

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA



Development of Sustainable Water Supply, Sanitation and Hygiene Program in Drought Prone Areas of Ethiopia



SUB-PROGRAMME DOCUMENT

Final Version

4th May 2018

Ministry of Water, Irrigation and Electricity
Development of Sustainable Water Supply Infrastructure in Arid and
Semi-Arid Regions of Ethiopia

1. Table of Contents

| | |
|---|----|
| 1. Introduction | 6 |
| 2. Major Challenges of Water Supply System | 10 |
| 2.1. The key challenges in service quality | 10 |
| 2.2. Inequalities in Service Delivery | 11 |
| 3. Major Strategic Areas of Water Supply System | 11 |
| 4. Achieved Results within OOWNP Components | 12 |
| 4.1. Rural WaSH | 12 |
| 4.2. Urban WaSH | 12 |
| 4.3. Institutional WaSH | 13 |
| 4.4. Other Intervention Areas | 13 |
| 4.5. Impacts of the progresses made | 14 |
| 4.6. Governance, management and capacity development | 14 |
| 5. Climate Resilient WaSH in Ethiopia | 15 |
| 5.1. Arid and Semi-Arid of Ethiopia | 15 |
| 5.2. Water Resources | 17 |
| 5.3. Water Scarcity | 17 |
| 6. Conceptual Framework for Resilient Water Supply | 18 |
| 7. Sub Programme Description | 20 |
| 7.1. Development Objective | 20 |
| 7.2. Intermediate Objective | 20 |
| 7.3. Guiding Principles | 20 |
| 7.4. Programme Pillars | 20 |
| 7.5. Phasing | 20 |
| 8. Programme Organization | 21 |
| 8.1. Existing WaSH National Institutional Arrangements | 21 |
| 8.2. Needed National Institutional Arrangement | 22 |
| 9. Methodology | 26 |
| 9.1. Key Principles to Be Followed In Creating Climate Resilient Woredas and Cities | 27 |
| 9.2. Values of Resilient Woredas and Cities to Be Acquired | 27 |
| 10. Stakeholders | 28 |
| 11. Tasks | 28 |
| 11.1. Scoping | 28 |
| Task 1: RS, GIS, DTM and Data Synthesis | 28 |
| Requirements for Task 1 - GIS, RS, and MIS | 28 |
| Task 2: Ground Water Assessment | 30 |
| Requirements for Task 2 – Ground Water Assessment | 30 |
| Proposed Sources and Technologies ranging from high resilient to low resilient technologies based on Vision 2030 document by WHO for various areas of arid and semi-arid areas | 31 |
| Task 3: Surface Water Assessment | 33 |
| Task 4: Planning and Design | 34 |
| Task 5: Fundraising | 34 |
| Task 6: Capacity Development for Operation and Maintenance | 34 |

| | |
|---|----|
| Task 7: Implementation..... | 34 |
| 11.2. Financial Requirement for the Sub Programme | 35 |
| 11.3. Economic Benefits | 37 |
| 12. Conclusions and Recommendations | 38 |
| References | 41 |
| Annexes | 42 |
| | 42 |

List of Tables

| | |
|---|----|
| Table 1: Indicative list of technologies suitable for different zones of arid and semi-arid areas | 31 |
| Table 2: Estimated Financial Requirement for study, design, construction, capacity building and admin costs of CR-WASH in arid and semi-arid areas..... | 35 |

List of Figures

| | |
|--|----|
| Figure 1: The key challenges in service quality in the four subsectors | 10 |
| Figure 2: Inequalities in service delivery across the four subsectors | 11 |
| Figure 3: Big achievements made in Rural WaSH services delivery in the past twenty years | 12 |
| Figure 4: Big achievements made in Urban WaSH services delivery in the past twenty years | 12 |
| Figure 5: Agro-Ecological Zones of Ethiopia, based on Global 16 Class classification system | 15 |
| Figure 6: Per Capita Water Availability in 1990 and 2025 in Africa (Bekele Shiferaw et al., 2014) | 18 |
| Figure 7: Flow Diagram of Activities for Resilient Water Supply in Arid and Semi-Arid | 19 |
| Figure 8: National Institutional Arrangement and Functions for the sub programme implementation | 22 |
| Figure 9: Needed National Institutional Arrangement and Functions for the sub programme implementation | 23 |
| Figure 10: Total Country level Budget Requirement for the two phases in mUSD | 35 |
| Figure 11: Total Country Level Aggregate Budget Distribution in (mUSD) Per Annum | 35 |
| Figure 12: Total Budget by Region (mUSD) During the Two Phases (2018-2025) | 36 |
| Figure 13: Regional Budget Distribution during the Two Phases in mUSD | 36 |

List of Annexes

| | |
|---|----|
| Annex 1 : Hydrogeological and hydrochemical mapping of Ethiopia | 42 |
| Annex 2: Brief guideline for feasibility level study and design and construction | 43 |
| Annex 3: Background Calculation Tables and Assumptions | 47 |
| Annex 4: National Funding Requirement for SDG WASH (2018-2030)- (Based on WASH cluster Estimate) | 49 |

List of Boxes

| | |
|---|----|
| Box 1: Recommended Strategic Actions by Woredas and Cities to Attain Climate Resilient Status | 38 |
| Box 2: Possible Regulatory/Administrative Actions..... | 39 |

List of Acronyms and Abbreviations

| | |
|----------|--|
| BoFED | Bureau of Finance and Economic Development |
| Co WaSH | Community Water Supply, Sanitation and Hygiene |
| CRWaSH | Climate Resilient Water Supply, Sanitation and Hygiene |
| CSOs | Civil Service Organizations |
| CWA | Consolidated WaSH Account |
| DEM | Digital Elevation Model |
| DTM | Digital Terrain Model |
| DSWSDPAE | Development of Sustainable Water Supply in Drought Prone Areas of Ethiopia |
| EDHS | Ethiopia Demographic Health Survey |
| EFY | Ethiopian Fiscal Year |
| EIGS | Ethiopian Institute of Geological Surveys |
| ESDP | Education Sector Development Programme |
| FITFIR | First in Time First in Right |
| GC | Gregorian calendar |
| GPI | Gender Parity Index |
| GTP | Growth and Transformation Plan |
| HSCs | Health Science Colleges |
| HRD | Humanitarian Requirements Document |
| LCD | Liter per Capita per Day |
| MDG | Millennium Development Goal |
| MoE | Ministry of Education |
| MoFEC | Ministry of Finance and Economic Cooperation |
| MoH | Ministry of Health |
| MoUDH | Ministry of Urban Development and Housing |
| MoWIE | Ministry of Water, Irrigation and Electricity |
| MVS | Multi-Village Schemes |
| NWCO | National WaSH Coordination Office |
| NWSC | National WaSH Steering Committee |
| NWTT | National WaSH Technical Team |
| OWNP | One WaSH National Programme |
| PASDEP | Plan for Accelerated Sustainable Eradication of Poverty |
| RO | Reverse Osmosis |
| RS | Remote Sensing |
| SDG | Sustainable Development Goal |
| SNNPR | Southern Nations, Nationalities, and People's Region |
| RWCO | Regional WaSH Coordination Office |
| RWSC | Regional WaSH Steering Committee |
| TDS | Total Dissolved Solids |
| TVETCs | Technical Vocational Training Centers |
| UN | United Nations |
| USD | United States Dollar |
| WaSH | Water Supply, Sanitation and Hygiene |
| WoFED | Woreda Finance and Economic Development |
| WWT | Woreda WaSH Team |
| ZoFED | Zonal Finance and Economic Development |

1. Executive summary

The overall objective of water supply and sanitation policy is to enhance the well-being and productivity of the Ethiopian people through the provision of adequate, reliable and clean water supply and sanitation services and to foster tangible contribution to the economy which satisfies the demands of livestock, industry and other water users.

Around 60% of Ethiopia is characterized (see figure 1) by high climate variability, frequent drought in most part and occasional floods in areas close to rivers or flush flood, arid or semi-arid conditions, scarce vegetation coverage and a low population density. These dry lands in the regional states of Afar and Somali, and large parts of Oromiya and the Southern Nations, Nationalities, and People's Region (SNNPR), are the least developed part of Ethiopia.

Despite the progresses made, Ethiopia is encountering complex challenges of recurrent drought, dwindling ground water and surface water resources for decades putting its vision of joining middle income countries by 2025 into a risk. Scholars are expressing their concerns that Ethiopia would be water stressed by 2025 due to high population increase and limitations of efforts in making its WASH development climate resilient specifically within its arid and semi-arid areas covering more than 40% of its territory. The two critical challenges facing the sector in the drought affected areas of the country include: **Firstly** – how to incentivize the private sector to work well in these challenging lowland areas. **Secondly**, the need to call for the importance of governance of water schemes to be recognized and given equal weight to technical solutions.'

Recorded reports on drought reveals that Ethiopians were being affected with draught for more than a century since 1988. It is known by many that the intensity of these droughts have increased since 1972. Accordingly, it is documented that about 1.2 million people and millions of cattle died between 1972 and 1984 alone while the number of people affected varies from 13.2 million people in 2003 to 260,000 in 2006. Though Ethiopia's double digit economic growth has been able to absorb the risks of drought during the past decade, climate resilient sustainable WASH development has increasingly become an agenda for survival specifically in its arid and semi- arid areas.

Accordingly, the arid and semi-arid areas of Ethiopia require a multi-faceted sub program under the One WASH National Program (OWNP) to provide sustainable WASH services to the dominantly pastoral and agro-pastoral community along with livestock watering, fodder production, nutrition support and Agro-industry development. Therefore the development of water supply system in these areas will be used for multiple purposes addressing the needs of the community and institutions (schools and health care facilities). This involves ground water and surface water development and construction of multi village schemes for cluster of communities employing cutting edge technologies like tomography, remote sensing, GIS etc...for the ground water mapping purpose which will significantly increase the success rates during drylining activities. It is to be noted that such schemes that cross multiple villages in remote arid and semi-arid areas require post construction support units as proposed in the One WASH Program document and the recent panel discussion on multi village schemes. Integration and partnership

with the different stakeholders is found to be very crucial and timely for this program to be realized in the target areas.

With the understanding of the situation, the FDRE, Ministry of Water, Irrigation and Electricity has made the initiative of assigning technical teams to develop a concept note, organizing a retreat workshop in Bishoftu Town for two days from **19th – 20th May 2017** at **Pyramid Hotel and Resorts**. Furthermore the technical team composed of different professional discipline to enrich the concept note in to a proposal level. Once the proposal is drafted, therefore; MoWIE has organized a one day **High Level National Stakeholders Consultative Workshop** on **Thursday 05th October 2017** at **Intercontinental Hotel, Addis Ababa**. Government delegates, Heads of UN Agencies, Ambassadors and Development Organizations have fully attended this national workshop The very objective of the workshop was to get inputs and properly integrate and coordinate the joint effort to put lasting solutions on drought affected areas with WASH services both for domestic use as well as livestock consumption. Once comments received from this workshop addressed in the draft, the Ministry has further presented the revised program document to the high level governmental official of ministers, Regional Presidents and commissioners on **Tuesday 10th Oct 2017** at **Hilton Hotel** with the objective of endorsement to the program. Therefore, this final version of the Climate Resilient Water, Supply and Sanitation Sub-Program has been agreed by the government of Ethiopia to proceed in to the next steps of resources mobilization and stakeholders engagement.

In the different discussions and consultative workshops conducted valid points were raised including that there needs to be incentivizing the private sector to work well in these challenging lowland areas and importance of governance of water schemes to be recognized and given equal weight to technical solutions. On the other hand over \$6m a month was spent in the AWD response in Somali region. Whilst acknowledging that this would require expensive up-front investment. On top of this, the government's vision of becoming a Middle Income Country (MIC) by 2025 is ambitious, and complex climatic challenges such as drought run the risk of undermining this vision if not addressed.

Accordingly, this final version of the Climate Resilient Water Supply, Sanitation and Hygiene program was developed after addressing the constructive comments given during the different consultative workshops at various level with different stakeholders.

Hence, the program implementation will have two phases the first from 2017 – 2020 and the second phase two to cover from 2021 to 2030. With these two phases the program will require a total budget of 5 billion USD where by Development Partners will cover the 50% of the budget, Federal Government will cover 40% and the remaining 10 will be covered by regional government and user communities.

Therefore, the program will take note of the following key statements in to considerations during the implementation period as strong and agreed recommendations:

- Prioritize Climate Resilient WASH development for chronically drought-prone areas.
- Focus must be on Disaster Risk Reduction rather than Disaster Management.

- Integrate CR- WASH with water conservation, catchment management and Integrated Water Resources Management to ensure sustainability.
- Establish post-construction support units as in OOWNP – particularly for MVWS
- Capacity development using regional universities and TVETCs.
- The Sub Program must be linked with livestock, fodder production and agro-industries to ensure ability to pay for water
- Promote and strengthen credit and savings institutions for smooth transition of implementation and management of facilities to be constructed.
- Enhance economies of scale for cost-effectiveness by using MVWS for clusters of villages
- Used coordinated graduate youth groups to support management of MVWS based on the recently approved Rural Water Utility Operation and Maintenance Management Manual.
- CSOs and development partners should mobilize their own resources and align with these projects wherever possible ensuring joint reporting and monitoring.

The UN Resident Coordinator's Office, USAID and all other bilateral and multilateral development organizations have also expressed their support by reiterating the unequivocal commitment to support the government and called for stakeholders to believe in this ambitious government agenda.

As part of the commitment for implementation phase of the program currently the ministry has started to conduct the first round of ground water potential mapping for selected 37 woredas in the drought affected areas. Hence; the government of Ethiopia want to emphasize the vital importance of WASH to economic development and poverty reduction and ultimately help to achieve the ambitious SDGs and calls for all potential stakeholders to support the implementation of the ambitious plan both with financing and equally with technical expertise. Finally the government of Ethiopia will deploy a sound and robust monitoring strategy for proper and quality program delivery purpose. With this, the government has committed itself to allocate significant budget as part of its commitment to the program.

2. Introduction

Ethiopia has a population of more than 100 Million where over 80% live in rural areas and depend on agricultural sector. The overall goal of Water Resources management Policy is to enhance and promote all national efforts towards efficient, equitable and optimum utilization of available water resources of Ethiopia for significant socioeconomic development in a sustainable manner., similarly the overall objective is to enhance the well-being and productivity of the Ethiopian people through the provision of adequate, reliable and clean water supply and sanitation services and to foster tangible contribution to the economy which satisfies the demands of livestock, industry and other water users.

Development of Sustainable Water Supply in Drought Prone Areas of Ethiopia (DSWSDPAE) will be one of the major sub-programmes under the One WaSH National Programme (OWNP) and is expected to bolster the success of OWNP. Development of the water supply will not only be used for domestic consumption but also for livestock, fodder production, agro-industry and other purposes.

This sub-programme document which focuses on water supply as an entry point to sanitation and all other sectors, will also address sensitization of communities in building capacity at all level. and using sanitation and hygiene facilities such as latrines. It will also consider institutional WaSH and recommends sanitation facilities in urban areas in line with OWNP.

Major Water Supply Objectives are:-

1. Providing as much as conditions permit, sustainable and sufficient water supply services to all the peoples of Ethiopia;
2. Satisfying water supply requirements for livestock, fodder production, agro-industries and other users as much as conditions permit;
3. Carrying out operation and maintenance of all water supply and sanitation services in a sustainable and efficient manner;
4. Promoting sustainable conservation and utilization of water resources by introducing efficiency in the use of water as well as control of wastage and pollution;
5. creating sustainable capacity building in terms of the enabling environment, including institutions, human resources development, legislation and regulatory framework for water supply and sanitation; and
6. Enhancing the wellbeing and productivity of the people by creating conducive environment for the promotion of appropriate sanitation services.

As indicated, water supply for human and livestock is top priority for Ethiopia specially in the drought affected pastoralist communities where people are moving regularly with their cattle. Investment in water supply and sanitation in Ethiopia is currently guided by Second Growth and Transformation Plan (GTP-II) and Sustainable Development Goals (SDG).

Five yearly plans in the past such as PASDEP and GTP-I, , MDG and related national, regional, bilateral and multilateral programmes helped to mobilize resources and investments for programmes like urban water supply, rural water supply and sanitation, One WASH, Co-WASH and similar programmes.

Efforts made in the past helped water supply system to reach 58% in urban areas and 59% in rural areas. The target is towards achieving middle income status by 2025 with 40 to 100 liters per capita per day (LCD) in urban areas and 25 LCD at maximum distance of 1 km access of supply point in rural areas. Although open defecation is reduced in the recent years, sanitation coverage is still at average low level of 28%.

In order to reach the goal of Ethiopia's vision for 2025, to follow the GTP-II and also to be in line with the 2030 Agenda or the Sustainable Development Goals (SDGs) focused programmes and serious investment are needed that guarantee water supply for all with adequate quantity, quality and safety.

