy[4]

Department of Water Management Resources, LM International/LM Chad

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ABSTRACT

Analysis of August and September data on water supply and sanitation in refugee camps in Eastern Chad reveals significant disparities between provinces and individual sites. Average water access ranges from 4 L/p/d to 18 L/p/d, compared to the Sphere standard of 15 L/p/d. Only a few camps meet or approach this minimum, while the majority remain below the threshold, exposing populations to elevated health risks.

Sanitation coverage also varies widely. Camps in Ouaddaï generally show acceptable conditions, whereas Wadi-Fira exhibits critical deficits, with up to 63–71 persons per latrine. Sila demonstrates relative stability, but some sites still experience moderate shortages.

Monitoring of water quality via residual chlorine indicates notable improvement across provinces between August and September, particularly following the cholera outbreak in Dougui. Increases in free residual chlorine at both reservoir and household levels reflect enhanced microbiological protection, although some camps remain below WHO thresholds due to temporary chlorine shortages or operational constraints.

Keywords— Water supply ; Refugee camps; sanitation Microbiological quality; chlorination

INTRODUCTION

Since 2022, the WASH (Water, Sanitation and Hygiene) sector has been one of the priority areas of humanitarian response in Eastern Chad. Under the coordination of the United Nations High Commissioner for Refugees (UNHCR) and in partnership with UN agencies and several NGOs, WASH interventions are primarily concentrated in the provinces of Ouaddaï, Sila, Wadi Fira, and Ennedi-Est—main areas receiving refugees from Sudan [1], [2].

The massive and recurrent influx of refugees is directly linked to the escalation of the crisis in Darfur and the intensification of intercommunal violence between 2020 and 2023, which triggered ongoing cross-border migration waves. These population movements have placed considerable pressure on already limited local services (water access, sanitation systems, health capacities), further exacerbated by structural poverty and climatic shocks such as floods and rainfall variability [3], [4], [5].

From a hydrological and climatic perspective, Eastern Chad presents a Sahelian, semi-arid profile characterized by low and irregular rainfall (200–400 mm/year depending on the area), high evapotranspiration, and limited groundwater recharge. These conditions make sustainable management of surface and groundwater resources particularly challenging and expose both host and refugee populations to chronic water insecurity [6], [7], [8].

Despite ongoing interventions (borehole drilling, water supply systems, water trucking, distribution of hygiene kits, and latrine construction), effective access to safe drinking water and adequate sanitation facilities remains insufficient in many camps and sites. Field observations and situation reports indicate that several sites fail to meet minimum humanitarian standards (≥15 L/person/day; 1 latrine/20 people) and that infrastructures are often outdated, undersized, or quickly overused [9], [10], [11].

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The public health consequences are well documented: outbreaks of Hepatitis E (Ouaddaï, 2024 and 2025) and episodes of acute diarrhea or cholera linked to WASH deficiencies have been reported in several camps. Medical organizations have identified insufficient access to safe water and sanitation as direct aggravating factors for these epidemic outbreaks [12], [13], [14].

Beyond health impacts, inadequate WASH services affect schooling (particularly girls' absenteeism), maternal health, protection (increased risks of exploitation and gender-based violence), and the dignity of displaced populations and host communities. Gender and protection reports emphasize the need to integrate gender-sensitive approaches and ensure basic services that strengthen the resilience of vulnerable households [15], [16].

Among the most frequently cited operational constraints are the high cost and logistical complexity of water trucking, shortages of spare parts and maintenance materials for pumps and boreholes, limited accessibility during rainy seasons or climatic crises, and insufficient long-term funding. These limitations underscore the need to promote mixed approaches, including infrastructure rehabilitation, local capacity building, and the adoption of context-appropriate solutions (solar-powered pumps, community water storage and filtration, behavioral hygiene programs) [17], [18], [19].

In this context, humanitarian actors highlight the importance of an integrated approach combining emergency, development, and resilience components, consistent with UNDP strategic frameworks and Chad's Humanitarian Response Plan [20], [21], [22]. This approach aims to enhance the sustainability of WASH services in a region where humanitarian, environmental, and socioeconomic crises intersect.

METHODOLOGY

The assessment of water supply conditions in refugee camps in Eastern Chad is based on a mixed-methods approach combining direct field observation and documentary analysis.

