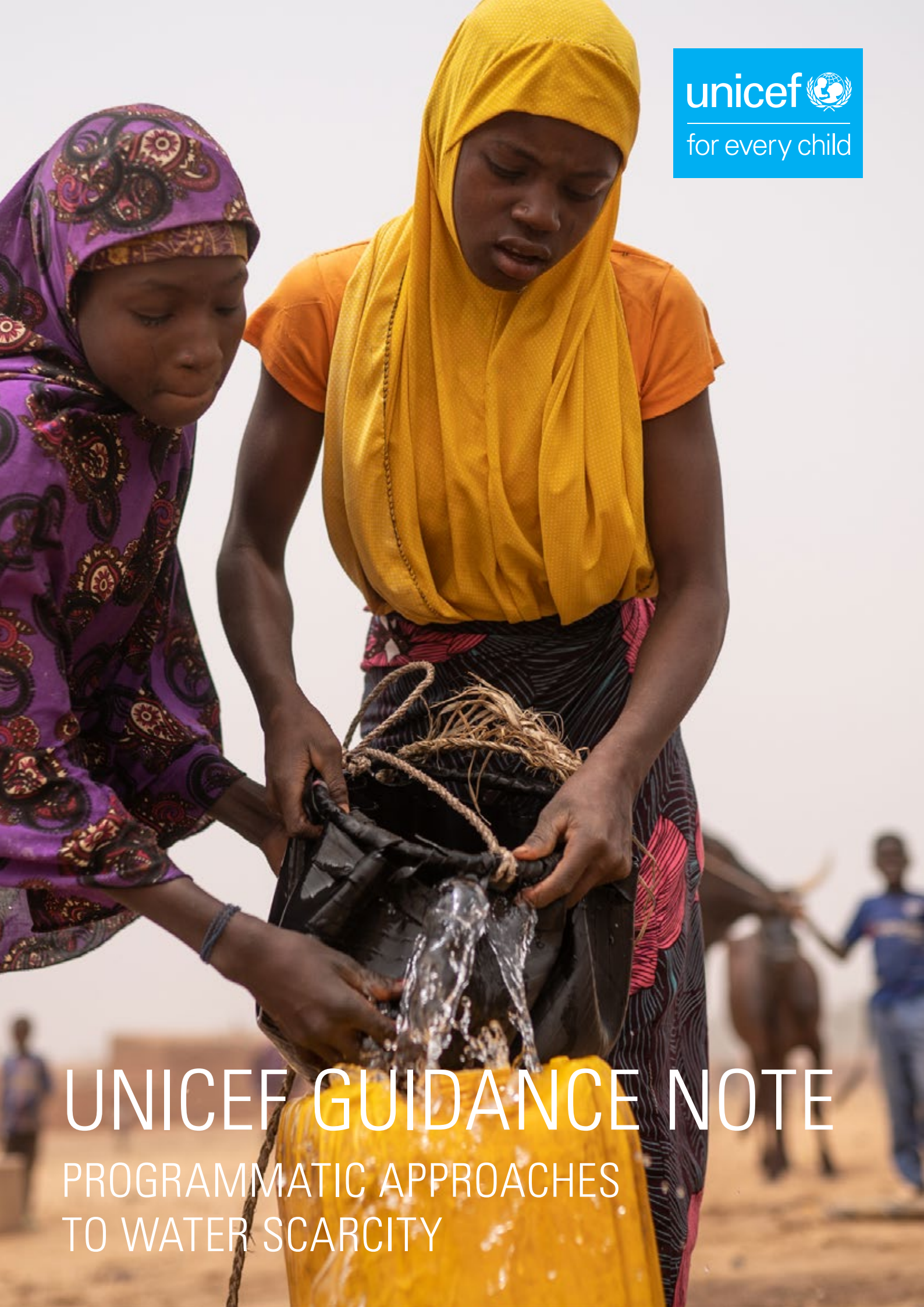

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UNICEF GUIDANCE NOTE

PROGRAMMATIC APPROACHES TO WATER SCARCITY

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PROGRAMMATIC APPROACHES TO WATER SCARCITY


unicef
CONSTRUCTION OF
HAND PUMP BOREHOLE
BY
RUWASSA
UNDER
unicef
2015 PROJECT
ALAKARAM

ACRONYMS

GDP	Gross Domestic Product
GWP	Global Water Partnership
HLP-W	High Level Panel for Water
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
MENA	Middle East and North Africa Region (UNICEF)
MHM	Menstrual Hygiene Management
NAPA	National Adaptation Plan of Action
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions
NRW	Non-Revenue Water
PPP	Public-Private Partnerships
SAR	South Asia Region (UNICEF)
SDGs	Sustainable Development Goals
UNGA	United Nations General Assembly
WASH	Water, Sanitation and Hygiene
WASHBAT	Water, Sanitation and Hygiene Bottleneck Analysis Tool

SUMMARY OF KEY TERMS

Integrated Water Resources Management (IWRM) is the process that promotes the coordinated development and management of water, land and related resources. The process maximises economic and social benefits in an equitable manner, without compromising the sustainability of vital ecosystems and the environment.[1]

Non-revenue water (NRW) describes losses in water systems resulting from leakage in pipelines, theft of water through illegal connections or commercial/administrative losses (e.g. through metering errors). NRW is typically measured by the volume or value of water lost.

Water accounting is a process that aims to improve water management by considering the status of, and trends in, water supply, demand, accessibility and use. It may include target-setting and processes that improve water use efficiencies.

Water demand management is the adoption of a strategy, policy or programme that promotes a more efficient use of water, either within the water supply system or the customers' use of water. Typical water demand management activities may include: customer/water user efficiency behaviour change campaigns; reducing physical losses, including leakage in networks; reducing illegal connections; improving tariff modalities (while balancing equity with a sense of resource valuation); water re-use; and implementing water use restrictions.

Water risk is the probability that a location will experience a water-related event. The World Resources Institute's Water Risk Mapping ('Aqueduct') maps risks such as floods, droughts and water stress.

Water scarcity is defined as the lack of available water resources to meet the demands of a specific population. Water scarcity can be experienced by a community, region or country and may be temporary (for example over several months of the year), or increase and decrease over time. Water scarcity can either be physical or economic. Physical water scarcity occurs where water resources are over-exploited for different uses and can no longer meet the needs of the population. Such scarcity may be related to the mismanagement or poor governance of water services and/or limited recharge of surface or groundwater resources. Economic water scarcity may occur in countries with adequate water reserves, but where access remains poor. It can be due to poor governance, limited human capacity, limited investments, and/or insufficient infrastructure. Water scarcity is a major barrier towards the achievement of all aspects of SDG 6.

Water security is the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.[2] Water insecurity occurs when any or all of these needs cannot be met.

Water stress is an outcome of water scarcity, amongst other variables. Water stress occurs where water scarcity leads to poor accessibility and poor water quality. Water stress may manifest as conflict over water resources, over-extraction of aquifers, declining water levels, or illness associated with contaminated water.[3] Other definitions of water stress offer a quantitative approach, which measure water stress as the ratio of total water withdrawals to available renewable surface and groundwater supplies.[4]

Water vulnerability (UNICEF interpretation for the purpose of the vulnerability analysis) occurs where physical water risks are combined with low levels of water service.

1. As defined by the Global Water Partnership.

2. Water Security and the Global Water Agenda – a UN-Water Analytical Brief, 2013.
3. The Institute of Civil Engineers, Oxfam and WaterAid, 2011.
4. World Resources Institute (WRI), 2013.

CONTENTS

EXECUTIVE SUMMARY

Water scarcity is affecting the lives and futures of children. Globally, there are 1.3 billion people – including 450 million children – estimated to be living in areas of high or extremely high water vulnerability.[5] Water scarcity has major implications on the life, health, development status, opportunities and futures of children, and their families.

Household water supply is threatened in situations where water scarcity leads to competition between water uses – for instance, between urban water use and agricultural water use, or between communities, regions and countries. When access to water is under threat, water scarcity can amplify tension, conflict and displacement, with the poorest and most marginalised suffering the worst consequences. The COVID-19 pandemic has shown the importance of having reliable, sustainable, affordable and safe WASH services for households; all of which are connected to available water resources, now and into the future.

Water scarcity undermines the sustainability of water, sanitation and hygiene (WASH) services, and is increasingly a barrier to achieving the targets set out in the Sustainable Development Goals (SDGs). This Guidance Note highlights the drivers of water scarcity, suggesting **programme actions** for the WASH sector to increase water security for children, and outlines **programme principles** to guide action at global, regional, national and local levels. The guide is the third in a series of papers, accompanying Drying Up Their Futures: The Impact of Water Scarcity on Children in the Middle East and North Africa Region and Urban Water Scarcity Guidance Note – Preventing Day Zero. It is being released under the umbrella of UNICEF's Water Security For All initiative, and complements the Global Framework for Urban Water, Sanitation and Hygiene.

The drivers of water scarcity are numerous. Incorporating water scarcity into the design, implementation and monitoring of WASH programmes is necessary to ensure sustainable, equitable, affordable, resilient and safe WASH services for households, communities, schools and healthcare facilities, in both rural and urban areas. While the technical, financial and strategic resources required to ensure water security are enormous, there are many new approaches, partnerships, technologies and financing opportunities which offer new solutions and ways of working – both within the WASH sector, and with other sectors.

Levels of water scarcity and its impacts, as well as innovations to address it are changing rapidly, and it is acknowledged that this is an emerging area for WASH programming. This Guidance Note was developed to provide technical guidance to UNICEF WASH staff and sector partners on programme and policy actions which can be considered in a range of programming contexts. This note proposes a set of core programming principles, including: risk-based approaches, valuing water resources, managing water sustainably and equitably, partnerships, and a continued focus on acceleration of WASH coverage. Suggested actions range from supporting the enabling environment and governance frameworks to reduce the over-extraction of water resources, to supporting water accounting actions that promote an understanding of water availability, and the means to sustainably enhance water supply. Pathways differ according to country contexts, needs and capacities; approaches need to be country-led but regionally harmonised. While the WASH sector has extensive experience in the provision of water services, this Guidance Note sets out new perspectives, as well as new areas and partnerships to ensure that WASH programming is both resilient to the impacts of water scarcity and continues to support the most marginalised children and their families.

Access to drinking water and sanitation is a human right, and it should never have to compete with demands for other uses of water. The WASH sector needs to evolve its programming to mitigate, and adapt to, water scarcity to improve household access to sustainable, equitable, affordable, resilient and safe WASH services, if this most basic of human rights is to be realised for all children, everywhere at all times.

5. UNICEF, 2021.

1

INTRODUCTION

This Guidance Note explores the drivers of water scarcity, and outlines programme principles and programmatic actions to guide WASH programming to help ensure water security for children and their families, with suggested actions at global, regional, national and local levels. Underlying this is the understanding that programmes can no longer continue as 'business as usual'; urgent interventions are required, creating opportunities to react to changing contexts and to adapt programming at different levels.

WASH programming must move beyond a focus purely on increasing access to services and consider the threats that water scarcity and climate change pose to sustainable, affordable, resilient and equitable WASH services. Integrating risk-based approaches that address the availability of water against current and projected resources and demand will be critical to this shift in perspective.

Water scarcity is the outcome of a diverse set of drivers. We must understand this range of potential causes and how they affect water scarcity in any given context in order to take effective programmatic action. These drivers are described in Section 3, while Section 4 outlines programmatic principles and action to improve water-secure outcomes.

Figure 1 below outlines the conceptual framing of this document.[6] It shows the 'drivers' of water scarcity (i.e. a range of factors that can lead to water scarcity in each given context), and some suggested programmatic approaches that aim to reduce the severity of water scarcity.

6. Definition of water scarcity is taken from the Water Security and the Global Water Agenda – a UN-Water Analytical Brief (2013)

FIGURE 1. WATER SCARCITY AND ASSOCIATED CONCEPTS

DRIVERS OF WATER SCARCITY (Section 3)

- Climate change
- Unsustainable water management and poor governance
- Undervaluing water
- Urbanisation and deteriorating infrastructure
- Deteriorating water quality
- Transboundary sharing of water resources
- Functionality and physical dimensions

Water Scarcity
Exists where the demand for water outstrips supply and where water resources development is approa ching or has exceeded sustainable limits.

Water Stress
Water stress refers to scarcity in terms of adverse quality, poor accessibility of water ("quantity") and the presence of water-rela ted risks.

PROGRAMMATIC APPROACHES (Section 3)

- Global and regional approaches
- Enabling environment
- Water resources data and climate modeling
- Preparedness, emergency and reconstruction planning
- Water supply enhancement
- Urban approaches
- Demand management

AIM OF WATER SCARCITY PROGRAMMATIC APPROACES

Water Security[6] capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic develop ment, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosy stems in a climate of peace and political stability

For UNICEF, Water Security comprises four dimensions:
- Safe and affordable drinking water services
- Climate resilient WASH services and communities
- Prevent water scarcity crisis through early action
- Water cooperation for peace and stability

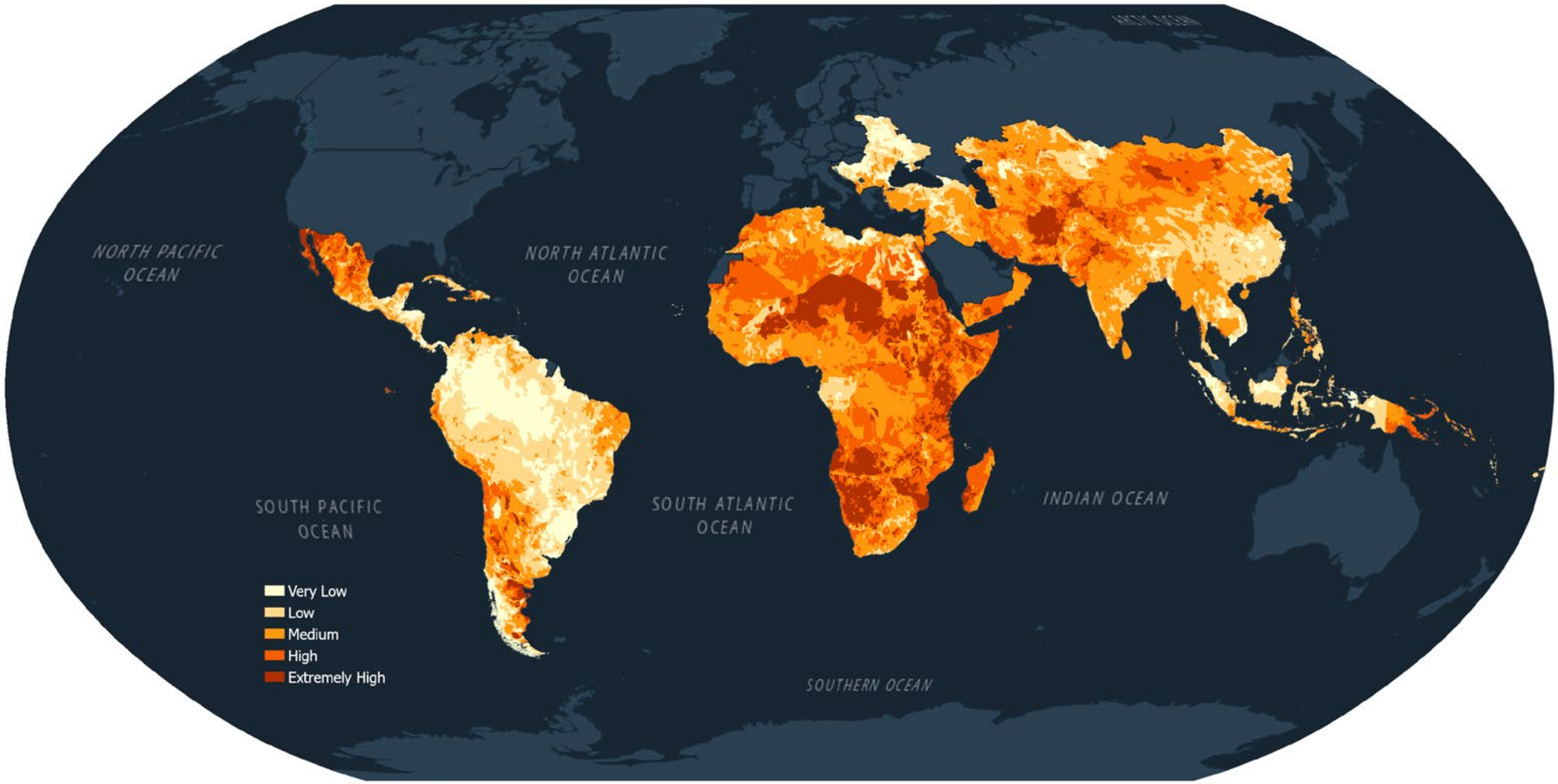
The vulnerability of children to water scarcity is related to the interdependence between physical water risks and water service type. A recent analysis[7] undertaken by UNICEF examined the interplay between these two elements, analysing physical water risks according to five parameters[8] against the respective national drinking water service levels.[9]The analysis suggested that 1.3 billion people, including 450 million children, live in areas of high and extremely high water vulnerability. The level of vulnerability, taking all these factors into consideration for UNICEF programme countries, is shown in Figure 2 below.