3. Major Challenges of Water Supply System

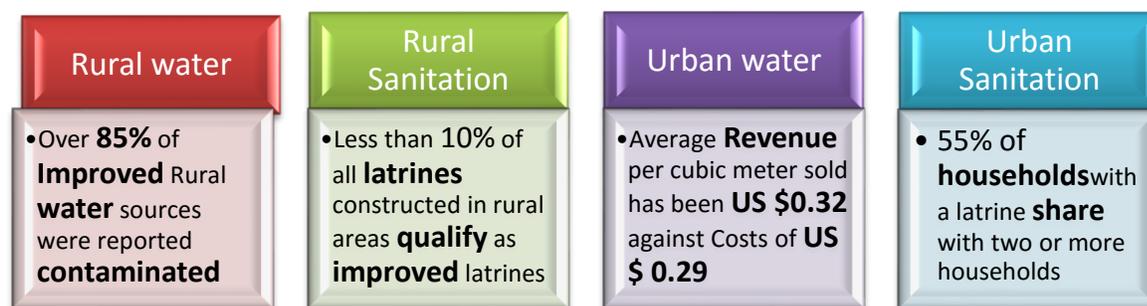
Despite progress, there remain major challenges in water supply systems that need to be urgently addressed. The most critical ones include:

- significant gap in the adequacy of water supply system for nearly 40 million people ;
- enhancement of existing and new water supply system to ensure quality, safety and reliability;
- adequate operation and maintenance capacity to reduce dysfunctional systems. An average non-functionality rate of 11% was reported by MoWIE (2016).
- matching the new infrastructure investment that significantly exceeds the rapidly growing population;
- occurrence of frequent drought exacerbated by climate change and the need for provision of water supply infrastructure that is resilient with adequate distribution network and supply points;
- poor quality construction and design by contractors and consultants due to limitations in capacity; and
- limitations in efficient contract administration, inspection and supervision which leads to installation of inappropriate pumps, poor quality pipes, etc. resulting in high breakage and water leakage.
- Capacity limitations specially in the regions to properly and sustainably administer the complex water supply facilities duet to lack of skilled manpower.

2.1. The key challenges in service quality

Though more and more facilities are being constructed, there are significant challenges in service quality as shown in figure below. The very key challenges include but not limited to onstruction quality, operation and maintenance specially in areas where complex system of facilities are built in.

Figure 1: The key challenges in service quality in the four subsectors

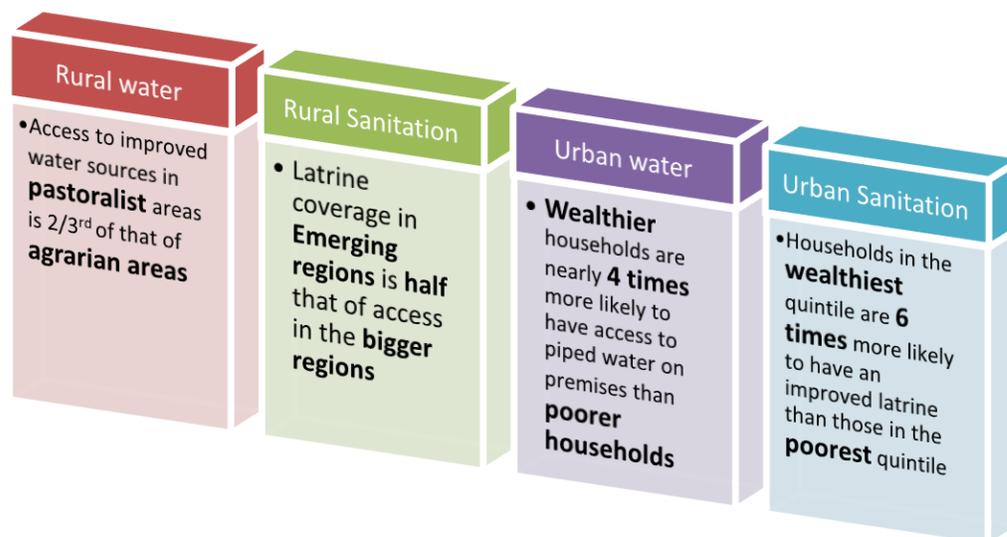


Source: WB (2017), WASH (Poverty Diagnostic Report)

2.2. Inequalities in Service Delivery

Despite a lot of improvement during the past decade, there are still significant inequalities to be strategically addressed as shown in figure below. One of the key issue to be understood in the pastoralist areas where this program is mainly targeting is the type of technology to be deployed will be capital intensive due to the geological and hydrogeological nature of the areas.

Figure 2: Inequalities in service delivery across the four subsectors



Source: WB (2017), WASH (Poverty Diagnostic Report)

4. Major Strategic Areas of Water Supply System

1. Urban water supply and sanitation
2. Rural water supply and sanitation
3. Institutional water supply and sanitation supplied at rural and urban institutions such as schools, health facilities, farmer training centers, religious centers and other community facilities
4. Reliable water supply in drought-prone, arid and semi-arid areas considered as resilient WaSH
5. Governance, management and capacity development for water supply and sanitation. Under this strategic area, the focus will be building the capacity of the regions and the private sector through

rolling out the rural water utility operation and management model for the purpose of proper accountability and responsibility purpose.

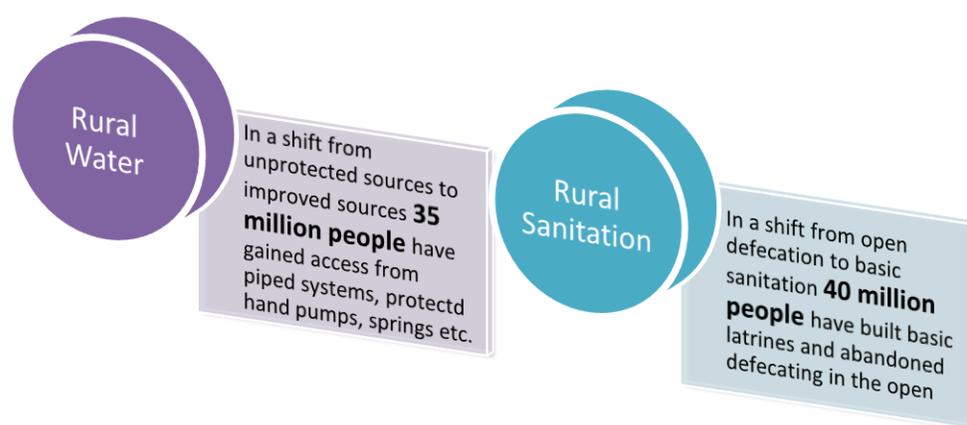
The above strategic areas have been tackled in the past with the exception of the fourth one which is pivotal to this concept note. It will be motivating to note that resilient WaSH in arid and semi-arid areas, if addressed rigorously, can help the country to address issues of inequality in service delivery, enhance operation and management, and its poverty alleviation outcomes.

5. Achieved Results within OOWNP Components

5.1. Rural WaSH

In 2008 EFY: i) 47.3 million or 63% rural population have got access to improved water supplies; ii) average non-functionality has been reduced to 11%; iii) 61% have some form of latrine facility. The big achievements made in Rural WaSH service delivery over the past 20 years could be depicted as in the figure below.

Figure 3: Big achievements made in Rural WaSH services delivery in the past twenty years



Source: WB (2017), WASH (Poverty Diagnostic Report)

5.2. Urban WaSH

In 2008 EFY: i) 52.5% of urban population have supplies meeting new GTPII standards; ii) 93% have some form of latrine facility. The big achievements made in Urban WaSH service delivery over the past 20 years could be depicted as in the figure below.

Figure 4: Big achievements made in Urban WaSH services delivery in the past twenty years



Source: WB (2017), WASH (Poverty Diagnostic Report)

5.3. Institutional WaSH

In 2008 EFY: i) 11% of primary schools have appropriate water facilities and 4% have all WaSH facilities; ii) 24% of primary schools have appropriate water facilities and 10% have all WaSH facilities.

5.4. Other Intervention Areas

One of intervention areas was emergency response. Accordingly, the government of Ethiopia and the WaSH Cluster developed the WaSH humanitarian or emergency needs and endorsed it through the Humanitarian Requirements Document (HRD). The predictions for the WaSH cluster HRD in 2016 were for 5.4 million beneficiaries. With the worsening of the El Niño induced drought in April 2016, the figures were revised for 9.6 million people. This target was reached and even exceeded by the cluster with a total of more than 10 million people gaining life-saving WaSH services and 83% of them in “drought affected” areas. There was also a short flood response in July-August 2016 in which more than 600,000 people received WaSH cluster supported services. The support provided for the emergency response amounted more than \$US120 million. This indicates that there is a strong need to link emergency response with regular development activities as fragmented response will not provide sustained solution in arid and semi-arid areas of Ethiopia. Furthermore, purely rainfall dependent solutions in drought prone areas for basic human and livestock needs are not the right solutions as they are frequently vulnerable to drought.

WASH has a multiplier effect on achieving all development goals. He identified three key intervention areas:

1. Improving WASH Service Delivery
2. Improving institutions and accountability – and providing capacity support to decentralized levels of local government
3. Bringing together and involving all relevant stakeholders in WASH and related sectors

These three intervention strategies will take note of and lessons gained in the implementation of the Multi Village Schemes (MVS) across the country by different stakeholders as they are among the list of limited alternatives of technology choices. Accordingly it is strongly recommended to look for new ways of working with the very objective of value for money before investment.

5.5. Impacts of the progresses made

- According to Ethiopian Demographic Health Survey (EDHS 2016), in 2008 EFY (2016 G.C), Under 5 child mortality has dropped to 67 deaths per 1000 live births compared to 88 in 2011, 123 in 2005 and 166 in 2000
- According to EDHS 2016, the percentage of children under 5 who experienced diarrhea I two weeks preceding the survey dropped to 12% from the 13% in 2011
- According to EDHS 2016, at a country level 45% of households spent 30 minutes or longer to obtain their drinking water in 2016. One can see a huge improvement as compared to the 2011 figure of 53%
- By 2008 EFY(2016 G.C), the Gender Parity Index (GPI) stands at 0.91% which is a little below the ESDP V target of 94% for the year
- The Grade 1-8 dropout rate for girls was 10.8% compared to the target of 10% in 2008 EFY (2016 G.C)

5.6. Governance, management and capacity development

The programme would be coordinated by the Ministry of Water, Irrigation and Electricity will be linked with OWP in order to bring relevant sector ministries and development partners on board. The sector ministries will include non-traditional WaSH ministries such as MoANR, MoLF, MoFP. It will also have a strong link with emergency response programmes for jointly shifting towards development of sustainable climate resilient water supply systems.

The routine administration of the programme would be undertaken by the a delivery team to be assigned by the ministry under the coordination of the directorate in collaboration with relevant other directorates who will also be involved in working out its details prior to its launch. Capacity development would be tackled vigorously at all levels in such a way that the sector could develop sustainable water supply systems in drought-prone areas of the country.

6. Climate Resilient WaSH in Ethiopia

6.1. Arid and Semi-Arid of Ethiopia

Around 60% of Ethiopia is characterized (see figure 1) by high climate variability, frequent drought in most part and occasional floods in areas close to rivers or flush flood, arid or semi-arid conditions, scarce vegetation coverage and a low population density. These dry lands in the regional states of Afar and Somali, and large parts of Oromiya and the Southern Nations, Nationalities, and People's Region (SNNPR), are the least developed part of Ethiopia.

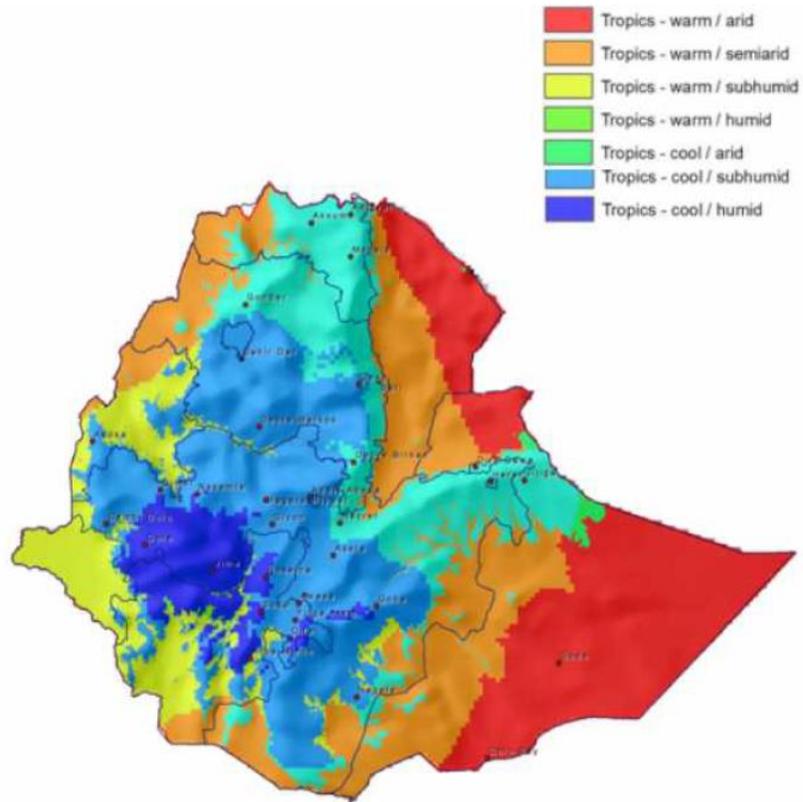


Figure 5: Agro-Ecological Zones of Ethiopia, based on Global 16 Class classification system

These are the areas which are water insecure and which require climate resilient intervention. A considerable part of the population in these areas follow a semi-nomadic pastoral system. Recurrent droughts, unreliable rainy seasons, degraded soils and intense erosion make the livelihoods of the local population highly vulnerable. The originally well adapted and drought resilient livelihood system is under increasing pressure due to population growth, climate change impacts, disease outbreaks, market failures, etc. Climate change effects are significant in the arid and semi-arid regions of Ethiopia and have worsened the living conditions of the pastoralists. The recurrent rainy seasons became less reliable and droughts are more frequent, so that rangelands receive only sporadic rainfall with decreased quality. Consequently, formally good rangelands are overutilized and deteriorated leading to undernourished livestock and decreasing herds.



The arid zones of the country are characterized by mean annual rainfall of between 100 - 800 mm, mean annual temperature of 21-27.50C and mean annual potential evapotranspiration of between 1700 - 2600 mm. The zone encompasses about 40 percent of the Somali and some 30 percent of the Afar regions and a little bit of the north-eastern part of Wollo and some 5 percent of the Oromia Region towards the southern tip which borders with the Somali Region.

The semi-arid zones of the country experience mean annual rainfall of between 300 – 800 mm, a mean annual evapotranspiration of 1600 - 2100 mm and a mean annual temperature of between 16-27⁰C. Almost 90 percent of the Tigray Region, some 20 percent of the southern, eastern and north-eastern part of Oromiya, more than 60 percent of Benishangul, some parts of the Southern Nations and Nationalities and People's Regional State as well as the extreme north-eastern part of the Somalia Region (including Jijiga) fall under this zone. Even if all fall under the same umbrella of semi-arid zone, there are distinct differences in characteristics within the semi-arid zone, between the semi-arid plains, the semi-arid lakes and the Rift Valley and the semi-arid mountains and plateaus.

The dry sub-humid zones of the country are characterized by a mean annual temperature of between 16-28⁰C and a mean annual rainfall ranging between 700 - 1000 mm. The regions falling under this zone are mainly the Oromia, Amhara, Benishangul, Gambella and some parts of the Southern Nations, nationalities and Peoples Regional State. The area coverage, as compared to the total land surface of each region, Oromia, Amhara, Benishangul and Gambella and Southern Nations, Nationalities and Peoples Regional State, is roughly estimated to be 10%, 10%, 10%, 15% and 5%, respectively. Areas of the Oromia Region falling in this zone include some parts of Bale, Arsi and Wollega.

Almost all arid areas are pastoralists, and most of the semi-arid areas are semi-pastoralist practicing mixed farming. The critical challenges in the arid and most of the semi-arid areas are unreliable and insufficient water supply sources; inadequate coverage in most areas; loss of livestock and livelihood due to lack of sufficient water during drought years; insufficient water quality and prevalence of water borne diseases including the AWD; and inadequate capacity and water institutions for operation, maintenance and further development of water sources.

A number of groundwater assessment projects supported by test wells drilling were undertaken in Afar and Somali regions by Ethiopian Water Works Design and Supervision Enterprise (WWDSE). In Teru, Southern Teru and Chifra areas there are more than 20 test wells are drilled. In the study conducted at Fafem and Jerer and Eastern adjacent Somali region supported with more than 10 test wells drilling has clearly shown the general groundwater setup of this specific area and could be extrapolated for large part of Somali region. Right now the sector has around 400 test and productive wells constructed previously including the the drought prone areas which could be steeped in to the next phase of the implementation activities.

Therefore, the current proposed drought resilience project will consider the above fundamental facts and any other previous pertinent information including the different studies of JICA and other development organization for preparing a master plan of drought resilience strategy from water resources point of view (both surface and groundwater).

6.2. Water Resources

The arid and semi-arid lowlands have varied water resources regimes and these are: (a) where there is widespread surface water and/or ground water with moderate to large quantities (e.g the Rift Valley Lakes); (b) where localized and moderately large quantities of groundwater, especially along valleys are found; and (c) Where limited quantity of ground water with fair to poor chemical quality is available. In addition, major rivers such as Awash, Wabi-Shebelle and Genale Dawa are passing through these regions which could be considered in this program for multiple purposes taking in to account of sustainability and the water resources management concern.