Data Sources

The main source of information comes from the compilation and analysis of weekly reports produced by LM International, the lead implementing partner for WASH activities. These reports, covering the period from August to September, provide data on distributed water volumes, number of beneficiaries, condition of water infrastructure, and service interruptions. The data were consolidated to calculate average per capita access ratios (L/person/day) and to assess compliance with the 2023 Sphere Humanitarian Standards.

Field Observation

Direct field observation was a key step in the data collection process. Visits were conducted in several camps (Farchana, Bredjing, Goz-Amir, Touloum) to verify the functionality of infrastructures, identify critical points in the network (breakdowns, leaks, illegal connections), and engage with water management committees and beneficiaries. These findings validated and complemented the documentary data, providing a more detailed understanding of technical realities and local constraints.

Data Processing and Analysis

The data were aggregated and compared against humanitarian standards to assess the level of water access, disparities among camps, and weekly variations. The analysis also considered explanatory factors such as borehole capacity, energy availability, logistical constraints, and the performance of WASH partners.

III. General Situation of Water Supply

Analysis of the monthly reports on drinking water supply for August and September reveals significant disparities among refugee camps in Eastern Chad. These disparities concern both the quantitative availability of water, the quality of the service provided, and the regularity of distribution.

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Tableau 1 : Monthly Water Supply Ratios in Refugee Camps of Eastern Chad (August–September) and Comparison with Minimum Humanitarian Standards

Camps	Ratio W29	Ratio W30	Ratio W31	Ratio W32	Ratio W33	Ratio W34	Ratio W35	Ratio W36	Average Ratio / Period
K-Moura	13	14	15	15	15	15	15	15	15
Gaga	11	12	11	9	8	9	12	17	11
Bredjing	14	14	14	14	14	14	14	14	14
Treguine	14	12	11	11	11	12	12	13	12
Aboutengué	9	10	9	9	10	10	11	11	10
Metché	14	12	12	10	9	9	9	9	11
Arkoum	11	10	12	12	12	12	12	12	12
Dougui	9	13	16	16	16	16	16	16	15
Farchana	18	17	9	7	9	9	9	5	10
Alacha	5	6	7	7	6	6	8	9	7
Iridimi	8	7	9	8	8	8	8	8	8
Touloum	5	5	8	7	8	7	4	4	6
Amnaback	2	2	3	3	4	4	5	5	4
Kounoungo	13	12	13	14	14	14	13	13	13
Milé	11	11	11	12	11	11	12	12	11
Koursigué	9	7	8	7	12	12	11	11	10
Ouré Cassoni	7	5	4	7	7	6	6	4	6
Djabal	13	12	13	13	12	12	6	6	11
Goz-Amir	10	8	19	19	19	10	12	12	14
Zabout	10	10	10	10	10	10	10	10	10
Kerfi	19	28	20	20	20	20	10	10	18

The average water access ratios (in liters per person per day) vary considerably from one site to another, ranging from 4 L/p/d in Amnaback camp to 18 L/p/d in Kerfi, compared with the minimum humanitarian standard of 15 L/p/d as defined by the Sphere Standards (2023).

Overall, only a few camps—such as Kerfi (18 L/p/d), Dougui (15 L/p/d), Bredjing (14 L/p/d), and Goz-Amir (14 L/p/d) —manage to meet or come close to the humanitarian threshold.

In contrast, the majority of the other camps face persistent deficits, with average values below 12 L/p/d, particularly Alacha (7 L/p/d), Touloum (6 L/p/d), Ouré Cassoni (6 L/p/d), and Amnaback (4 L/p/d).

These disparities reflect an unequal distribution of water resources among camps and point to multiple structural constraints:

- Limited capacity of boreholes and distribution networks ;
- Recurrent breakdowns of pumping systems and generators;
- Logistical challenges related to water trucking in the most remote area

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From a temporal perspective, the week-to-week fluctuations (ratios W29 to W36) indicate instability in water production and distribution, linked to fuel availability, weather conditions, and the operational capacity of WASH partners.

Overall, less than 30% of the assessed camps meet the minimum recommended standards, confirming that equitable access to safe drinking water remains a major challenge for the region. These disparities expose refugee populations to heightened health risks, particularly waterborne diseases such as cholera, diarrhea, and hepatitis E, and highlight the need to strengthen water planning and preventive maintenance of infrastructure.

