

## TOWARD A SUSTAINABLE WATER AND SANITATION STRATEGY FOR DUHOK GOVERNORAT

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### ABSTRACT

This article focuses on building a resilient sector based on a unified approach for a comprehensive social, economic and environmentally viable water and sanitation sector development for Duhok Governorate. The article highlights the challenges of meeting the growing water demand, the impact of water scarcity, the changing geo-political scenarios, the sanitation policy of Duhok, the need to prepare for a water-secure future for all citizens and residents of Duhok Governorate. To achieve an integrated approach to manage water resources and sustainable water and sanitation services in light of future sector imperatives there is a need to protect our water resources while ensuring equitable and efficient water allocations to meet all social and economic development needs, with secured wastewater/sanitation services to our populations. Furthermore, there is a need to revise the institutional and legal frameworks to streamline sector management and administration. The management and protection of water is a shared responsibility among various government sectors, municipalities, businesses, industry, and individuals. Residents need to be aware of how much water they use, practice water conservation, and respect the environment. Water and sanitation management could include developing a better understanding of water resources and using this information to support sustainable economic development; implementing improved long-term management developed through joint work of all stakeholders; and evaluating opportunities to share more information with the public.

**KEYWORDS:** Sustainable, strategy, water, sanitation

### 1. INTRODUCTION

Urban growth and development in Duhok Governorate has been increasing rapidly since 2003 because of economic growth in region, and this contemporary expansion has made it one of the fastest growing cities in the region. This substantial change is related to a variety of factors, including the rising influx of immigrants into the city, increased economic activities, and the lifestyle changes which the citizens have been undergoing (Directorate of Statistic and Demography, 2017). The direct effects of these factors have put a lot of pressure on the sustainability and availability of the city's water resources.

Water quantity and quality impact health. According to UN Environmental Programme (UNEP) and UN-Habitat, due to water pollution, 1.8 million children under the age of five die every year, and 2.2 million people die every year due to diarrhea. It is of critical importance to take urgent actions in order to provide clean water (Water and Sustainable Development

From vision to action/ Report of the 2015 UN-Water Zaragoza Conference).

This study is trying to address Water and Sanitation problems in Duhok Governorate. The fast population growth in Duhok city, large influx of Syrian Refugees and Internally Displaced Persons (IDPs) due to ISIS into the governorate, urbanization and the change in lifestyle led to the increase in water demand by the citizens. The increase of water consumption led to pressure on current quantity of water. There is a need to consider the different expected scenarios facing the water and sanitation sector considering the future of IDPs in Duhok.

The magnitude of rainfall ranges from 100 to 1,300 mm/ year, with an annual average of about 700 mm/year. The direction of the wind often is from north to east. When the summer wind blows this causes drought weather and erosion. During summer, the atmosphere is dusty and very hot, but during winter, the climate is very cold with snowfalls and frost (Saeed 2001; and Ahmed 2001).

Duhok governorate of the Kurdistan region is located in the far north-west of Iraq. Duhok city is capital of Duhok governorate that is located in the middle of valleys, hills and mountains, and it has six towns which are Zakho, Amedi, Akre, Sarsing, Summel and Shekhan.

## **2. LITRICTURE REVIEW**

### **2.1 WATER SITUATION IN DUHOK**

The gap between water supply capacity and demand intensify can be considered as a crisis. When this imbalance is not controlled by management strategies, the issues within the water sector will become controversial at the local, regional, national and global scale. Inherent constraints on water resources, the occurrence of drought and environmental degradation. All of these are a major challenge in the use of fresh water resources in Kurdistan Region -Iraq. The importance of water consumption management and the management of water resources development should be pursued simultaneously and purposefully.

Consumption is increasing due to population growth. Also the expansion of urbanization, industrial and agricultural development and especially migration has caused that the water consumption rate will quickly approach the limit of available water from renewable water sources in the region (Stephen Dovers and Colin Butler 2015, Population and environment: a global challenge/ Australian Academy of Science).

There is a huge impact on the availability of financial resources for the development and management of water resources. Iraq falls within the low capita income countries and high water tensions (IAU Report 2010). The category of classification will be the first victims of the global water crisis. Many countries in the Middle East are facing serious drought conditions since the beginning of the current century. These countries – including Iraq, Turkey, Jordan, Iran and Syria- have been dealing with decreased rainfall, reduced water storage, and consequently many of these countries have declared drought. Global

warming and climate change have affected the regional precipitation patterns which resulted in reducing rainfall rates. At the same time, the increased water consumption for domestic, agricultural and industrial uses have exacerbated drought conditions (IAU Report 2010).

The expected loss in the average water discharged to the two main sources of surface water in Iraq – Tigris and Euphrates – will decrease in the year 2025 to about 50-80% of the water discharged. The reduced water discharged to the main rivers is expected as a result of the drought affecting the region, as well as the damming of water resources in the neighboring countries. In this report projected that the Tigris and Euphrates rivers might be depleted by 2040 (IAU 2010).

Generally, the climate of Kurdistan region is characterized by cold and snowy winters, warm, and dry summers. Precipitation occurs from October to May. Rainfall is the main climatic parameter and it is seen to vary highly within short periods of time (Cagatay tanriverdi and Bayar a. Ragab/ drought analysis for duhok province using standardized precipitation index/ Journal of University of Duhok/2016).

Duhok, a governorate with 1.5 million populations today is hosting more than 617,145 Refugees and IDPs due to conflict, violence and occupation of their areas by ISIS. 35% of them are living in 27 camps and the rest are living among the hosting community across Duhok governorates. (Board of Relife and Humanities BRHA's report 2018).

This large displacement has led to a severe humanitarian crisis that has exceeded the capacity of the local government. United Nations agencies and other humanitarian and development agencies funded by European countries and the US has been trying to support the local government of Duhok governorate with the basic needs of the IDPs and Refugees with focus on shelter, water and sanitation, education and health.