7. UNICEF, 2021.
8. Water stress, interannual variability, seasonal variability and groundwater table decline were derived from the WRI Aquastat Risk Analysis platform, while the drought events were calculated from the UNEP Global Data Risk Platform. The drinking water service level data were derived from the JMP data set.
9. UNICEF/WHO, 2019.

The urgency and sheer number of children affected, as well as the extensive geographic spread, has led UNICEF to launch its 'Reimagine WASH: Water Security for All' initiative, which aims to ensure water security for these 450 million children by 2025. The initiative aims to urgently mobilise attention, partnerships, innovations, resources and results to sustainably address water vulnerability from both within the WASH sector, and across other sectors.

The COVID-19 pandemic has shown the importance of having adequate WASH services for households; all of which are connected to available water resources, now and into the future.

FIGURE 2. DISTRIBUTION OF WATER VULNERABILITY ACROSS UNICEF PROGRAMME COUNTRIES



2

THE THREAT FROM WATER SCARCITY

Water scarcity is one of the greatest global challenges to sustainable development, hindering the secure provision of drinking water, food and energy. It is intimately linked to climate change, whose effect on water scarcity can be sudden and severe. The World Economic Forum has ranked water crises as the world's gravest risks in terms of likelihood and impact.[10] Water scarcity is a major barrier to progress, both within the WASH sector and beyond. It poses an increasing and fundamental risk to the realisation of the human right to water and sanitation, and to the achievement of SDG 6.[11] Currently, nearly half the world's population live in areas of water scarcity for at least one month of the year, and if nothing is done, as many as 5.7 billion people could live in water-scarce areas by 2050[12] (see Figure 3 below for a selection of data on how water scarcity affects human development). As many as one-quarter of the world's cities are already considered to be water-stressed.[13]

10. World Economic Forum, 2019.
11. Mekonnen and Hoekstra, 2016.
12. WWDR, 2018.
13. According to a survey of 500 cities (McDonald et al., 2014).

There is growing evidence that water scarcity is a major challenge to sustainable development. Figure 3 outlines a selection of facts which underline the severity of water scarcity and impacts on development.

Water scarcity undermines the sustainability of WASH services and is becoming increasingly prevalent, manifesting itself as both intermittent water supply during dry seasons and as permanent water scarcity. It is often due to the over-exploitation of aquifers, or the increased water demands for growing populations and from other sectors. Household water supply is threatened when water scarcity leads to competing water demands, for instance between rural, urban and agricultural users, or between communities, regions and countries.

In fragile contexts where access to water is under threat, water scarcity is a dangerous risk multiplier, contributing to and amplifying tension, conflict and displacement. Equitable access and distribution remain a challenge. It is the poor and the most marginalised who suffer the worst consequences of water scarcity, losing out when water resources are secured by those who can afford it, worsening inequality.

FIGURE 3: WATER SCARCITY AS A PRIMARY CONTRIBUTOR TO GLOBAL CHALLENGES

Water scarcity affects every inhabited continent. Water use has been growing at more than twice the rate of population increase in the last century.[2a]

Irrigation claims 70% of the water used globally.[3a] To feed a population of 9 billion in 2050, a 19% increase in agricultural water consumption will be needed.[4a]

One in four children will be living in areas of extreme water stress by 2040.[1a]

Water scarcity may displace as many as 700 million people by 2025.[5a] Water influences politics, diplomacy and conflict.

78% of jobs constituting the global workforce are highly dependent on water.[6a] Water scarcity threatens economies; it reverses hard-won development gains.

Environments in which WASH programmes operate are becoming increasingly challenging; providing safe water is becoming more expensive and technically demanding. The symptoms of water scarcity are increasingly apparent in programming; service providers are increasingly faced with water quality challenges, including where groundwater has been over-pumped, inducing flow from more mineralised zones, coastal areas, or due to upstream toxic contamination. Water tankering – a common response when water is scarce – is unsustainable in the long-term, and further marginalises the poor because of the high cost involved (see **Box 5**, which looks at the economics of water tankering in Ethiopia).

Water scarcity has an impact on access to WASH services, and its impact on children is both direct and potentially long-term. Living in areas of water scarcity has major implications for the life, health, development, and future opportunities of children and their families, in both rural and urban areas. Increasing water scarcity increases the amount of time and physical effort children have to spend to collect water, leaving less time and energy for school and recreational activities. Water scarcity has a negative impact on water quality too, exposing children to recurrent bouts of diarrhoea and impeding their absorption of key nutrients, both of which have an irreversible impact upon the mental and physical development of young children. It also impacts the volume of water available for domestic use, reducing livelihood options, and contributing to migration and risks of tension and conflict. Where families depend on water for livelihood opportunities, water scarcity can have direct impacts on household income, as well as spending, forcing many families into negative coping strategies, including removing children from school, child labour and child marriage. Girls in particular suffer as a result of many of these coping strategies. Annex A details how water scarcity directly and indirectly affects children's safety, protection, survival, development, education and rights to a prosperous and secure future.

Water scarcity is one of the greatest challenges of our time, and the consequences of not ensuring water security are enormous. However, the opportunities presented by achieving water security are equally profound. If we are to realise these, the changes required in WASH programming must be understood and put in place urgently, sustainably and equitably.

"Sustainable water security will not be achieved through business-as-usual approaches."

World Water Development Report, 2018

The integrated nature of water provision necessitates a coordinated, cross-sectoral response, so that water resources and water supply can be planned and programmed together.

For example, diminished flows, poor water quality and general environmental degradation can happen if the water needs of the agricultural sector are not balanced with those of households and communities. Achieving SDG 6 – clean water and sanitation for all – requires that no elements of WASH programming are considered in isolation. The SDG targets 6.1 and 6.2 represent a deliberate broadening of the scope of WASH programming, from a traditional focus purely on service delivery. This means that the WASH sector will fail to deliver on every single element of SDG 6 if water scarcity is not addressed as an interlinked, cross-sectoral problem. Figure 4 below illustrates how water scarcity undermines efforts to achieve clean water and sanitation for all.

FIGURE 4: WATER SCARCITY AS A MAJOR BARRIER TOWARDS THE ACHIEVEMENT OF ALL TARGETS OF SDG 6

SUSTAINABLE DEVELOPMENT GOAL 6: ENSURE AVAIBILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

6.1 By 2030 achieve universal and equitable access to safe and affordable drinking water for all	6.2 By 2030 achieve access to adequate sanitation and hygiene for all	6.3 By 2030 improve water quality	6.4 By 2030, substantially increase water-use efficiency	6.5 By 2030, implement integrated water resources management at all levels	6.6 By 2030, protect and restore water-related ecosystems
Water scarcity undermines availability of water supply and the sustainability of existing services.	A lack of sanitation undermines water availability that is safe to drink. Insufficient volumes of water has dire consequences for sanitation networks.	Poor water quality compromises valuable water resources. Catchment level water quality risks need to be controlled to protect water resources.	Inefficient and unsustainable use of water is a major factor contributing to water scarcity.	Balancing different uses of water is necessary to contribute to water security. Basic human use of water should be given priority to protect the most margainalised.	Protecting ecosystem functions leads to better water scarcity outcomes. Nature based solutions have great potential to protect water sources.

This Guidance Note is accompanied by *The Impact of Water Scarcity on Children in the Middle East and North Africa Region*- (internal UNICEF guidance) and the Urban Water Scarcity Guidance Note – Preventing Day Zero, which outlines suggested actions to address increasingly frequent and severe water shortages in urban areas and small towns. A further set of resources are found in Annex B and can be used in conjunction with this document.

Water scarcity is a complex systemic problem, associated with a range of cross-sectoral risks and threats to water services and resources. Solutions are numerous, interdependent and interconnected, and this note outlines key entry points in a variety of contexts. Risks to programmes can have multiple causes, as well as multiple impacts. Threats that impact the quantity of water available at the water source, for example, must be considered alongside water quality threats and wider concerns relating to reliable access. Policy makers and water service providers all play a key role to safeguard against growing risks. Each risk must be considered in the context of all the other risks – water scarcity, as a risk to the WASH sector, cannot be considered in isolation[14] Each option, when implemented, carries its own risks, and these must also be considered.

14. This note does not detail definitions of risk and associated terminology (e.g. hazard, exposure, vulnerability and capacity) or the processes that identify, manage and minimise general risks to programming. It is recommended to review the UNICEF and GWP Publication "WASH Climate Resilient Development: Guidance Note – Risk assessments for WASH" for an in-depth discussion of these issues.

A risk-based approach proactively identifies the pathways that drive water scarcity in a particular context.

This means actively searching for opportunities and balanced approaches that will safeguard water resources, integrating programme interventions that will improve water security.

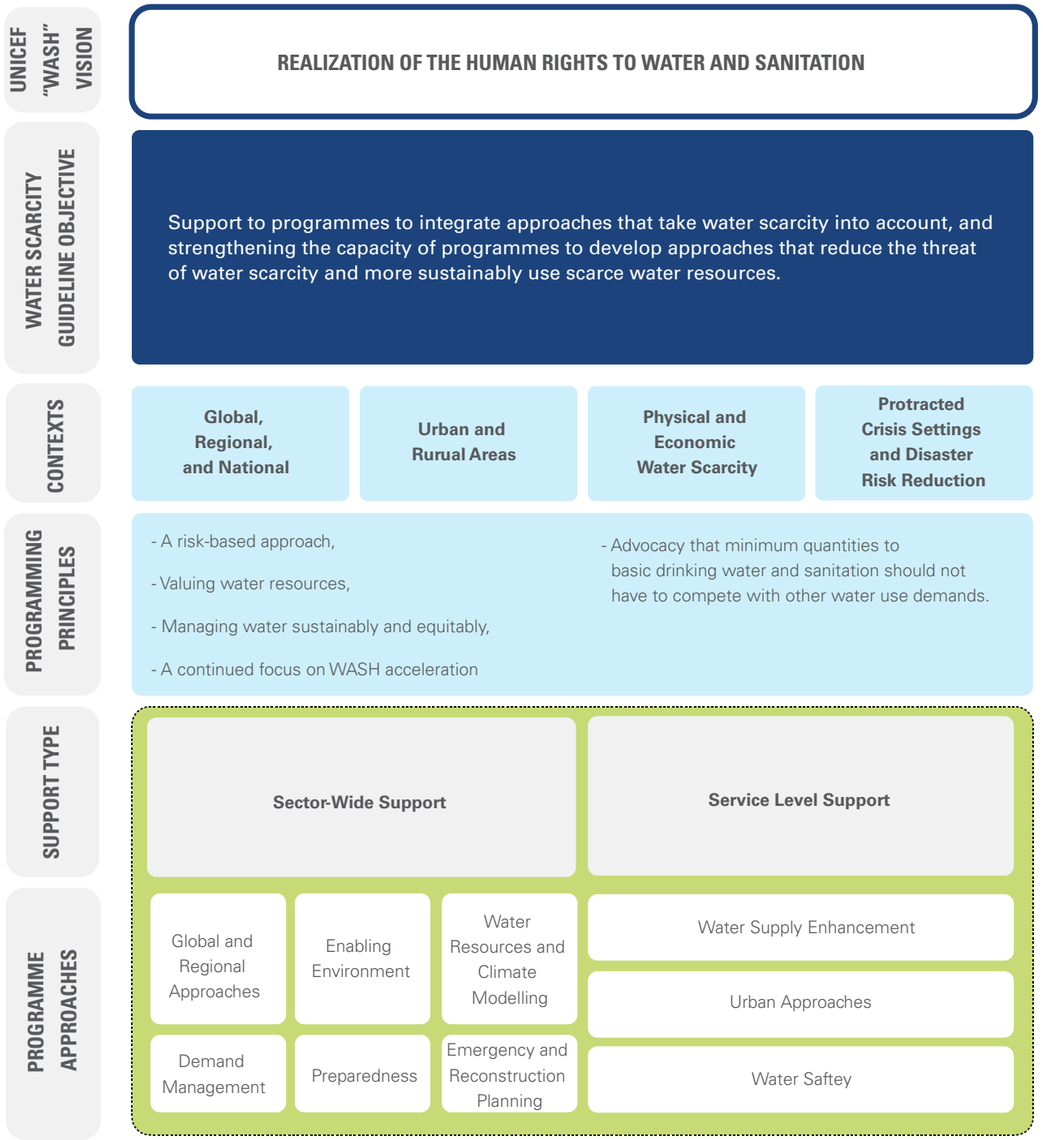
As water scarcity is closely linked to climate change, programmes with a climate lens should encompass water scarcity. This note complements the Strategic Framework for WASH Climate-Resilient Development and the associated Technical Briefs, developed by UNICEF and the Global Water Partnership (GWP). To ensure sustainable, affordable, equitable, resilient and safe WASH services, UNICEF is working to ensure that by late 2021, all UNICEF WASH results are climate-resilient. For UNICEF, there are four aspects of climate resilience for water services:

- a risk analysis has identified potential impacts of extreme weather events, and preventive measures have been included;
- water sources are reliable at all times, both throughout the year and during extreme weather events;
- management/service delivery models are sufficiently robust to cope with crisis and ensure longer-term sustainability of the infrastructure
- solutions are low-carbon where possible.

This note provides guidance to UNICEF programmes and the WASH sector by outlining programming principles for addressing water scarcity, and suggests programme and policy approaches.