1 – Camps in Ouaddaï Province

Analysis of data from August and September (Figure 1) reveals an overall deficit and instability in water supply across the refugee camps in Ouaddaï Province. Average water access ratios range between 11 and 15 liters per person per day, which remain below the recommended humanitarian standard of 15 L/p/d (Sphere, 2023).

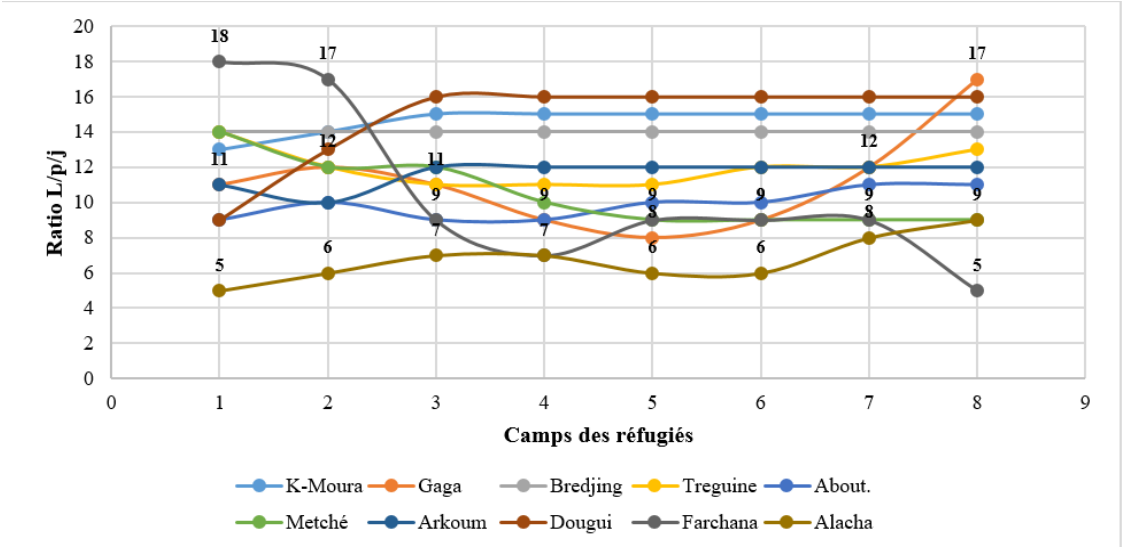

Figure 1. Levels of Water Access in Refugee Camps of Wadi Fira

The camps of K-Moura (15 L/p/d) and Bredjing (14 L/p/d) show relatively stable levels, though slightly below the standard, while Arkoum (11–12 L/p/d) remains in the lower range, indicating an insufficient yet consistent water supply.

In contrast, the camps of Dougui (9–16 L/p/d), Gaga (8–17 L/p/d), Farchana (5–18 L/p/d), and Metché (9–14 L/p/d) display significant fluctuations, reflecting strong instability in water provision. These variations highlight a growing dependence on generator functionality and water trucking deliveries.

The main causes identified for these deficits include aging water infrastructure, frequent generator breakdowns, water theft (notably in Farchana) or leakages along distribution lines, as well as insufficient storage capacity and fuel availability.

None of the assessed camps reach the optimal threshold of 20 L/p/d, underscoring a structurally deficient and irregular situation across the Ouaddaï Province.

2 – Camps in Wadi Fira Province

Examination of Figure 2 shows that the water situation in the Wadi Fira camps is significantly more critical than in Ouaddaï.

Several sites record water access levels well below the minimum humanitarian threshold.