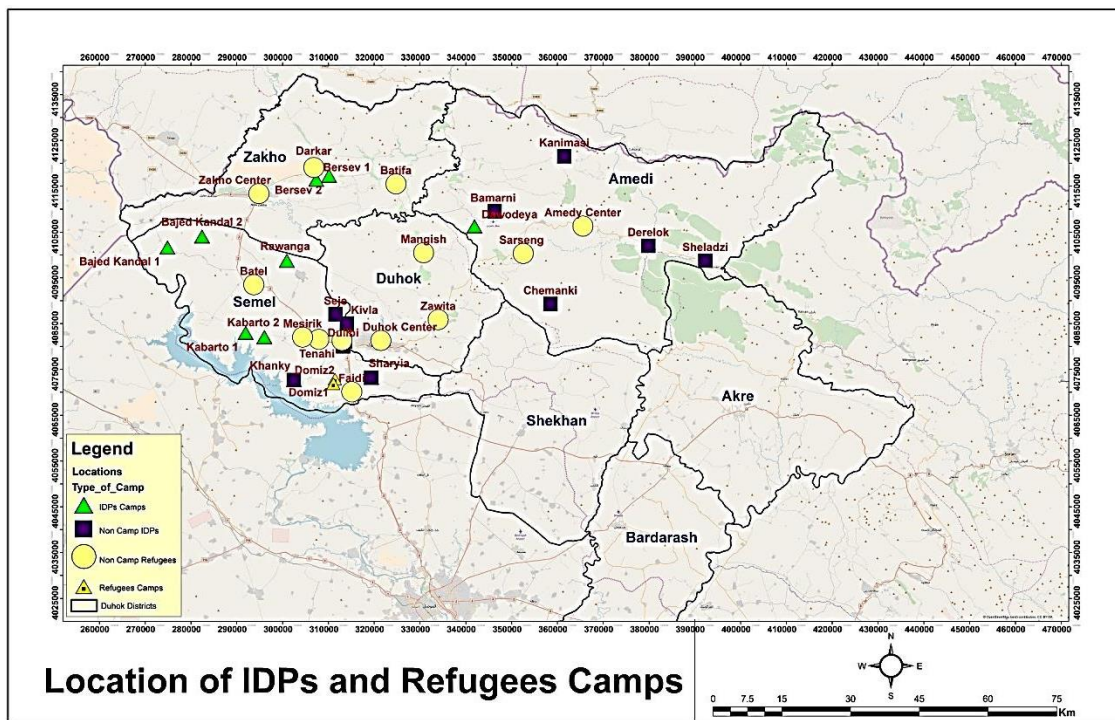
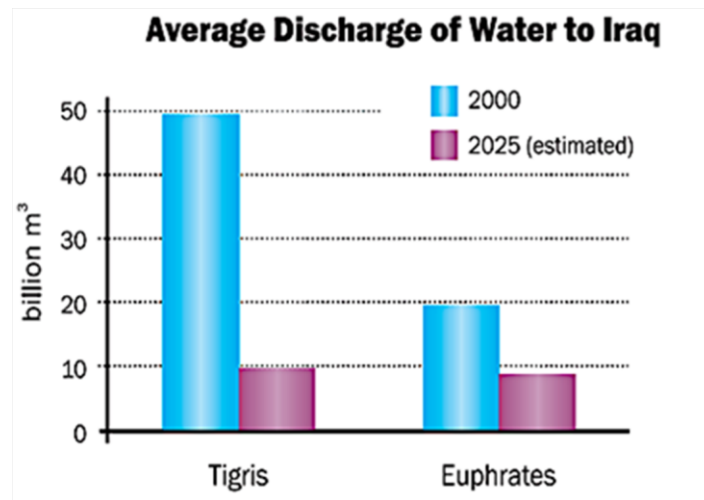


Fig. (2): IDPs/Refugees Camps locations prepared by resarches.

One of the most important human needs is clean water and the lack of access to water may cause health crisis and it could lead to conflict between the hosting community and the IDPs and Refugees as both compete to get what they need within a reduced or overburdened resources.

### 3. RESEARCH QUESTIONS

Considering Duhok population in 2018 which

was estimated to be 1,557,021 persons (Statistics Department-Duhok 2018), the IDPs consist of 24% and the Syrian refugees consists of 4% of Duhok governorate population. This increase in population is adding pressure of Duhok already depleted infrastructure which calls of an attempt to understand the impact on the migration crisis on the water and sanitation sectors in Duhok governorate.

The article attempted to answer the following questions:

1. Where IDPs & refugees would be in the next 5-10 years?
2. How should be the situation of water and sanitation sector in Duhok Governorate in the future?

#### **4. RESEARCH METHODOLOGY - SCENARIO PLANNING APPROACH**

To better deal with future challenges, water utility providers will increasingly have to favor integrated solutions over siloed interventions. This provides the chance for water utilities to play a fundamental role in the shaping of healthy and water sensitive cities. Increasing investment in green infrastructure, primarily for storm water management as a water harvesting, would offer the opportunity to access and directly treat a new, currently under-utilized water source. Another opportunity area is engagement in behavior change interventions to better influence and manages demand. Availability of more and more data through increasing digitization offers opportunities for investment in real-time monitoring of network utilization to enhance operations and asset management.

The methodology has been used as a tool for systematically thinking and planning for resilience within utilities.

The approach of scenario planning for the exploration of future trends and forecasts on water management, alongside with the analysis of challenges and opportunities in socio-economic, environmental, technological, and political terms, provide stakeholders in the water sector with a better understanding of possible pathways into the future and enable conversations about how we can influence and shape the direction in the sector. This enables water utilities and other stakeholders to plan effectively for the long term and to respond to their challenges.

Workshops and focus group meetings were conducted with the relevant stakeholders in the water and sanitation sectors to discuss and agree on common understanding on the challenges and possible scenarios for the next 5-

10 years. Joint agreement on the best strategy were adopted for Duhok.

Quantitative and qualitative data collection and analysis aided the scenario development and formulation.

#### **5. CASE STUDY: WATER SECTOR IN DUHOK GOVERNORATE**

Duhok Governorate is located in north-west of Iraq and between the latitude  $36^{\circ} 15' 0''$  to  $37^{\circ} 5' 0''$  North and the longitude  $42^{\circ} 30' 0''$  and  $44^{\circ} 10' 0''$  to the East. The area of Duhok province is about 10972 km<sup>2</sup>. This study was done in Duhok Governorate with its districts and sub-districts include Zakho, Bamarneh, Amediya, Sarsink, Summel, Batel, Zaweti and Manghash by applying annual records of precipitation, temperature and evaporation data of 11 meteorological stations for the time period 1997-2018.

Water consumption has increased due to the influx of refugees and IDPs and is still increasing due to population growth. Also the expansion of urbanization, industrial and agricultural development as well as misuse put scarce water resources on strain. Water consumption in different parts of the Kurdistan Region of Iraq (KRI) is from 350 to 550 liters per person per day, which includes also water losses (50-60%), as a result from leakages or illegal private connections to the public grid (GIZ report Nov. 2018). It is foreseen that water consumption will increase by 15.8% by 2023. Over-exploitation and misuse critically affect the regional water balance. Despite recent improvements to the water infrastructure, the quality of services remains poor in terms of the continuity of services, water pressure and access to clean water.

Additionally, Iraq has been dealing with decreased rainfall, reduced water storage and drought as a result of a climate change. Annual precipitation in the Duhok Governorate in the past 15 years has been declining as presented in the graph (3) below.