This note complements UNICEF's Urban Water Scarcity Guidance Note – Preventing Day Zero, and the Global Framework for Urban Water, Sanitation and Hygiene Figure 5 below shows how the Urban WASH Framework can be modified to incorporate for water scarcity programming.
Different countries, contexts, capacities and needs all demand different pathways to mitigate water scarcity. Most approaches need to be country-led but regionally harmonised. The WASH sector will need to increasingly expand into new areas, approaches and partnerships. This will require additional skills, for example to increase sector efficiency and incorporate risk programming. It will also mean influencing national policies, advocacy and reforms in 'new' areas beyond the WASH sector.

FIGURE 5: ADAPTED FROM THE UNICEF URBAN WASH FRAMEWORK – DESCRIBING WHERE WATER SCARCITY PROGRAMMING IS REFLECTED IN UNICEF'S WASH STRATEGY (2016-2030)



2.1 WATER SCARCITY IS A RISK MULTIPLIER

Water scarcity is not a new phenomenon – it has long been a challenge that communities in arid regions across the world have adapted to. However, recent threats and trends are exerting enormous and increasing pressure on dwindling freshwater resources – such as unsustainable water use, population growth, migration, crisis and conflict, and increased water demand and competition.

All of these are exacerbated by climate change. Rising global temperatures and increasing rainfall variability are contributing both to increased flooding and periods of drought. This has a range of implications for water services. These include: increased concentration of harmful contaminants in water resources, with associated health implications; declining water levels; water shortages; increased costs for service delivery; increased risks of service disruption due to extreme events; and damage and destruction to WASH infrastructure.

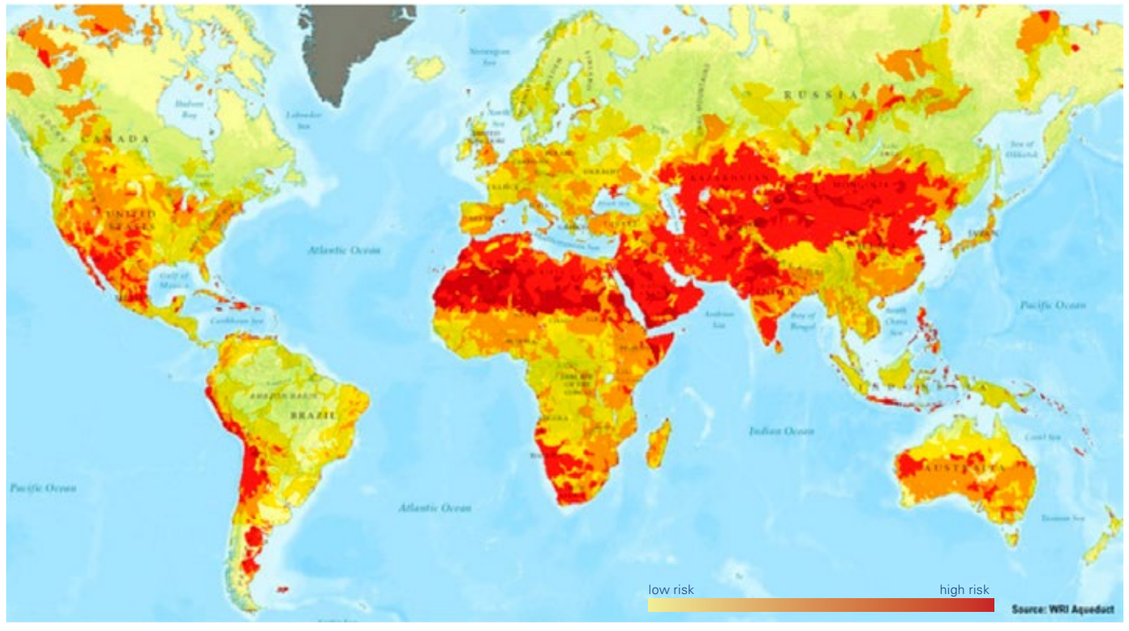
Rapidly growing urban populations are further contributing to water scarcity, due to the increasing volumes of water consumed, as well increasing wastewater production, putting ever-increasing pressure on sanitation systems. Rapid urbanisation also impacts aquifer recharge levels, by increasing the coverage of impervious surfaces. Construction of urban areas in basins and channels also disrupts natural drainage systems, hugely increasing the risks of flooding.

When water security is threatened by these or other influences, existing stresses on communities, as well as local and international tensions are amplified.

The distribution of different levels of water risk globally is illustrated in Figure 6 below, as calculated by the World Resources Institute (WRI) Aqueduct tool. The areas of red and dark red show where water risk is high or very high – and therefore, where water scarcity may inflame and multiply existing problems or tensions. The water risk map is based on 13 site-specific indicators, including groundwater table decline and drought risk. The map shows the risk on a colour scale of 1 (low water risk, in pale yellow) to 5 (extremely high risk, in red).[15]

15. The open-access tool can be navigated on the WRI Aqueduct Water Risk Atlas. Available here.

FIGURE 6: THE DISTRIBUTION OF WATER RISK GLOBALLY (WRI, AQUADUCT) LINK TO MAP IS HERE



2.2 PHYSICAL AND ECONOMIC WATER SCARCITY

Water scarcity is a relative and dynamic concept, and local context and conditions determine how and why supply is not meeting demand. Water scarcity can increase or decrease over time; it can be affected negatively by factors such as climate change, or positively, for example by interventions such as the programmatic approaches suggested in this note.

Water scarcity exists where the demand for water exceeds supply and where water resources are approaching or have exceeded sustainable limits. The definition focuses on the relationship between supply and demand, rather than just the availability of water itself – a region does not have to be arid, for example, to be considered water scarce.

Water scarcity can be physical or economic, and it is important from a programming perspective to recognise the difference, and the extent to which each applies, in any given programmatic context.

Physical water scarcity occurs when water resources are over-exploited for a variety of reasons, and no longer meet the needs of the population. Water quality is an element of physical water scarcity, because pollution and contamination of water resources have the same effect as unavailability of water for domestic use. Seasonality, where water is available for part of the year, may also affect physical water scarcity, as can exposure to water-related risks, where access may be inhibited by flooding or seasonal declines in water levels (increasingly extreme and frequent droughts).

Economic water scarcity occurs in regions where adequate water resources are available, but are not fully accessible. This could be as a result of poor governance, infrastructure or the high costs of providing water services, as well as the inefficient use and mismanagement of water resources leading to wastage and contamination. It is recognised that strong institutional structures are required to ensure access to WASH services; when water services and water resources are inadequately managed, it inevitably reduces access. Poverty and marginalisation are key defining features of economic water scarcity.

It is important to note that physical water scarcity and economic water scarcity are not mutually exclusive: physical and economic water scarcity can occur in the same location – for instance, a region where water is available for only part of the year may also suffer from poor institutions or infrastructure.

Whether water scarcity is physical or economic, the poor and marginalised suffer the most severe consequences of water scarcity, and are affected disproportionately. These effects can be direct, through deteriorating quality and quantity of their domestic water service, resulting in little choice but to pay for expensive, poor quality alternative supplies, with associated health risks. But the effects can also be indirect, as the lack of water affects their food security, as well as access to energy, if power generation is water-dependent.[16]

16. Both thermal (steam-driven) and hydroelectric power generation are highly dependent on water to produce electricity.

Box 2: Overcoming physical water scarcity

Some of the most water-scarce locations in the world are also the most water-secure[17] – often because they have the financial resources and technical capacity to develop solutions.

Research has put Tokyo at the top of a list of the most water stressed cities globally,[18] followed by New Delhi, Mexico City and Shanghai. All of these megacities have for the most part been able to develop effective solutions to adapt to water stress. Singapore is typically hailed as an example of a city that is physically water scarce, but has overcome its water scarcity through implementing a set of highly effective policies and initiatives, as well as investing in research and technology which has allowed it to manage water scarcity. Singapore's main strategies to address water scarcity include a high investment in rainwater collection, re-using water continuously including for potable re-use, managing water demand, and desalinating seawater.

17. World Bank, 2018.
18. McDonald, R., et al. (2014).

Households depending upon lower levels of service ('surface water', up to a 'limited service' on the service ladder) are particularly vulnerable to physical water scarcity. Increasing physical water scarcity can dry up and contaminate surface and unimproved sources, and lowering water levels can result in increased collection time, easily extending the 30-minute threshold that defines a basic water service – potentially pushing many households down the service ladder. By contrast, households with access to piped systems (even where they have not integrated climate risks and increased water demand into system planning) have an added level of protection, because of the scale of those services and their systems of management and regulation. The status and trends in water scarcity across regions, and illustrated impacts resulting from water scarcity, are shown in Figure 7, on the next page.

2.3 REGIONAL TRENDS IN WATER SCARCITY

FIGURE 7: A SUMMARY OF STATUS AND REGIONAL TRENDS IN WATER SCARCITY, AND SOME ILLUSTRATED IMPACTS RESULTING FROM WATER SCARCITY

Much of Sub-Saharan Africa is believed to suffer from both physical and economic water scarcity. Despite the existence of vast groundwater reserves, investigations into groundwater have shown that many aquifers are not adequately recharged, and large-scale borehole developments could rapidly deplete resources.[xvi] Spatial and temporal access to groundwater reserves have resulted in irregular water availability in many areas of the continent.[xvii] Sub-Saharan Africa is highly affected by climate change; a predicted increase in average temperatures, frequency of warm spells and duration and intensity of rainfall all have a profound effect on water resource availability.[xviii] As an indicator of the threats to water resources in the region, Lake Chad has shrunk by 90%, which has been attributed to climate change, expansion of irrigation and population growth.[xix] Water shortages in North-eastern Nigeria are leading to displacement and also discouraging conflict-affected people from returning home.[xx]

Although Latin America has the most water resources of any regions in the world, recurrent drought has a major impact. The 'dry corridor' in Central America, particularly Guatemala, El Salvador and Honduras, is experiencing the worst droughts of the last 10 years, with 3.5 million people in need of humanitarian assistance.[x]

Droughts decrease income, increase unemployment and have become one of the factors leading to migration to the US.[xi] In El Salvador, water shortages are fueling unrest and forcing displacement.[xii] Migration is expected to intensify with worsening climage change.[xiii] Mismanagement of water resources has also intensified water scarcity. In Venezuela, deteriorating political and economic conditions have triggered power outages that regularly shut down water treatment plants. Three quarters of the region's wastewater is discharged into rivers and other water sources.[xiv] Aquifers are not recharged adequately because deforestation and eroded river basins limit water flow.[xv] Climate change is accelerating the melting rate of glaciers, impacting on vital water supply for which many cities, such as La Paz, depend.

South Asia is highly affected by water scarcity, and cities across the region, including Delhi, Dhaka, Kathmandu, Karachi and Kabul, face severe and frequent water shortages. Over- extraction of groundwater resources, largely to fuel agricultural production, is a critical factor in water scarcity – there are over 20 million wells across South Asia.[vi] Groundwater use in South Asia accounts for nearly half of the global groundwater used for irrigation.[vii] Groundwater over-abstraction increases the possibility of geogenic sources of water contamination, such as fluoride and arsenic. It is predicted that Pakistan could effectively run out of water by 2025.[viii] The UN has stated that water scarcity – not war – is the biggest cause of displacement in Afghanistan.[ix]

MENA region has very high levels of unsustainable water use and is the most water-scarce region in the world. More than 60 per cent of MENA's population is concentrated in areas of high or very high surface water stress, compared to a global average of 35 per cent.[i] Sixty per cent of surface water resources in MENA are generated outside the region, and the region has only three shared river systems.[ii] In MENA, "nearly 9 out of 10 children live in areas of high or extremely high water stress".[iii] Of the most water stressed countries in the world are in MENA region. Conflict, fragility and displacement in the region all closely relate to water scarcity.

In the megacities of East Asia and the Pacific Region, extreme water stress is pronounced, as urbanisation is having an extreme effect on water resources. Accelerated groundwater depletion means that Jakarta is currently sinking faster than any other major city in the world. Water shortages are occuring more frequently, with a recent Asia Development Bank evaluation showing that, among the nations of the region, 29 out of 48 economies were found to be 'water insecure'.[iv] Groundwater depletion – with its secondary effect of saltwater intrustion into aquifiers – compounds water shortages in coastal areas. Coupled with the impacts of drought, saltwater intrusion has extended up to 90km inland in some coastal areas in Viet Nam.[v] The impact of rising rea levels on the Pacific Islands is creating absolute water scarcity. Several atoll islands are completely reliant on rainwater, due to climate change.

Accelerated groundwater depletion contributes to result in subsidence in cities such as Jakarta, which is sinking at 1-28cm per year and half of the city is currently below the sea level.[xxi]

3

DRIVERS OF WATER SCARCITY

As water scarcity intensifies across the globe, it has become increasingly urgent to understand the factors that are driving it – within local, district, national or regional contexts – to identify the best course of programmatic mitigation or adaptation. This section illustrates some of the most recognised drivers that cause water scarcity.

3.1 CLIMATE CHANGE

Climate change exacerbates water scarcity, disrupting the water cycle and reducing available volumes of safe drinking water through variable rainfall, increased frequency and severity of droughts, and deterioration of water quality. The primary cause is a change in precipitation, the main source of recharge to water systems.[19] Other impacts of climate change also exacerbate water scarcity. These include the increasing demand from agriculture for irrigated water, due to shorter rainy seasons and higher evapotranspiration rates, and the damage to WASH infrastructure caused by extreme weather events. Some of the main causes and effects of climate change-related water scarcity are set out below.

19. UNICEF (2011).

Rainfall variability and reduced recharge

Climate change affects the volumes of groundwater and surface water through changes in rainfall.[20] Reduced recharge to water sources is caused by the twin effects of increased evapotranspiration and the reduced capacity of the land to absorb water. Heavy rainfall on very dry soil, often already degraded in quality and structure due to drought conditions, inhibits effective infiltration. This increases the risk of floods and surface flow, and reduces groundwater recharge. Short periods of intensive rainfall can lead to flooding, rather than efficient recharge. Semi-arid and arid regions are particularly exposed to any variability in rainfall, because of their limited freshwater reserves and their dependency on seasonal recharge.[21] Droughts have become increasingly common and more extreme in recent years. Evidence suggests that increasing numbers of the world's population are facing dry season water shortages due to rainfall variability. In the future, it is possible that the hardest hit regions, especially those in Africa, may be unable to sustain their present populations.[22] The relationship between drought and water scarcity is outlined in Figure 8 in more detail.

20. Ibid.
21. Ibid.
22. UNICEF 2011 referring to the 2007 Report of the Working Group 1 of the Intergovernmental Panel on Climate Change: https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-spm-1.pdf.

FIGURE 8: DROUGHT AND WATER SCARCITY: DIFFERENT STATES, INTERCONNECTIONS[23]

23. Some of the information for this figure is from Wanders and Rangecroft, 2017

Warming temperatures

As the world warms, the cycle of evaporation, condensation and precipitation is speeding up, which leads to lower recharging rates for aquifers and less surface water. While the warming trend has also seen a short-term increase in the availability of freshwater from icecaps and glaciers, once these frozen reservoirs are gone, this route of recharge for rivers and connected groundwater systems will stop.[24] The consequences of losing this type of recharge will be enormous: more than one sixth of the world's population lives in regions supplied by meltwater from major mountain ranges such as the Hindu Kush, the Himalayas and the Andes.[25] Changes to the melting rates of glaciers can also lead to infrastructure challenges including damage and destruction of reservoirs and retention structures/dams, as well as increasing sedimentation rates.