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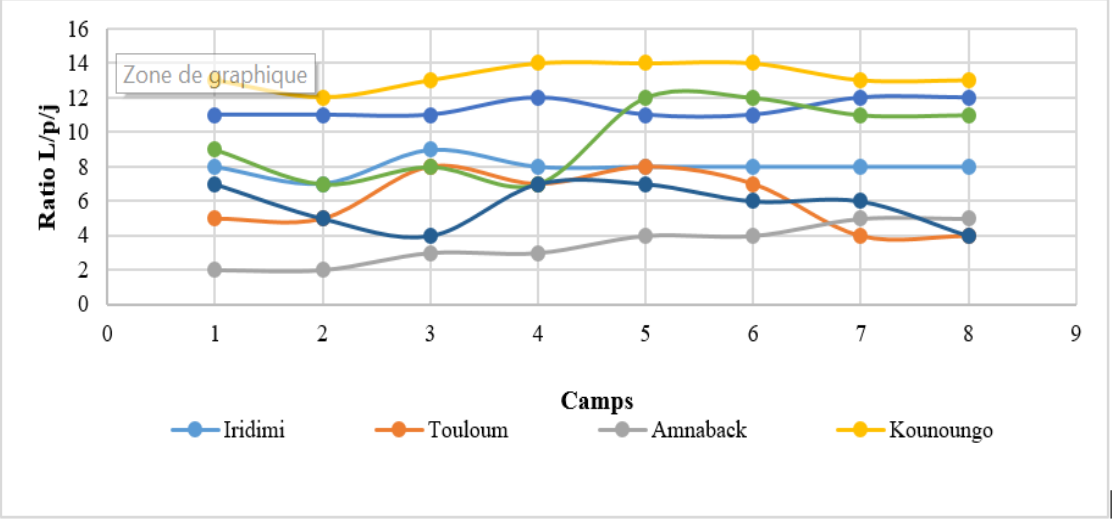

Figure 1 : Levels of Water Access in Refugee Camps of Wadi Fira

The camps of Amnabak (2–5 L/p/d), Touloum (4–8 L/p/d), and Ouré Cassoni (4–7 L/p/d) are in a humanitarian emergency situation, with available water volumes covering less than one-third of basic daily needs.

The Iridimi camp (8 L/p/d) remains in a state of chronic deficit, reflecting a structural and long-term shortage.

The camps of Kounoungo (12–14 L/p/d) and Milé (11–12 L/p/d) show slightly higher levels but still fall below the minimum standard, while Koursigué (7–12 L/p/d) exhibits significant week-to-week variations.

This situation illustrates a marked heterogeneity in water distribution within the province, where hydrogeological constraints, equipment breakdowns, and logistical limitations (fuel shortages, maintenance issues, and distance from water sources) represent the main barriers to adequate coverage of needs.

In summary, Amnabak, Touloum, and Ouré Cassoni constitute priority intervention zones, while Kounoungo and Milé, though slightly better supplied, still require corrective measures to stabilize water provision.

3 – Camps in Sila Province

Monitoring data from the August–September period (Figure 3) indicate that the drinking water supply situation in the Sila Province camps remains mixed, with only one site meeting humanitarian standards while several others experience varying degrees of shortfall.

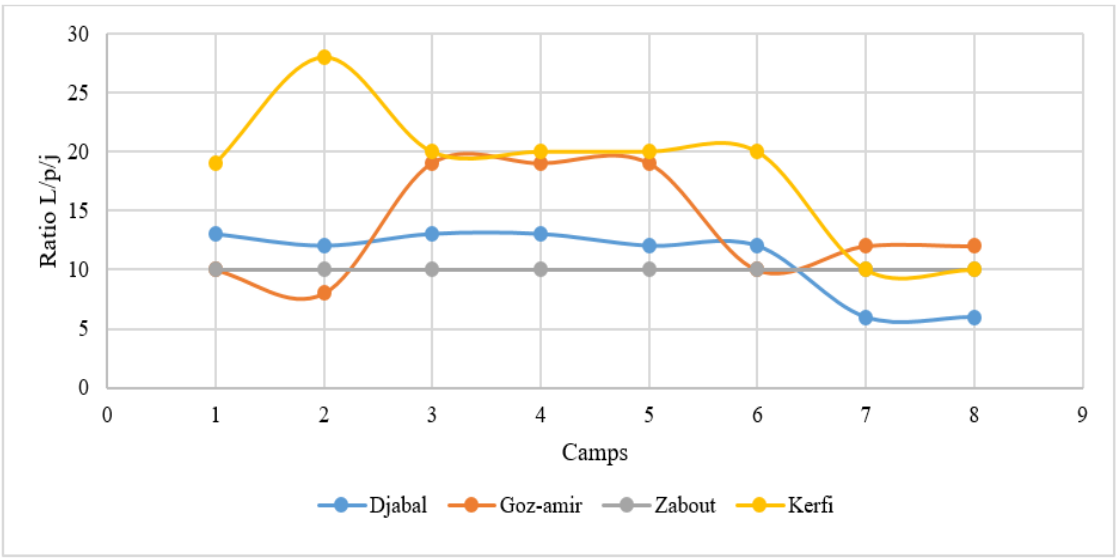

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Figure 2 : Figure 2. **Levels of Water Access in Refugee Camps of Sila**

The Kerfi camp (10–28 L/p/d) shows the best indicators in the province, consistently reaching and at times exceeding the Sphere standard of 15 L/p/d. This performance can be attributed to functional hydraulic infrastructure, proximity to water sources, and effective coordination of water distribution operations. Kerfi thus represents an example of operational stability within an otherwise fragile regional context.

