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Research Article

Assessment of Water Supply and Demand, a Case Study of Elfasher Rural Area-North Darfur State

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ABSTRACT

This study was conducted in Elfasher Rural Area. The area is located within North Darfur State. The objectives of this study are to assess Water Supply and Demand Assessment in Rural of Elfasher and possible future scenarios; to provide and highlight the status of water resources in Elfasher Rural, and to give recommendations to take remedial actions and potential solutions for identified problems.

The study includes the water supply situation in Elfasher Rural for different areas and evaluates the role of the community in the management part. The data collected from field visits and questionnaires were analyzed: It was found that the main problems in quality were the presence of Nitrate, hardness and bacteriological contamination in the hand pump. In the recommendations, some of them are conducting groundwater monitoring to test groundwater depletion. Promote surface water harvesting and aquifer artificial recharge. Taking immediate action to solve the problems that have been identified.

Keywords: *Elfasher Rural Area, Water Supply, bacteriological contamination, water harvesting, aquifer artificial.*

INTRODUCTION

The study area is located within Wadi El Kucatchment that extends from North to South Darfur States. Groundwater in the study area occurs in the alluvial deposits along the major watercourses and in the fractured zones of the Precambrian rocks under favourable tectonic, geologic and hydrologic conditions. In Darfur, since 2003, many people have been displaced internally or externally, and about two million people have been displaced from different areas and settled in 30 Internally Displaced People camps in North Darfur State. Tear fund, in early 2007, conducted studies to assess the capacity and the vulnerability of Darfur's environment with a special focus on the water resources available.

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Large numbers of people have been moving within the State affected by conflicts with regard to Darfur since 2003. There are about 100 camps in Darfur, forty in south Darfur, about thirty in North Darfur and 30 in West Darfur. They provide these services and facilities according to different phases of the Darfur emergency. This statement clearly indicates the importance of management and the development of appropriate administrative structures to operate rural water sources. Rural water programmes in many countries emerged from the Ministries of Health to combat waterborne and water-related diseases.

In contrast, in others, it has been transferred to the agencies responsible for urban water supplies or part of the organization responsible for rural development programmes. In Sudan, rural water development programmes have been connected to soil conservation programmes and later to land use. Water was provided as a social service and as a catalyst for development.

Under such circumstances, not only water supply policies are changing but also the agencies responsible for planning, construction and operations, Problems of administration of rural water supplies in Sudan became very serious in mid-sixties when large numbers of water sources were not working because of breakdowns, lack of maintenance and spare parts. These problems led to changes in the system of management. Thus, two bodies were formed to share the administration and management responsibility. Land Use and rural water Development became responsible for planning, construction, maintenance and general supervision of all water sources, while the local councils became responsible for the administration and revenue collection.

At this stage, administration problems started to arise, but the department still controls administration, maintenance and personnel. Thus after 1966, the Rural Water Development Corporation was created. To carry out its functions properly, the corporation involved the rural councils in revenue collection and in return, they get 10% of the total involvement in the administration of rural water supplies. However, this attempt failed because the rural councils failed to supervise and collect revenue from the different water users. The problems of maintenance, fuel, provision and efficiency of the sources become serious. To solve these problems, different types of administrative structures were created. In 1994, the declaration of the Federal Governments system resulted in the creation of new states and accordingly, the structure of water institutions has been amended. In states, the State Water Corporation was created to look after the operation, maintenance, and management of water services.

Committees, including community members, managed part of the water systems; in others, the State Water Corporation solely managed the system. The quality of water is as important as the quantity of water for the survival of human beings. Many factors contribute to the determination of water quality for different usages. For drinking water supply, the quality of water is controlled by the biological and chemical constituents contained in water in addition to the physical asp

MATERIALS AND METHODS

The study methods were planned to achieve the study's objectives. They include the collection of previous data, the fieldwork (3 visits), office data and the computer analysis and processing using software programs.