24. UNICEF 2011. Referring to Jansson, P et al, 'The concept of glacier storage: a review', J Hydrol, 282, 116-129, 2003.
25. IPCC, 2007.

Extreme weather

Extreme weather events – floods, tropical cyclones and other natural weather-related disasters – are also expected to increase in frequency and intensity due to climate change. Disaster events can result in contamination of water resources and cause huge damage to WASH infrastructure, heavily impacting long-term access to water, as reinstating services poses a massive financial and logistical challenge. It has been estimated that approximately 74 per cent of natural disasters between 2001 and 2018 were water related, including droughts and floods.[26]

The 2015 El Nino event had a profound impact on the socio-economic conditions of millions of people across the world. The impact of the drought continued well beyond the dry conditions caused by the phenomena. Several months after one of the strongest El Nino events ever recorded, over 50 million people in Eastern and Southern Africa continued to be food-insecure, and with an appeal for US$ 3.9 billion launched for 19 countries affected.[27]

26. WWAP, 2020.
27. UNOCHA, 2016

3.2 UNSUSTAINABLE WATER MANAGEMENT AND POOR GOVERNANCE

Water resources are under threat from patterns of unsustainable agricultural, domestic and industrial water use, all of which fuel economic growth and the demands of growing populations. As a result, water availability is deeply impacted by competing demands for water that exist outside the WASH sector. Water scarcity is intimately connected to the expansion of irrigated agriculture, which is often used inefficiently. Globally, water for irrigated agriculture accounts 70% of the worlds' freshwater withdrawals[28] – and irrigation accounts for the single largest withdrawal of groundwater. Surface water is also subject to unsustainable water use and management. A number of large lakes, including Lake Chad and the Aral Sea, have decreased in size or disappeared completely in recent decades, primarily due to over-exploitation.

Water availability is badly affected by demands outside the WASH sector. Globally, the agriculture sector accounts for an average of 69% of all water use.

28. OECD, 2010.

Non-revenue water (NRW) refers to water lost through system leakage, theft or metering inaccuracies. The global volume of NRW is an estimated 346 million cubic metres per day, conservatively putting the value of lost water at US$ 39 billion per year.[29] As a comparison, this figure is significantly more – $10.6 billion more – than the estimated investment required to meet universal coverage of WASH by 2030, at US$ 28.4 billion per year.[30] High levels of NRW are a result of inefficient water utility management, weak capacity and poor maintenance. Losses due to NRW mean that enormous amounts of additional water must be pumped, at substantial additional financial and energy costs, or new sources have to be found.

Inefficient water management is closely related to poor water governance. Laws and policies, as well as the institutions that regulate and implement them, are necessary to protect valuable water resources. Poor governance has enormous consequences for water availability. It is often due to a lack of political will to address difficult water resources challenges, or a lack of progress in developing, and implementing, appropriate laws and policies that effectively protect water for domestic use (including use by marginalised groups), and for environmental protection. Although many governance issues are highly sensitive, it is vital to establish effective systems of water governance that adapt to social, economic and environmental conditions in order to protect water supplies now, and for the future.

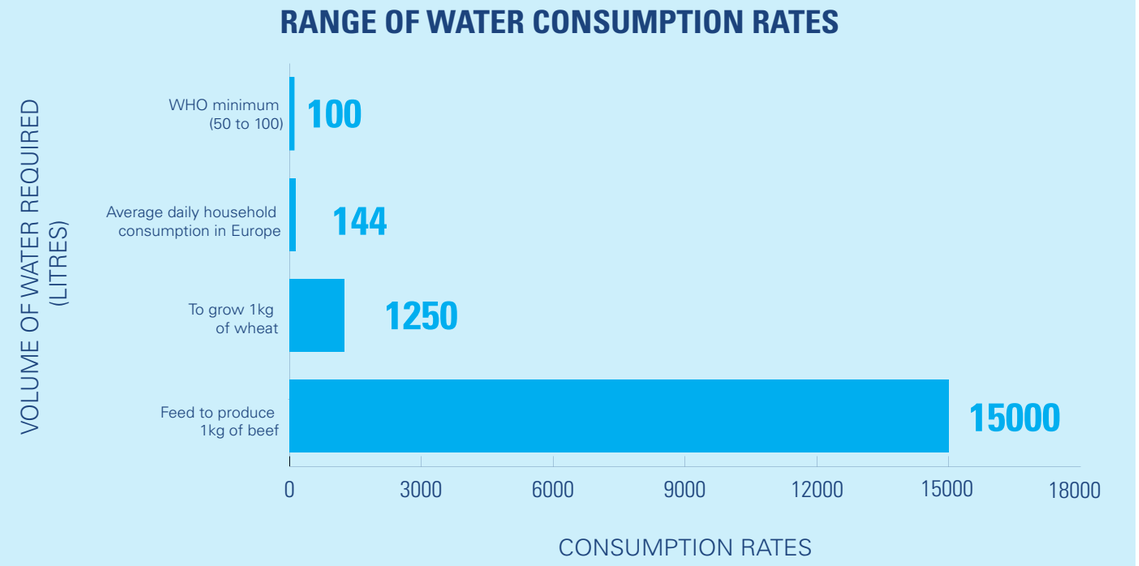
29. Liemberger, R and Wyatt, A, 2019. Recent research suggests avoiding the use of a percentage indicator in performance comparison, especially in target areas where there are large differences in consumption per service connection.
30. Hutton and Varughese, 2016.

Box 3: Agriculture, food and water

According to the World Health Organization, 50-100 litres/person/day is the required amount of water needed for an intermediate to optimal service level.[31] Below this, health concerns arise. On average, 144 litres/person/day is supplied to households in Europe.[32] Water requirements in relation to food are enormous in comparison. Growing 1 kg of wheat requires 1,250 litres of water. Feeding a cow to produce 1 kg of beef requires 15,000 litres of water.[33] Irrigated agriculture, particularly in relation to growing feed for livestock, also creates problems for water quality, because excess nutrients and chemicals in feed for cows and dairy farming is a major source of pollution of water supplies.

31. Howard and Bartram, 2003.
32. European Environment Agency, 2019.
33. IME, 2013.

FIGURE 9: DROUGHT AND WATER SCARCITY: DIFFERENT STATES, INTERCONNECTIONS



3.3 UNDERVALUING WATER

Competing demands for water, between large-scale uses as well as at different parts of the catchment, have increased the pressure on the sustainability of water services, particularly for marginalised populations. Where water is insufficient to satisfy the demands of all sectors, allocation decisions must be made on the basis of an assessment and agreement on the priority uses of water, and must include the recognition of the basic human right to adequate amounts of water. Even in countries where water scarcity is severe, there is often insufficient recognition that domestic water use has a high value, and must be protected against other water use demands.

Approaches are needed to determine the value of water according to social, environmental and economic considerations.[34] Determining how to correctly price water to balance between the cost of delivering the service and the 'value perception' of water, as well as ensuring equitable access, is a challenge.

34. It is important to note that several initiatives have taken place to further these considerations. Some examples include:
World Bank: https://blogs.worldbank.org/water/standing-value-water
https://blogs.worldbank.org/water/advancing-global-dialogue-value-water
https://blogs.worldbank.org/water/charting-path-valuing-world-s-most-precious-resource
The University of Oxford
UN Food and Agriculture Organization (FAO)
UN High level Panel on Water

Determining this is further complicated by differences in how various sectors value water and the trade-offs across sectors to be considered. Low tariffs and high subsidies in the water sector, as well as low energy tariffs for pumping water, are all critical factors contributing to the over-extraction of groundwater, which can lead to landowners/ water users being able to extract water at virtually no cost where legal frameworks are absent, or laws remain unenforced. Where groundwater use has not been regulated, and where electricity for pumping groundwater is unmetered, billed at subsidised rates or without tariffs, water scarcity has expanded. For example, the Middle East and North Africa region (MENA) has some of the world's lowest water tariffs and the highest proportion of GDP spent on public water subsidies.[35] The increasing use of solar powered water systems for irrigation purposes, including in India, Afghanistan and Yemen, and the perception that water from such systems is 'free', as they do not require daily operating costs, is leading to major concerns that such systems will lead to further unchecked demand for groundwater.

Although the proportion of water used for domestic purposes is significantly lower than for other uses, like agriculture, the high rates of subsidy and associated low cost of water for domestic use does not contribute to the perception of the value of water and does not invoke critical water conservation behaviours.

As water scarcity increases, ensuring water services are equitable, while dealing with rising costs of water abstraction, treatment and delivery, due to lowering water levels and additional water treatment processes required, is an enormous challenge. Large proportions of highly marginalised populations in water-scarce countries, such as in MENA region, already struggle to pay for water services, which is anticipated only to worsen.

3.4 URBANISATION AND POPULATION GROWTH

By 2050, it has been estimated that an additional 2.5 billion people will be living in cities, and by 2030, the world could have 43 so-called 'megacities' (urban agglomerations with more than 10 million inhabitants).[36] A factor in the growth of urban populations, and in particular, secondary towns and cities, is the migration from rural areas, in part due to water scarcity – a trend that is witnessed in the MENA region.[37] Concentrated population growth is leading to increased demand for water across all sectors and also puts pressure on sanitation systems. In many urban areas, water supply and sanitation systems are designed based on given levels of water availability. When these levels decline, such water and sanitation infrastructure can be rendered much less efficient, or even ineffective.

Insufficient volumes of water available affect sanitation systems, as minimum amounts of water are needed for the effective operation of sewerage systems. Insufficient water volumes have detrimental consequences for sanitation networks, causing corrosion and blockages. Reduced water availability can also significantly increase the concentration of wastewater contaminants flowing into wastewater treatment plants, reducing the efficiency of treatment systems. At the household level, reduced water quantities inhibit the practice of key hygiene behaviours.

The world's growing megacities and secondary cities exert a huge demand on water resources. In the areas surrounding urbanised areas, the groundwater levels in aquifers can be greatly lowered due to the heavy pumping required to meet the growing water needs. Drawdown of groundwater over a large area can result in subsidence in the overlying ground. Dhaka, Jakarta and Mexico City are all pumping so much groundwater that the land is suffering from subsidence. Over-pumping also contributes to the effect of saline intrusion seen in some of the coastal megacities of the world, with saltwater extending inland. In Chennai, saltwater has been detected 16 kilometres from the coast.[38]

3.5 DETERIORATING WATER QUALITY

Water scarcity is closely associated with deteriorating water quality. For example, diminished flows in rivers and streams can increase concentrations of harmful pollutants, and decreasing groundwater levels can lead to saline intrusion.

Pollution both leads to water scarcity and is impacted by it – contamination of water resources leads to ineffective and inefficient use of water resources. Major causes of contamination include: a lack of adequate sanitation and faecal sludge management; poor agricultural practices which release nutrients and chemicals into water; discharge of industrial effluent into waterways; and poor management of urban storm water runoff (including damage to wastewater systems from storms, or major flooding leading to contamination of water points). When water resources are contaminated, the water often requires expensive treatment to ensure it meets drinking water standards. Drinking water quality in urban areas can be highly affected by insufficient wastewater treatment, when water sources are contaminated by sewage overflow, leaking sewer lines and poorly constructed septic tanks. Globally, it is estimated that over 80 per cent of wastewater is released into the environment without adequate treatment.[39] The drinking water of two billion people is reported to be contaminated.[40]

35. World Bank, 2018.
36. UN DESA, 2018.
37. WWAP, 2016.
38. Senthikumar, M et al, 2018.
39. WWAP, 2017.
40. WHO, 2019.

3.6 PRESSURES ON TRANSBOUNDARY SHARING OF WATER RESOURCES

Countries highly dependent on the flow of transboundary waters – the aquifers and the surface water in lakes and rivers that are shared by more than one country – are prone to uncertainty and risk in water resource management and planning decisions beyond their borders. Upstream development affects downstream water quantity and quality,

creating the potential for heightened tensions.[41] Indeed, the issue relates not just to the quantity and quality of upstream water, but their predictability. Dam construction, industrial processes and agricultural production in upstream catchments can lead to degraded water quality and reduced volumes of water that may be vital for populations downstream. Transboundary river basin authorities (such as the Mekong River Commission) can use integrated water resources management processes (IWRM) to address these types of issues, and contribute to shared benefits for affected countries.

3.7 FUNCTIONALITY AND PHYSICAL DIMENSIONS

Developing access to water supply can be technically challenging and costly in places of complex hydrogeology and challenging terrain – limiting the availability of water for populations. Similarly, poor functionality of water supply infrastructure and inadequate management arrangements can lead to communities experiencing water scarcity. Higher rates of breakdown of traditional water points, like handpumps, can be related to the high levels of use and poor maintenance, particularly when there are insufficient water points available to meet the needs of the population.[42] These situations are linked to economic water scarcity, where sufficient water resources are available but poor governance, limited capacity and/or limited investment in developing water resources for supply are not sufficient for the proper operation of the systems throughout the year. In places where water scarcity exists, poor investments in storing or retaining water during the rainy season for use in the dry season increases the effects of water scarcity felt by a population. Poor water resource management practices can also lead to a reduction water availability in reservoirs during the dry season or during droughts.

In areas of conflict, the delivery of safe WASH services can be impeded by the ongoing conflict due to direct damage or destruction of infrastructure, and limited resources or capacity to undertake repairs. The delivery of WASH services is also impacted by conflict due to the disruption to supplies (importation and distribution), including fuel and chemicals, as well as reductions in the number and capacity (or 'brain-drain') of service providers' human resources.

41. World Bank, 2018.
42. Several technical resources exist that explore ways of improving the functionality and sustainability of the water supply. This includes the UNICEF Programming for Sustainability in Water Services – A Framework and a series of guidelines on water exploration and borehole drilling between UNICEF and skat_foundation which can be found on the Rural Water Supply Network's website.

Box 4: The Cape Town water crisis – a lesson in demand management

In 2018, the impacts of severe drought conditions over three successive years (the worst in more than a century) led to a sudden, major water shortage crisis in Cape Town. In 2014, the six dams that fed the city water supply (Cape Town's water supply was entirely dependent on dams) were full, but they began to decline, eventually falling below 13.5%, leading the city authorities to predict the day when the city would completely run out of water. The projection of this so-called 'Day Zero' was in early 2018, and led to the initiation of severe water restrictions, and an intensive public messaging campaign that prompted widespread efforts to reduce water use, as well as encouraging users to feel a personal responsibility to reduce their water consumption.

The crisis itself came as surprise to many. Cape Town had recognised the growing threat of water scarcity, and, before the crisis, had made good progress reducing water demand. The city reduced leaks, installed meters and developed progressive tariffs that ensured large consumers of water paid more, promoting water efficiency. Between 2000 and 2015, despite a population growth of 3 per cent per year, Cape Town's water demand was still lower than it had been 14 years before. Cape Town had won several international water management and conservation awards.

In the end, 'Day Zero' was averted because of the city's successful water demand management (with urban water use coming close to a 50 per cent saving). Cape Town continues to work intensively on demand management, as well as diversifying their water sources, knowing that water crises have not been averted forever.

More information on the Cape Town water crisis can be found in the UNICEF's Urban Water Scarcity Guidance Note – Preventing Day Zero that accompanies this note.