Conversely, the Djabal (12–13 L/p/d) and Goz-Amir (12–19 L/p/d) camps remain below or close to the recommended threshold, while showing high weekly variability in distributed volumes. The case of Goz-Amir illustrates structural instability in water production, likely linked to intermittent generator failures and fluctuating fuel supply.

The Zabout camp (10 L/p/d) is characterized by a chronic and persistent deficit, reflecting insufficient pumping and storage capacity. This deficit exposes refugee populations to heightened health risks, particularly during periods of intense heat when water demand significantly increases.

Overall, the Sila Province displays substantial internal disparities: one compliant camp (Kerfi), two moderately deficient camps (Djabal and Goz-Amir), and one camp in a concerning situation (Zabout). These results underscore the need to strengthen preventive maintenance of hydraulic facilities, optimize energy management at pumping stations, and establish contingency measures to secure water supply in high-risk areas.

IV – General Sanitation Situation

Analysis of August–September sanitation data for refugee camps in Eastern Chad reveals considerable variability in access to household and communal latrines across provinces.

The ratios, expressed as number of persons per latrine, highlight significant deviations from the Sphere Project (2023) humanitarian standard, set at 1 latrine per 20 persons.

Some localities meet or approach the standard, while others show pronounced deficits, indicating urgent needs for infrastructure upgrades and maintenance.

1 – Camps in Ouaddaï Province

Data (Figure 4) show a generally acceptable but heterogeneous sanitation situation in the Ouaddaï camps.

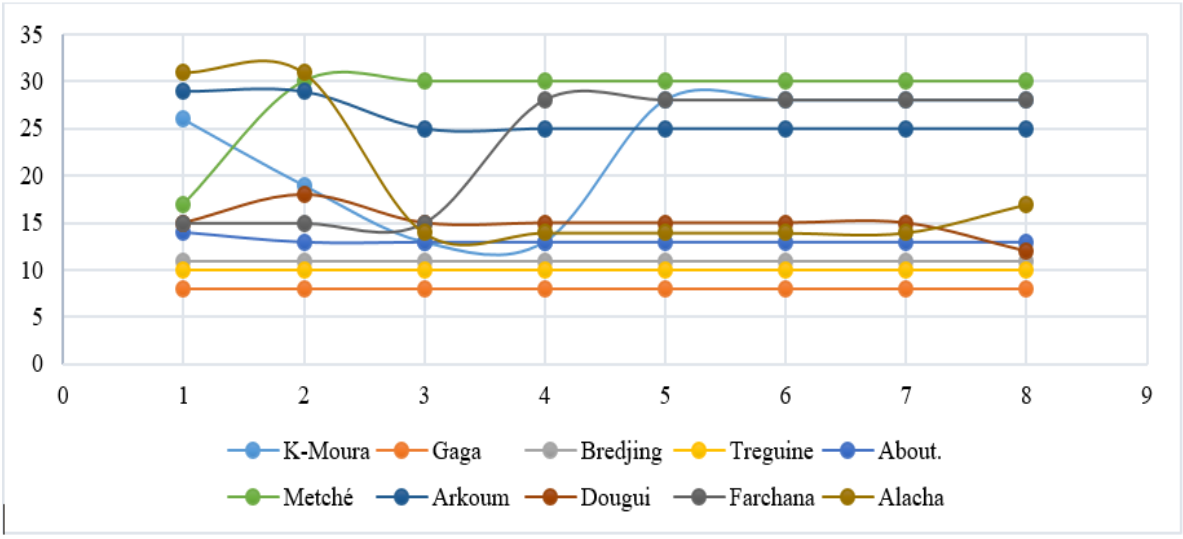

Figure 3 : Sanitation Coverage and Latrine Access in Refugee Camps of Ouaddaï Province

Sites such as K-Moura (23), Metché (28), Arkoum (26), and Farchana (23) have ratios slightly above the standard, suggesting moderate pressure on sanitation infrastructure.