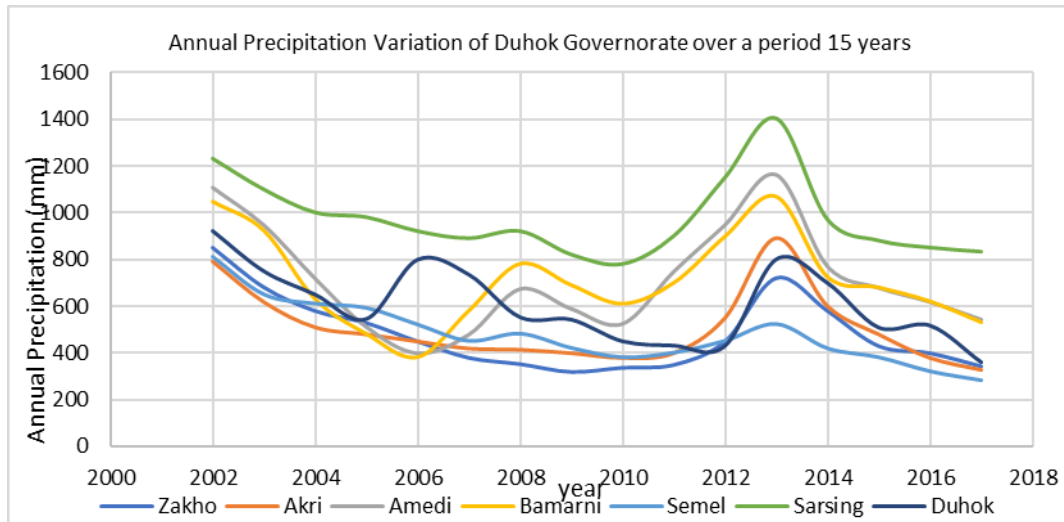


Fig. (3): Annual precipitation of Duhok Governorate (Meteorological Directorate)

Even though ground water makes most of water supply sources, no serious action has been taken to scientifically investigate, research the amount and condition of groundwater reserves in the KRI. There is also no action to seal the unauthorized wells. Moreover, there is no reliable statistics for the number of wells authorized. The latest unofficial data from the Duhok Groundwater Directorate was 3,620 authorized wells for drinking, 1,260 wells for agriculture and 425 unauthorized wells.

Sewage is collected mostly in septic tanks. They produce faecal sludge which requires appropriate management to protect public and environmental health. Most households in Duhok empty their septic tanks at long intervals or when they become blocked and overflow. In most cases neither black water nor grey water are treated and are discharged directly to the environment at distances ranged from 3 to 15 kilometers from the cities and IDPs and refugee camps. The exemptions are Shariya and Kabarto camps: in Shariya black and greywater are treated before discharge, whereas in Kabarto greywater and some additional blackwater from Domiz are treated.

Taking into account the above described situation and future of Dohuk Governorate the need to define a strategy to develop water and sanitation sectors appeared to be inevitable.

## 5.2 CHALLENGES

The current institutional framework is not conducive to achieving sector policy objectives within a definite time-frame, or to guaranteeing that public funds are spent effectively or efficiently, or to ensuring that facilities are well operated and adequately maintained. The sector

is facing many challenges including:

- a. Sector management capabilities are limited. Although many directors and employees in the sector are hard-working and well-intentioned, the neglect of the sector over the last few years has resulted in poor recordkeeping and reporting, limited understanding of system performance attributes and improvement needs, and inappropriate staffing composition and skills. Current systems and capabilities do not enable effective planning, budgeting and control.
- b. There are few pressures on the various directorates to improve performance. The governorate's role in monitoring is poorly defined, and the governorates do not have sufficient technical capacity to assess system weaknesses. The technical capacity of the Water and Sanitation General Directorate to monitor the performance of the directorates is weakened by the poor state of recordkeeping, reporting, and information systems. Since customers are not yet fully metered and tariffs are low, their interests are easy to ignore.
- c. The financing system is inappropriate. First, annual financing is not conducive to the implementation of long-term investment programs, especially when public funding levels fluctuate unpredictably from one year to the next. Second, the sector must compete with other sectors for funds. Third, public financial regulations often make it difficult for sector managers to actually spend budgeted funds.
- d. Limited cooperation among agencies of government impedes the work of the W&S directorates and increases their costs.
- e. Residents and establishments do not always understand or respect the value of water or their

obligation to use public water and sewerage infrastructure properly.

In addition to these institutional weaknesses, the sector faces growing environmental challenges. Drier weather conditions have resulted in a decline in groundwater levels. Increasing reliance on surface water sources and rivers will increase capital costs of water supply and also the urgency of protection of surface water sources from pollution.

## 6. KEY FINDINGS

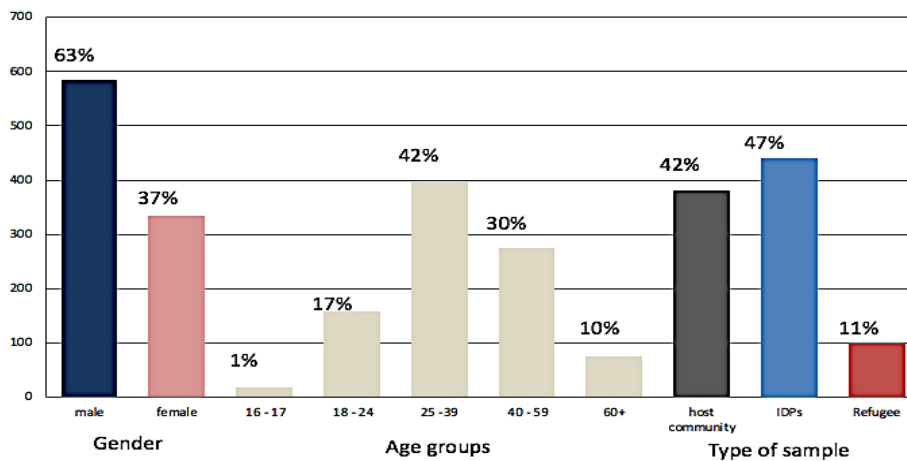
This section of the article presents the main findings from the intentions survey of IDPs living in and outside the camps and is comprised

of an overview of key household and population and intentions to move or remain in the camp to determine expected population remaining for scenario development.

### 6.1 Household demographics

Interviewees are divided by two types. First, the IDPs/Refugees living in camps, and the second, the IDPs/Refugees living in housing communities. 47% of the interviewed were in-camp IDPs, 11% Syrian refugees and 42% were IDPs/Refugees living within the hosting community and members of the hosting community too. The majority of IDPs and refugees interviewed falls under the age range of 18-60 years (89%) and 37% of the research sample was women. Figure (4)

**General information on research sample**



**Fig. (4):** General information on research sample

### 6.2 Area of origin

The majority of internally displaced households interviewed in Duhok originated from Ninawa Province (83%), followed by Baghdad (17%). More than 90% of all in-camp IDP households are Yazidi Kurds and originated from Sinjar district. Other samples are Sunni Kurds, Shia Kurds, Sunni Arab, Shia Arab, Sunni Turkmen, Shia Turkman and Christians.

This is compatible to the overall breakdown of the IDPs in Duhok Governorate. According to BRHA, 90% of the IDPs are Yazidi Kurds. 60% said they do feel settled in their current location or will settle there. 26% said they don't feel settled in their current location, 12% did not know, and very few refused to answer.