Box 5: Water tankering in Ethiopia and Jordan

Water tankering is a common response during periods of water scarcity. In many areas, unregulated local private sector tankers supply water at a very high cost, and often of questionable quality. Even so, the immediate cost of investing in highly capital-intensive, technically challenging, but more sustainable water supply is much higher than the immediate cost, and results of, water tankering. However, over a longer period, the cost of water tankering dwarfs the cost of investing in the more sustainable water supply. Once water tankering starts, it can be very hard to end. Water tankering exacerbates inequalities due to high costs, and the time required to wait for the water, inhibiting other livelihood activities. The transition to longer-term, more durable and sustainable infrastructure solutions (particularly in emergency contexts) is both the capital and time investment required – even though infrastructure investment is ultimately a better longer term choice in terms of cost, quality of service, and reduced environmental impact and emissions.

A UNICEF study in drought-prone regions of Ethiopia showed that water tankering cost US$ 2,257 per capita per year over a 10-year period, compared with US$ 65 per capita per year for piped water systems, for a project spanning a 20-year period.[43] Water tankering interventions also distort local markets. The trend may also deter and delay service providers from boosting productivity, and exacerbate humanitarian consequences in the long run, for instance, when a municipal system collapses due to the lack of concerted attention to address long-term sustainability.[44]

To support the rapid onset of the Syrian refugee crisis in Jordan, UNICEF provided water using water tankers to Za'atari, Azraq and Rukban refugee camps at very high cost. As the water was sourced from outside the camps, the delivery was vulnerable to service interruptions due to strikes and weather events (e.g. sandstorms, heavy rainfall and floods). The use of water tankers in the refugee camps also necessitated a complex system of water quality and volume monitoring, to ensure that the water delivered to the camps met the required drinking water quality standards and was adequately chlorinated, and that it was evenly distributed. To address this, UNICEF transitioned to drilling boreholes in all three camps, which resulted in a more continuous and predictable delivery of water of consistent quality, at significantly lower costs. The Za'atari water and wastewater infrastructure has reduced operational costs by 66%, with a payback period of 6 to 8 years. In Rukban, the construction of a borehole, complex treatment system, 13 kilometre pipeline and parallel water distribution lines across 'no-man's land', enabled a reduction in the operational costs of 85%, and an increase of over 20% in available water volumes. Importantly, these systems ensured that the production and distribution of water was within the camp area, and was no longer vulnerable to service interruptions.

43. Godfrey and Hailemichael, 2017.

44. ICRC, 2015.

4

PROGRAMMATIC APPROACHES TO WATER SCARCITY

Water scarcity is a complex systemic problem, associated with a range of cross-sectoral risks. The solutions are equally as numerous and interconnected. Threats that impact the quantity of water available at the water source, for instance, must be considered alongside water quality threats and wider concerns relating to reliable access. Policy makers, water service providers and major users of water all play a key role in safeguarding against growing risks. Each risk has to be considered in the context of all the other risks – water scarcity, as a risk to the WASH sector, cannot be considered in isolation.[45] Each option, when implemented, carries its own risks, and these must also be considered.

As explored below, addressing water scarcity requires understanding the many potential drivers of it in any given context, and how these may change with time. But there is one critical change we can make to WASH programming which may be most effective.

45. This note does not detail definitions of risk and associated terminology (e.g., hazard, exposure, vulnerability and capacity) or the processes that identify, manage and minimise general risks to programming. It is recommended to review the UNICEF and GWP Publication WASH Climate Resilient Development: Guidance Note – Risk assessments for WASH for an in-depth discussion of these issues.

That is to increase the climate-resilience of WASH services and communities, since water scarcity is intimately linked to climate change. To ensure sustainable, affordable, equitable, resilient and safe WASH services, UNICEF is working to ensure that by late 2021, all UNICEF WASH programming is climate-resilient. This note will therefore be relevant for designing, implementing and monitoring climate-resilient WASH programmes more broadly, both for UNICEF, and the wider sector. The principles and actions outlined below complement the Strategic Framework for WASH Climate Resilience, developed by UNICEF and the Global Water Partnership (GWP), and the publication's accompanying Technical Briefs.

A risk-based approach proactively identifies the pathways that drive water scarcity in a context. It means actively searching for opportunities and balanced approaches that will safeguard water resources, integrating programme interventions that will improve water security.

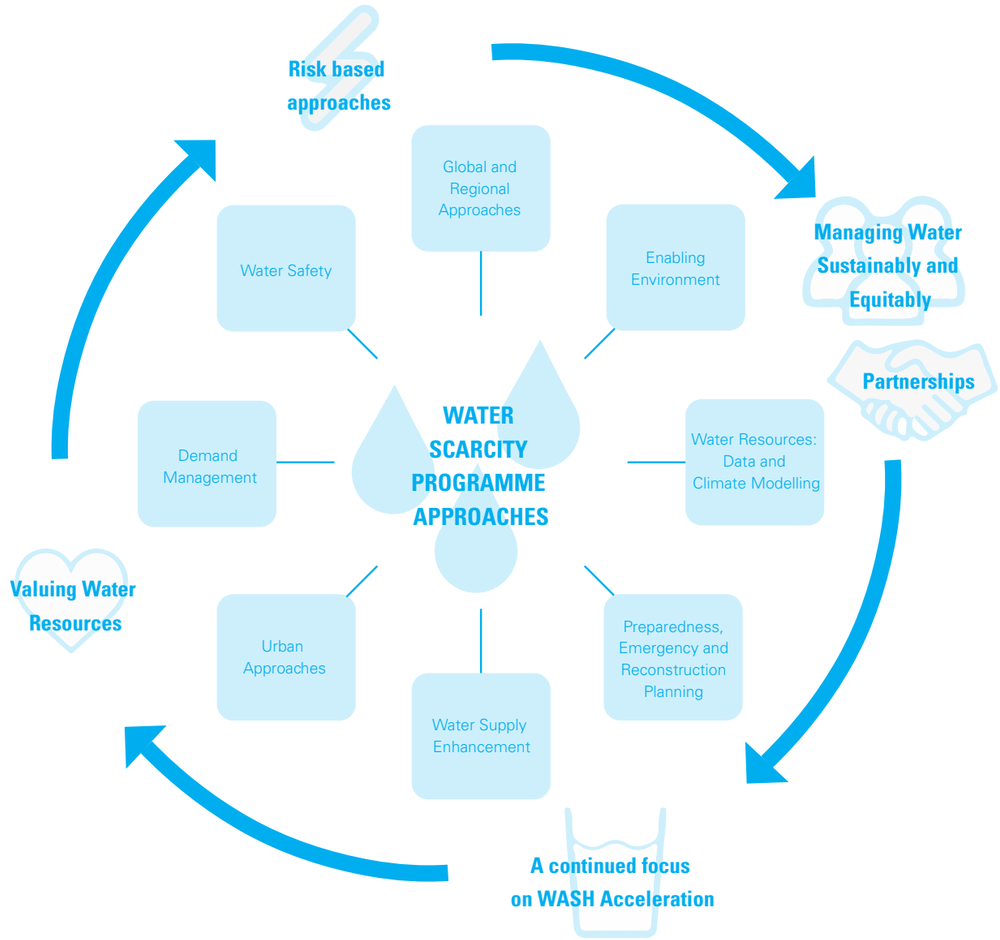
4.1 PROGRAMMING PRINCIPLES FOR ADDRESSING WATER SCARCITY

The programming principles outlined below (and given in Figure 10) should guide the sector's efforts to address water scarcity and protect water resources. They uphold the principle that, as a basic human right, water sourced for drinking and basic household use should not have to compete with other water-use demands.

A risk-based approach – promoting resilient development

Water scarcity presents a risk to WASH programmes and to wider human, economic and social development. A risk-based approach addresses water scarcity in any given context by identifying what drivers are affecting water scarcity – political,

FIGURE 10: WATER SCARCITY PROGRAMME PRINCIPLES AND ACTIONS (DESCRIBED IN SECTION 4 OF THIS DOCUMENT)



economic, social and/or physical – and develops strategies to manage critical risks to water supply. The multiple risk factors that lead to water scarcity should be analysed as interconnecting pressures – and addressed together. Although climate change is a critical driver, it should not be addressed in isolation. Other potential risk factors that may need to be understood and addressed in conjunction include population growth, urbanisation, risks to water quality from upstream activity, competing uses of water (unsustainable water extraction), poor governance frameworks and inefficient uses of water (in the WASH sector and others). Many of these risk factors impact the vulnerability of WASH services as well as water scarcity: identifying such risks to WASH services can also be a programming entry point for increasing resilience in water resource management.

Additional attention must be paid to risks in humanitarian programming. As part of the humanitarian commitment to ensure a 'do no harm' approach, the WASH sector must understand the risks to water resources used to respond to emergencies, and the impact of emergency programming responses on such resources (for example to protect water resources from contamination or over-exploitation) as well as on local, host communities in terms of the volumes, quality and cost of available services and resources.

Valuing water resources

The WASH sector needs to communicate the nature and urgency of water scarcity to decision-makers to demonstrate that water is a finite and essential resource that must be protected, and to promote the human value of water resources for drinking and basic human use, as well as the value of healthy ecosystems for sustainable development.

The progressive realisation of the human right to water and sanitation should guide the actions on water scarcity. This means stressing that water should always be prioritised for all, in a non-discriminatory manner, and that basic human use should be given priority. Such discussions are framed by UNGA Resolution 64/292, which recognises the human right to water and sanitation as essential to the realisation of all human rights. The UN Convention on the Rights of the Child also states that countries must not restrict a child's right to food and water (Article 24). The High Level Panel on Water (HLP-W) outlined five principles under their HLPW Principles on Valuing Water which emphasised the diverse values of water to different groups; inclusivity and transparency; resource protection; education and awareness and investment.[46]

46. HLP-W, n.d. The five principles are given as: Principle 1. Identify and take into account the multiple and diverse values of water to different groups and interests in all decisions affecting water; Principle 2. Conduct all processes to reconcile values in ways that are equitable, transparent, and inclusive; Principle 3. Value, manage, and protect all sources of water, including watersheds, rivers, aquifers, associated ecosystems, and used water flows for current and future generations; Principle 4. Promote education and public awareness about the intrinsic value of water and its essential role in all aspects of life; Principle 5. Ensure adequate investment in institutions, infrastructure, information, and innovation to realize the many different benefits derived from water and reduce risks.

While UNICEF and many sector partners have focussed on the delivery of water services to date, water resource management has not been a primary area of programming. This means that collaboration is needed with others engaged in integrated water resource management (IWRM), to increase learning, identify gaps and avoid duplication. The WASH sector could play a greater role in water resource frameworks, for instance, particularly in protracted emergencies, where conventional IWRM actors might not be fully engaged.

Placing greater emphasis on water resources can be incorporated into WASH programming in both humanitarian and development contexts. In places where water scarcity exists, the WASH programming can promote the identification of potential new areas of water resources. It can also implement groundwater monitoring, promote alternatives to drilling new boreholes, explore new approaches on demand management, as well as develop and implement water conservation behaviour change campaigns.

Managing water sustainably and equitably

Addressing water scarcity means promoting more sustainable development and understanding access to water as an element of interconnected development goals.

Demand management is an approach that helps to achieve sustainability (using water more efficiently can reduce the need to develop additional water resources), but it must be equitable. Demand management measures, such as user restrictions, should be carefully targeted at the wider public, but should specifically avoid impacting the poorest or most marginalised users – groups that survive on already-limited quantities of water. When demand management targets other sectors' use of water, including agriculture, WASH stakeholders must consider the potential wider impacts. For example, women are routinely disadvantaged by water use restrictions, as operators of small-scale horticultural projects in Africa.[47] User restrictions must consider the impact on critical small-scale livelihoods.

47. Lefore, et al., 2019.

The Convention on the Law of the Non-Navigational Uses of International Watercourses includes articles related to the *equitable and reasonable utilization* of international watercourses[48].

Box 6: What is water demand management?

Water demand management is the adoption of a strategy, policy or programme to influence more efficient use of water, either within the water supply system or in consumers' use of water.

Typical water demand management activities include:

- Customer/water user efficiency behaviour change campaigns- Improving physical losses, including leakage in pipelines
- Addressing the commercial elements of water supply, including water volumes billed to customers and reducing 'non-revenue water' (NRW)
- Improving tariff modalities
- Developing re-use water (e.g. wastewater treatment and re-use)
- Implementing water use restrictions.

Water demand management approaches have a greater impact on reducing water consumption when targeted at specific populations using large quantities of water that can be reduced; they are likely to be far less effective targeting marginalised populations which only have access to lower quantities of water.

As was demonstrated in the Cape Town crisis,[49] where systems are already quite efficient (after years of progressive improvements), the options for physical water demand management reduce, increasing the relative impact of behaviour change campaigns.

Demand management approaches can provide the opportunity to reformulate tariff and subsidies which historically have negative impacts by, for instance, making groundwater over-extraction cheaper than investing longer-term in sustainable water supply. Introducing "smart" tariffs (i.e. those who use more water pay higher unit costs, wealthier households cross subsidize vulnerable ones, or cross-subsidizing sectors paying higher unit costs than households). Such tariffs can help reduce unsustainable water extraction patterns (across sectors) and thus ensure the value of water is better integrated into water use.

48. Convention on the Law of the Non-Navigational Uses of Internationl Watercourses (1997).

49. For more on the Cape Town water crisis, see the UNICEF paper that accompanies this Guidance Note, Urban Water Scarcity Guidance Note – Preventing Day Zero.

Partnerships

With a broader programming outlook, there are enormous opportunities for the WASH sector to expand or form new collaborations, working with a wider, cross-sectoral range of stakeholders at all levels to address water security challenges, as outlined under SDG6a, 6b and SDG17. This could include working with health, nutrition and education sectors, as well as between countries, and across catchments, basins and regions. Different partnerships may include working globally, regionally and in-country. They could be with a range of UN organisations, non-governmental organisations, and community-based organisations working across sectors, as well as with transboundary entities, river basin authorities, bilateral donors and financial institutions, to explore and implement effective approaches to water scarcity.

At a national level, WASH stakeholders can expand their 'traditional' partnerships forged with governments, including decentralised institutions responsible for managing and supplying water, as well supporting governments' transitions to using re-using wastewater for irrigation. There is huge potential to collaborate with other sectors to prioritise groundwater resources for domestic needs, as well as opportunities for more efficient water use.

Public-private partnerships (PPPs) can be an approach to improving services, including the planning, construction, rehabilitation and operation of water supply, effluent treatment and re-use of wastewater, as well as initiatives to improve water and energy efficiency. Other opportunities presented by PPPs include leveraging the scale-up of effective and innovative technologies.

WASH programmes across the sector will also need to build capacity so that the complexities of programming in water-scarce contexts can be fully understood, integrated, learned from and scaled-up. For many sector partners this will require a significant investment in capacity building to anticipate and adapt to the new challenges presented by increasing water scarcity. In some situations, skills will need to be drawn from a broadened spectrum of external expertise. This could mean energy experts supporting the scaling-up of solar-powered technologies, or water planning experts developing a more sustainable water supply for current and future conditions, or hydrogeologists identifying new water resources and future sustainable yield estimates.