According to the study made by the Ethiopian Institute of Geological Surveys (EIGS), the country is classified into five main water resource regions and three regions are found in the lowlands (dry land areas) as follows:

Lowland 1: These areas cover a widespread surface water and/or ground water with moderate to large quantities. There are seven major lakes located in these areas, namely, Ziway, Langano, Abijata, Shalla, Awassa, Abaya and Chamo. Currently, these lakes are used for commercial fisheries, irrigation, recreation and industrial purposes. Most streams in these areas are perennial and the depth of ground water is 0-150 m.

Lowland 2: These areas cover most of the drier lowlands situated in the southern parts of Oromia (Moyale area), most of the eastern part of Afar and some areas in the north-eastern part of Tigray. They are characterized by localized and moderately large quantities of ground water, especially along the valleys; most of the streams in these areas are intermittent, and some are perennial. The ground water has a fair-to-poor chemical quality with TDS ranging between 1000 and 3000 ppm. Most streams are intermittent, with a few perennials; the depth of the ground water is 0 to 270 m.

Lowland 3: These areas are mainly situated in the south-eastern part of the country (predominantly the Ogaden area). They are characterized by localized and limited quantity of ground water with a fair-to-poor chemical quality. The TDS range from 1000 to 3000 ppm. All the streams are intermittent. The depth of the ground water is larger.

6.3. Water Scarcity

According to relevant sources (Bekele Shiferaw et al., 2014), Ethiopia will fall under water stress situation by 2025 unless mitigation measures for climate change and water source degradation are quickly taken at a scale as depicted in figure 2 below. One can clearly see how the Ethiopian situation is deteriorating since 1990 due to climate change and population increase from the graph.

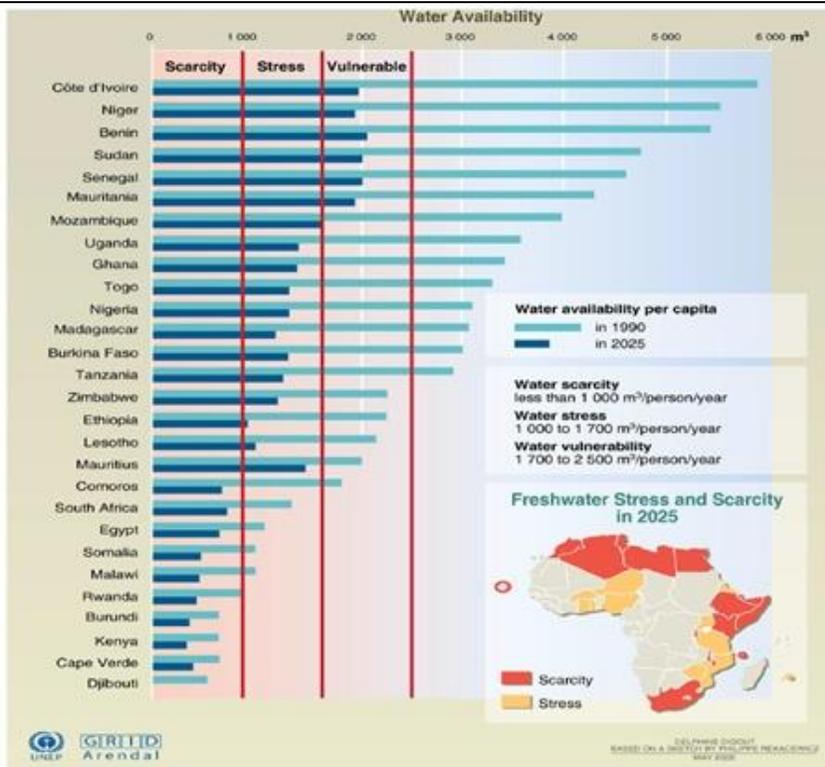


Figure 6: Per Capita Water Availability in 1990 and 2025 in Africa (Bekele Shiferaw et al., 2014)

7. Conceptual Framework for Resilient Water Supply

The water supply system is to be completely overhauled, leaving no one behind, with a new approach that allows comprehensive investment that creates resilient infrastructure, adequate and reliable access, water security, disaster reduction and secure investment efficiency that contributes to Ethiopia’s growth and transformation. The major conceptual bases include:

- i) Reliable water as sources of water. This is mainly to explore sources of deep ground water that is reliable and does not dry or become vulnerable in case of drought. Where appropriate consider the option of treated surface water
- ii) All options like the use of water from moisture, ground, surface water, saline water for different regions and areas would be explored and utilized gradually as capacity is built.
- iii) New and modern technologies for reuse of water, for de-fluoridation, desalination and treatment would be introduced along with committed capacity-building efforts. Similar action will be taken in the area of drilling.
- iv) Reduce water loss and abuse of water through latest water saving methods accompanied with awareness creation at all levels.
- v) Provide adequate water access not only for human, but also drinking water for livestock, nutrition, schools and health facilities, agro - industries
- vi) Frame the intervention as programme of development on resilient WaSH
- vii) Base the analytical work, planning, design and monitoring on modern technologies such as remote sensing, geographic information system and automated monitoring and management system

viii) Build relevant capacity and water utilities at different regions. The steps of interventions involve the following flow of activities as shown in the figure below:

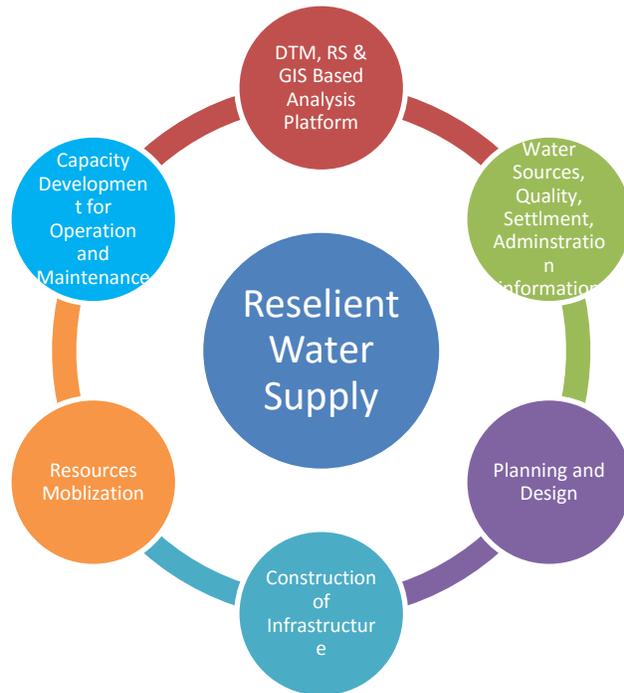
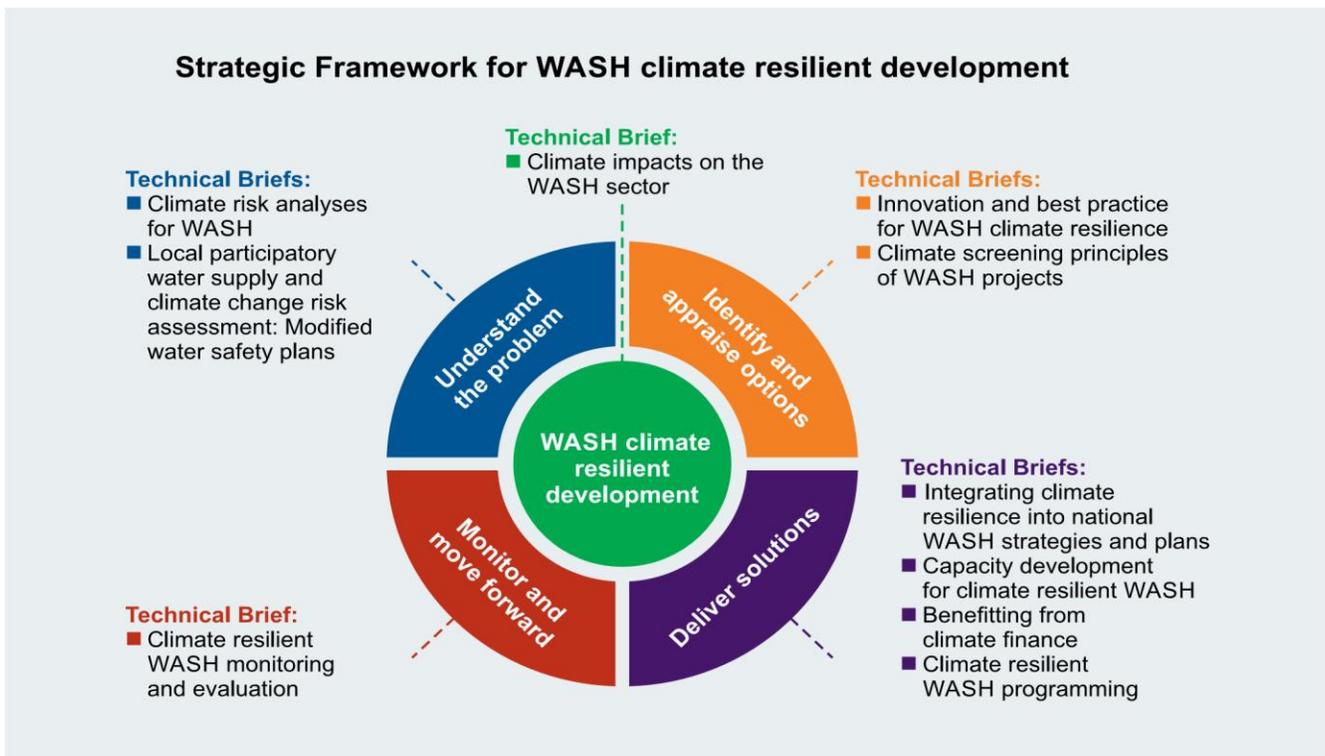


Figure 7: Flow Diagram of Activities for Resilient Water Supply in Arid and Semi-Arid



Source: WASH Climate Resilient Development Technical Brief, 2014 GWP and UNICEF Bangladesh

Sub Programme Description

7.1. Development Objective

The sub-programme's development objective is to contribute to improving the health and well-being of rural and urban people in arid and semi-arid zones by increasing water supply and sanitation access and adopting good hygiene practices in an equitable and sustainable manner under the umbrella of One WaSH National Programme (OWNP). Above all, water development will be at the center of all other development agendas of the country for Ethiopia as a country to achieve both the GTP – 2 and SDG targets.

7.2. Intermediate Objective

The intermediate objective of the Programme is to achieve increased coverage of water supply and sanitation in rural and urban areas in Ethiopia particularly in the drought prone areas in line with the GTP 2 and SDGs by giving emphasis on arid and semiarid areas as part of the One WaSH National Programme (OWNP).

7.3. Guiding Principles

The guiding principles set in the OOWNP are:

- Integration with stakeholders;
- Alignment of partners;
- Harmonization of partners; and
- Partnership between implementing parties with a focus on arid and semi-arid areas.

7.4. Programme Pillars

The sub-programme's tasks rest on three overarching domains or pillars recommended for OOWNP:

1. Creating an enabling environment and good governance;
2. Maximizing availability and efficient use of human and financial resources to create demand for better WASH services; and
3. Capacity development for improved delivery of WASH services at all levels.

The sub-Programme will seek to improve aid effectiveness and promote institutional reforms, with particular emphasis on capacity development at woreda, kebele and community levels. WASH training will be increasingly professionalized and institutionalized through support to training institutions at all levels.

7.5. Phasing

The programme duration will be eight years, implemented in two phases; Phase I from April 2018 to June 2020 and Phase II from July 2020 to June 2025. There can be changes in important GoE policies, strategies and plans as GTP-1, UAP and MDGs have ended in 2015 and an effort in meeting GTP-2 and SDG targets is ongoing. Phasing will allow for these changes to be accommodated in the second phase of the programme. Before the end of Phase I, during the JTR in early 2020, a comprehensive review of the programme's progress and achievements will take place and any adjustments/revisions

required for Phase II will be identified and implemented. Until then the pilot implementation of the program in some selected regions and intervention areas will continue.

8. Programme Organization

8.1. Existing WaSH National Institutional Arrangements

The highest governing body of the sub Program will be the National WASH Steering Committee (NWSC) whose members include Ministers and State Ministers from the ministries of Water and Energy, Health, Education, Finance & Economic Development. Other ministries like M,MoLPD, MoFAPD, and MoUDH are expected to join the steering committee soon. The NWSC is chaired by the Minister of Water, Irrigation and Electricity.

The technical arm of the NWSC is the National WASH Technical Team (NWTT) consisting of directors from the four WASH ministries. A similar structure is prescribed at regional level. The lowest level of WASH governance is the Woreda. At this level WASH activities are implemented by the District WASH Team led by the District Administrator. Its members are from the four WASH sector offices (Water, Health, Education and Finance with additional members from the Women Affairs and Agriculture offices). Development partners are presently represented by the Development Assistance Group – Water Technical Working Group.

National WASH Coordination Office (NWCO) will be responsible for coordinating, planning and oversight of the programme implementation at federal level. The NWCO will report to a National Steering Committee chaired by the Minister of Water, Irrigation and Electricity and supported by a National WASH Technical Team consisting of representatives from participating ministries and partners. Implementation of the sub-programme in the sector ministries will be the responsibility of WASH Programme Management Units (PMUs) in the existing WaSH line ministries

At regional, zonal and city levels, planning and implementation of the programme will be coordinated by a WASH Coordination Office which will report to a Regional WASH Steering Committee and be supported by a Technical Team. Implementation will be managed by WASH PMUs in the bureaus of water resources, health, education and finance and economic development.

At woreda level, the planning and implementation of the sub-programme will be coordinated by a dedicated WASH Team consisting of members from the water, health, education and finance desks. The Woreda WASH team will report to a Woreda WASH Steering Committee appointed by the Woreda Cabinet.

At kebele level WASH plans will be approved by the Kebele Chairman and Council, and health extension workers will be deployed to support communities in construction of latrines and to promote safe hygiene practices.

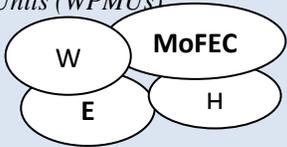
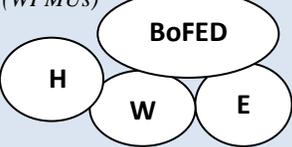
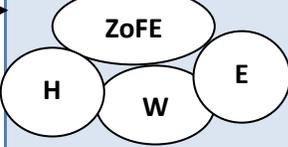
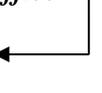
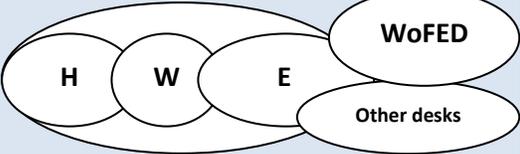
At community level, WASH committees (WASHCOs) consisting of elected community members will be formed to undertake planning, operation and maintenance and in some cases, construction of improved water supply and sanitation facilities.

The sub-programme will be implemented as a joint effort between Government, development partners, NGOs, training institutions, the private sector, community members and other stakeholders. In addition to the Government, a number of development partners are expected to maximize their support to OWNPs's Consolidated WASH Account at federal level. Other partners, including bilateral and multilateral aid organizations and NGOs, are also expected to support the sub-programme through

other funding arrangements, as well as through provision of technical assistance, supplies and other means until they join the consolidated WaSH account.

The diagram below shows the existing institutional arrangements and functions for implementing the One WaSH National programme:

Figure 8: Existing National Institutional Arrangement and Functions for OWNP.

| <i>Level</i> | <i>Governance & Guidance</i> | <i>Oversight & Management</i> | <i>Programme Implementation</i> | <i>Programme Coordination</i> |
|--|---|-------------------------------------|---|---|
| <i>Federal</i> | <i>National WaSH Steering Committee</i> | <i>National WaSH Technical Team</i> | <i>Federal Sectors' WaSH Programme Management Units (WPMUs)</i>  | <i>National WaSH Coordination Office</i>  |
| <i>Regional</i> | <i>Regional WaSH Steering Committee</i> | <i>Regional WaSH Technical Team</i> | <i>Regional Sectors' WaSH Programme Management Units (WPMUs)</i>  | <i>Regional WaSH Coordination Office</i>  |
| <i>Special Zones (or other zones where applicable)</i> | <i>Zonal WaSH Management Team</i> | | <i>Zonal WaSH Programme Management Units –(Water, Health, Education, and ZoFED)</i>  | <i>Zonal WaSH Coordination Office</i>  |
| <i>Woreda</i> | <i>Woreda WaSH Steering Committee (Woreda Cabinet)</i> | | <i>Woreda WaSH Team</i>  | |
| <i>Town/City</i> | <i>Town/City WaSH Steering Committee (Town Cabinet)</i> | | <i>Town/City WaSH Technical Team Municipality</i> <i>Health Desk/Education Desk</i> <i>Town Water Board</i> <i>Town Water Utility</i> | |

Source: WASH Implementation Framework, Government of Ethiopia, 2012.