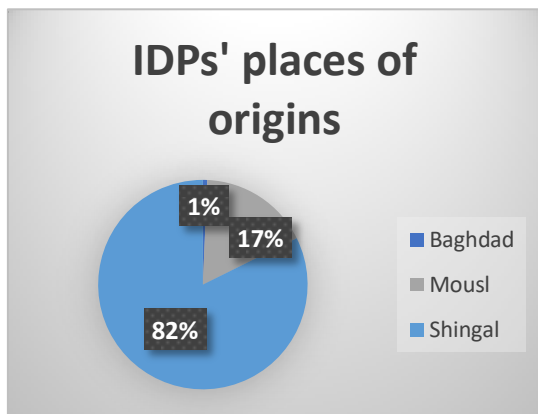


Fig. (5): Research sample for IDPs

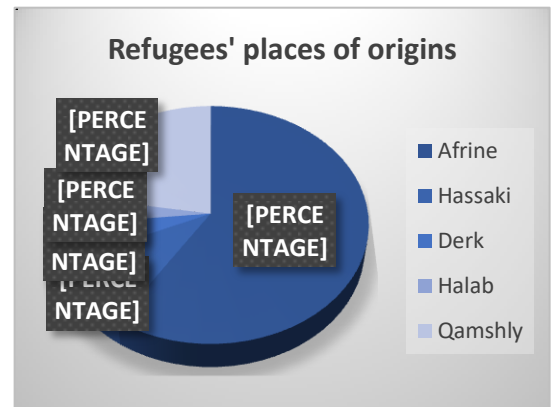


Fig. (6): Research sample for Refugees

Syrian refugee's sample survey, 59% were originated from Afrine, 23% from Qamishli, Syrian areas that are predominantly Kurds and

are close to the border of Duhok governorate from the west side.

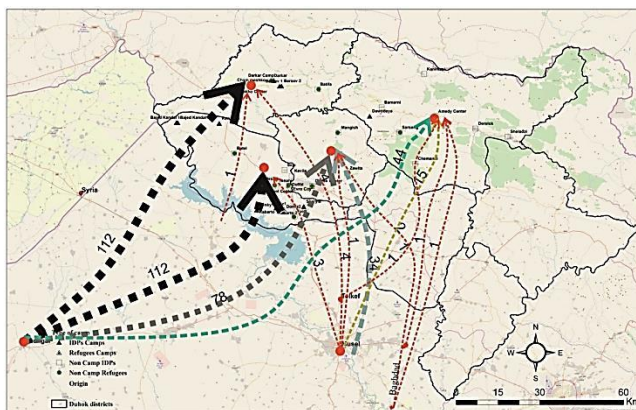


Fig. (7):IDPs movement from PoO to PoD

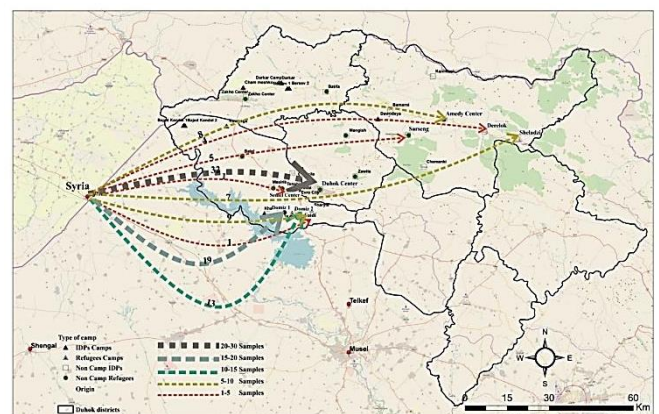


Fig.(8):Syrian Refugees movement from PoO to PoD (PoO: Place of Origin, PoD: place of displacement)

### 6.3 Relocation intentions

61% of in-camp IDP households residing in 14 camps have not relocated since displacement, while 36% did relocated and

3% refused to answer. For the Syrian refugees, 70% did not relocate, 26% did, and 4% refused to answer.