A continued focus on WASH acceleration

Support to accelerate progress towards the achievement of SDG 6 is being galvanized by the Global Acceleration Framework which aims to deliver quick results at a large scale, as part of the Decade of Action.
To ensure the required level of progress, the Global Acceleration Framework is mobilising support to countries through four action pillars.[50]

Regardless of how a household gains access to water, be it through a household connection or a community water point, water is needed for a variety of uses to maintain healthy and productive lives. While households primarily use water for drinking and hygiene, water supply service providers also often supply water for other uses, such as small-scale agriculture, urban gardening, livestock-rearing and small-scale enterprises.

While the WASH sector's focus is on the provision of safe and affordable WASH services, the sector will increasingly need to understand and contribute to more complex conversations on resource assessments and to advocate for quantities for domestic use beyond the minimum required as a basic human right.

It is also recognised that equitable, climate-resilient WASH services protect the most marginalised from disasters and crises, even where water has been in short supply. This includes specific interventions to provide marginalised communities with better water services, which are also more resilient. As a response to the drought in 2016/2017 in Mozambique, hand pumps were converted to solar-powered water systems, after comprehensive testing of the sustainable yield and water quality. These systems continued to operate, even when Cyclone Idai decimated the area in early 2019. Such interventions also include protecting more vulnerable communities during more frequent urban water shortages, ensuring informal settlements with established access to WASH services continue with their mode of access throughout periods of shortages – such as during the Cape Town water crisis of 2018.[51]

50. The four pillars of the Global Acceleration Framework are: 1) Engage – swift responses to country requests through leveraged expertise and mobilization, 2) Align – coordinated approaches across sectors and actors through unified strategies and initiatives, 3) Accelerate – unlocked bottlenecks through five accelerators, and 4) Account – strengthened accountability through joint review and learning.
51. For more on the Cape Town water crisis, see the UNICEF paper that accompanies this Guidance Note, Urban Water Scarcity Guidance Note – Preventing Day Zero.

4.2 PROGRAMMING ACTIONS FOR ADDRESSING WATER SCARCITY

The table below suggests areas of water scarcity responses, and describes actions for WASH programming that can help address water scarcity. Risks to programming must be considered in the specific context, with potential risks to consider also outlined.

Many of the 'Example actions' are inter-linked, and could fall under more than one heading.

WATER SCARCITY RESPONSES	EXAMPLE ACTIONS	DESCRIPTION	EXAMPLE RISK CONSIDERATIONS (NB: Adjust according to local evidence and context; assess, evaluate and re-adjust)
GLOBAL AND REGIONAL APPROACHES	Water allocation advocacy, including transboundary	At the global and regional levels, advocacy promotes agreements that manage shared waters (aquifers and surface water). Following the principle that drinking water is a human right and should not compete with other uses of water. Part of the UN charter is to develop relations among countries, making transboundary water advocacy a key element of the UN mandate.	Geopolitical risks, complexity, high-level legal understanding, difficulty in changing status-quo
	Strengthening recognition of the value of water	Providing on-the-ground evidence, related to impact on children and the most marginalized to opportunities which address the value of water and sustainable management of water, such as the High-Level Panel on Water (HLP-W) initiative and the UN Climate Action Summit.	Determining and balancing trade-offs between sectors
	Regional water programming (for agencies)	Strengthening regional cooperation on water to ensure coordinated approaches across the sector. As coordinated approaches are necessary to streamline best practices, and bring stakeholders together, a regional programme serves as a means to link country programmes in shared basins, to promote joint situation analyses and knowledge transfer. Regional programming is also an opportunity to contribute towards tangible lessons and advocacy messages to global level agreements that further transboundary water agreements.	Focus on country-centred programming; lack of capacity to contextualise shared learning and integrate lessons
ENABLING ENVIRONMENT	Support to national governance frameworks, including regulation	Drawing on existing national level partnerships with government, influencing development of water laws, policies, and governance frameworks that promote the sustainable and equitable allocation of water. Promoting legally enforceable regulations that inhibit over-extraction of aquifers and implementing polluter-pays principles or incentives for not-polluting. The use of the WASHReg tool could contribute to improve regulatory roles and functions.	Requires high degree of government priority and acceptance; risk from changes in government
	Strategic national planning	Promoting water scarcity solutions into appropriate national strategic planning processes and policies (including both Water and Climate sector policies and strategies) which set out national development priorities. Opportunities could include integration into Nationally Determined Contributions (NDCs), National Adaptation Programme (NAPs) and climate adaptation processes, and National Economic Development Plans (NEDPs). The WASH Bottleneck Analysis Tool (WASHBAT) has been expanded to include climate change, both as a standalone pillar, as well as a cross-cutting theme. Undertaking the WASHBAT helps the sector understand the main bottlenecks to scaling-up and other elements that would strengthen the enabling environment and national WASH systems.	Requires high degree of government priority and acceptance; risk from changes in government
	Technical support to national governments	Providing appropriate technical advice and guidelines to governments to advise on appropriate approaches to address water scarcity, including advice on alternative options to groundwater over-abstraction, either through direct technical support or through helping to develop appropriate national guidelines. This could include, for example, providing technical advice on the feasibility of using recycled and treated wastewater as a water supply source. Review the degree to which the impact of climate change on WASH services are reflected as national climate priorities in key climate documents, including NDCs and NAPs, as well as ensuring that climate is reflected in key WASH strategies and plans. Once these gaps have been identified, provide support to ensure that these are reflected as priorities accordingly. Capacity building to improve water scarcity programmes and policy. This could include: climate risk assessments; technology identification; building investment cases; climate finance opportunities; water demand management; water resource identification; early warning systems; solar powered water systems; energy efficiency; water re-use; groundwater monitoring; alternative technologies (including approaches to increase water retention); or leakage assessments, among other technical areas.	Availability of data to inform changes; capacity (human and institutional) for change

WATER SCARCITY RESPONSES	EXAMPLE ACTIONS	DESCRIPTION	EXAMPLE RISK CONSIDERATIONS
WATER RESOURCES DATA AND CLIMATE MODELLING	Water accounting influencing allocation decision-making	Water accounting helps communicate the status of water scarcity to decision-makers, developing and promoting data which illustrate aggregate supply vs. demand, either at a national, city-wide or in targeted (water-scarce) districts. All water accounting quantifies water resources availability, how water is used (at sub-sector level) and develops balances of water availability. Support to development of water resources mapping and monitoring systems, including groundwater tables and sustainable yield extraction rates in critical regions. Water accounting requires solid data. This data can be used for advocacy, and to develop sector targets for water allocation, and links to governance frameworks. It is the basis for working with authorities on institutional arrangements which oversee and make decisions on water use. At the local (sub-national) level, attention to local or traditional approaches in water management is needed alongside formal approaches.	Lack of capacity (human and institutional) for systems-led decision-making and data analytics. Inadequate funds for long-term running of systems.
	Climate modelling analysis	Modelling the impact of climate change on WASH services for different scenarios, analysis of either general circulation models (GCMs) or other climate models, and local estimates with the view to developing narratives on impacts of climate change on water scarcity.	Relies on modelling being at a level suitable to inform programming.
	Strategic water resources assessments at national, district or programme level	Development of water security action plans/ strategies in areas where high water scarcity is experienced, at the national, district or programme level. This could include setting goals and action areas, institutional responsibilities and outlining financial requirements.	Lack of capacity (human and institutional) for systems-led decision-making and uptake of strategic plans.
	Situation analyses including vulnerability	Opportunities for analysis of the causes and drivers behind water scarcity and climate change, including unsustainable water policies and poor water governance, should be integrated into UNICEF situation analysis at different points of the programme cycle. Vulnerability assessments identifying populations with the lowest levels of service and the highest risks and vulnerability would strengthen situation analyses.	Lack of capacity to undertake multi-sectoral analysis; requires a cooperative approach across sectors to be effective
	Water vulnerability and climate change risk analysis	Water vulnerability and climate change risk analysis would identify the risks for each country, and the impact on the most vulnerable of climate change and water scarcity, while simultaneously identifying programmatic solutions (as part of a CLAC – a Climate Landscape Analysis for Children).	Lack of capacity to undertake multi-sectoral analysis; requires a cooperative environment and approach across sectors.
PREPAREDNESS, EMERGENCY AND RECONSTRUCTION PLANNING	Integrating water scarcity into preparedness and disaster risk reduction	Integrating water scarcity into existing preparedness scenarios for natural disasters (or other crises, including public health emergencies), as well as political, economic or social events, or conflict scenarios where water scarcity exists. This could also include developing preparedness planning for the water shortages scenario in urban areas, and also considering the anticipated impact of climate change on the water services.	Lack of capacity throughout system, particularly institutional capacity, to contribute to reduction of disaster risk.
PREPAREDNESS, EMERGENCY AND RECONSTRUCTION PLANNING	Integrating water scarcity into conflict and reconstruction analyses	Making the case for sustainable, equitable and resilient water management, including institutional and governance frameworks, to be built into reconstruction analyses. Using reconstruction processes to ensure that historical patterns of unsustainable water use are not repeated.	Requires in-depth community knowledge and trust building, ability to understand complexity of political and social environment.
	'Hotspot' analysis in areas of potential conflict	Where inter- or intra-community tensions or conflict have occurred, analysis could feed into targeting of water supply with the aim of diffusing or avoiding future conflict.	Requires in-depth community knowledge and trust building, ability to understand complexity of political and social environment.
	Drought planning and management and support to early warning systems	In regional/national level drought management, support to processes or policies promoting water scarcity management and drought as complementary approaches. This could include policy or technical approach integration, or contribution of water scarcity knowledge and approaches into Early Warning Systems. Where possible, contribution of water resources management understanding into government decision-making could help with drought response. Support to early warning systems could include identification of gaps in monitoring surface water and groundwater volumes and quality (and addressing these gaps), and understanding the relationship between these and climate change, as well as other threats including increasing abstraction and competing demands.	Lack of capacity throughout system for planning. National-level policies must support risk reduction.
	Climate-proofing humanitarian interventions	Promoting sustainable options in humanitarian interventions, particularly in protracted crises, e.g. promoting sustainable supply and efficient water use, and wastewater re-use.	Requires policies, funding and other requirements to be in place for longer-term options in humanitarian programming. Policy environment supportive of technological improvements.
	Building back better in humanitarian crisis	Introducing the principle of 'building back better' in areas affected by water scarcity, in particular if those crises are the consequence of natural disasters (e.g. droughts).	Implies acknowledging some level of past failure, in order to analyse what has to be different during the reconstruction/recovery phase.
	Coordinated approaches	Promoting coordinated and strategic approaches among critical actors in developing responses to ongoing water crises, through the WASH cluster, WASH sector coordination mechanisms, or other cross-sectoral coordination platforms. This could include developing national level task forces, by collaborating across ministries, UN agencies and with external stakeholders.	Requires mechanisms/a receptive environment for coordination, and effective uptake of strategies.

WATER SCARCITY RESPONSES	EXAMPLE ACTIONS	DESCRIPTION	EXAMPLE RISK CONSIDERATIONS
WATER SUPPLY ENHANCEMENT	Climate-resilient WASH services	Identify the risks to WASH services due to climate change and water scarcity now and in the future, and identify technologies (low-carbon where possible) and approaches to mitigate and adapt to these risks. Investment in technology and approaches that ensure access to climate-resilient water supply and WASH services, so that year-round access is available including during drought periods. Solutions vary according to context; in some cases this may include accessing deeper aquifers, and in others could be through water efficiency measures. In all cases, relevant environmental and social safeguards must be followed. Once the risks associated with climate change have been identified and solutions proposed, a climate rationale can be developed to scale-up climate-resilient solutions across the sector.	Requires funding and available capacity to obtain, operate and maintain technologically advanced solutions. Requires long-term operation and maintenance/ sustainability arrangements for advanced options.
	Reducing non-revenue water (NRW)	Programmes could support utilities to reduce water losses in the network due to leakages by repairing infrastructure. Introducing water metering and smart water networks can help to identify levels of NRW, as well as promote more efficient water use.	Political obstacles – preference for capital-intensive supply enhancement options instead of efficiency enhancement options. Lack of capacity and funding available for introduction of NRW – possibility of PPP integration and technical quality control.
	Renewable energy for water supply	Where a sustainable power supply from the grid presents a challenge (i.e. irregular supply, limited access in remote locations) the use of renewable energy, including solar, can be promoted. The transition from diesel-based generators to renewable energy sources can contribute to reducing emissions in the sector, and in many cases offers a more reliable supply that can, if designed properly, continue to operate after extreme events which may cause an interruption to the grid supply. Renewable energy, where the sustainable yield is sufficient, can also support the construction of multiple use water systems which can provide water to communities, schools and healthcare facilities and contribute to livelihood opportunities.	Theft of key components of renewable energy systems. Limited service support for renewable energy in rural areas where the market is at an early stage.
	Reverse osmosis/ desalination	In some areas, where water resources may be highly mineralised and brackish/saline, or along water scarce coastal areas, there may be few alternatives other than desalination. While this technology is very expensive and requires significant energy, the impact can be reduced where renewable energy is used, and where the by-products are disposed of safely. As this technology continues to develop quickly, the desalination process is becoming more efficient and more cost effective in terms of operational costs.	Volatile/rising energy prices (where not connected to solar systems). By-product (e.g. brine) management and disposal.
WATER SUPPLY ENHANCEMENT	Rainwater harvesting	Rainwater harvesting, on a large scale in urban areas, can be encouraged to reduce water consumption and complement existing water sources. For example, rooftop rainwater harvesting systems can be used to supplement drinking water or to supply other water needs (e.g. flushing toilets, gardening).	Policies/regulations must be in place to promote uptake. Lack of technical capacity available to inform approaches. Systems required for ongoing monitoring and long-term functionality. Limits due to storage, and contamination risks.
	Water storage enhancement	The process of capturing and storing water as a 'buffer' is important in all contexts – to compensate for increasing rainfall variability. Promoting methods that retain water and recharge groundwater aquifers (i.e. sand dams, managed aquifer recharge) can reduce vulnerability to increased rainfall variability. See GWP/UNICEF WASH Climate Resilient Development Technical Brief: Linking Risk with Response: options for climate resilient WASH for more details.	Technical risks, possibility of contamination. Risks to long-term maintenance and management of systems and functionality.
URBAN APPROACHES	Urban water source enhancement and safeguarding	Supporting utilities to plan urban water supplies, and safeguarding urban water resources. This could include support to integrated planning approaches that support a long-term vision and actions that support catchment water management, such as clearing excess vegetation to improve stream flow into water supply sources, and improving forestation on catchments. In the long-term, support to city-wide planning for supply enhancement and targeting the most marginalised (for more information, see UNICEF's Global Framework for Urban WASH; and Urban Water Scarcity Guidance Note – Preventing Day Zero.	Lack of capacity throughout system to enable strategic long-term planning and action. Lack of capital funding and long-term funding risks.
	Wastewater treatment and re-use	Treating urban effluent is vital in order to protect water resources from contamination and protect public health. Actions can include planning for financial resources to achieve the capital investment and long-term running of sewerage collection, and support to capital development of wastewater (including support to wastewater policy, where required). Once treated, wastewater can be re-used for a variety of uses from low- to high-value purposes, depending on the water quality levels after treatment.	Policies and regulations in place to support technology development and specific policies for re-use. Risks relating to contamination of the environment and public health risks.
	Disaster planning for water shortages	Support to utilities to develop disaster planning for urban water shortages which could include development of multi-phased disaster plans and a suite of policy and demand management options to introduce in the event of water shortages. More on this can be found in the accompanying UNICEF Guidance Note Urban Water Scarcity Guidance Note: Preventing Day Zero.	Lack of capacity throughout system including funding available for planning and action in the event of crises. National-level policies must support risk reduction.