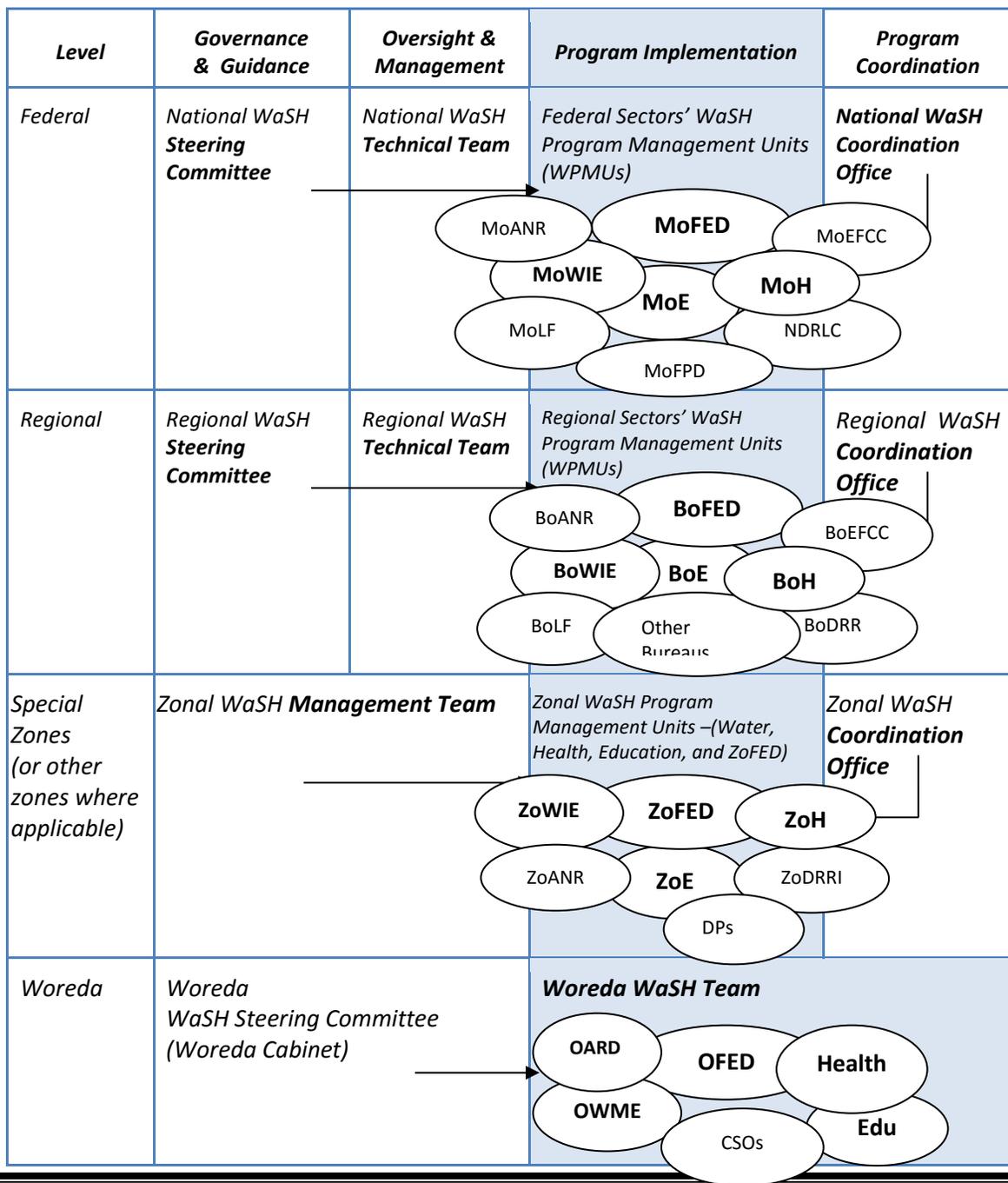
8.2. Needed National Institutional Arrangement

For CR-WaSH broader national implementing stakeholders need to work together that includes new and relevant ministries like Ministry of Agriculture and Natural Resources; Ministry of Livestock and

Fishery; Ministry of Environment, Forest and Climate Change; Ministry of Federal and Pastoralist Development Affairs; and National Disaster Risk Leadership Commission, Key Development Partners and others as needed. The new institutional arrangement that requires broader engagement of stakeholders is indicated in the following figure:

For the purpose of proper accountability and quality program implementation a delivery team assigned by the national WaSH steering committee with clear role and responsibility but under the coordination of the National WaSH Coordination Office. Other ministries as mentioned in the table below will also be member of the steering committee and other structures down the line. Going forward the program will look in to improving institutional arrangement based on evidence for better performance.

Figure 9: Needed National Institutional Arrangement and Functions for the CR – WaSH sub programme.

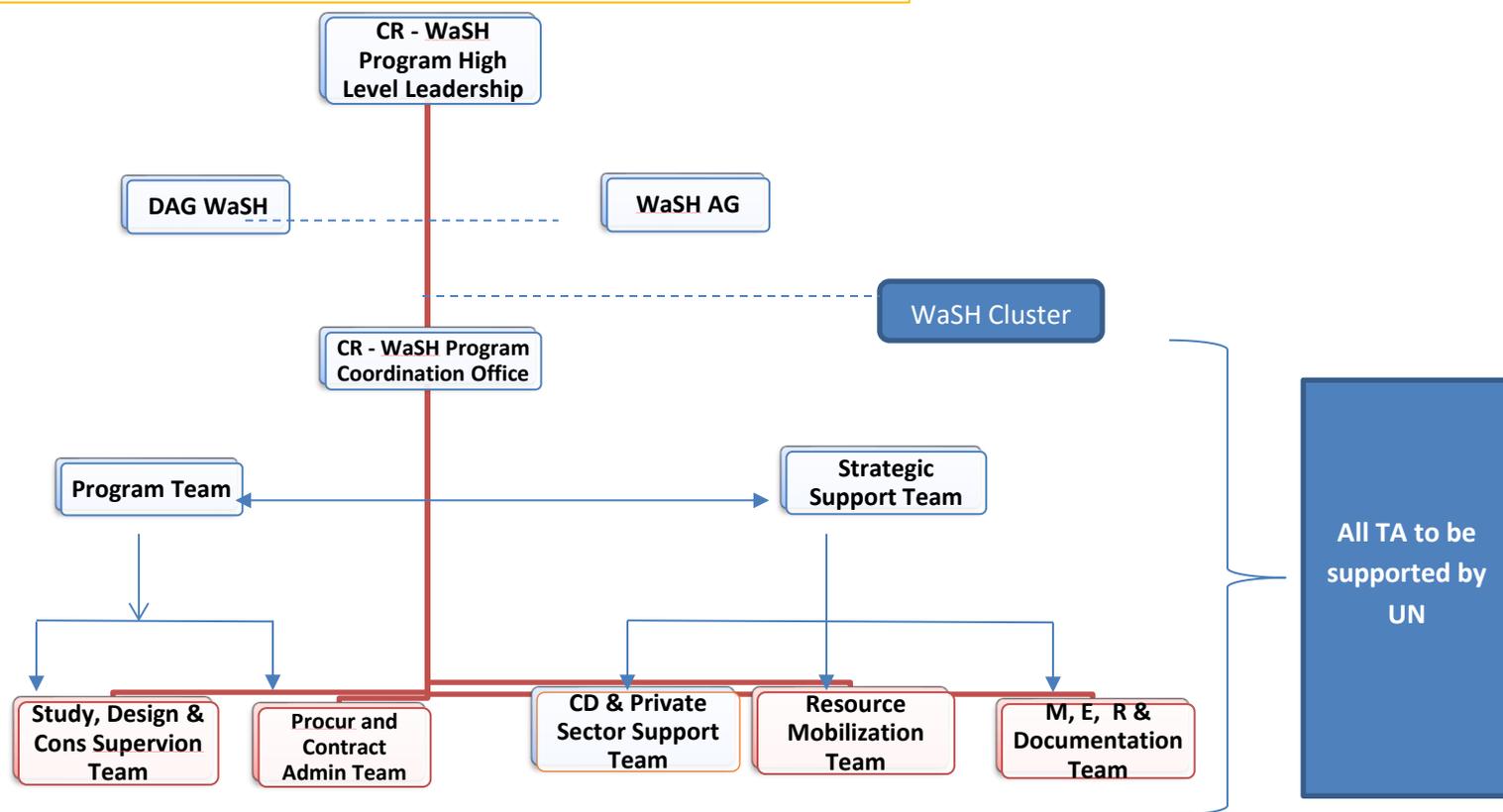


| | | |
|------------------|---|--|
| <i>Town/City</i> | <i>Town/City WaSH Steering Committee (Town Cabinet)</i> | <i>Town/City WaSH Technical Team Municipality Health Desk/Education Desk Town Water Board Town Water Utility</i> |
|------------------|---|--|

The new institutional arrangement requires mobilization and coordination of institutions at various levels. Furthermore the below details explain the institutional arrangement of the program. The

existing regional WaSH structure will work as it is but as needed some required technical assistants (TA) could be assigned by DPs as needed.

CR - WaSH Sub Program National Structure





CR – WaSH Program Coordination Office

9. Methodology

Although the activities could be independently and sequentially designed, due to the urgency of the needed interventions, the identified work areas will be implemented in parallel. Where possible, they will be done as Engineering, Procurement and Construction model through mobilization of various institutions and organizations.

Since the region is vast, a GIS and RS at high resolution will be developed and used. Digital satellite data will be procured and used as a basis of analysis. High resolution Digital Terrain Model (DTM), administrative data, climate data, population data, existing water sources and quality data, and water supply infrastructure data will be developed. To this effect, the following methodologies are considered:

- Tomography, GIS software will be obtained, RS and DTM will be developed using current cutting-edge data and software system;
- Development partners will be approached to support access to such information;
- Integrated climatic and hydrologic assessments will be undertaken based on hydrometeorological data of the arid and semi-arid areas;
- A desk review of surface water potentials will be undertaken based on the various master plans studies like Genale Dawa, Awash, etc.;
- Population and administrative data will be obtained from existing repository of maps and population census and projection information;
- Data on existing water supply sources, quality and infrastructure will be obtained from existing sources, and will also be supplemented with new inventory.

Resources assessment and needs identification should have continuity in order to respond to the growing demand in a sustainable manner. To that end, a continuous development programme, monitoring of surface and groundwater resources, collecting and interpreting climate change

information and hydro-metrological data, along comprehensive and integrated approach of water resource management policy and strategy shall be put in place to tackle with the emergency challenges the country is encountering.

9.1. Key Principles to Be Followed In Creating Climate Resilient Woredas and Cities

The following key principles will be followed during the sub-programme assessment and implementation:

- Building and maintaining a water supply system resilient to climate shocks which requires “**Multi-Barrier**” **Methods** to strengthen all infrastructure components;
- **Redundancy**¹ in water supply should be a policy priority with the flexibility to shift between surface and groundwater options wherever possible and applicable.
- Wherever integrated systems like MVS may not be feasible due to rugged terrain **relevant feasible decentralized water supply options** would be sought based on detailed study and design. .;
- **Water conservation and green infrastructure options for storm water management** are proven approaches for reducing climate risks.

9.2. Values of Resilient Woredas and Cities to Be Acquired

The following Values shall be acquired by Resilient Woredas and Cities:

- **Reflective:** people and institutions reflect and learn from past experiences and leverage this lesson to influence future decision-making.
- **Robustness:** urban and rural physical assets are designed, constructed and maintained in anticipation of high-impact climate events.
- **Redundancy:** spare capacity is built into the system to account for disruptions and surges in demand which also involves multiple ways of fulfilling a need or function.
- **Flexible: Refers** to the willingness and ability to adopt alternative strategies in response to changing circumstances or sudden crises. This can be achieved through new knowledge and technologies.
- **RESOURCEFULNESS:** citizens and institutions are aware of climate risks and are able to adapt to shocks and stresses as well as quickly respond to a changing environment.
- **Inclusive:** inclusive processes emphasize the need for broad consultation and many views to create a sense of shared ownership or a joint vision to build cities and woredas' resilience.
- **Integrated:** integrated processes bring together and align city and woreda systems to promote consistency in decision making and investments. Exchange of information between components of the system enables them to function collectively and respond rapidly.

¹ Redundancy means building spare capacity into the Climate Resilient WaSH system to account for disruptions and surges in demand

10. Stakeholders

The stakeholders for the programme are Ethiopian Federal and Regional Governments; ministries with One WaSH National Programme (OWNP) (i.e. MoWIE, MoH, MoE, MoFEC), other Non-WaSH ministries stated in the above structure, CWA donors, UN organizations involved in drought emergency, bilaterals and multi laterals, TVETCs, HSCs, research and higher education institutes, the media, CSOs and the public at large. In addition, the ecological Survey of Ethiopia which is working on hydrogeological and hadrochemical mapping projects (See Annex 1) and aiming at mapping and assessing groundwater sources for water supply and irrigation could also be considered as a strong counterpart in the initiative. Together, these development partners will fulfill the programme objectives

11. Tasks

11.1. Scoping

Task 1: RS, GIS, DTM and Data Synthesis

The scope of the work includes establishing an integrated system that collects relevant primary and secondary data followed by data synthesis, identifying and mapping of ground and surface water potential using Tomography, RS, DTM and GIS. Information about past climate, recent trends, current conditions, and future trajectories would be a critical component of ensuring water availability, and thus the analysis need to adequately cover these areas.

Requirement details for the task are depicted below.

Requirements for Task 1 - GIS, RS, and MIS

The scope of work of Tomography, GIS, RS and MIS includes establishing an integrated system that collects relevant primary and secondary data from various applications and portraying service level access indicators and decision support information in an appropriate format to policy makers. The details are presented below in the sub tasks.

Sub-task 1.1 GIS and RS

Under this category the following activities are envisaged:

1. Reviewing and identifying pertinent information from previous master plan studies: Genala-Dawa, Wabishebele, and Awash River Basin, that can be used in the assessment of drought prone areas. There might be a need to update some of these datasets.
2. Identifying and collecting useful information from sectoral organizations such as CSA, NMA, GSE, MoANR, MFL, MoEF, INSA and the Regions.
3. Identifying and collecting useful information from NGO's and CSO's operating in the drought-affected regions.

4. Identifying and collecting third party data (satellite images, aerial photographs, etc.) from the internationally available data/information sources.
5. Strategizing macro- and micro-level planning for a cost effective and purposeful use of high resolution satellite data.
6. Assessing and analyzing high resolution satellite information that is good enough to formulate implementation plan at village, community and household levels.
7. Ensuring water availability by gathering information on past climate, recent trends, current conditions, and likely future trajectories
8. Maps to be produced will include (but not limited to):
 - Base maps at a detailed scale,
 - Thematic maps from high resolution satellite images,
 - Digital Terrain Model (DTM),
 - Climate Information (rainfall, temperature, humidity, wind speed, sunshine hours, evaporation, evapotranspiration etc.) with a verification with ground/recorded data,
 - Groundwater and surface water potential areas,
 - Geological, hydrogeological, flow direction and groundwater storage map,
 - Water harvesting / storm water harvesting spots,
 - Watershed management /conservation sites,
 - Flood prone areas,
 - Drought prone area map classified with severity level,
 - Land use / land cover and, land suitability maps
 - Soils,
 - Infrastructure (water supply, road, and other services) accessibility maps,
 - Energy access (electric and alternative energy),
 - Administrative, settlement and demographic maps
 - Livestock population and distribution, etc.
 - Generate analytical maps showing the extent of drought and sustainable resource management plan of intervention focusing on ground and surface water access,

Sub-task 1.2 Management Information System (MIS)

1. Identify and propose software and hardware requirements related to drought area management intervention;
2. Prepare specification and bid document for the required software and hardware and other applicable tools;
3. Undertake setup, installation and testing;

4. Develop/ adopt an MIS and ensure system integration of all applications to tap data/information and to make informed decision.
5. Establish a digital monitoring, evaluation and reporting system.

Sub-task 1.3 Capacity Building and Knowledge Transfer

1. Prepare documentation of all GIS and RS data collection, compilation, analysis and results metadata including a user guideline,
2. Prepare documentation of all software, hardware and the MIS system including a user guideline,
3. Undertake capacity building and knowledge transfer training in the field of GIS, RS and MIS, on-the-job training and tailor-made training in specialized areas to ensure sustainable utilization of the system.
4. The task requires a GIS, RS expert and MIS experts for a duration about a year initially.

Task 2: Ground Water Assessment

The scope of ground water assessment in arid and semi-arid zones will be identification of potential well fields by conducting integrated study so that subsequent development for supporting life is possible in a sustainable and cost-effective manner. This activity is partly underway for some selected regions and intervention areas.

Requirement details for the task are depicted below.

Requirements for Task 2 – Ground Water Assessment

Climate, Surface Water and Ground Water Report

Existing sequencing of technologies in OneWASH national Programme is not sufficient to address the challenges in Arid and semi-arid environments. It needs innovative/strategic approaches. Large functionality/sustainability problem is already felt even in water rich environments. Therefore, the challenge is even direr in arid/semi-arid areas. Accordingly, there is an urgent need to first undertake

- A rapid assessment of various regions in order to determine where and what to do
- Finding existing information and the gaps rough cost estimate
- Determination of areas which fall under Resilient WASH
- Mapping Woredas with chronic water insecurity
- Lessons from existing failures and successes in:
 - Existing Multi Village Schemes in Ethiopia and elsewhere
 - Lessons learned of technologies to be adopted in arid and semi-arid environments for various geophysical setting

- Out-scaling existing programmes to arid areas (PSNP, SLMP)

Technologies

Selection of appropriate technology based on specific situations of the regions need to be addressed.