Office data:

Data from the literature about the area under consideration were collected. Most of the previous data, such as reports, research and journals, were reviewed and investigated thoroughly. The previous Meteorological data includes: the data of Runoff, temperature, rainfall and evaporation measurements are obtained from the meteorological Station of Elfasher town. This is in addition to the collection of data related to well lithological data and some related hydrological data from

State Water Corporation and WES Project files. In addition to a review of available maps related to the study area that covers hydrogeological, geological, location and other related maps. Participatory meetings and focus group discussions with community leaders, local authorities and resource persons were conducted to collect water supply data and shed light on operation and maintenance issues.

Field data:

The fieldwork conducted in the intended locations during the researcher's work, and visits to the villages and Zamzam IDP camp. During these trips, boreholes and hand pumps were sampled (Appendix). All relevant data from the study area such as name, location, borehole description, depth of hand pumps, measuring of Static Water Levels and other's hydrogeological parameters were measured by using water level indicator. Measuring water sources coordinates using GPS and collecting related data, especially groundwater level and water samples for water quality test. In addition, a field observation was applied to collect data from some of these locations.

The questionnaire was designed, and 200 households were interviewed to obtain information related to daily water consumption to compare that to the available water resources and future demand, the role of the community in water supply management, along with the main problems and possible solutions.

Data related to atmospheric pressure, rainfall, average monthly maximum temperature and average minimum monthly temperature were collected, entered in computers, tabulated and processed using computer programs such as excel to produce charts, maps, graphs, diagrams, etc.

The quality of water is used as an indicator of its safety for human consumption. 101 water samples from boreholes and hand pumps from different parts of the study area (Elfasher villages 70, Zamzam 31) were analyzed physically and chemically. Analysis showed that 30% of the samples were unfit for human consumption. The main reason is the high concentration of nitrites and nitrates.

Data collection from WES database covering the information of drilling reports, including date of drilling and the type of borehole and the implementing partner's home supported drilling. Pre-analysis gave results showing that most of the boreholes were drilled in the basement complex. Comparing what is in the database with the current source, it was found that more than 40 boreholes are either unsuccessful or dry in Elfasher rural shown in annexes.

Samples of the drilling reports in Zamzam camp.

Methods of analysis

The questionnaire was prepared, and a sample of 200house hold for study area. The questionnaire covered the agencies home supported the drilling of borehole-based hand pumps (HP) or water yards (WY).and type of water sources, and the most issues that impact water consumption and water demand.

The filed data indicated that the population in the selected village was estimated at 69,894 persons, and the assessment concluded that 53% of them using unsafe water supply from Hafiers and dams. The analysis also in figure 1 & 2 indicated 90% of this category who are using unsafe water supply sources are travelling on a daily basis more than two kilometres, walking and waiting more than an hour to collect their daily water supply, which also indicating inadequate water supply despite that it is not safe. The assessment highlighted the most vulnerable groups are women and children – figure 1- that, collecting water and spending most of their time fetching water, and they represent 74% of who is collecting water in areas using Hafiers and dam for daily water supply.