WATER SCARCITY RESPONSES	EXAMPLE ACTIONS	DESCRIPTION	EXAMPLE RISK CONSIDERATIONS
DEMAND MANAGEMENT	Water efficiency and water use campaigns	Awareness-raising and behaviour change activities around water conservation, targeted at schools and at the wider public, aiming to reduce household consumption and wastage of water. In some countries, this may involve campaigns on building public trust in the quality of network-provided water, which is of a very high standard. In some of these same countries, households pay significant amounts for bottled water, yet there is enormous public resistance to any changes in the tariff structure to ensure adequate revenue for operational costs, as well as instilling a sense of value of water. In collaboration with other sectors (e.g. food and nutrition), awareness and action on water and energy efficiency processes and technologies could reap enormous benefits in terms of water consumption. Furthermore, food choices through demonstration of virtual water needed for food production can also increase awareness and deter the growing of crops with high water needs. Awareness could also be raised to reduce food wastage, as part of any action.	Requires in-depth knowledge of target audience and trust building, and the ability to understand complexity of environment to introduce changes in behaviour. Reliance on cross-sector partnerships on water and food campaigns.
	Support to developing tariff frameworks	Support initiatives to provide better pricing of water services, which balance affordability considerations, with environmental sustainability and social inclusion aspects being considered, and inclusivity objectives. Use of smart metering and technological improvements to supply systems that can inform tariff settings.	Risks related to unintended consequences of tariff setting. Lack of capacity for full cost recovery where poverty levels are high, and inequalities in vulnerable groups' access of services due to affordability. Can require a level of advanced technology, so can be affected lack of funding, and lack of capacity to operate and maintain technologies (e.g. smart meters, etc.). .
CLIMATE FINANCE	Support to identify climate finance opportunities	Support to undertake an assessment of what projects have been funded by the main climate funds to strengthen the resilience of WASH services in-country or in the region.	
	Building the investment case for sustainable WASH services	Support to develop investment cases and studies on the cost of not investing. Highlighting the economic and social benefits for resilient WASH services, to leverage more investment in climate-resilient and water-secure WASH services from the national government, the private sector and international financing institutions.	

WATER SCARCITY RESPONSES	EXAMPLE ACTIONS	DESCRIPTION	EXAMPLE RISK CONSIDERATIONS
CLIMATE FINANCE	Develop potential projects to increase the climate resilience of WASH services	Support the development of concept notes and proposals to mitigate and adapt to impacts of climate change on WASH services for a range of funding instruments.	
WATER SAFETY PLANNING	Water safety planning from catchment to service	Development of mapping and planning for water risks at the catchment level, with the objective of protecting valuable water resources. Water safety plans can proactively address risk management, providing the tools for urban and rural areas. Once threats are identified, actions can be taken through governance frameworks, including regulation as part of strengthening the enabling environment. Water Safety Plans can be a good tool to evaluate risk and protect catchment areas. [52]	Political and economic risks related to highlighting major pollution sources in catchment areas and river basins. Requires effective regulatory system to be in place to ensure mitigation is possible; requires ability/mechanisms to develop inter-sector solutions, and the willingness/capacity for good practice uptake.
	Sanitation safety planning	Sanitation safety planning, taking a similar approach to water safety planning, will become increasingly necessary to avoid negative impacts (health and environmental) associated with wastewater treatment and re-use.	Requires effective regulatory system to be in place to ensure mitigation is possible; requires ability/mechanisms to develop inter-sector solutions, and the willingness/capacity for good practice uptake.
	Nature-based solutions	Nature-based solutions (also known as 'green solutions') use or mimic natural processes to improve the management of water resources. Nature-based solutions offer great potential to protect water sources, including recycling and harvesting water, and protecting watersheds. Wetlands provide high-level water treatment, like deposition, nitrification and anaerobic digestion of organic waste, and processing of excess nutrients.	Requires effective regulatory system to be in place to ensure mitigation is possible; requires ability/mechanisms to develop inter-sector solutions, and the willingness/capacity for good practice uptake.

52. For more information please visit: WHO | Water safety planning.

4.3 FINANCING FOR WATER SCARCITY

To ensure sustainable access to safe water services now and in the future, large-scale investments are required at all levels, from the provision of climate resilient services, to water resource management and a strong enabling and regulatory environment. The resources for investments of such a scale, and the necessary timeframes, are beyond the capacity of national governments and the WASH sector alone. However, the benefits of such investments are equally enormous and long-term. Building the investment case, in social and economic contexts, is a first step, and one which can highlight the vast array of benefits for sustainable water resource management and service delivery, across multiple, interconnected sectors.

Although water management generates a mix of public and private benefits, as well as reduced water risks, many of these benefits cannot be easily monetised[53] and may appear abstract to investors and donors. Investments in water security also comprise a very wide range of activities; investing in a wastewater treatment plant is very different from financing demand management activities that influence behaviour change. At the same time, the range of potential financial sources is also diverse, each with their own mandates, investment objectives, risk appetites and liquidity needs.[54] While some projects are small and context-specific, transaction costs might be high, making innovative financing models initially more challenging to scale up.[55]

Increasingly, pooled investments and the innovative use of a range of financing instruments, with inputs from national governments, the private sector, financial institutions and development agencies, offer a number of opportunities. Co-financing of these with climate funds are also another option. To date however, the WASH sector has not been very successful in mobilising climate finance for WASH projects. This is for a number of reasons, including the low visibility of WASH as a national climate priority in key national climate strategies and plans, including the Nationally Determined Contributions (NDCs) and the National Adaptation Plans (NAPs) (or the earlier iterations as National Adaptation Plans of Action). Another factor for the relatively low amounts of climate funds invested in the WASH sector is the poor formulation of a sufficient climate rationale to directly link the impacts of climate change on WASH services to the proposed solutions, often instead listing 'business as usual' interventions. There are a vast array of WASH interventions for both mitigation and adaptation actions which can attract both climate and private sector finance and can lead to more efficient, cost-effective and reliable service delivery.

The GWP and UNICEF The GWP/UNICEF Strategic Framework for WASH Climate Resilient Development offers a methodology to systematically identify the current and future risks posed by climate change to WASH services, and the identification, implementation and monitoring of solutions to mitigate these risks. Integrating climate resilience into the analysis of risks to WASH services includes risks associated directly water scarcity, including changes in recharge, as well as water demand.

Once the risks and solutions have been identified and agreed upon by the sector, both at national and sub-national levels, the climate rationale can be established. This forms the basis of any proposal for climate financing. Mobilising the sector on the various options for climate finance, as well as the associated requirements, investments and resources required, is critical to both manage expectations and identify which financing instruments.

The WASH sector has an enormous role to play to convene the broad range of stakeholders to identify the future and projected climate change impacts and associated risks and solutions, and to ensure that these are reflected in key national climate priorities. As the NDCs are only revised every five years, the timing for the revision of these is critical. While the timeframe for the NAPs is longer, the extensive consultation process can be quite complex. Prior to 2019, there were few examples of where the WASH sector had been actively involved in the development/revision of NDCs or NAPs. However, this has changed over recent months, and is set to scale-up considerably. The inclusion of climate-resilient WASH services as a national climate priority is important for many reasons, including the allocation of domestic budgets and resources, as well as it being a key investment criteria for a number of the major climate funds.

One of the other reasons for the relatively low success rate of WASH projects for climate financing has been the inability of the WASH sector to understand and speak the language of their climate counterparts. This is particularly evident in the poor development of climate rationales, and the sector's limited grasp of the investment criteria for the major climate funds. While this is evolving, the WASH sector needs to rapidly embrace climate financing as a possible co-financing mechanism, and to accept that the sector needs to expand its partnerships, associations with different line ministries and ways of working. An important first step is to undertake a comprehensive stakeholder analysis of who is doing what in the climate sector at a national level, and to identify possible

53. OECD, 2018
54. Ibid.
55. Ibid.

synergies and relationships, including with the National Designated Authority (NDA), as well as the respective ministries responsible for climate and the environment.

Whether climate financing is an option or not, a pipeline of projects to address water scarcity should be developed, including benefit cost analyses and costs of inaction studies. Programme options, and the risks associated with them, should be evaluated in the light of available evidence. Cost considerations, both capital and longer-term operations, as well as the environmental impact and energy requirements, may effectively eliminate a range of technological solutions. For example, some high-income countries may choose desalination as a viable option, despite its high capital, operational and energy costs, as well as its potential problems with management of associated by-products (highly concentrated brines, or hypersaline water generated during treatment). More appropriate options in other contexts could be to: identify new areas of groundwater; identify and rehabilitate leaking water infrastructure; institute large-scale storm water management and groundwater recharge; implement large-scale water conservation campaigns, or the re-use of water on a large scale, to conserve groundwater for more critical uses.

Appropriate reforms and significant improvements in sector efficiency (including energy) can be made at a much lower cost than supply enhancement and can be implemented in parallel to larger, capital-intensive projects that contribute to sustainable development pathways over the long-term. Large-scale investments in WASH infrastructure need to consider the initial capital costs, as well as the funds required to ensure the proper operation and maintenance systems, and modalities, for the long-term. This also requires that revenue is generated which covers the costs to deliver and maintain the services, which are both equitable and which instil a sense of value associated with water. The role of a strong regulatory authority in this capacity is critical, supported by implementing strategies which contribute to water security.

CONCLUSION

Water scarcity affects the quantity and quality of available water resources. Reduced water quantities and compromised water quality have major implications on the life, health, development status, opportunities and futures of children, and their families, and the scale of this is enormous. The drivers of water scarcity are highly diverse and many of these drivers are outside of the WASH sector.

Household water supply is threatened in situations where water scarcity leads to competition between water uses – for example, between urban water use and agricultural water use, or between communities, regions and countries. When access to water is under threat, water scarcity can amplify tension, conflict and displacement, with the poorest and most marginalised suffering the worst consequences. Water scarcity undermines the sustainability of WASH services, and is increasingly a barrier to achieving the targets set out in the SDGs.

The number of children affected by water scarcity, and the impact on their current and future lives necessitates a paradigm shift in thinking, approaches, partnerships and financing to address water scarcity, at all levels, from service delivery to the enabling environment. Despite the many challenges posed by the scale and increasing intensity of water scarcity, there are also enormous opportunities open to the WASH sector to collaborate with new partners within WASH and across other sectors, and to implement measures which can reduce water scarcity, while ensuring progressively better services which can be sustainable, resilient, affordable, equitable and safe, for both water and sanitation.

Programmatic interventions comprising a mix of political, technical and behavioural actions will be more effective than a strategy consisting of one single intervention, such as supply enhancement. If water scarcity is not addressed strategically and aligned with other issues, including inequality and governance, and well as with other sectors, programmes will be caught in a permanent response scenario, such as drilling deeper boreholes or water tankering, which results in a continuous cycle of water supply implementation.

The first step to addressing water scarcity in WASH programming is to understand that the reasons for it are varied, and that they will differ in every context. In order to take programmatic action, the WASH sector must therefore take steps to understand the drivers, both now and in the future, as well as the extent of water scarcity, in relation to local, national and regional contexts.

This Guidance Note has explored those drivers and illustrated the principles and actions that are needed to address them, if we are to succeed in taking the action necessary to address water scarcity effectively.

The benefits of a well-functioning, sustainable WASH sector, which realises the human right to water and sanitation are clear – as are the threats to that goal from water scarcity. The WASH sector, and key water stakeholders, must do all they can to address those threats and build a water-secure future for every child and their families.

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ANNEX A

This Annex illustrates some of the many ways that the impacts of water scarcity can affect children and youth.[56]

The impacts of water scarcity on children's survival and long-term development prospects are wide-ranging. Direct impacts come from the lack of access to drinking water, and indirect impacts from other factors, such as rising levels of water-related disease due to poor water quality, and reduced access to nutritional food. Most of the direct impacts from water scarcity on children stem from increasingly frequent water cut offs, shortages and general variability of water supply, including during drought periods. The impacts of water scarcity on children are outlined below.

56. The following table is summarized from an internal MENA water scarcity report: Drying Up Their Futures: The Impact of Water Scarcity on Children in the Middle East and North Africa Region.

IMPACT	TREND	EFFECT ON YOUTH AND CHILDREN
FRAGILITY	• Water scarcity may exacerbate conflict or fragility, amplifying tensions where there are pressures on resources. There are growing incidences of urban water shortages leading to violence and unrest. • Water scarcity is a driver of localised conflict in regions where resources are scarce. In arid regions, access to land and water is critical for the livelihoods of pastoralists and agro-pastoralists and conflict occurs between these groups when water is scarce. • Conversely, compounding tensions and fragility make it harder to address water issues, and cause additional challenges in providing sustainable water services.	Water scarcity-induced conflict and fragility reduce access to education, healthcare and other essential services. Instability has a negative effect on psycho-social and physical child development, and experiences can affect lifelong health and learning abilities. Fragility can heighten water scarcity, disproportionately affecting children's access to water even further.
DISPLACEMENT AND PROTECTION	• Water scarcity could become one of the main drivers of displacement in the future, becoming more frequent due to drought or competition over scarce resources, leading to conflict.[57]	As women and children make up a large proportion of displaced populations, they will be the most vulnerable to increasing levels of displacement. Children, tasked with securing water during these periods, take on larger risks to obtain water. They take dangerous risks when they are tasked with collecting water when it is scarce, having to walk long hours in search of water, putting them at risk of exploitation, violence or death.
HEALTH-RELATED RISKS	• Heightened public health risks emerge when water scarcity combines with a lack of sanitation and hygiene. People who suffer from water shortages and variable water supply are more likely to access water from unsafe sources that are contaminated with harmful bacteria, and be subject to viruses that proliferate where there is a lack of sanitation. • In urban areas, water is needed for sewage systems to work, and where water is not available it can lead to a breakdown in sanitation. Where treatment of wastewater is low, much of the untreated sewage contaminates valuable water resources. A lack of water often affects hygiene, as households who are forced to get by on reduced quantities may reduce attention to children's hygiene (e.g. bathing, handwashing). • Over-extraction of groundwater – a common response to water scarcity – can lead to higher concentrations of harmful minerals and radioactive elements which may be prevalent in geological formations in deeply accessed groundwater .	Contaminated water resources are threats to children's health through increased incidence of diarrhoeal disease and other water-borne diseases. A lack of water affects sanitation as water is needed for sewerage systems; at the household level, reduced water quantities force a reduced attention to hygiene. Health risks in children occur as a direct consequence of the higher concentrations of fluoride found in deeply accessed groundwater, (e.g. skeletal fluorosis can cause permanent disability in children).
CHILD DEVELOPMENT, EDUCATION AND NUTRITION	•Water scarcity could become one of the main drivers of displacement in the future, becoming more frequent due to drought or competition over scarce resources, leading to conflict. • Recent research suggests that the conditions experienced in water-scarce environments impair long-term child development. Severe drought is related to stunting, and arid, low-income countries with poor governance and political instability are identified as areas where drought could have the largest effect on child stunting. Evidence demonstrates the long-term consequences of water shocks (i.e. droughts) on children, with data from rural Africa showing that women born during severe droughts bear the marks throughout their lives, growing up physically shorter, receiving less education and becoming less wealthy.[58] • When water scarcity leads to the drying up of traditional water sources, water must be collected from alternative sources at longer distances – reducing the opportunities for children to enrol, attend and participate in schools, detrimentally affecting their future prospects. When the livelihoods of families are negatively affected by water scarcity (reduced productivity and increased costs), households must make difficult choices about alternative sources of income, including taking children, particularly girls, out of school. [59] • A lack of water can lead to inadequate washing facilities and sanitation in schools, which can act as a particular barrier for girls' attendance, especially if they feel unable to manage their menstrual hygiene in an effective, safe and healthy way. • Children need adequate nutrition to survive and thrive, and water is the key to nutrition and food security. Food production will need to increase by 60 per cent by 2050[60] to meet the needs of a growing population, and agriculture requires massive water resources.	Water scarcity affects children's ability to thrive in the long term. The consequences of water shocks on children can last throughout their lives. Water scarcity leads to reduced educational opportunities for children, particularly for girls. Water scarcity is a threat to children's nutritional security, during a critical period in their lives.
LIVELIHOODS	• There is a strong link between water scarcity, and economic growth and job creation with 78% of the global workforce in jobs that are highly dependent on water. The links between water, jobs, living standards and the local economy are fragile in developing countries which are local 'hotspots' of water-related economic stress. • When money is available, families pay inflated rates for reduced quantity and quality of water from private water suppliers, increasing their vulnerability. If they cannot afford these prices, coping strategies for survival become more harmful, including selling assets, arranging migration of family members, and increasing the time and effort taken by women to meet household water needs.	Limiting opportunities for jobs and economic growth affects the future prospects of children and youth. Water scarcity and youth unemployment are root causes of migration, both inter-regionally and from rural to urban settings. Increasingly harmful coping strategies which vulnerable families enact in response to water scarcity have drastic effects, making already vulnerable populations more vulnerable.