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Alacha (19) meets the compliance threshold, while Aboutengué (13), Dougui (15), Bredjing (11), Treguine (10), and Gaga (8) show favorable ratios, reflecting satisfactory access to latrines.

Several factors explain this relative improvement:

- The planned relocation of some populations to better-equipped areas ;
- The gradual decommissioning of emergency latrines, replaced with more durable models;
- The construction of new family latrines ;

And the involvement of local cooperatives in the production of slabs and sanitation materials.

These initiatives have significantly improved sanitation coverage, particularly in camps affected by the 2025 cholera outbreak.

2 – Camps in Wadi Fira Province

The situation in the Wadi Fira camps (Figure 5) reveals major disparities between sites.

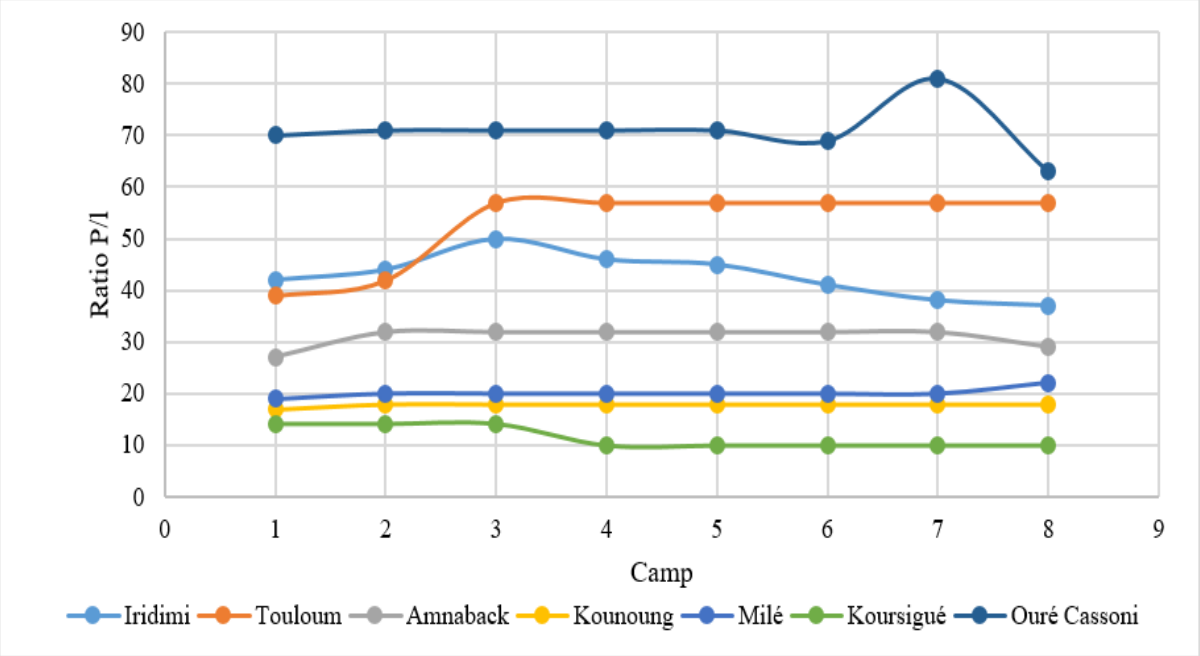

Figure 4 : Sanitation Coverage and Latrine Access in Refugee Camps of Wadi Fira Province

The camps of Koursigué (10–14), Milé (19–22), and Kounoungo (17–18) comply with or approach humanitarian standards, indicating a generally satisfactory coverage level.

However, Amnabak (27–32) shows a moderate deficit, while Iridimi (37–50), Touloum (57), and Ouré Cassoni (63–71) are in critical condition, with ratios three to four times higher than the recommended standard.

These latter sites therefore represent the most severe sanitation gaps in the region, exposing populations to high health vulnerability and increased risk of waterborne disease transmission. Contributing factors include overcrowding, advanced degradation of existing latrines, insufficient resources for desludging and maintenance, and limited space for new constructions.

3.3 – Camps in Sila Province

In the Sila Province (Figure 6), the situation appears more stable than in Wadi Fira, although disparities persist among camps.