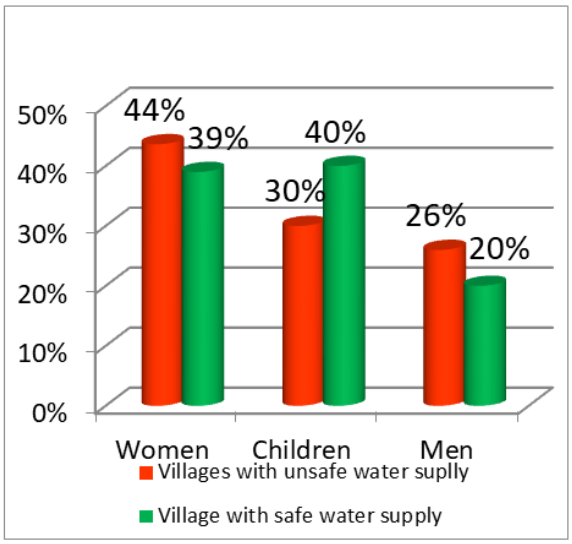

Fig. 1: Who collects water in Elfasher Rural

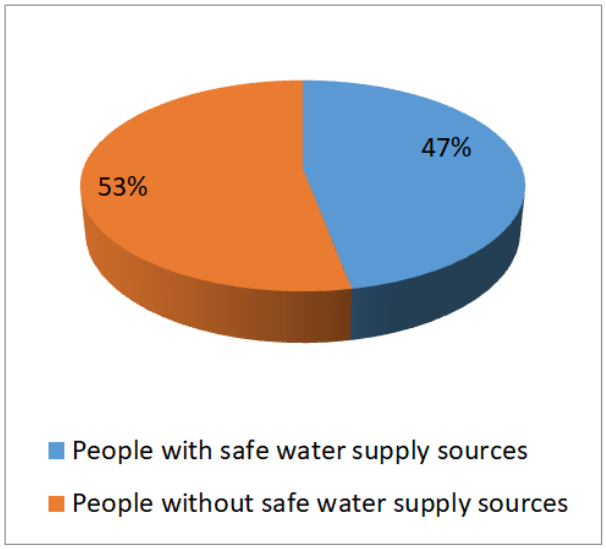

Fig. 2: Percentage of safe water supply users in Elfasher Rural?

The communities with improved water supply sources make up about 47% of the population, and in areas with safe water supply, about 80% of the population walk more than two kilometres to collect their daily water supply, with 43% of them waiting more than 30 minutes.

This may be due to the area's 30% of hand pumps drying up, as well as pressure from nearby communities using hafiers, which typically dry up in January to February. Additionally, it shows that the water supply is inadequate and insufficient, where communities must travel great distances to obtain water.

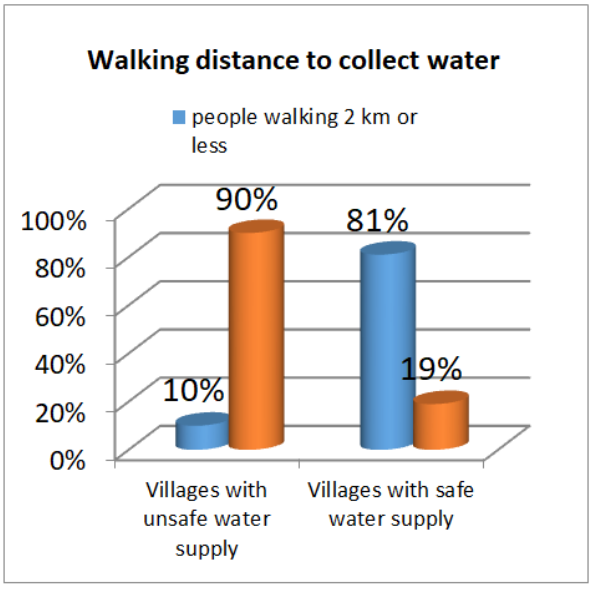

Fig. 3: Walking distance to collect water in Elfasher rual

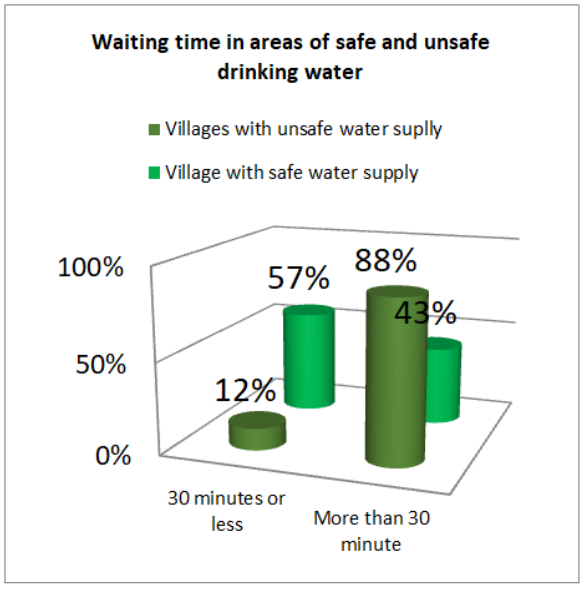

Fig. 4: Waiting time at water facilities in Elfasher rural

The total No. of students in schools in visited villages is about 7,388 students (3,296 boys and 4,092 girls) see figure 5, safe water supply provided for only two out of 19 schools, connected to water yard through pipes representing only about 11%. So far, the rest of the children in 17 schools are walking more than 0.5 kilometres to get water from a nearby water sources. However, six schools out of 19 have storage facilities and paying for water supply from their own resources.