57. A number of resources discuss these trends included this WRI blog which summarises recent evidence; and Gleick and Iceland, 2008 discuss the multiple pathways from water risk to insecurity.
In 2017 alone, water played a major role in conflict in 45 countries (OCHA, 2018).

58. Cooper et al, 2019.
59. Damania et al, 2017.
60. FAO, 2008.

ANNEX B - ADDITIONAL RESOURCES

This Guidance Note is accompanied by the Impact of Water Scarcity on Children in the Middle East and North Africa Region (internal UNICEF guidance) and the, which outlines suggested actions to address increasingly frequent and severe water shortages in urban areas and small towns.

Below are some further resources that can be used in conjunction with this document.

MENA paper

- UNICEF Global Framework for Urban Water, Sanitation and Hygiene
- UNICEF/GWP Global Water Strategic Framework on WASH Climate Resilient Development
- UNICEF Programming for Sustainability in Water Services – A Framework
- UNICEF WASH Bottleneck Assessment
- UNICEF Water Game Plan
- UNICEF Water Security For All
- Urban Water Scarcity Guidance Note – Preventing Day Zero

REFERENCES

Cooper, M.W., et al., 'Mapping the Effects of Drought on Child Stunting'. Proceeding of the National Academy of Sciences of the United States of America (PNAS), 116 (35) pp. 17219-17224, 27 August 2019.

Damania, R., et al., Unchartered Waters: The New Economics of Water Scarcity and Variability, World Bank, Washington D.C., 2017.

European Environment Agency, 'Water use in Europe: Quantity and quality face big challenges', 2019. Available at: https://www.eea.europa.eu/signals/signals-2018-content-list/articles/water-use-in-europe-2014 [Accessed November 2019]

FAO, 'Coping with water scarcity: An action framework for agriculture and food security', FAO, Rome, Italy, 2008b.

Gassert, F, et al, 'A Weighted Aggregation of Spatially Distinct Hydrological Indicators', World Resources Institute (WRI) Working Paper, 2013.

Gleick, P, and Iceland, C, 'Water, Security and Conflict'. World Resources Institute and Pacific Institute, Washington DC, US, 2018.

Godfrey, S., and Hailemichael, G., 'Life cycle costs analysis of water supply infrastructure affected by low rainfall in Ethiopia', Journal of Water, Sanitation and Hygiene for Development, vol. 7, no. 4, pp. 601–61, August 2017.

Howard, G and Bartram, J, 'Domestic Water Quantity, Service, Level and Health', World Health Organisation Report (WHO/SDE/WSH/03.02), 2003.

Hutton, G and Varughese, M, 'The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation and Hygiene', The World Bank, Water and Sanitation Program (WSP): Washington, USA, 2016.

Institution of Mechanical Engineers (IME), 'Global food: waste not, want not'. IME: London, UK. 2013.

International Committee of the Red Cross (ICRC), 'Urban services during protracted armed conflict: a call for a better approach to assisting affected people', ICRC, Geneva, Switzerland, 2015.

Intergovernmental Panel on Climate Change (IPCC), 'Report of the Working Group 1 of the IPCC: Summary for Policymakers', IPCC, 2007. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-spm-1.pdf

Howard, G and Bartram, J; 'Domestic Water Quantity, Service, Level and Health', World Health Organization, Geneva, Switzerland and WEDC, Loughborough, UK. 2003.

HLP-W, 'Transboundary Water Governance', information sheet, n.d.

HLP-W, 'Value Water' n.d. Available at: https://sustainabledevelopment.un.org/content/documents/hlpwater/07-ValueWater.pdf

Institute of Civil Engineers (ICE), WaterAid and Oxfam, 'Managing Water Locally'. ICE, London, UK. 2011.

Lefore, N., Giordano, M., Ringler, C., & Barron, J. 'Viewpoint–Sustainable and Equitable Growth in Farmer-led Irrigation in Sub-Saharan Africa: What Will it Take?' Water Alternatives, Vol 12 No 1, pp 156-168, 2019.

Leimberger, R and Wyatt, A 'Quantifying the global non-revenue water problem' Water Supply, Vol 19 No 3, pp 831-837, IWA Publishing, 2019.
Mekonnen and Hoekstra, 'Four billion people facing severe water scarcity', Sciences Advances, Vol 2, No 2, 2016.
McDonald, R et al 'Water on an urban planet: Urbanization and the reach of urban water infrastructure', Global Environmental Change (27), p 96-105, 2014.

NITI Aayog (National Intuition for Transforming India), 'Composite Water Management Index', 2018.

United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), 'World Humanitarian Data and Trends', UNOCHA: Geneva, 2018.

Organization for Economic Cooperation and Development (OECD), 'Sustainable Management of Water Resources in Agriculture', OECD: Paris, France, 2010. Available at: https://www.oecd-ilibrary.org/docserver/9789264083578-sum-enpdf?expires=1615476641&id=id&accname=guest&checksum=905DA609F0027A52E6623461A6D45B9D

Senthikumar, M et al, 'Deciphering Freshwater/Saline Water Interface in and around Northern Chennai Region, Southern India', Clean and Sustainable Groundwater in India, Springer Nature Singapore, 2018.

UNICEF, 'Reimaging WASH: Water Security For All, UNICEF, New York, US, 2021.

UNICEF, 'Urban Water Scarcity Guidance Note – Preventing Day Zero,' UNICEF, New York, US, 2021a.

UNICEF, 'Thirsting for a Future: Water and children in a changing climate', UNICEF, New York, US, 2017.

UNICEF, 'Strategy for Water, Sanitation and Hygiene 2016-2030', UNICEF, New York, US 2016.

UNICEF, 'Water Under Fire: For every child, water and sanitation in complex emergencies', UNICEF, New York, US, 2019.

UNICEF, 'Drying Up Their Futures: The Impact of Water Scarcity on Children in the Middle East and North Africa Region', Internal Report, UNICEF MENA Region, 2020a.

UNICEF NYHQ WASH Section, 'Climate Change Adaptation in the WASH Sector: A Literature Review', Internal document, 2011.

UNICEF and WHO, 'Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment', WHO: Geneva and UNICEF, 2015.

UNICEF and WHO, 'Progress on household drinking water, sanitation and hygiene 2000-2017', WHO: Geneva and UNICEF, 2019.

United Nations Convention to Combat Desertification (UNCCD), 'Desertification: The Invisible Frontline' 2nd ed., UNCCD, Bonn, Germany, 2014.

UN DESA, '2018 Revision of World Urbanization Prospects', UN DESA, New York: USA, 2018.

UN OCHA, 'El niño: Overview of impact, projected humanitarian needs and response.' UN OCHA, New York USA, 2016. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/OCHA_ElNino_Monthly_Report_2Jun2016.pdf

UN OCHA, 'World Humanitarian Data and Trends', UN OCHA: New York, US, 2018.

United Nations Water, 'Sustainable Goal 6: Synthesis Report 2018 on Water and Sanitation', United Nations Water, 2018.
United Nations Water website, 'Water Scarcity', <www.unwater.org/water-facts/scarcity>, accessed March 2019.

United Nations Water, 'Water Security and the Global Water Agenda', UN-Water Analytical Brief, 2013.

Wanders N and Rangecroft S, 'Drought and water scarcity', Oxfam views & voices [online]. Available at: https://views-voices.oxfam.org.uk/2017/05/drought-and-water-scarcity/ [accessed Sept 2019]

WaterAid UK, 'Water Security Framework', WaterAid, London, UK, 2012.

The World Bank, 'Beyond Scarcity: Water Security in the Middle East and North Africa'. MENA Development Series. World Bank, Washington, DC, 2018.

The World Bank, 'Using Performance Based Contracts to Reduce Non-Revenue Water', The World Bank: Washington, DC, 2016.

The World Economic Forum, 'The Global Risks Report 2019: 14th Edition', World Economic Forum, Geneva, 2019.

World Resources Institute Aqueduct, 'National Water Stress Rankings', Water Resources Institute, Washington, DC, USA, 2019.

WWAP (United Nations World Water Assessment Programme), 'World Water Development Report 2016: Water and Jobs', UNESCO: Paris, France, 2016.

WWAP (United Nations World Water Assessment Programme), 'World Water Development Report 2017: Wastewater: The Untapped Resource', UNESCO: Paris, France, 2017.

WWAP (United Nations World Water Assessment Programme), 'World Water Development Report 2018: Nature-Based Solutions for Water', UNESCO: Paris, France, 2018.

WWAP (United Nations World Water Assessment Programme), 'World Water Development Report 2020: Water and Climate', UNESCO: Paris, France, 2020.

UN DESA, 'The World's Cities in 2018'. UN DESA: New York, USA. 2018.

World Health Organization (WHO), 'Drinking water: key facts', 2019. Available at: https://www.who.int/news-room/fact-sheets/detail/drinking-water [Accessed Sept 2019].

World Resources Institute (WRI), AQUEDUCT 3.0: 'Updated decision-relevant global water risk indicators (Technical Note)'

Figure 3 – References from graphic

1a: UNICEF, 'Thirsting for a Future: Water and children in a changing climate', UNICEF: New York, US, 2017.
2a: UNDP, 'Beyond Scarcity: Power, poverty and the global water crisis', UNDP Human Development Report 2006. UNDP: New York, USA, 2006.
3a: OECD, 'Sustainable Management of Water Resources in Agriculture', 2010, OECD: Paris, France, 2010..
4a: WWAP (World Water Assessment Programme), 'The United Nations World Water Development Report 4: Managing Water under Uncertainty and Risk', UNESCO: Paris, France, 2012..
5a: United Nations Convention to Combat Desertification (UNCCD), 'Desertification: The Invisible Frontline' 2nd ed., UNCCD: Bonn, Germany, 2014.
6a: WWAP (United Nations World Water Assessment Programme), 'World Water Development Report 2016: Water and Jobs', UNESCO: Paris, France, 2016..

References for Map

MENA

i. World Bank, 'Beyond Scarcity: Water Security in the Middle East and North Africa'. MENA Development Series. World Bank, Washington, DC, 2018.
ii. Ibid.
iii. UNICEF MENA Regional Office, 'Drying Up Their Futures: The Impact of Water Scarcity on Children in the Middle East and North Africa Region', 2020 (internal report).

Asia-Pacific

iv. ADB, 'Asian Water Development Outlook 2016', ADB, Manila, Philippines, 2016.
v. Reliefweb, 'South-East Asia: Drought 2015-2017', Reliefweb [online], n.d. Available at: https://reliefweb.int/disaster/dr-2015-000180-vnm [Accessed Sept 2019]
xxi. Abdin, H et al, 'Land subsidence of Jakarta (Indonesia) and its relation with urban development', Natural Hazards, 59, Article 1753, 2011.
South Asia
vi World Bank, 'Drilling down into South Asia's Groundwater Dilemma', World Bank Feature Story [online], 2015a. Available at: https://www.worldbank.org/en/news/feature/2015/05/26/drilling-down-into-south-asias-groundwater-dilemma [Accessed Sept 2019]
vii. Ibid.
viii. Tunio, 'Pakistan could run dry by 2025 if government fails to act', The Express Tribune [online], 2019. Available at: https://tribune.com.pk/story/1934680/1-pakistan-may-run-dry-2025-govts-fail-act-next-5-years/ [Accessed Sept 2019]
ix. Reuters, 'More Afghans displaced by drought than conflict', Reuters [online], Available at: https://www.reuters.com/article/us-afghanistan-drought/more-afghans-displaced-by-drought-than-conflict-u-n-says-idUSKCN1LR0UZ [Accessed Sept 2019]

LACRO

x. FAO, 'Drought in the dry corridor of Central America', FAO in emergencies [online], n.d. Available at: http://www.fao.org/emergencies/crisis/dry-corridor/en/ [Accessed Sept 2019]
xi. Lakhani, N, 'People are dying: how the climate crisis has sparked an exodus to the US', The Guardian [online], 2019a. Available at: https://www.theguardian.com/global-development/2019/jul/29/guatemala-climate-crisis-migration-drought-famine [Accessed Sept 2019]
xii. Lakhani, N, 'Living without water: the crisis pushing people out of El Salvador', The Guardian [online], 2019b. Available at: https://www.theguardian.com/global-development/2019/jul/30/el-salvador-water-crisis-privatization-gangs-corruption [Accessed Sept 2019]
xiii. Lakhani, 2019a
xiv. World Bank, 'Latin America: a thirsty region with abundant water sources', World Bank Feature Story [online], 2015b. Available at: https://www.worldbank.org/en/news/feature/2015/03/20/america-latina-tener-abundantes-fuentes-de-agua-no-es-suficiente-para-calmar-su-sed [Accessed Sept 2019]
xv. Lakhani, 2019b

Sub-Saharan Africa

xvi. MacDonald, A et al, 'Quantitative maps of groundwater resources in Africa', Environmental Research Letters, Vol 7, 2012.
xvii. Mekonnen, M and Hoekstra, A, 'Four billion people facing severe water scarcity', Science Advances, Vol 2, No 2, 2016.
xviii. Ringler, C, 'What's really causing water scarcity in Africa south of the Sahara?', International Food Policy Research Institute', 2013.
xix. Ross, W, 'Lake Chad: Can the vanishing lake be saved?', BBC news [online], 2018. Available at: https://www.bbc.co.uk/news/world-africa-43500314 [Accessed Sept 2019]
xx. Obaji, P, 'Nigeria: A displacement crisis that runs deeper than Boko Haram', African Arguments [online], 2018. Available at: https://africanarguments.org/2018/08/28/nigeria-displaced-persons-crisis-deeper-boko-haram-drought/ [Accessed Sept 2019]

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