There should also be well established guidelines on how to choose the right technology.

- Robustness/redundancy/variation
- Appropriateness to the geophysical setting
- Resilience instead of cost
- Consideration of the management of technologies
- Identification of the problem prior to the design Solitary deep groundwater wells
- Solitary shallow wells
- Multi community schemes from reliable surface water or groundwater sources
- Managed Aquifer Recharge or Artificial Recharge technologies
- Large surface water ponds for cattle watering combined with safe sources for human consumption
- Adopting customary water access structures- Birkads, Elas and Haffirs
- Engineered surface and subsurface dams, solitary or cascade
- Cascade of small surface water reservoirs
- One, two or more of the above
- The demand side measurement
- Map Woredas with Chronic water scarcity
- Fluoride and salinity safe-sourcing
- Reverse Osmosis(ROS) and water treatment technologies

Proposed Sources and Technologies ranging from high resilient to low resilient technologies based on Vision 2030 document by WHO for various areas of arid and semi-arid areas

Based on the hydrogeological climatic and accessibility and development of infrastructure 11 groups of regions have been identified to start with the Rapid assessment of the water resources for filling gaps as shown in table below.

Table 1: Indicative list of technologies suitable for different zones of arid and semi-arid areas

| Region | High resilience | Medium resilience | Low resilience |
|-----------------------------------|--|---|--|
| Ethiopia Arid and Semi-Arid areas | Deep Boreholes, utility managed multi village schemes and improved pit | community-managed piped supplies, improved pit latrines are appropriate | cisterns and hafir dams from harvested rain water appropriate provided local conditions permit |

Development of Sustainable Water Supply in Drought Prone Areas of Ethiopia

| Region | High resilience | Medium resilience | Low resilience |
|---|---|--|---|
| | latrines with reasonable safeguards | | |
| Western Ogaden | Spring based MVS in headwater regions of Wabisheble and Genale and improved pit latrines with reasonable safeguards | Surface water for multi community and small urban areas, improved pit latrines are appropriate | Solitary shallow wells in alluvial sediments adjacent to river beds (eg. Fafam and Jarer Valleys] |
| Eastern Ogaden- Jessoma Sandstone, Taleh and Awuradu | Deep solitary wells some sites may be poor quality and improved pit latrines with reasonable safeguards | Managed aquifer recharge particularly along the fringes of Jessoma Sandstone and improved pit latrines are appropriate | Engineered Birkas, surface water ponds for cattle watering |
| Borena- Basement rocks area | Multi-community scheme from dependable sources in the highlands and improved pit latrines with reasonable safeguards | Solitary or cascades of subsurface or surface dams and improved pit latrines are appropriate | Solitary shallow wells in favorable areas |
| Omo- Kuraz to Turkana | Solitary wells in alluvial fans in the eastern boundary of Omo Delta and improved pit latrines with reasonable safeguards | Freshwater zones within the Omo delta sediments and improved pit latrines are appropriate | Solitary shallow wells in favorable areas |
| Rift Valley | Multi community schemes from reliable sources in the escarpment area and improved pit latrines with reasonable safeguards | Surface water source development from the lakes, Use of Deflouridization technique in drilled boreholes and improved pit latrines are appropriate | Fluoride and salinity safe sourcing approach |
| Southern and Central Afar | Proven Multiple options exist for multi community scheme or for solitary wells and improved pit latrines with reasonable safeguards | Surface and subsurface dams, Surface water treatment and distribution from AWASH river and dams, Reverse Osmosis (RO)for Lake Beseka and improved pit latrines are appropriate | cisterns and hafir dams from harvested rain water appropriate provided local conditions permit |
| Afar- Kori, Elidar, Erepti | Deep solitary wells and improved pit latrines with reasonable safeguards | Reverse Osmosis options when water turns saline and improved pit latrines are appropriate | Shallow wells adjacent to wadi beds |
| Waghmra, Lasta, Tekeze valley | cascade of dams and improved pit latrines with reasonable safeguards | | (Chronic water insecurity- Options are limited) Accumulated springs with low yield |
| East Tigray-West Afar Escarpment | Abala, Shiket valley/ graben for solitary wells (there may be options for multi village schemes) and improved pit latrines with reasonable safeguards | Narrow grabens in the region between Dallol and the western escarpment (but limited option) and improved pit latrines are appropriate | (Limited options) cisterns and hafir dams from harvested rain water |
| Shewarobit to Raya (food insecure but water secure) | Springs for MVS in western escarpment and improved pit latrines with reasonable safeguards | In foot areas consider pumping groundwater from the valley up the hill and improved pit latrines are appropriate | Solitary shallow wells in the alluvial valleys |
| Mekele, Shire, shiraro | Surface water (Consider demand side measurement in large urban areas) and improved pit | carefully located wells like in Aynalem well field of Mekele and improved pit latrines are appropriate | |

| Region | High resilience | Medium resilience | Low resilience |
|--------|-------------------------------------|-------------------|----------------|
| | latrines with reasonable safeguards | | |

Methodology

The investigation will involve review of existing documents and use of different study techniques mainly GIS and Remote sensing data which comprises of High Resolution RS, Digital Elevation Model (DEM), Digital Terrain Model (DTM) and image along with relevant Survey of Ethiopia, topo sheets and field observation data. Existing ground water information, especially from the existing well points will also be extensively used.

The methodology includes generation of thematic maps showing drainage pattern, lineament, slope and geomorphologic units through processing and visual interpretations of remotely sensed data. As part of the integrated approach to groundwater exploration combined geological, hydrological, hydrogeological and geophysical exploration tools will be implemented. Thematic layers of geomorphologic units, slope, lineament and drainage density should be generated and integrated into GIS to determine suitable zones for groundwater prospecting.

Once the ground water potential areas are identified using the above stated materials and methods, drilling of boreholes and conveyance to drought affected arid and semi-arid areas can be undertaken in multi village schemes.

Task 3: Surface Water Assessment

The scope of surface water assessment in arid and semi-arid areas will be identification of potential surface water sources so that subsequent development for supporting is possible in a sustainable and cost effective manner.

Surface water sources include rivers like Awash, Genale Dawa, Wabishebele the rift valley lakes, etc. rain water harvesting like haffir dams, earth dams, cisterns, sand dams etc. possibilities will also be part of the assessment.

Methodology

A desk review of surface water potentials in arid and semi-arid areas will be undertaken based on various master plan studies like Genale Dawa, Awash etc. Integrated hydrologic assessments will be undertaken based on hydrometeorological data, of the assessment will also use high resolution data and information system under task 1.

Task 4: Planning and Design

The task comprises the following sub tasks.

- i. Study and Design that will involve
 - a. Water sources investigation
 - b. Water Supply design
 - c. Construction as outlined in the concept note

Details are shown in Annex 2.

Task 5: Fundraising

The purpose is to mobilize adequate resources for investment. This will be done through various communications and promotion of the programme. The major envisaged sources could include, budget from government of Ethiopia through MoWIE, regional government budgets, budget from other ministries such as WaSH line ministries, Ministries of Agriculture, Livestock and Fisheries, Forestry and Climate Change, WaSH and non-WaSH water supply programme partners, bilateral and multilateral organizations, UN organizations involved in humanitarian activities, NGOs, etc.

Task 6: Capacity Development for Operation and Maintenance

From the very nature of the schemes to be constructed in the drought prone areas, the management style of the WaSH facilities will be carefully considered. As the technologies and the WaSH facility systems are to be very complex, the operation and maintenance of the facilities will be unique. Based on the experience gained from the pilot exercise from other development partners including UNICEF, (which could play a role in providing the required technical assistance at various level) there needs to be establishing rural WaSH Utilities for woredas depending on the size and scope of the systems to be built. The capacity development activities will be with due attention to private sector engagement and capacity development including but not limited to tax free importing of deep ground drilling machines, blended financing for ultimate benefit of the user communities, looking in to credit access for the private sector as long term loan financing...etc. Therefore, the capacity development will be undertaken in parallel with other activities. This includes management and operation capacity in relevant regions through strengthening of TVETCs & HSCs in developing relevant curricula and subsequent skill transfer for enhanced implementation.

Task 7: Implementation

As indicated above, implementation takes place in parallel to the studies. The primary owners of the programme are regional governments, supported by federal institutions and one WaSH and other partners.

Each of the above will be further detailed in terms of methodology, implementation arrangement upon completion of the tasks and budget requirement details.

11.2. Financial Requirement for the Sub Programme

An indicative financial requirement for climate resilient WASH(CRWASH) is estimated by taking the current per capita cost of Rural piped scheme for multi villages, livestock watering, distance, infrastructure, labor availability , technology, borehole depth, etc. for two phases(i.e. phase 1-2018 to2020; phase 2- 2021-2025) into consideration. A total of 4,892,838,875 USD is required for two phases (2018-2025).Table 2 below shows the requirements by region.

Table 2: Estimated Financial Requirement for study, design, construction, capacity building and admin costs of CR-WASH in arid and semi-arid areas

| Region | Estimated Financial Requirement Based on Design Population as of 2017 Including 10% admin and CB expense (USD) | Budget Distribution in Two Phases | | | | | | | | Total Budget including 3.5% inflation per annum |
|--------------|--|---|--------------------|--------------------|--|--------------------|--------------------|--------------------|--------------------|---|
| | | Phase 1 requiremnt including 3.5% inflation per annum | | | Phase 2 requirement including 3,5% inflation Per annum | | | | | |
| | | 2018 (USD) | 2019 | 2020 (USD) | 2021 (USD) | 2022 (USD) | 2023 (USD) | 2024 (USD) | 2025 (USD) | |
| Afar | 277,267,782 | 28,697,215 | 43,045,823 | 43,045,823 | 43,045,823 | 43,045,823 | 28,697,215 | 28,697,215 | 28,697,215 | 286,972,152 |
| Amhara | 694,600,554 | 71,891,157 | 107,836,736 | 107,836,736 | 107,836,736 | 107,836,736 | 71,891,157 | 71,891,157 | 71,891,157 | 718,911,571 |
| Oromia | 1,719,588,395 | 177,977,399 | 266,966,098 | 266,966,098 | 266,966,098 | 266,966,098 | 177,977,399 | 177,977,399 | 177,977,399 | 1,779,773,990 |
| SNNP | 514,956,412 | 53,297,988 | 79,946,983 | 79,946,983 | 79,946,983 | 79,946,983 | 53,297,988 | 53,297,988 | 53,297,988 | 532,979,886 |
| Somali | 1,122,897,545 | 116,219,896 | 174,329,844 | 174,329,844 | 174,329,844 | 174,329,844 | 116,219,896 | 116,219,896 | 116,219,896 | 1,162,198,962 |
| Tigray | 398,069,865 | 41,200,232 | 61,800,347 | 61,800,347 | 61,800,347 | 61,800,347 | 41,200,232 | 41,200,232 | 41,200,232 | 412,002,313 |
| Total | 4,727,380,553 | 489,283,888 | 733,925,831 | 733,925,831 | 733,925,831 | 733,925,831 | 489,283,888 | 489,283,888 | 489,283,888 | 4,892,838,875 |

Source: Ethiopian WASH Cluster (MoWIE,2016)

N:B For background calculation tables and assumptions see Annex 2

A preliminary attempt is done in determining budget breakdown by region for both phase 1 and phase 2. Phase 2 requirement will further be refined towards the end of phase 1 once the performance of phase 1 is known..

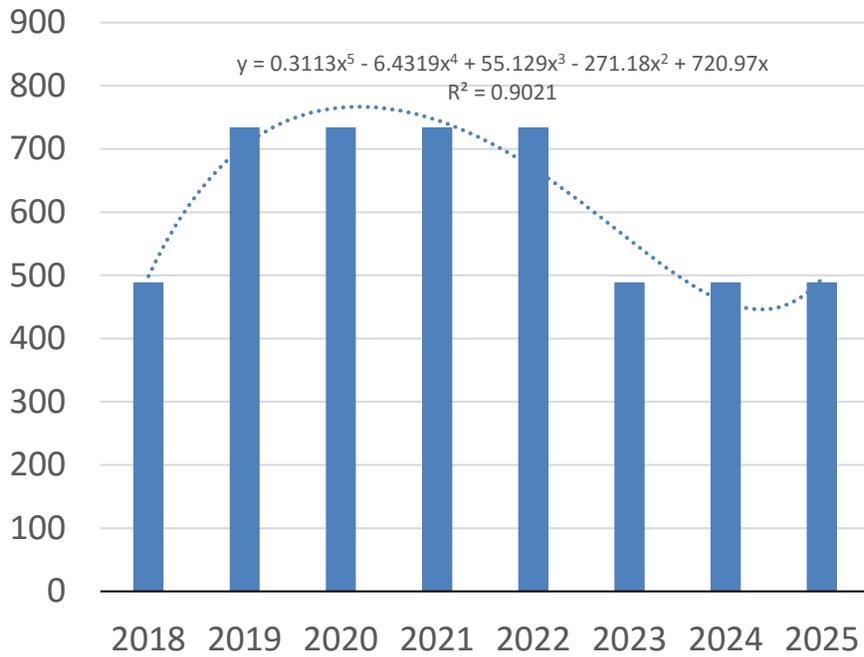
Budget requirements during the two phases at country level is as depicted in figure below.

Figure 10: Total Country level Budget Requirement for the two phases in mUSD



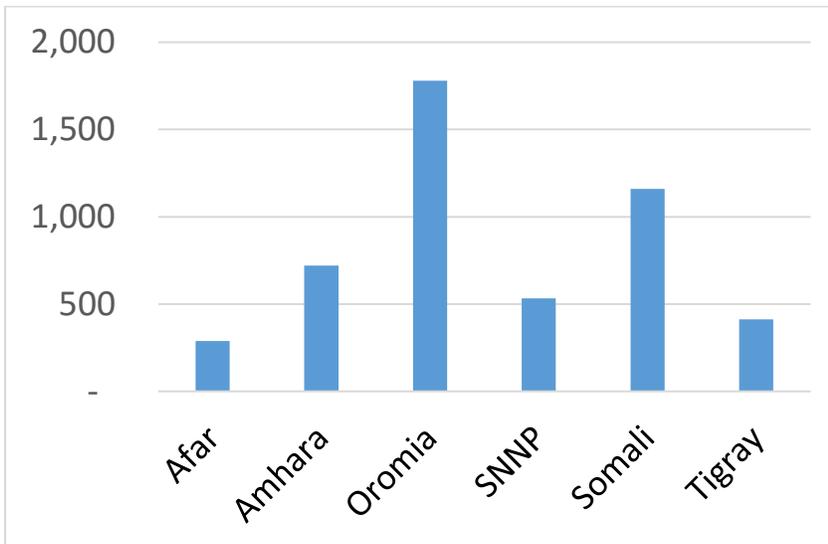
The aggregate country level budget distribution takes the shape shown in figure below.

Figure 11: Total Country Level Aggregate Budget Distribution in (mUSD) Per Annum



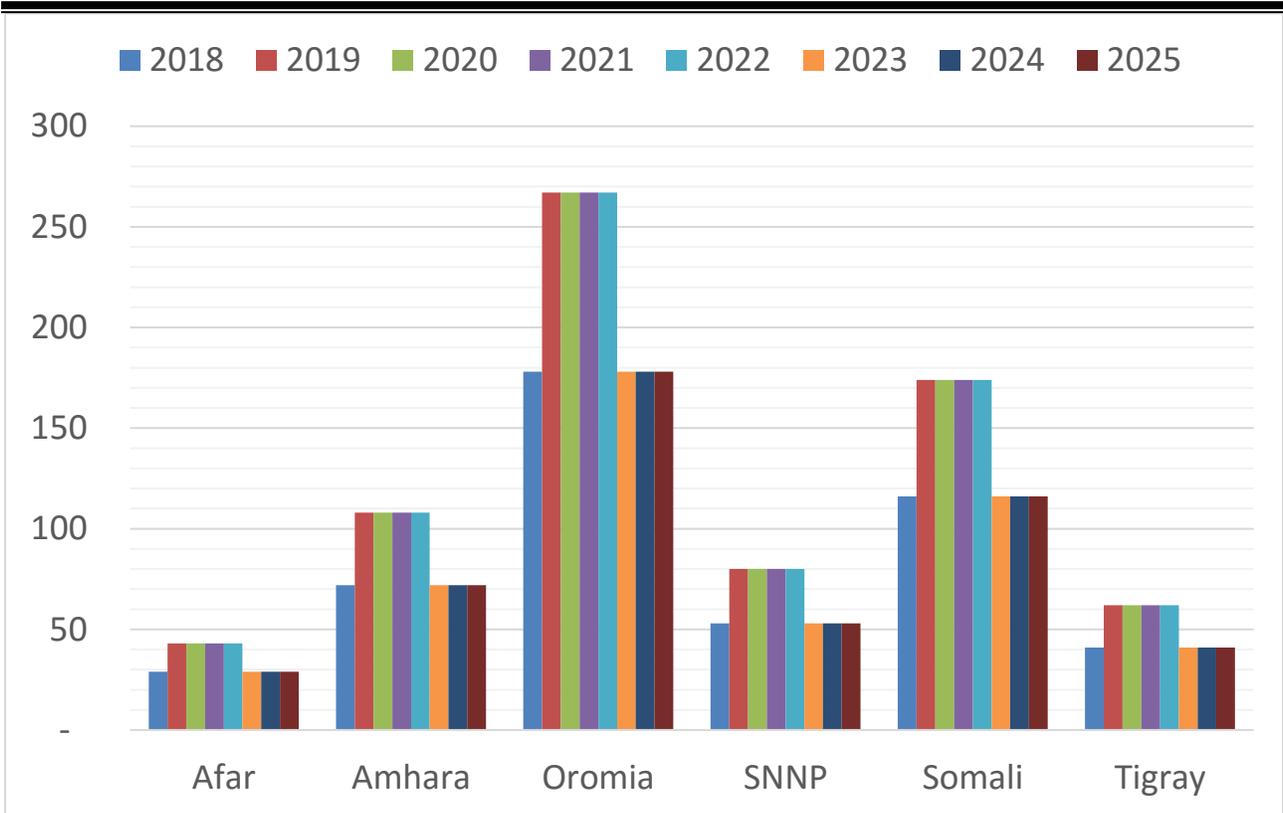
The regional budget distribution as shown in more details in table 2 above is depicted in figure below for better conception.