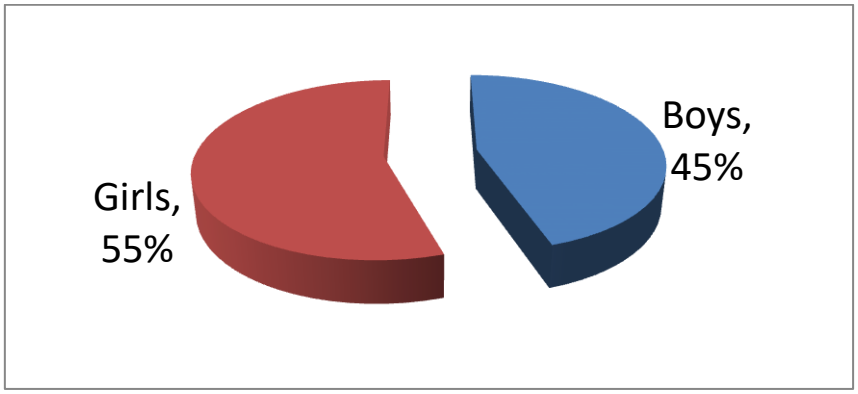

Fig. 5: Schoolchildren in Elfasher rural

Only four health centres were available in the rural area, and two of them were located close to hand pumps at a distance less than 0.5 kilometres, the other two were located more than 0.5 kilometres from the nearest improved water supply source.

In conclusion, the low access to safe drinking water in the rural area of Elfasher is confirmed by that more than 50% of the population are using unimproved water supply sources mainly; Hafiers and dams. Moreover, the access to safe drinking water from hand pumps and water yards is low, most of people are walking long distance, and waiting for long time to collect water, women and children are the most vulnerable groups. Additionally, out of 19 schools, only two of them have improved water supply sources, and out of four health centres, only two were located close to hand pumps.

Zamzam IDP camp:

Zamzam IDPs are estimated at 182,441 persons according to UNICEF and OCHA figure 6 and they distributed over three sections as indicated in figure 7 in all locations, they are using safe drinking water from hand pumps and motorized systems.

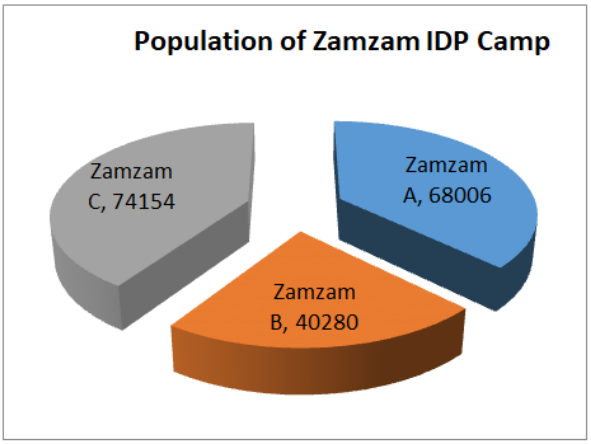

Fig. 6: Total population

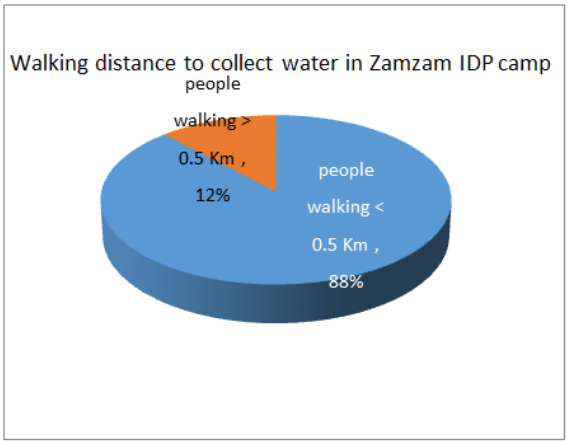

Fig. 7: Access to safe drinking water

According to the assessment, the total production of water supply estimated at 1,440 m3/day, about 780 m3/day (54%) of these supplies from motorized water supply systems and the balance from 60 hand pumps distributed over three sections and access estimated to be 9 l/c/d. According to the current assessment, access to safe drinking water supply at Zamzam is varying about 44% have access to safe water from 6 to 12 l/c/d, and about 54% have more than 12 l/c/d as per figure 3.14. on the other hand, a recent assessment conducted by Plan International concluded that about 84% of the Zamzam