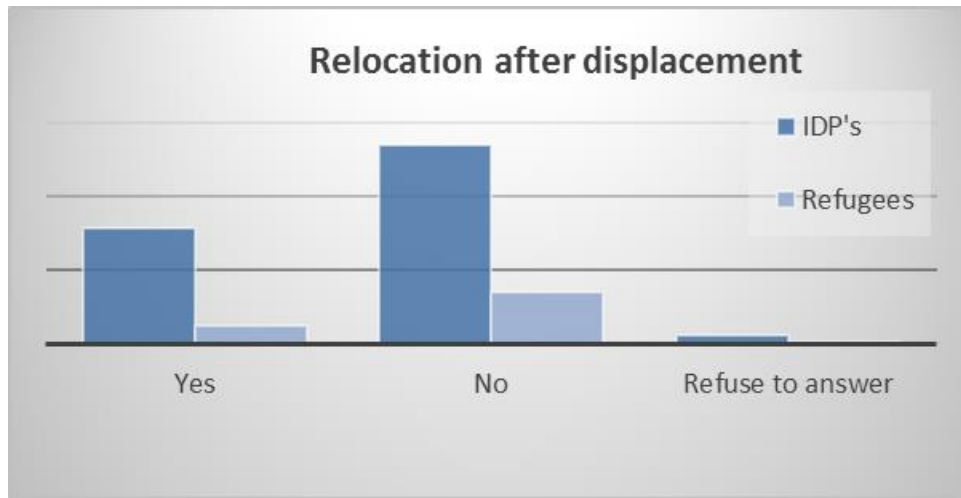


Fig. (9): Relocation after displacement

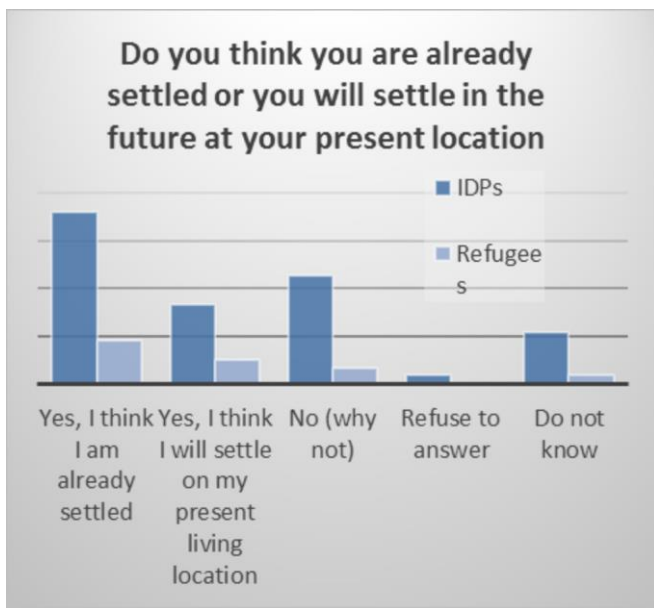


Fig. (10): sense of settlement at current place

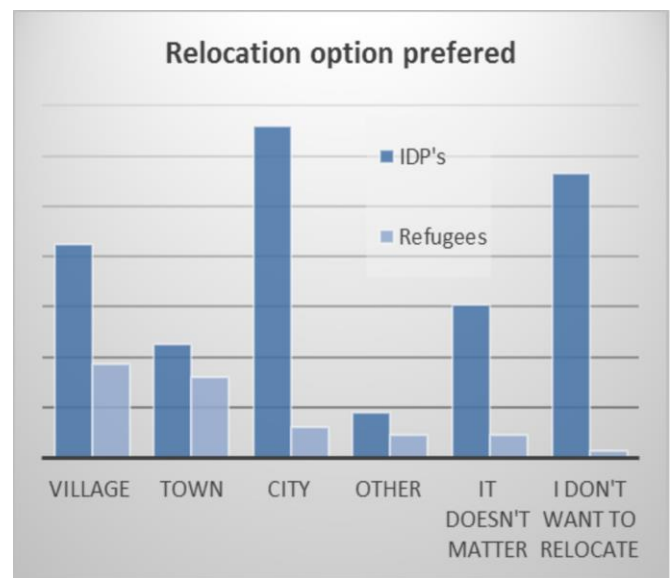


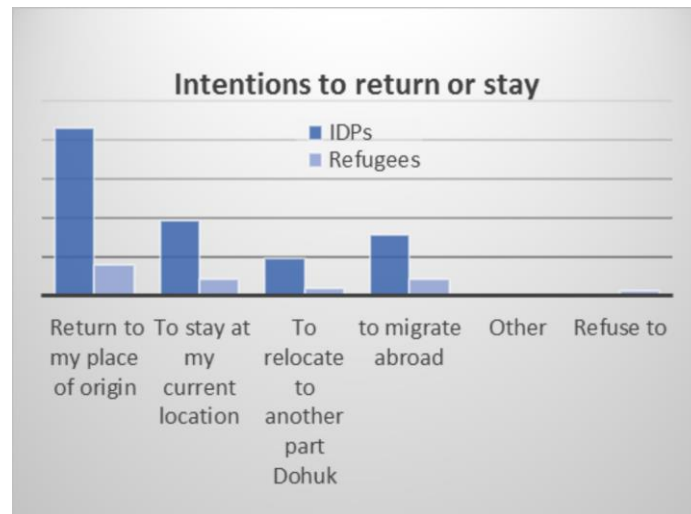
Fig. (11): Relocation options of displacement Figures

**6.4 Intentions to return to PoO**

48% of the interviewed IDPs households expressed intention to return to places of origin, while 51% expressed willingness to stay at the current location or relocate within Duhok or migrate. 1% refused to answer. For the Syrian

refugees, 40% said they would return to their places of origin, while 60% expresses that they either want to stay at their current location or move within Duhok and a portion 21% said they prefer to migrate.





**Fig. (12):** Intentions to return or stay

### 6.5 RESULTS ON IDPs POPULATION

Based on the data 48% of IDPs and 40% of the refugees wish to return to places of origin if all conditions are guaranteed. The other 52% and 60% would definitely stay or relocate. Therefore, it's expected that 50% of IDPs and Refugees are expected to stay, and for planning purposes this estimation was considered in the subsequent calculation regarding population projection and water consumption. The following sections will analyze the water sector in Duhok governorate followed by possible scenarios to guide the recommendations.

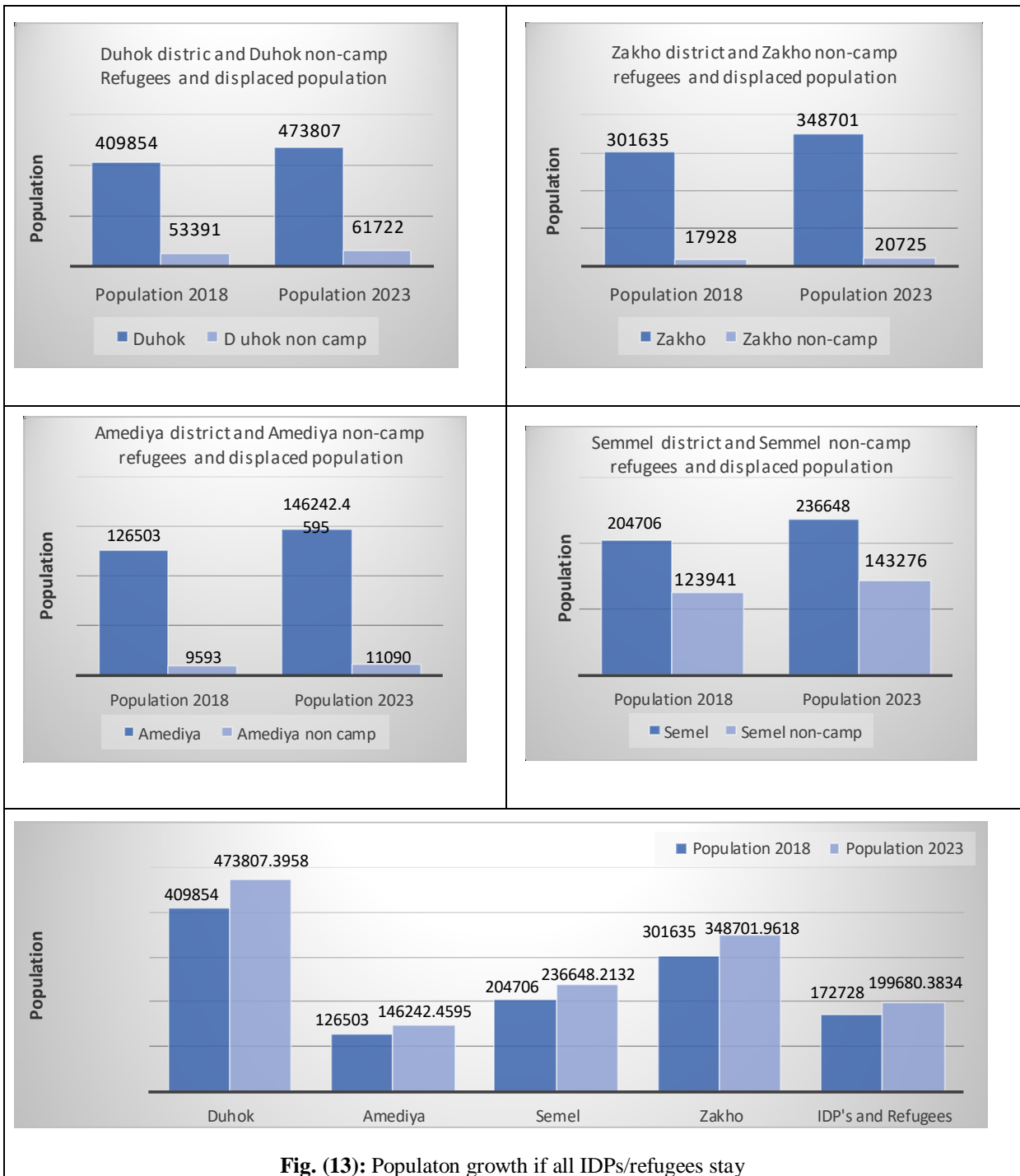
### 6.6 RESULTS ON POPULATION GROWTH AND THE NEED FOR CLEAN WATER

Data analysis was performed based on two years 2018 and 2023 with a rate of %2.9 growths at an average rate of water consumption for each person 200 m<sup>3</sup> per year. In this section, we also have the parameters of IDP's and refugees in the data analysis. According to data collected in the first part of the study, about 50% of IDP's and refugees said that will not return to their city and country.