Figure 12: Total Budget by Region (mUSD) During the Two Phases (2018-2025)



The annual budget distribution during the two phases is shown in figure below.

Figure 13: Regional Budget Distribution during the Two Phases in mUSD



Summing up, a total of about 5 billion USD or about 0.625 billion USD per annum which is 1.09% of the GDP is required for arid and semi-arid areas of the country. This justifiable estimated funding requirement is about 12% of what the country requires for SDG WASH development with much bigger scope as proposed by the WASH cluster being hosted by UNICEF at the moment. See Annex 4 for details.

11.3. Economic Benefits

As regards to Economic feasibility, it can be deduced that Economic benefits that range from 1.7 times the costs of sustainable water supply development to 3 times the cost of sanitation facilities could be obtained for justifying the feasibility of the sub program. On the other hand going for sustainable climate resilient water supply schemes is proved to be much cheaper as compared to water trucking².

² Cost and benefit comparison for 15,000 people for 10 years has shown sustainable water supply costs between USD 900,000 -2,100,000 depending on the type of scheme and drilling depth while providing water for 100days/year costs about USD 2,700,000 proving provision of sustainable water supply is highly cost effective.

12. Conclusions and Recommendations

Water scarcity is a key challenge and a major constraint to economic and human development in the arid and semi-arid areas of Ethiopia. People living in these areas are mostly pastoralist, inaccessible, highly vulnerable and disadvantaged or remotely located to access development benefits. Climate extremes are expected to further reduce water availability. Therefore, water quantity and quality is a growing concern in these arid and semi-arid areas of Ethiopia.

Coping strategies must be implemented by making water as an entry point to safeguard the **livelihood of the local community**. High cost of emergency humanitarian interventions and fragmented and project based approaches by different actors couldn't provide sustainable solutions. It requires strategic actions for comprehensive **poverty alleviation** which will integrate all available resources and stakeholders..

This assessment which will be followed by in-depth study and implementation as one of the strategies is at a reconnaissance level to initiate the programme to identify potential areas for future development needs. This programme is expected to deliver resilient solution and sustained development during the GTP-II period and beyond.

With regard to economic aspects the following tasks shall be accomplished:

- Review of tariff structures
- Analysis of water-use efficiency for human and Livestock use
- Industrial parks support close to arid and semi-arid areas

Concerning development of well sensitized community linkages, the following can be envisioned:

- Develop public education materials for a “water smart” culture, with household-level conservation and low-impact development such as permeable surface materials for paved areas, rainwater collection systems and bioswales in cities and catchment management in rural areas.

Box 1: Recommended Strategic Actions by Woredas and Cities to Attain Climate Resilient Status

- The foremost strategic decision cities and woredas face is the degree to which they choose an **ecosystem-based perspective to source water protection and develop the relationships with upstream and downstream administrations, watershed management bodies, and municipalities. Well-designed ecosystem service approaches** create a rural-urban relationship that can foster mutually beneficial green infrastructure investments.
- **Conduct leading-edge climate impacts analysis on source watersheds using stochastic hydrology based on multi-model global circulation models.** Such an exercise will help managers understand the range of future hydro-climatologic risk and will advocate more clearly the infrastructure investment including green infrastructure options.
- **Conduct risk management scenario planning exercises** for managers that consider the joint effects of simultaneous flooding and power outages and drought and power outages as a second phase of the source watershed climate impact analysis.
- **Conduct a scoping study on decentralized water supply and wastewater treatment** with respect to emerging technologies, economic development opportunities for the benefit of increased climate resilience.
- Develop position papers regarding Water conservation and water-use efficiency followed by strategic actions on water conservation and efficiency.

- Promote citizen science in the educational system for water and hydrology, including crowd-sourced monitoring of precipitation, temperature, stream flow and water quality to augment official data gathering to introduce water stewardship and climate change concepts to school-age children.
 - Integrate climate resilient WASH development with water safety management and catchment management for desired sustainability
 - **Establish Post construction support units as proposed in OWP(2013) and recent panel discussion on multi village schemes to realize sustainable WASH services provision**
 - Strengthen capacity and create Climate WASH Resilient culture through successive training and action research by involving regional universities and TVETCs
 - Link the sub program with livestock development, agro industries development, etc. for enhancing the ability to pay for the services. Promotion and strengthening of credit and Savings associations as demonstrated in Afar and Somali region will have an added value
 - Enhance the economy of scale for cost effectiveness by constructing multi village schemes for cluster of villages
 - Move towards well organized management of the multi village schemes by promoting the establishment of rural utilities as such schemes are beyond the capacity of WASHCOMs
 - Conduct a review of the infrastructural and institutional mechanisms that would permit reallocation of existing water supply in crisis situations (such as from industrial to residential), including a review of the regulatory vulnerabilities associated with first in time first in right (FITFIR) water allocation system in the context of hydrologic drought.
- Box 2: Possible Regulatory/Administrative Actions

 - Conduct a review of the infrastructural and institutional mechanisms that would permit reallocation of existing water supply in crisis situations (such as from industrial to residential), including a review of the regulatory vulnerabilities associated with **first in time first in right (FITFIR) water allocation system in the context of hydrologic drought.**
 - **Review the regulatory context for decentralized water supply and wastewater treatment facilities** (cisterns, grey water recycling, and decentralized water and wastewater treatment) following construction of such system during GTP II period. **Identify regulatory obstacles to innovative applications of multi village and multidistrict water technologies and institutional setup.**

Furthermore, basin authorities shall expand their roles and carryout efficient regulation of scarce water resources in arid and semi-arid areas through IT enabled MIS system.

As a way forward, based on feedbacks and conclusions for further strengthening the Program document by delivery team and development partners in a one day workshop undertaken in Intercontinental Hotel on October 5, 2017, the following crucial recommendations are forwarded:

- A Programme Implementation Manual that shows how the CR-WaSH sub program will be implemented under the umbrella of OWP need to be prepared
- The CR – WaSH need to have its institutional arrangement with a steering and delivery team under that umbrella of the OWP Steering Committee which shall include additional ministries ministry of Agriculture and Natural Resources, Ministry of Livestock and Fisheries, Ministry of Environment, Forestry and Climate Change, Ministry of Federal and

- A knowledge group shall be established that can undertake research and support regional ministries and implementing partners. This will be supported by relevant Ethiopian universities.
- Highly skilled and qualified people in fields such as Remote Sensing, Hydrogeology, groundwater mapping should be brought in through the North South relationship and developed locally through formal education and on the job training .
- Study, design and implementation capacity shall be enhanced through well organised training and capacity building for achieving SDGs
- Create a reliable and sustainable Climate Resilient WaSH system based on sound management structures through the active involvement of the public and private sector along the user communities.
- Ensure safe water supply provision through undertaking water quality monitoring in fluoride & salinity prone areas in particular and other areas where there are water quality problems due to coliforms, nitrate, iron etc.
- Involve microfinance institutions in revenue generation and funding for new schemes.
- Utilities should be given a responsibility for organizing groups to maintain and operate water schemes either at district or scheme level – this is also a smart way of providing employment opportunities.
- Enhance partnership with all the organizations that are striving to realize sustainable livelihood development in arid and Semi-arid areas of the country. Such a partnership is expected to realize sustainable livelihood development through climate smart rangeland, dairy, fisheries development etc. that will use Climate Resilient WaSH as a spring board.
- Build a coalition of sustainable development across sectors with WaSH at the centre of the intended development. (The fact that the proposal is expected to be presented to council of Ministers and Regional Presidents shortly is expected to ensure cross-government support for the strategy).
- Complex schemes may be beyond the capacity of local WASHCOs to maintain and called for professionalized rural water utilities to be considered as a management option – as suggested by a recently convened MoWIE panel of experts.

13. References

1. MoWIE, One WaSH National Programme Document, 2013
2. MoWIE, WaSH Implementation Frame work, 2013
3. MoWIE, Climate Resilient Water Safety Strategic Framework, 2015
4. MoWIE, Unpublished presentations from Bishouftu Sustainable, climate resilient WaSH Workshop, May 2017
5. MoWIE, WaSH Cluster, Population in Arid and Semi-arid Areas of Ethiopia, 2017
6. Prof. Dr. Matthias Schmidt, Augsburg University, Livelihoods and Natural resources Management in Arid and Semi-Arid environments of Ethiopia, 2015
7. University of Winnipeg, Prairie Climate Center, Building a Climate-Resilient City Water supply and Sanitation Systems, 2017
8. WaterAid, Bangladesh, Handbook on Climate Change and Disaster Resilient WaSH practices, Dec. 2012
9. World Bank, Maintaining the Momentum while addressing Service Quality, A Diagnostic of WaSH and Poverty in the Federal Democratic Republic of Ethiopia, draft, June 2017
10. Ministry Of Water & Energy (MoWE), Somali Regional Water Resources Development Bureau, The Study On Jarar Valley And Shebele, Sub-Basin Water Supply Development Plan, And Emergency Water Supply, Final Report, August 2013, Japan International Cooperation Agency (Jica), Kokusai Kogyo Co., Ltd.
11. Explanatory Text Of Geological And Hydrogeological Maps Of Jarar Valley And Shebele Sub-Basin In Somali Region, Final Report, Final Report August 2013, Japan International Cooperation Agency (JICA), Kokusai Kogyo Co., Ltd.
12. MoWIE, Climate Resilient Water Safety Strategic Framework, July 2015 Addis Ababa, Ethiopia
13. Water Security and Climate Resilient Development, STRATEGIC FRAMEWORK, 2012. AMCOW
14. Climate Resilient Development, Eleventh Malaysian Plan (2016 – 2020), Director General of Economic Planning Unit, Prime Ministers Department.
15. WASH Climate Resilient Development Technical Brief, 2014 GWP and UNICEF Bangladesh

15. Annexes

Annex 1 : Hydrogeological and hadrochemical mapping of Ethiopia

The Geological Survey of Ethiopia and the Czech company GEOtest a.s. have signed a Memorandum of understanding regarding the implementation of a significant project “Hydrogeological and hydrochemical mapping - Completion of hydrogeological mapping in Ethiopia” which will be performed within the framework of Development Cooperation between the Czech Republic and the Federal Democratic Republic of Ethiopia. The project is funded by the Czech Government via Czech Development Agency. The local partner organization is Geological Survey of Ethiopia (GSE).



The objective of the project “Hydrogeological and hydrochemical mapping”, which started in June 2015 and will be finished in November 2019, is to contribute to the fulfillment of Sustainable Development Goal, SDG 6 in Ethiopia: Ensure availability and sustainable management of water and sanitation for all. Mapping and assessment of groundwater resources for the purpose of water supply and irrigation are fundamental for further development of the country.

The project comprises of compilation of hydrogeological and hydrochemical maps including explanatory notes at a scale of 1 : 250 000, publication of all hydrogeological outputs at the GSE website and their further dissemination to all regions of the country and to all potential users. The project also aims at building the capacities of Ethiopian experts in the field of research and assessment of groundwater sources, compilation of hydrogeological and hydrochemical maps at various scales and their practical interpretation.

The final output of the project is that Ethiopia will be completely covered by hydrogeological maps at a scale of 1: 250 000 by 2019. To achieve this output, it is still necessary to complete hydrogeological and hydrochemical mapping of 37 map sheets of various parts of Ethiopia. In addition, unification of these new maps with the maps which have been already compiled by GSE will be done in a format suitable for online presentation.

Mapping of groundwater resources in the form of hydrogeological maps accompanied by explanatory notes has been carried out by GSE since early 80s (with Mekele being the first sheet published) and has accelerated over the past 10 years. From the beginning the Czech Republic has been supporting the mapping activities of GSE using a scheme where the participation of Czech experts has been financed by the Czech Government via Czech Development Agency within the framework of the

Czech Republic Development Cooperation Programmeme. Participation of Ethiopian professionals has been financed by the Ethiopian Government.

Annex 2: Brief guideline for feasibility level study and design and construction

i) Study and Design

a) Water sources investigation

The major features of dry/semidry land areas in respect to water resources are;

- ✓ Except those large river basins flowing from the highlands, most of the river drainages in the lowlands are intermittent with low or non-flow regime during dry seasons and torrential flooding during the rainy season. This necessitates either surface or sub-surface storage facilities to use it as a source for water supply. Moreover, as evaporation is high (it is also anticipated to increase because of global warming) in these areas underground storage facilities are more preferable to reduce its effect and get relatively good quality of water.
- ✓ As there are less vegetation cover and the rain is usually intense ground water recharge is low except in some flooding plains and those lowland areas adjacent to highlands. Thus, in most dry land areas groundwater may be either deep or with high salinity and other chemicals making it unfit for drinking without treatment. As well, the temperature may also be relatively high. Thus, groundwater assessment in these areas needs to consider these issues.
- ✓ As the highlands have relatively better precipitation and thus better groundwater potential in the form of spring or at depth which could be transferred to the arid/semiarid lowland areas located adjacent to the highlands. This option also needs to be looked into in water sources investigation.
- ✓ The interaction between the surface and ground water needs to be carefully studied and understood for their optimal development and conjunctive use. This will also help for development of appropriate technologies such as rain/run-off water harvesting, groundwater recharge (natural and artificial). Overall, rainwater, surface and groundwater need to be considered as options of water sources separately or in conjunction.
- ✓ In arid/semiarid areas the pattern of settlement is mainly determined by water. The people in arid/semiarid area are mainly pastoralists without permanent settlement year round travelling with their herds looking for water and fodder, water points could be pulling factors for the pastoralists and their herds to come together which may have environmental impact if the area is overpopulated by livestock and people. Thus, this kind of environmental impacts needs to be looked into as the environment of arid/semiarid areas is very fragile. Precaution is also required not to over extract the ground water in excess of the recharge.
- ✓ As water is the first priority need of the dry/semidry land areas, the people here has developed reach traditional experience from generation how to locate water sources, what technology to use, water management aspects, water conservation works, predict future climatic condition (draught, rainfall, etc.). It is very important to study this reach traditional culture and devise how to use it in addressing the water problem of the area.

- ✓ It is also important to intensively consult the local communities in water source investigation and consider their need.
- ✓ It is very important to review water sources investigation studies conducted by various stakeholders (MoWIE, e.g. the national fluoride project, the regional Water Bureaus, NGOs, etc.) and technologies used to abstract water sources and conduct evaluation in respect to their climate resilience capacity.
- ✓ Water source investigation work should be conducted by multi-disciplinary team including hydrogeologist, hydrologist, water engineer, sanitary expert, socio-economist, etc. rather than unilateral assessment by only hydrogeologist/hydrologist. As well, the investigation need to employ the state of the art investigation methods and instruments.
- ✓ From the current experience, borehole drilling success rate in respect to availability of water is very low even in areas where there is better precipitation. The problem further exacerbates in arid/semiarid areas where ground water potential is relatively low and the quality is also not reliable. Thus, it is advisable to conduct ground water investigation with test well drilling (designed in such a way to be used as productive well later on if the study is found successful) which will be drilled as soon as the groundwater source investigation is completed. The drilling will be contracted out by the client or consultant will take the job as turnkey with joint venture with a drilling company.
- ✓ The Client need to strengthen study document appraisal capacity with multidisciplinary team and ensure the quality of the project document through desk and field level review mechanism. This is very important to be given due attention by all program implementing agencies.
- ✓ The Client need to carefully prepare ToR for outsourced consultancy services with consultation of multidisciplinary professionals as the gap at this level significantly affect the quality of the service output.

b) Water Supply design

Based on the above special features of dry/semidry lands, design of water supply in these areas needs to consider the following;

- ✓ Assessment of existing water supply sources and infrastructure is very important before going to new water source and infrastructure development. Accordingly, the quantity, quality, reliability (period of scarcity, causes of scarcity, coping mechanism, etc) climate resilience status, etc. of existing water sources and type, service status, water use efficiency, management status and capacity (financial, technical, legal, institutional, etc.) needs to be assessed to recommend augmentation of the existing system to meet the demand alone or use it to complement the new project.
- ✓ Water demand assessment needs to include the present and design period population and livestock. However, as inclusion of livestock in the demand analysis will significantly increase the capacity of the water supply system and thus the investment and O&M cost, it is advisable to evaluate the available options for livestock water supply from separate source of lower water quality.