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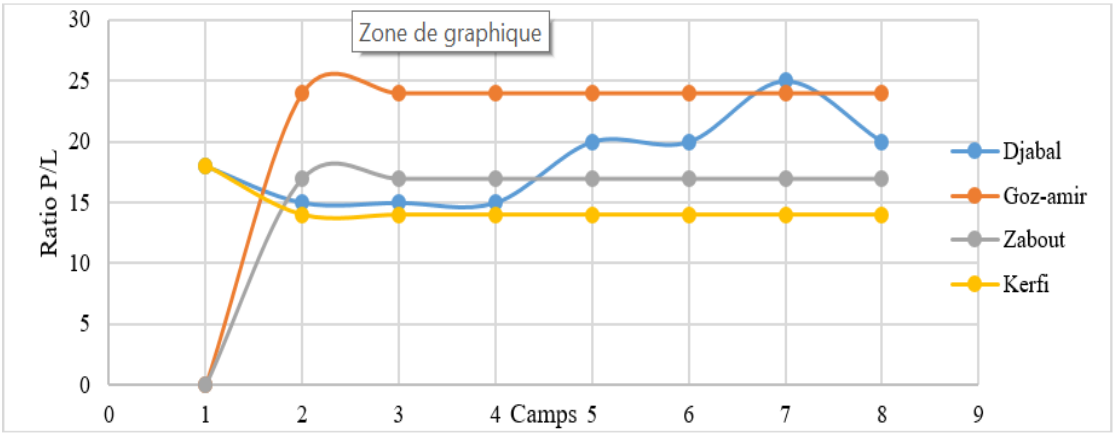

Figure 6 : L'évolution des ratios d'assainissement dans les camps du Sila (Août-Septembre)

Figure 5 : Sanitation Coverage and Latrine Access in Refugee Camps of Sila Province

The sites of Zabout (10), Djabal (12–13), and Kerfi (14–18) are broadly compliant with humanitarian standards, reflecting good sanitation coverage and adequate infrastructure management.

Conversely, the Goz-Amir camp (24) slightly exceeds the standard, indicating a moderate deficit that requires targeted reinforcement measures to prevent deterioration.

This relative balance in Sila can be attributed to better infrastructure planning, stabilized refugee populations, and effective coordination among WASH partners.

However, regular maintenance and replacement of aging latrines remain essential to sustain these gains.

V- **Monitoring of Water Quality through Chlorination**

Access to safe drinking water is essential for public health, particularly in the refugee camps of Eastern Chad, where populations are exposed to waterborne diseases. Chlorination is the main disinfection method, and free residual chlorine serves as an indicator of the microbiological quality of water. According to WHO standards, a concentration ≥ 0.3 mg/L ensures effective disinfection, while a lower value indicates a risk of contamination. Monitoring residual chlorine is therefore a key indicator of water quality.

The results by province show the evolution of this situation between August and September.

1- **Ouaddaï Province**

Camps concerned: Moura, Gaga, Bredjing, Treguine, Aboutengué, Metché, Arkoum, Dougui, Farchana, Alacha.

Camp	**W29–S32 (August)**	**W33–W36 (September)**	**Evolution**
Moura	60% > 0.3 mg/L	100% > 0.3 mg/L	+40%
Gaga	100% > 0.3 mg/L	80–85% > 0.3 mg/L	Slight decrease
Bredjing	40–50% > 0.3 mg/L	75–80% > 0.3 mg/L	+30%
Treguine	40–50% > 0.3 mg/L	80–85% > 0.3 mg/L	+35%
Aboutengué	50–60% > 0.3 mg/L	60–70% > 0.3 mg/L	Stable
Metché	45% > 0.3 mg/L	70–80% > 0.3 mg/L	+35%

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Arkoum	50% > 0.3 mg/L	70–80% > 0.3 mg/L	+30%
Dougui	40% > 0.3 mg/L	70–75% > 0.3 mg/L	+35%
Farchana	50% > 0.3 mg/L	75% > 0.3 mg/L	+25%
Alacha	65% > 0.3 mg/L	70% > 0.3 mg/L	+5%

In August, the majority of households showed a residual chlorine level < 0.3 mg/L, indicating insufficient disinfection. The outbreak of cholera in Dougui at the beginning of September led to a large-scale reinforcement of WASH activities, including more systematic chlorination in both storage tanks and at the household level.