## 7. PROPOSED SCENARIOS

### 7.1 Scenario 1: all IDPs and refugees will stay

The scenario foresees that all IDPs and refugees stay in Duhok Governorate. The population is estimated to be 1,999,655 persons by 2023 (increased by 28%).



**Fig. (13):** Populaton growth if all IDPs/refugees stay

Increase in population will result in increased water consumption and at the same time increased supply demand. On average water consumption is estimated to increase by 15.8% in districts by 2023. In 2023, to provide clean water for all Duhok governorate inhabitants

(including IDPs/refugees) (2,285,500 persons), Duhok will need to supply a total amount of 457,100,000 m<sup>3</sup> per year, whereas the current total supply is 399,931,156 m<sup>3</sup> per year resulting on a shortage of 57,168,844 m<sup>3</sup> per year.

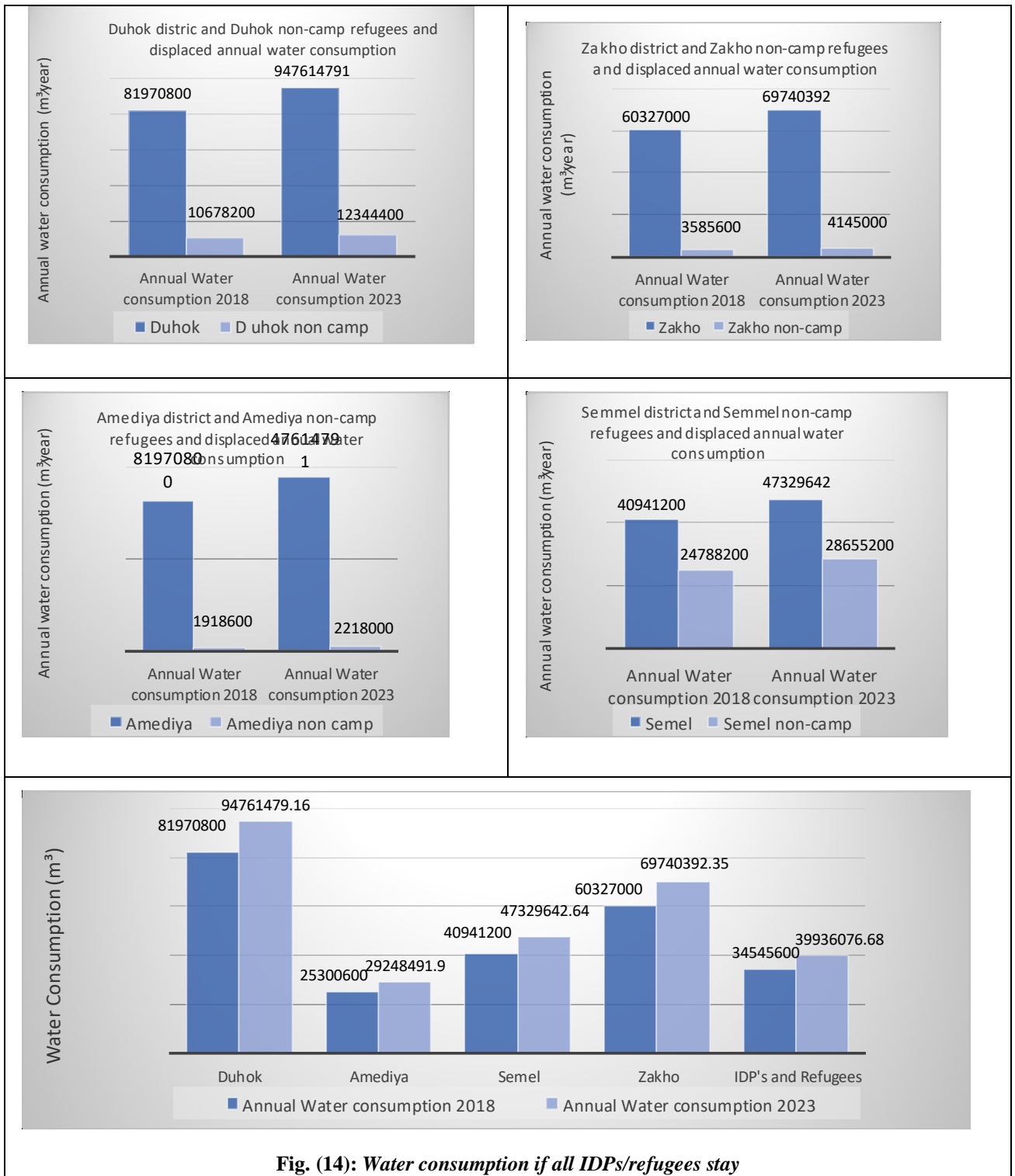


Fig. (14): Water consumption if all IDPs/refugees stay

Increased number of population will also cause increased production of greywater as well as sewage.

### 7.1.1 Implications for scenario 1

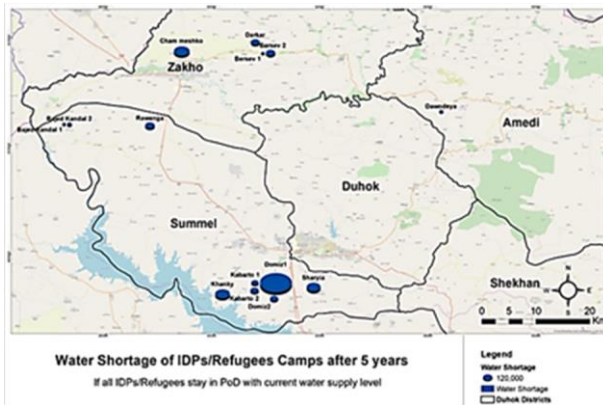
The main implication expected in this scenario is the increased demand of water and sanitation services. Existing infrastructure will require rehabilitation and extension to meet population needs. If water supply quantity is to

be increased for all remaining IDPs and refugee camps from their current level (40 to 100 Litrle/Capita/Day) to 120 Litrle/Capita/Day, 59 new wells will need to be developed or alternative ways to meet the needs will need to be found.

If current supply rate is maintained for the next five years, the shortage in water supply would be 2,337,344 Litrle/Capita/Day taking into

consideration only the population growth. If IDPs/refugees stay, their living conditions would need to be improved and they should be supplied with enough water

(estimated 120 Litre/Capita/Day), which would lead to a total shortage of 8,849,783 Litre/Capita/Day in five



**Fig. (15):** water shortage if all IDPs/refugees stay with current

**Fig. (16):** Water shortage if all IDPs/refugees stay with increased supply level

On the side of sanitation, major hazards to the soil, surface water and groundwater quality, and serious health impacts are expected.