population gets about 13 l/c/d, which is in line with these results, and this also indicates adequate water supply in the Zamzam IDP camp. However, despite the availability of water supply, more than 50% of the population waits more than 30 minutes to collect their daily water supply, which may be related to the limitation of the distribution system. The assessment showed that in IDP camp of Zamzam, water collection is the responsibility of women, and it was found that women collect 88% of the water.

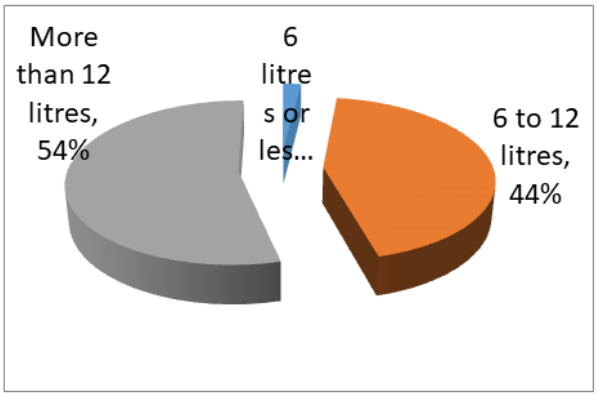

Fig. 8: Waiting time to collect water

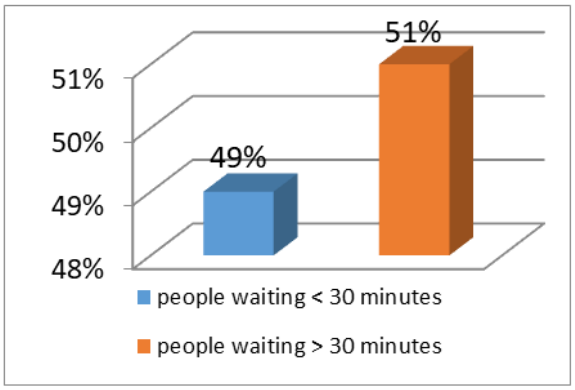

Fig. 9: Access to safe drinking water

In addition to spending more than 30 minutes collecting water – figure 8 - in addition to that, they are walking more than 0.5 Km to access safe water sources. Generally, the limitation of the distribution system increased waiting time for most of the population.

Description of the Area

Location:

North Darfur State is located in a semi-arid zone in the western part of Sudan and covers an area of 296,420 square kilometres the State's capital is Elfasher (map 1). The State is administratively divided into 18 Localities which are El Fashir (Elfashir Rural, Elfasher Town), Tawilla, Elkoma, Malit, ElMalha, Dar El Salam, Kuttom, ElWaha, Kabkabia, Saraf Omera, Elseraif, Um Kadada, ElLait, Eltewisha, Kalamendo, Eltina, Karnoi and Umbaro. Elfashir town, the State's capital, is the only urban area, while the rest of the State's Municipalities are rural and nomad. Elfasher Locality is located around Elfasher town, and currently most of its villages are accessible. Zamzam IDP camp is located about 15 kilometres south of Elfasher town.

Water Consumption:

A) Elfasher villages estimated at 208,849 they using safe drinking water from hand pumps and motorized systems, the summary of available water supply facilities is shown in table 1 below:

Table 1: Summary of status of water supply in Elfasher Rural

No. Population	No. WY	No. HPs	Total water prod. M3	l/c/d
208,849	16	201	2506	12

B) Zamzam IDPs are estimated at 182,441 persons according to UNICEF and OCHA, and they are distributed over three sections in all locations they are using safe drinking water from hand pumps and motorized systems, the summary of available water supply facilities shown in the table 2 below:

Table 2: Summary of status of water supply in Zamzam IDP camp

Camp sector	No. Population	No. WY	No. MWY	No. HPs	No. water point	No. elevated Tank	No. bladder	Total water prod. M3	l/c/d	No. WY with Solar System
A	68,006	3	0	38	8	1	3	1440	9	2
B	40,280	2	4	22	29	2	8			1
C	4,154	2	6	12	24	2	10			-
Total	182,441	7	10	72	61	5	21			3

Water demand in Elfasher Rural Areas:

A) The Elfasher Rural demand for water means the amount of water required by all users regardless the availability of supply, the present population projected from 2015 - 2025 and according to information provided by (IOM) - the total of peoples verification by them (203.556), The requirements of the Elfasher rurals is calculated for the number of population (203.556) with 2.6% rate of growth.

B) Zamzam IDPs demand for water means the amount of water required by all users regardless of the availability of supply. The present population is projected from 2015 - 2025, and according to information provided by OCHA and UNICEF, the total of peoples verification by them (182,441), The requirements of the IDPs is calculated for the number of population (182,441) with 3.4 rate of growth.

CONCLUSION

The present source of water supply for Elfasher Rural and ZamZam IDPs cannot satisfy water requirements in quantity and quality; the research to gather both qualitative and quantitative descriptive data on the water supply and demand of the population of Elfasher rural Locality and Zamzam IDP camp. This is expected to contribute to conflict mitigation and improve the people's socio-economic conditions by alleviating the water shortage problem in Elfasher rural area, mainly by devising a comprehensive master plan addressing the root causes of the water shortage in the area. This includes gathering WASH information for local communities, schools and Primary Health Clinics (PHCs).

Acknowledgement

I would like to express my deepest and most sincere gratitude to my colleague in WASH sector Project, North Darfur, for helping me conduct the assessment, water quality tests, and laboratory assessments.

Funding: NIL.

Conflict of Interest:

There is no such evidence of conflict of interest.

Author Contribution

Both authors contributed equally to establishing the research and design experiment topic.

RECOMMENDATIONS

- Monitoring of groundwater level is a high priority due to huge water abstraction and limited rainfall over the last few years.
- The medium- and long-term solution to the State's water supply issues will be surface water harvesting. Building dams and large-capacity Hafirs offers the chance to create a sustainable water supply for people and livestock and lessen competition and hostility between nomads and sedentary farmers.
- Conduct a comprehensive assessment for surface water supply facilities to compare the cost of rehabilitation to the cost of construction of new facilities to assess the efficiency and effectiveness of rehabilitation and value for money.
- Conduct a comprehensive hydrogeological investigation to locate potential areas for surface water facilities and drilling of boreholes; the investigation should use various techniques and tools, including land sat image, remote sensing, radar imagery, and structural analysis.

- Apply community-based and demand-responsive approaches at community and government levels to fulfil their responsibilities and enhance sustainability.
- Conduct intensive water quality monitoring for the water sources
- Improvement of water sources management system by water committee through monitoring and follow up the functionality of water sources
- Recommending taking immediate action to solve the problems that have been identified.
- Apply Integrated Water Resources Management (IWRM) techniques and practices at all levels to ensure water resources sustainability.
- Since about 90% of surface water facilities lost more than 50% of their design capacities, rehabilitation or construction of new and additional facilities must be supplemented by a treatment system to improve water quality.
- Target under-served and vulnerable people (women, children and the aged) in providing water supply surfaces.
- Promote partnership and strengthen coordination with Government, UN Agencies, NGOs, and the private sector.
- Strengthening existing monitoring, evaluation, follow-up and MIS system to enhance data reliability and support proper decision-making.
- Reduce aid dependency and promote durable solutions through:
- Strengthening inter-sectoral coordination among WASH, Health, Nutrition, Education, Protection, Food Security & Livelihoods, and Returns sectors.
- Mainstream Gender (in needs analysis, intervention targeting, and outcome analysis) and Environmental concerns (using environment-friendly materials and other remediation measures) in all the WASH activities.
- Promoting alternate water supply sources such as Hafirs, dams and rainwater harvesting systems for livestock and humans (with appropriate treatment systems).

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