This resulted in a clear and widespread improvement, with several camps exceeding 75% compliance. Despite a few isolated decreases (Gaga), WASH control now ensures better microbiological protection.

2- Wadi-Fira Province

Camps concerned: Iridimi, Touloum, Amnaback, Kounoungou, Milé, Koursigué.

Camp	**W29–S32 (August)**	**W33–W36 (September)**	**Evolution**
Iridimi	85% > 0.3 mg/L	90% > 0.3 mg/L	+5%
Touloum	70% > 0.3 mg/L	75% > 0.3 mg/L	+5%
Amnaback	65% > 0.3 mg/L	70% > 0.3 mg/L	+5%
Kounoungou	40% > 0.3 mg/L	60% > 0.3 mg/L	+20%
Milé	65% > 0.3 mg/L	75% > 0.3 mg/L	+10%
Koursigué	40% > 0.3 mg/L	50% > 0.3 mg/L	+10%
Ouré Cassoni	0% > 0.3 mg/L	30% > 0.3 mg/L	+30%

The camps of Iridimi and Touloum maintained good chlorination, while Kounoungou and Koursigué remained below WHO standards due to a temporary chlorine stock shortage.

The case of Ouré Cassoni is particularly noteworthy: there was no residual chlorine in August, followed by 30% compliance by mid-September, indicating a rapid and effective technical intervention. Overall, the province shows significant progress thanks to cholera emergency measures (enhanced chlorination, WASH monitoring, increased supervision), leading to a substantial reduction in microbiological risks.

3- Sila Province

Camps concerned: Djabal, Goz-Amir, Zabout, Kerfi.

Camp	**W29–S32 (August)**	**W33–W36 (September)**	**Evolution**
Djabal		60–70% > 0.3 mg/L	+70%
Goz-Amir		70–80% > 0.3 mg/L	+75%
Zabout	50% > 0.3 mg/L	70–75% > 0.3 mg/L	+25%
Kerfi	0% > 0.3 mg/L	70% > 0.3 mg/L	+70%

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Sila Province shows a late but significant improvement beginning in September. The Kerfi and Zabout camps improved rapidly, while Djabal and Goz-Amir reached satisfactory chlorination levels. These results reflect better WASH coordination and increased water treatment intensity in response to the epidemic threat.

DISCUSSION

The analysis highlights significant disparities in access to water and sanitation across refugee camps in Eastern Chad, resulting from structural constraints, operational limitations, and harsh environmental conditions.

Less than 30% of camps meet the minimum humanitarian threshold of 15 L/p/d ([9]). Camps in Wadi Fira (Amnabak, Touloum, Ouré Cassoni) face acute water shortages, while Kerfi and Dougui perform better due to more stable energy management and functional infrastructure.
These disparities—confirmed by the WASH Cluster ([10]) and the World Bank ([8])—reflect the sector's dependence on energy availability and borehole maintenance. The arid climate, low aquifer recharge, and high evaporation rates ([6]; [7]) further weaken the system, making it essential to adopt sustainable solutions, including solar pumping and diversification of water sources.

Access to latrines also varies widely between camps. Some (Bredjing, Koursigué, Kerfi) meet standards, while others (Touloum, Ouré Cassoni) exceed one latrine for 60–70 persons, exposing populations to elevated health risks (Hepatitis E, Cholera – [12]; [13]).

Lack of maintenance, overuse of facilities, and demographic growth exacerbate these vulnerabilities.

WASH challenge are further compounded by weak inter-agency coordination and insufficient long-term funding. The UNDP ([22]) and UNHCR ([19]) advocate for an integrated approach linking emergency, development, and resilience.

Finally, gender considerations ([15]) remain critical: women and girls are disproportionately affected by the lack of facilities and the related safety and hygiene risks.

CONCLUSION

The assessment of water supply, sanitation, and water quality in Eastern Chad refugee camps highlights persistent disparities and vulnerabilities. While some camps achieved the minimum humanitarian standards through strengthened WASH interventions, most remain below safe thresholds, exposing residents to waterborne diseases. The results underscore the need for sustained efforts in infrastructure maintenance, water quality monitoring, and community engagement. Targeted, context-specific strategies are essential to gradually ensure reliable access to safe drinking water and adequate sanitation across all camps.

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