### 7.1.2 Recommendations for scenario 1

In order to meet needs of growing population following recommendations are proposed:

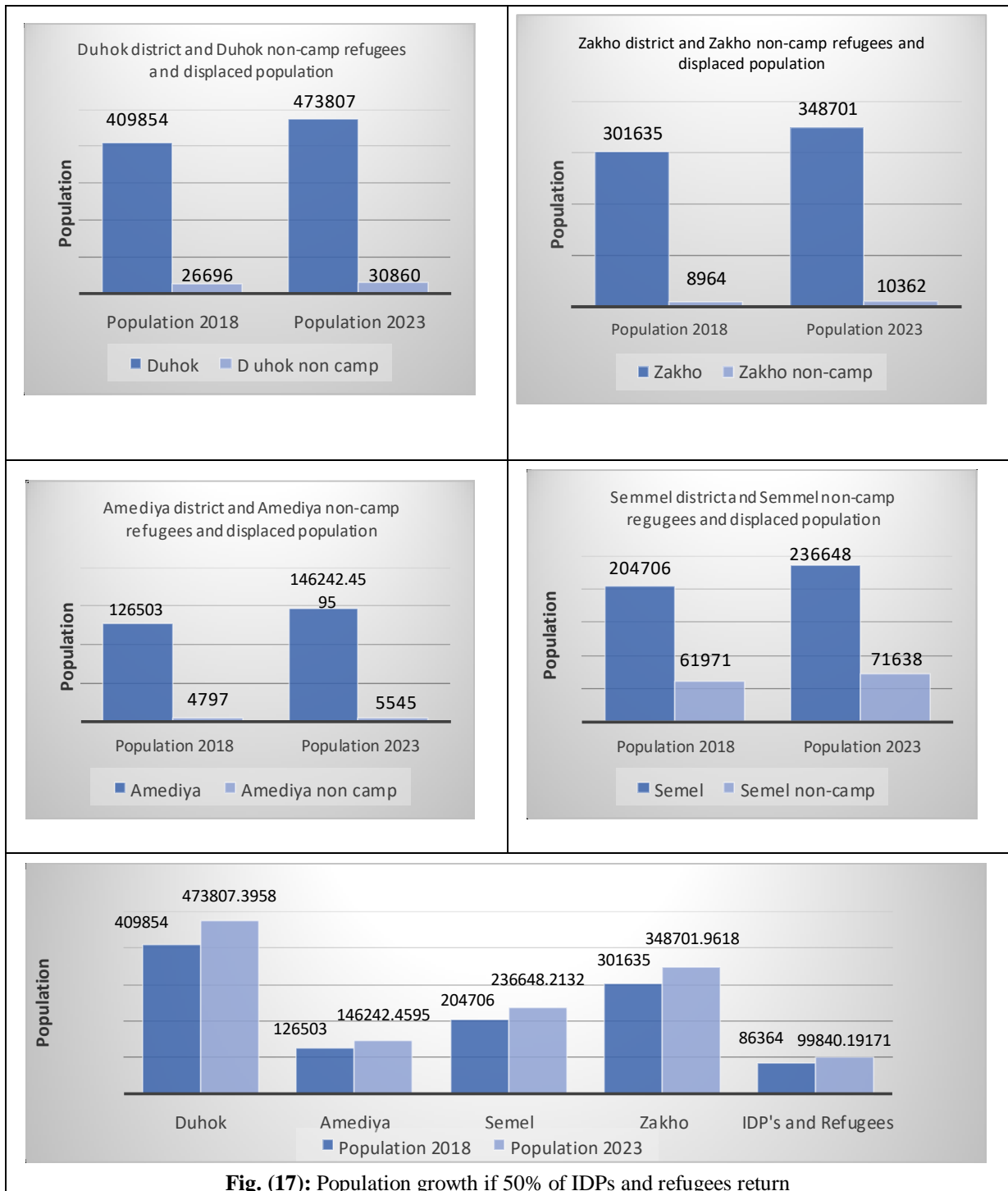
- ✓ Existing water and sanitation infrastructure need to be rehabilitated and extended, including network, wells, septic tanks, etc.,
- ✓ Master plans need to be updated and developed further in a holistic manner to include issues of governance, public participation and modernization,
- ✓ Network and supply management need to be improved, e.g. pressure management,
- ✓ New sources of water need to be explored, including reuse of grey water,
- ✓ Water resources management need to be improved, which includes decentralization, institutional restructuring of the sector, empowering local water and sewerage departments,
- ✓ Water consumption needs to be controlled:
  - water metering introduced,
  - laws & regulations implemented (including tariffs and protection of water resources) and executed,
  - awareness among population should be built,

✓ Waste water treatment plants/stabilization ponds/wetlands etc. should be constructed, especially for camps (can serve several camps located nearby e.g. Domiz 1&2 and Kabarto 1&2 and nearby villages),

- ✓ De-sludging needs to be controlled, including period (emptying septic tanks), location of de-sludging sites
- ✓ Public private partnership should be promoted,
- ✓ Coordination among stakeholders including donors, NGOs and local government needs to be improved,
- ✓ Continuation of funding and support to Duhok IDPs/refugees by the international community and local government.