- ✓ Water conservation and water utilization efficiency are very important in these areas. Thus, conservation and efficiency of use need to be seriously considered in designing of the technology, the management, the capacity building, etc.
- ✓ As these areas have significant potential for renewable energy such as solar and wind, use of these energy sources for water supply is vital.
- ✓ The Design need to consider social and environmental impacts and their mitigation measures, current and future population settlement patterns and its dynamics, development interventions planned in the area within the design period both in rural and urban which can positively or negatively affect the water supply design, cost particularly O&M cost, inclusiveness, implementation and O&M capacity of the community, the public and the private sector at local and regional level, the NGOs, etc.
- ✓ Surface water treatment need to consider natural filtration such as sub-surface dam and simple treatment plants such as plain sedimentation, roughening filters, slow sand filters among the others.
- ✓ Multi-village rural water supply schemes needs to be considered when there is a need to transfer water from water surplus area to water deficit area and there is no alternative climate resilient water source option in the locality of the water source deficit area. It is important to note that multi-village RPSs are particularly not preferable if the length and diameter of the transmission pipeline (not delivering water on the way) between the villages is large and pumping is required. Its complexity also will affect the sustainability of O&M by the user community. In this case it is important to evaluate all available water source options for each villages separately and have separate RPSs.
- ✓ Design of electromechanical equipment, pipes and fittings, and storage reservoirs needs to consider the ambient air temperature of the area, the water quality and topography of the area as these differing from the highlands are specific features of arid/semiarid areas that affect proper functioning of the system.
- ✓ Water supply infrastructure design need to be conducted based on verified water source in terms of quantity and quality, e.g. drilled well pump test results and water quality data.
- ✓ International experience particularly experience of developing countries in addressing the problem needs to be taken into account contextualizing to our condition.
- ✓ The Client need to strengthen study document appraisal capacity with multidisciplinary team and ensure the quality of the project document through desk and field level review mechanism. This is very important to be given due attention by all program implementing agencies.
- ✓ The Client need to carefully prepare ToR for outsourced consultancy services with consultation of multidisciplinary professionals as the gap at this level significantly affect the quality of the service output.

c) **Construction**

The special features of arid/semiarid areas which affect drilling and construction among others are hardship of the area for living, remoteness and low accessibility, weak institutional and staff capacity of the water sector to support and supervise the construction work, may be low community participation in the construction work, scarcity of local construction materials, long hauling distance of industrial construction materials etc. Thus, it is important to foresee the challenges that could face

the program implementation particularly in construction and devise in advance some coping mechanism to face the challenges. Construction challenges that could face may be;

- ✓ Less competition for the contract and thus highly inflated construction/drilling cost as contractors will not be willing to work in the area,
- ✓ No response from the private sector for construction/drilling contract advertised by the program showing no interest at all.
- ✓ Even if some will have interest, they might have not the required financial, technical, human capacity, and experience to undertake the work in the prevailing working environment as discussed above putting the projects at high risk to be completed on time, with the required quality, and cost.
- ✓ Similar problem might also face to outsource the contract management and project supervision service to well experienced consultancy service providers affecting the Client monitoring and supervising capability and overall exacerbating the risk.

Thus, it is important to set some strategies to cope with the above challenges. Some of them may be the following;

- ✓ Encourage federal and public consultancy and construction/drilling enterprises to participate in the program implementation along the private sector in open to all bidding process. In this regard, regions could capacitate and use their own public enterprises or as some of the arid/semiarid regions have cooperative agreement with regions at their neighborhood having public enterprises they could use this cooperative agreement for the program implementation.
- ✓ Build the local contract management and project supervision capacity of both the public and private sector and use them along with more experienced national level consultancy service providers. This on one hand will solve the current problem and at the same time build the local capacity to solve the problem sustainably.
- ✓ Recognizing the hardship for construction/drilling in the area, regions, Woredas and the community need to be very supportive to the construction/drilling work within the framework of the contract agreement and sometimes even beyond.

From experience, separate contracts for pipe supply, electromechanical equipment supply and construction results in delay of project implementation. Thus, it is advisable to have turn-key contracts to enhance implementation with stringent material and construction quality monitoring

Annex 3: Background Calculation Tables and Assumptions

| Region | Priority 1 | | Priority 2 | | Priority 3 | | Total | | | | |
|--------------|--------------|-------------------|--------------|-------------------|--------------|-------------------|--------------|--------------------|-------------------------------|--------------------------------------|--|
| | # of Woredas | Sum of Pop (2017) | # of Woredas | Sum of Pop (2017) | # of Woredas | Sum of Pop (2017) | # of Woredas | Overall Pop (2017) | Unservd Percentage Pop (2017) | Unservd Projected Overall Pop (2017) | Unservd Overall Projected Overall Pop (2032) |
| Afar | 29 | 1,592,732 | 3 | 176,270 | | | 32 | 1,769,002 | 64% | 1,132,161 | 1,738,356 |
| Amhara | 26 | 3,352,784 | 28 | 4,053,655 | 13 | 1,845,656 | 67 | 9,252,095 | 35% | 3,238,233 | 4,972,087 |
| Oromia | 48 | 5,637,011 | 42 | 6,089,578 | 35 | 5,439,864 | 125 | 17,166,453 | 46.70% | 8,016,734 | 12,309,151 |
| SNNP | 11 | 1,564,626 | 14 | 1,832,837 | 9 | 1,347,065 | 34 | 4,744,528 | 50.60% | 2,400,731 | 3,686,159 |
| Somali | 71 | 6,055,077 | 17 | 1,661,234 | 5 | 837,980 | 93 | 8,554,291 | 53.60% | 4,585,100 | 7,040,110 |
| Tigray | 4 | 574,981 | 15 | 1,899,517 | 12 | 1,394,680 | 31 | 3,869,178 | 45.80% | 1,772,084 | 2,720,915 |
| Total | 189 | 18,777,211 | 119 | 15,713,091 | 74 | 10,865,245 | 382 | 45,355,547 | | 21,145,043 | 32,466,778 |

Table B: Per Capita Unit rate including Various Factors

| Region | Average Per Capita Unit Rate for RPS and Sanitation | Livestock Watering Factor (USD) | Distance and Infrastructure level factor (USD) | Technology and Declining Ground Water Level factor (USD) | Per capita Unit Rate that takes account of the various factors (USD) |
|--------|---|---------------------------------|--|--|--|
| Afar | 90 | 1.15 | 1.2 | 1.17 | 145 |
| Amhara | 90 | 1.15 | 1.05 | 1.17 | 127 |
| Oromia | 90 | 1.15 | 1.05 | 1.17 | 127 |
| SNNP | 90 | 1.15 | 1.05 | 1.17 | 127 |
| Somali | 90 | 1.15 | 1.2 | 1.17 | 145 |
| Tigray | 90 | 1.15 | 1.1 | 1.17 | 133 |

Development of Sustainable Water Supply in Drought Prone Areas of Ethiopia

Table C: Estimated Financial Requirement Excluding Inflation

| Region | Projected Overall Design Pop (2032) | Per capita Unit Rate that takes account of the various factors (USD) | Estimated Financial Requirement Based on Design Population as of 2017 (USD) | Estimated Financial Requirement Based on Design Population as of 2017 Including 10% admin and CB expense | Budget Distribution in Two Phases | | | | | | | | |
|--------------|-------------------------------------|--|---|--|--|--------------------|--------------------|--|--------------------|--------------------|--------------------|--------------------|--------------------|
| | | | | | Phase 1 requirement excluding 3.5% inflation per annum | | | Phase 2 requirement excluding 3,5% inflation Per annum | | | | | |
| | | | | | 2018 (USD) | 2019 | 2020 (USD) | 2021 (USD) | 2022 (USD) | 2023 (USD) | 2024 (USD) | 2025 (USD) | |
| Afar | 1,738,356 | 145 | 252,061,620 | 277,267,782 | 27,726,778 | 41,590,167 | 41,590,167 | 41,590,167 | 41,590,167 | 41,590,167 | 27,726,778 | 27,726,778 | 27,726,778 |
| Amhara | 4,972,087 | 127 | 631,455,049 | 694,600,554 | 69,460,055 | 104,190,083 | 104,190,083 | 104,190,083 | 104,190,083 | 104,190,083 | 69,460,055 | 69,460,055 | 69,460,055 |
| Oromia | 12,309,151 | 127 | 1,563,262,177 | 1,719,588,395 | 171,958,840 | 257,938,259 | 257,938,259 | 257,938,259 | 257,938,259 | 257,938,259 | 171,958,840 | 171,958,840 | 171,958,840 |
| SNNP | 3,686,159 | 127 | 468,142,193 | 514,956,412 | 51,495,641 | 77,243,462 | 77,243,462 | 77,243,462 | 77,243,462 | 77,243,462 | 51,495,641 | 51,495,641 | 51,495,641 |
| Somali | 7,040,110 | 145 | 1,020,815,950 | 1,122,897,545 | 112,289,755 | 168,434,632 | 168,434,632 | 168,434,632 | 168,434,632 | 168,434,632 | 112,289,755 | 112,289,755 | 112,289,755 |
| Tigray | 2,720,915 | 133 | 361,881,695 | 398,069,865 | 39,806,987 | 59,710,480 | 59,710,480 | 59,710,480 | 59,710,480 | 59,710,480 | 39,806,987 | 39,806,987 | 39,806,987 |
| Total | 32,466,778 | | 4,297,618,684 | 4,727,380,553 | 472,738,056 | 709,107,083 | 709,107,083 | 709,107,083 | 709,107,083 | 709,107,083 | 472,738,056 | 472,738,056 | 472,738,056 |
| | | | | %ge Budget Distribution | 10% | 15% | 15% | 15% | 15% | 15% | 10% | 10% | 10% |

Table D: Estimated Financial Requirement including Inflation

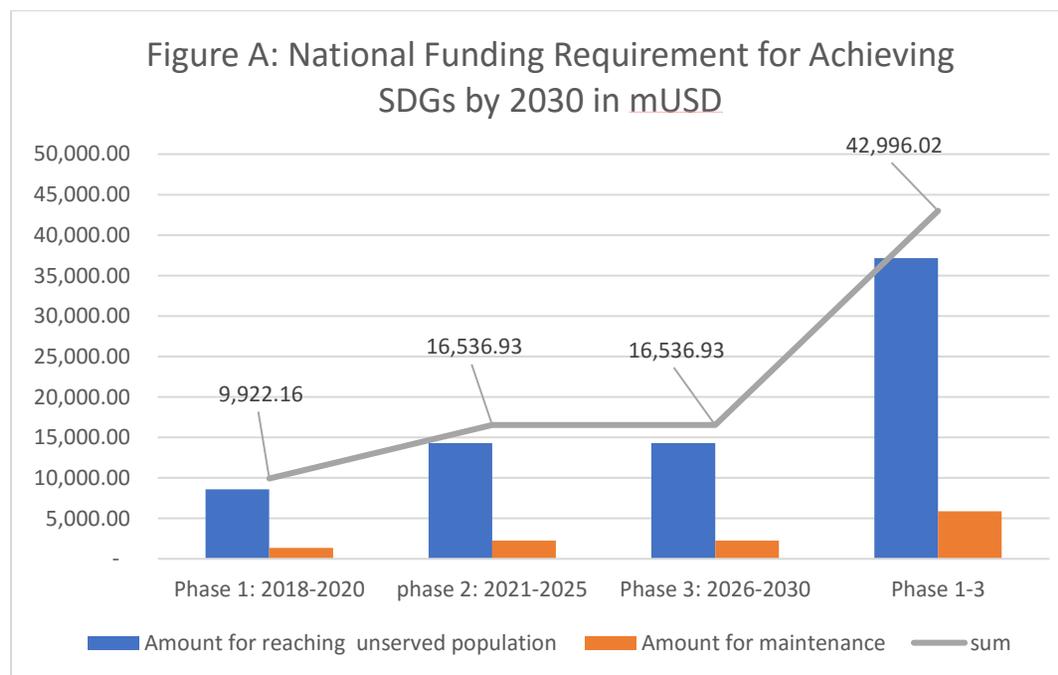
| Region | Estimated Financial Requirement Based on Design Population as of 2017 Including 10% admin and CB | Budget Distribution in Two Phases | | | | | | | | |
|--------------|--|--|--------------------|--------------------|--|--------------------|--------------------|--------------------|--------------------|---|
| | | Phase 1 requirement including 3.5% inflation per annum | | | Phase 2 requirement including 3,5% inflation Per annum | | | | | Total Budget including 3.5% inflation per annum |
| | | 2018 (USD) | 2019 | 2020 (USD) | 2021 (USD) | 2022 (USD) | 2023 (USD) | 2024 (USD) | 2025 (USD) | |
| Afar | 277,267,782 | 28,697,215 | 43,045,823 | 43,045,823 | 43,045,823 | 43,045,823 | 28,697,215 | 28,697,215 | 28,697,215 | 286,972,152 |
| Amhara | 694,600,554 | 71,891,157 | 107,836,736 | 107,836,736 | 107,836,736 | 107,836,736 | 71,891,157 | 71,891,157 | 71,891,157 | 718,911,571 |
| Oromia | 1,719,588,395 | 177,977,399 | 266,966,098 | 266,966,098 | 266,966,098 | 266,966,098 | 177,977,399 | 177,977,399 | 177,977,399 | 1,779,773,990 |
| SNNP | 514,956,412 | 53,297,988 | 79,946,983 | 79,946,983 | 79,946,983 | 79,946,983 | 53,297,988 | 53,297,988 | 53,297,988 | 532,979,886 |
| Somali | 1,122,897,545 | 116,219,896 | 174,329,844 | 174,329,844 | 174,329,844 | 174,329,844 | 116,219,896 | 116,219,896 | 116,219,896 | 1,162,198,962 |
| Tigray | 398,069,865 | 41,200,232 | 61,800,347 | 61,800,347 | 61,800,347 | 61,800,347 | 41,200,232 | 41,200,232 | 41,200,232 | 412,002,313 |
| Total | 4,727,380,553 | 489,283,888 | 733,925,831 | 733,925,831 | 733,925,831 | 733,925,831 | 489,283,888 | 489,283,888 | 489,283,888 | 4,892,838,875 |

Annex 4: National Funding Requirement for SDG WASH (2018-2030)-(Based on WASH cluster Estimate)

Table A: National Capital costs of reaching unserved pop to achieve universal access of different service levels by 2030 in million USD

| Population group served | Output | Ending OD | Universal Basic service | | | | Universal Safely Managed Services | | | |
|--|---------------|-----------|-------------------------|------------|---------|----------|-----------------------------------|----------|----------|-----------------|
| | | | Water | Sanitation | Hygiene | WaSH | Water | San | Watsan | Targets 6.1+6.2 |
| Reaching unserved 2015 to 2030 | Amount in USD | 105.61 | 325.23 | 663.55 | 129.25 | 1,118.03 | 713.37 | 1,025.25 | 1,738.62 | 2,856.65 |
| Maintaining Service for served in 2015 | Amount in USD | 388.78 | 57.00 | 6.93 | 15.41 | 79.35 | 55.82 | 315.57 | 371.39 | 450.74 |
| Reaching unserved 2015 to 2030 | As % of GDP | 0.10% | 0.59% | 1.21% | 0.21% | 2.01% | 1.30% | 1.80% | 3.10% | 5.11% |
| Maintaining Service for served in 2015 | As % of GDP | 0.71% | 0.20% | 0.01% | 0.03% | 0.24% | 0.10% | 0.58% | 0.68% | 0.92% |

Source: SDG WaSH Costing estimate by WaSH Cluster(2016)



**Proceedings of the High Level National Consultative
workshop on Climate Resilient WaSH Program
initiative,**

25th October 2017,

Intercontinental Hotel, Addis Ababa,

High Lights

Ahunna Eziakonwa – ‘Two challenging issues that need further consideration.

Firstly – how to incentivise the private sector to work well in these challenging lowland areas.

Secondly, call for the importance of governance of water schemes to be recognised and given equal weight to technical solutions.’

Leslie Reed: ‘We need to take a long-term investment approach to reduce costly humanitarian responses – she highlighted that over \$6m a month was spent in the AWD response in Somali region. Whilst acknowledging that this would require expensive up-front investment, she committed the DAG group to this supporting the Government of Ethiopia in achieving this Climate Resilient WASH strategy.’

H.E Dr. Eng Seleshi Bekele – ‘The government’s vision of becoming a Middle Income Country (MIC) by 2025 is ambitious, and complex climatic challenges such as drought run the risk of undermining this vision if not addressed. The key challenges facing these regions are insufficient access to water, inadequate supply, loss of livelihood, poor water quality, water-borne diseases, and weak capacity of institutions to maintain and develop new water sources.’