### 7.2 Scenario 2: 50% of the IDPs and refugees will return to their places of origin

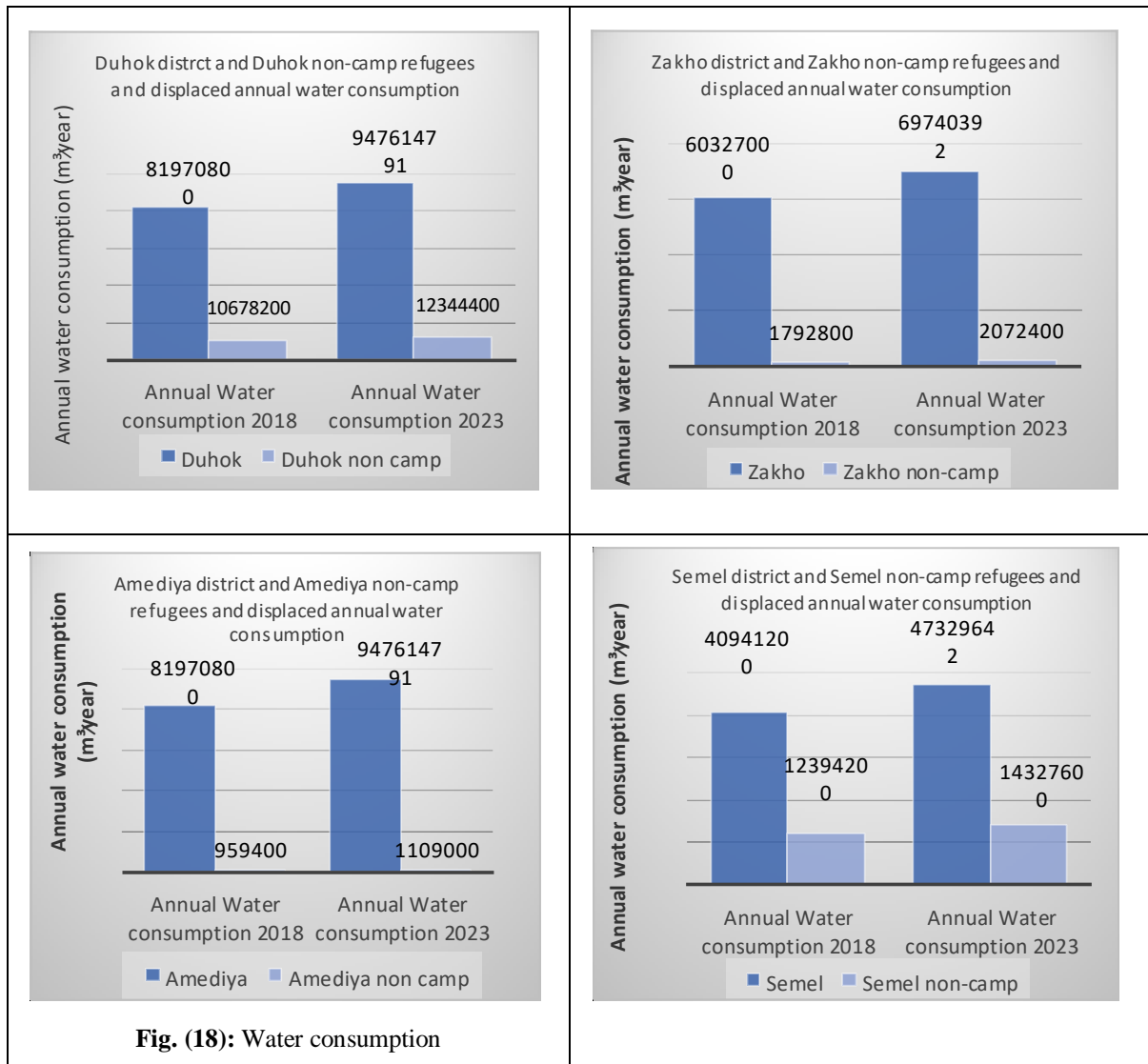
The findings of the research show that if all preferable conditions such as security, services and livelihood are established in areas of origin, around 50% of IDPs and refugees would return back within the next 5 years. The remaining 50% expressed that they will never return. The scenario presents a 50% stay of the IDPs and refugees including population growth.



Even if 50% of IDPs and refugees leave, the increase in population will result in increased water consumption and the same time increased supply demand.

On average water consumption is estimated to increase by 14.8% in districts by 2023. In 2023, to provide clean water for all Duhok

governorate inhabitants (including IDPs/refugees) (1,899,815 persons), Duhok will need to supply a total amount of 379,963,118 m<sup>3</sup> per year, whereas the current total supply is 328,676,600 m<sup>3</sup> per year, resulting in an expected new demand of 51,286,508 m<sup>3</sup> of water.



Increased number of population will also cause increased production of greywater as well as sewage.

### 7.2.1 Implications for scenario 2

The main implication expected in this scenario is slightly increased demand of water and sanitation services. However, taking into account that currently population in camps are underserved, new wells will need to be developed or alternative ways to meet the needs to be found. Moreover, existing infrastructure will need to be rehabilitated and extended. Additionally, humanitarian aid may be cut for IDPs/Refugees living in camps and within the hosting community resulting in increased pressure on the local authorities.

### 7.2.2 Recommendations for scenario 2

In order to meet needs of hosting communities and remaining IDPs and refugees following recommendations are proposed:

- ✓ Rearrangement, relocation of camps considering geography, merging camps considering social divisions or integration of IDPs/refugees within hosting communities,
- ✓ Master plans need to be updated and developed further in a holistic manner to include issues of governance, public participation and modernization,
- ✓ Existing water and sanitation infrastructure need to be rehabilitated and extended, including network, wells, septic tanks, etc.,
- ✓ Network and supply management need to be improved, e.g. pressure management,

- ✓ IDPs and refugees should participate in repairing and maintenance of services in their places of residence including paying fees,
- ✓ New sources of water need to be explored, including reuse of grey water,
- ✓ Water resources management need to be improved, which includes decentralization, institutional restructuring of the sector, empowering local water and sewerage departments,
- ✓ Water consumption needs to be controlled:
  - water metering introduced,
  - laws & regulations implemented (including tariffs and protection of water resources) and executed,
  - awareness among population should be built,
- ✓ Waste water treatment plants/stabilization ponds/wetlands etc. should be constructed, especially for camps (can serve several camps located nearby e.g. Domiz 1&2 and Kabarto 1&2 and nearby villages),
- ✓ De-sludging needs to be controlled, including period (emptying septic tanks), location of de-sludging sites
- ✓ Public private partnership should be promoted,
- ✓ Coordination among stakeholders including donors, NGOs and local government needs to be improved,
- ✓ Continuation of funding and support to Duhok IDPs/refugees by the international community and local government.

## 8 CONCLUSIONS

The management and protection of water is a shared responsibility between various government departments, municipalities, businesses, industry, and individuals. Each of us has a role to play. Residents need to be aware of how much water they use, practice water conservation, and respect the environment. Water is a natural resource which is needed for drinking, bathing, and recreation; it powers many of industries, supports agriculture sector, sustains ecosystems, as well as tourism. Water and sanitation management opportunities could

include developing a better understanding of water resources and using this information to support sustainable economic development; implementing improved long-term management developed through joint work of all stakeholders; and evaluating opportunities to share more information with the public. Each camp is a consumer of natural resources as a consequence of its own operations and people living activities. Camps can reduce operational costs through:

- ✓ Energy and water use reduction,
- ✓ Re-use of grey water,
- ✓ Development and implementation of water safety plans.

Building capacities on aspects related to water and water sustainable management are necessary. After the analysis of the water situation in each area/camp, and of the abilities and capacities the inhabitants have to deal with it, it is important to build up capacities in aspects such us:

- ✓ State of water resources and sustainable approach to the protection,
- ✓ Ways to reduce waste of water and maximize its use,
- ✓ Re-use of grey water e.g. for flush toilets or irrigation,
- ✓ Water conservation,
- ✓ Rain water harvesting, especially for irrigation purposes,
- ✓ Understanding the challenges to community wellbeing from climate change, ways to respond to climate change and how to manage its risks.

In order to achieve above defined objectives following approaches and measures are foreseen to be taken:

1. Water and sanitation related data management to be introduced and maintained and data (especially on water quality and quantity) is available for everyone.
2. Water supply and sanitation services to be managed and used in the sustainable way protecting environment and water resources while allowing economic opportunities.

3. Water and sanitation sector to be managed in a participatory way and cooperation and coordination between related directorates is improved.

4. Water and sanitation related information sharing with stakeholders and general public to be improved.

#### ACKNOWLEDGMENT

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