Key Points:

Following the different focused presentations and plenary discussions and conversations throughout the day, the Minister identified the following key points from the discussions of the day:

1. Importance of the proposed Rural Water Supply Programme Implementation Manual
2. OWNPN Steering Committee needs additional members from relevant Ministries.
3. A knowledge group to be established that can undertake research and support regional ministries and implementing partners. This will be supported by Ethiopian universities.
4. Critical importance of bringing in and developing highly skilled and qualified people in fields such as Remote Sensing, Hydrogeology, groundwater mapping.
5. Must increase the capacity to design and implement water schemes at all levels.
6. Investigate further issues of vandalism, illegal connection to piped systems to ensure that the overall system functions well.
7. Importance of water quality monitoring – particularly on fluoride levels.
8. Involve microfinance institutions in revenue generation and funding for new schemes.
9. Utilities should have responsibility for organizing groups to maintain and operate water schemes either at district or scheme level – this is also a way of providing employment opportunities.
10. Partnership with all the organizations present is critical, and with organizations working in different sectors.

11. Ministry of Water, Irrigation and Electricity will lead – but we must also build a coalition of support across sectors. Minister himself will present at the Council of Ministers and to Regional Presidents to ensure cross-government support for the strategy.

Key Note Address: Ahunna Eziakonwa, UN Resident Coordinator, UNDP Resident Representative and UN Humanitarian Coordinator in Ethiopia

Ahunna Eziakonwa's keynote address said that the 21st century will be defined by the world's relationship to water. She praised the Minister for convening this event and stated that Ethiopia is at the forefront of global thinking.

Her speech focused on the importance of bridging the gap between humanitarian emergencies and sustainable development as set out in the UN Reform Plan. She highlighted the commitment of all UN agencies in Ethiopia to working together, speaking with one voice and presenting a common position. Her speech called for the need for integration across sectors such as health, nutrition, agriculture when thinking about WASH – the need to bring different stakeholders together. WASH as a sector is providing leadership on bringing together partners to address the overlapping Sustainable Development Goals (SDGs).

She highlighted that resilient water supply is an excellent example of the benefits of bringing together humanitarian and development parts of the UN system and partners from different sectors. She set out some recent examples of this partnership, such as scientific centres of excellence in Europe and US working with the MoWIE and development partners to create ground water suitability maps, or the DAG successfully mobilising front-loaded development financing in response to the El Nino Crisis.

She offered the UN's support to provide capacity and technical assistance to regional and woreda levels who will have a significantly increased workload under the proposed plans, and are already overstretched dealing with emergency response.

Her speech also challenged conference attendees to focus their thoughts on two challenging issues that need further consideration.

Firstly – how to incentivise the private sector to work well in these challenging lowland areas. She suggested cluster of contracts for economies of scale would be necessary to attract high quality national and international private sector partners.

Secondly, she called for the importance of governance of water schemes to be recognised and given equal weight to technical solutions. In particular, she underlined the importance of management, operation and maintenance – particularly given the fact that as many as 30% of deep boreholes in Somali region are non-functional. These complex schemes may be beyond the capacity of local WASHCOs to maintain and she called for professionalised rural water utilities to be considered as a management option – as suggested by a recently convened MoWIE panel of experts.

Her speech concluded by reiterating the unequivocal commitment of the UN to support the government, and called for attendees to believe in this ambitious Government agenda.

Key Note Address: Leslie Reed, USAID Mission Director, Co-Chair of the DAG

Leslie Reed's keynote address set out the need for a new approach for Climate Resilient WASH under the One WASH National Programme (OWNP) and thanked the Minister for convening this event.

It reviewed the success made in meeting the MDGs in water supply in Ethiopia, but emphasised that a new strategy is needed for the SDGs – since they are focused on universal targets. Given this focus on universality – we need to place particular emphasis on the hardest to reach areas, in arid and semi-arid climates. We also need to focus on providing a quality service which works all of the time.

Echoing the speech given by the UN Resident Coordinator and Humanitarian Coordinator Ahunna Eziakonwa she stated that we need to take a long-term investment approach to reduce costly humanitarian responses – she highlighted that over \$6m a month was spent in the AWD response in Somali region.

She set out the need for deeper drilling to make wells resistant to drought, guided by new technologies and processes for finding water in harsher climates. USAID are currently using these technologies to determine groundwater potential in the lowland areas of Ethiopia, particularly the Eastern part of Somali region. She also underlined the importance of proper pricing and management of water so that a professional service is provided to communities.

Whilst acknowledging that this would require expensive up-front investment, she committed the DAG group to this supporting the Government of Ethiopia in achieving this Climate Resilient WASH strategy. Development partners will support by developing new financial programmes, exploring innovative financing options, promoting private sector engagement and offering in-kind expertise and technical assistance.

She ended by calling for Climate Resilient WASH to be a central pillar in the One WASH National Programme.

Opening remarks – His Excellency, Dr. Eng. Seleshi Bekele, Minister for Ministry of Water, Irrigation and Electricity

Dr. Eng Seleshi welcomed the opening speeches from development partners and thanked attendees for convening to discuss the critical issue of Climate Resilient WASH.

His speech emphasised the vital importance of WASH to economic development and poverty reduction. The government's vision of becoming a Middle Income Country (MIC) by 2025 is ambitious, and complex climatic challenges such as drought run the risk of undermining this vision if not addressed.

Ethiopia is a water scarce country and needs investment in infrastructure to manage its water resources – particularly given high population growth and climate change.

The Minister stated that the different regions of Ethiopia face very different challenges. But that the greatest challenges are in the drought prone, arid and semi-arid Eastern areas of the country.

While drought is not a new risk for Ethiopia, it is increasingly severe and frequent. He highlighted the progress that has been made on reducing fatalities when hit by drought, but underlined that this has come at a cost of short-term emergency spending which could have been used for long-term investment in resilience.

The key challenges facing these regions are insufficient access to water, inadequate supply, loss of livelihood, poor water quality, water-borne diseases, and weak capacity of institutions to maintain and develop new water sources.

The Ministry is taking leadership in addressing these challenges, and will use sustainable investment to turn these regions into economically productive ‘bread baskets’ in Ethiopia.

He invited conference attendees to strategize together on how to meet this goal.

Presentation –Background to WASH Sector Service Delivery, Ato Nuredin Mohammed, Director of Water Supply and Sanitation Directorate, MoWIE.

Ato Nuredin’s presentation set out the history of water sector development in Ethiopia, placing the current water resources management policies in a wider context of the overall government framework for development.

It noted important milestone in the sector such as the increasing decentralization of strategy development, the creation of the GTP I and II plans and the creation of the One WASH National Programme (OWNP) and the first WASH inventory in 2011. It set out how financing from donors and NGOs had increased, the shift from discrete project interventions to programmatic approaches and then the current a sector-wide approach, increased coordination amongst Government Ministries such as Water, Health and Education and Finance and the increasing role of the Private Sector.

His presentation set out the core principles and approach of the OWNP – specifically that it is the sector wide approach for WASH and then it advocates for One Plan, One Budget and One Report for the sector. He also explained how the OWNP links with the Consolidated WASH Account (CWA) – which is often confused by those new to the sector in Ethiopia. The CWA is part of the OWNP, and is currently financed by the World Bank, African Development Bank, DFID and UNICEF, with Finland and others expected to join shortly.

His presentation highlighted the coverage of the OWNP and the CWA and showcased the impressive recent results, for instance in increasing water supply access in Ethiopia from 14% to 57% to achieve the Millennium Development Goal.

The presentation also described the current situation with respect to the SDGs on urban and rural water access, and stated the ambitions of the Growth and Transformation Plan (GTP) II. Finally Ato Nuredin called for the need to align long term Resilient OWNP, GTP II and the SDG Goals, the need

to focus more on water quality monitoring, and the overarching requirement of bringing greater financing into the WASH sector to achieve these goals.

Presentation on Resilient WASH – His Excellency, Dr. Eng. Seleshi Bekele, Minister MoWIE.

His Excellency Dr. Eng. Seleshi returned with a more technical presentation to create a common understanding amongst the audience of the government’s current thinking on Climate Resilient WASH. He characterised his presentation as a deep dive into the challenges associated with drought prone areas.

Dr. Seleshi emphasised that WASH has a multiplier effect on achieving all development goals. He identified three key intervention areas:

4. Improving WASH Service Delivery
5. Improving institutions and accountability – and providing capacity support to decentralised levels of local government
6. Bringing together and involving all relevant stakeholders in WASH and related sectors

He stated that Ethiopia had missed opportunities in the past to invest in resilience and reduce the money needed for emergency spending in response to crises. The need now is even greater because of the increasing demand from all economic sectors, rising income, growing population and more climatic risks. He stated the need for a much stronger Management Information System (MIS) in WASH – which collects and manages information using satellite technology, cell phones and other ICT capabilities.

The Minister pointed out that Ethiopia has long faced drought, but that it is becoming increasingly frequent and severe due to climate change. He noted however the success in emergency efforts in reducing the number of fatalities suffered greatly, even while the number of people affected has increased.

The Minister stated his core objectives for the Climate Resilient WASH programme and emphasised the high relevance of Climate Resilient WASH to all SDGs, and the consequent need for multiple Ministries to work together on this agenda.

The Minister provided the practical example of Lega Multi Village Water Scheme (MVWS) in the Awabel Woreda, East Gojjam Zone of Amhara Region. The scheme currently serves 25,000 people in 21 villages and cost \$1.8m. It was financed jointly by the Government and UNICEF. Whilst the costs initially may seem high, they represent excellent value for money. The Minister also noted the increased potential for revenue generation now that a quality service is being provided.

The Minister also showcased a major project in Oromia, Borena Zone which covers 4 woredas and over 230,000 people and almost 1.4m livestock. The scheme shows the extent of the ambition the Ministry and the Regional Water Bureau has and underlines the importance of the management challenge.

The presentation detailed some of the new ways of working and new technologies that can be used to identify groundwater sources, such as topography, GIS software, Remote Sensing and DTM. These are much more economical than field surveys and can help identify where people are settling,

and their movement patterns which are particularly important in pastoralist areas. The Minister pointed to the good work that UNICEF and the US Geological Survey have done in this area. The Minister also presented indicative technologies for different zones in arid and semi-arid areas, and how they could be ranked according to resilience.

Partnerships within government, and with external stakeholders were identified as crucial, and the Minister committed to working with a wide range of organizations and partners given WASH's inter-sectoral nature. Initial institutional arrangements for the different actors have been identified at all levels which will help govern and guide the Sub-Programme's implementation.

The funding requirement for this Sub Program is substantial, it will require around \$5 billion USD for phases 1 and 2 (2018 – 2025). Proposed contributions were broken down as Development Partners (50%), Government (40%) and Communities (10%).

The presentation concluded with the following recommendations:

- Prioritise Climate Resilient WASH development for chronically drought-prone arid and semi-arid areas.
- Focus must be on Disaster Risk Reduction rather than disaster management so as to accelerate development.
- Integrate Climate Resilient WASH with water conservation and catchment management to ensure sustainability
- Establish post-construction support units as in OOWNP – particularly for MVWS
- Capacity Building using regional universities and TVETCs.
- Sub Program must be linked with livestock, agro-industries to ensure ability to pay for water
- Promote and strengthen credit and savings associations
- Enhance economies of scale for cost-effectiveness by using MVWS for clusters of villages
- Used coordinated graduate youth groups, in an organized manner, to support the management of MVWS.
- CSOs and development partners should mobilise their own resources and align with these projects wherever possible ensuring joint reporting and monitoring.

Plenary Discussion

DFID: Privileged to be part of the very successful OOWNP. The Minister has shown excellent vision in this initiative on Climate Resilient WASH. DFID agreed with the emphasis on developing a role for the private sector, in particular on the financing of this ambitious plan. The UK has considerable expertise in Public-Private Partnerships and offered technical assistance in this area. DFID also requested increased focus on supporting host communities of refugees, as is currently happening in partnership with UNICEF for WASH services. They requested MoWIE to partner with DFID on this issue.

WFP: Whilst not typically a member of OWNPN, WFP completely recognise the importance of WASH, particularly given the acute food and nutrition situation at present in Somali region. WFP are keen to work closely with Climate Resilient WASH programme to ensure safe reliable water sources for school feeding programmes which are going to be scaled up in arid and semi-arid regions. WFP thanked the Minister for his focus on bringing together sectors, and stated that nutrition and WASH should work closely together on this programme of work.

WHO: Fully support this initiative, particularly because they believe water is at the centre of development. WHO called for Climate Resilient WASH to be at the heart of the OWNPN. They emphasised the importance of a cross-government approach.

WHO stated that discussion is needed to prioritise water-centred development in Ethiopia. They called for an integrated water and livelihoods scheme that covers all forms of water usage and provides for water in schools and health facilities. They stated that their efforts to respond to the emergency in Somali region had been hampered by lack of access to water, but that this must be avoided in future. Water should be used as the entry point to development across the entire Ethiopian Government.

Water.org: Fully support the increased focus on the private sector. Microfinance should provide loans for water and sanitation to raise financing from the community. Government should look to examples in India of how the private sector can be involved.

International Water Management Institute: Called for higher standards from local manufacturers in technology. Also highlighted the importance of water pricing, particularly in irrigation. Without a functioning credit and financing mechanism it will be difficult to attract investment. Also requested further attention to be paid to environmental water quality, particularly waste disposal which will be of growing importance in the coming years.

Ethiopian Institute of Water Resources: Requested careful consideration of the impact of omitting some villages from Multi Village Water Schemes (MVWS), since some villages are too remote even for MVWS. Also called for attention to be paid to other climatic risks such as flooding – rather than focusing only on drought. They agreed entirely with the Minister’s point that Emergency WASH is much more expensive, and that resilience can save money and lives. They called for fuller definition of resilience, and warned against assuming that deep boreholes are always more resilient. They also suggested a new OWNPN implementation modality might be needed to rapidly deliver against the priority of Climate Resilient WASH.

Ethiopian Institute of Water Resources: – Addis Ababa University: Called for catchment management and restoration of landscape to be included as a crucial part of the programme. Protecting wetlands is also critical to sustainable Climate Resilient WASH. They requested the Ministry to work closely with the scientific and academic community – particularly on a comprehensive monitoring system. They said that this approach was relevant not only to lowland areas – but also to highland areas that are also facing climate challenges.

Catholic Relief Society (CRS): Very much appreciate the Minister's vision and the Key Note Speeches. They called for partners to learn from the innovations already ongoing – for instance on how borehole drilling in challenging areas is now better facilitating emergency response. The importance of local capacity at woreda and kebele level is also critical. One of the biggest challenges to the CR WASH Programme will be supply chains, particularly of maintenance equipment and spare parts. Rural water utilities can help support this. They called for civil society at all levels to give their full support to the CR WASH strategy.

Richard Wilson - Independent Consultant–for UNICEF: Raised issues for consideration in the development of the programme. Some boreholes at great depths (>600m) tap groundwater which does not recharge- careful modelling needs to be done to look at how much demand these can supply, for how long and what can be done when water runs out. High power costs of MVWS means government policy should be re-examined to determine whether power should be covered by scheme revenue or will receive government subsidy. Finally, urban and rural water utilities should very closely work together, or be merged to harness technical capacity and professional expertise.

European Union: Institutional Integration is critical in Ethiopia, particularly recommend working closely with Ministry of Environment, Forest and Climate Change; Ministry of Agriculture and Natural Resource Management; Ministry of Livestock and fisheries, Ministry of Federal Affairs and pastoralist communities. Called for CSO and development partners to integrate. The EU have a resilience building program with UNICEF which is focused in pastoralist areas, very happy to work with partners and share lessons learnt. Intersectoral links with nutrition, DRR, health, livelihoods are rightly highlighted by the Minister.

WaterAid: Bridging the development and humanitarian nexus is crucial. Calls for more research on CR WASH – in particular how to increase community-level resilience and how to identify climate vulnerability. Offered to work with CSOs to do action research on this. Called for a reallocation of budget to allow for more equitable approach which focuses on those left behind and developing regions.

SNNP Regional Bureau: Welcomed this ambitious but achievable plan. Called for greater capacity building efforts at a regional level, particularly in terms of groundwater studies and design capacity. Woredas and zones have limited resources and cannot adequately manage complex water supply schemes at present. Asked whether it is possible for WASH scheme administration units to go to the lowest Kebele level as currently happens in health or agriculture. This will enable problems to be escalated and addressed very quickly. Reiterated that current budget allocation using national budget index is not appropriate since it is based on population, but should also include consideration of coverage access.

USAID: USAID is a very strong advocate of the MVWS approach, but cautioned against assuming MVWS approach will work in all contexts – many communities are too remote this approach, or may have significant topographical challenges which make it uneconomical to pump water long distances. We need a parallel approach for these areas.

Ministerial Response: Agrees with the importance of involving the private sector. Minister said private sector engagement comes in different ways. All projects are built by the private sector. Even those which are constructed by state-owned companies or utilities are done so in competition with the private sector. Whilst the PPPs model should be used in some contexts, it may not be profitable in other contexts, so utilities must be used there – particularly in vulnerable markets. The Minister welcomed the suggestions on microfinance.

The Minister also highlighted the importance of water quality, water treatment and tight monitoring of these issues.

Minister acknowledged that \$5bn is a significant funding challenge, but noted that \$1.4bn was spent responding to the 2016, and that much of that money could have been saved had proper CR WASH been already in place. He acknowledged that MVWS are not a silver bullet, but that they have the potential to significantly reduce the money spent combatting drought problems. He also pointed out that water is a human right, and therefore we must find a way to make these investments whether the community can fully finance operation and maintenance or not. Research has a key role to play in determining who needs support and who can pay fully for water.

Minister agreed with those who called for integration with other parts of Government. He will be presenting CR WASH to other Ministries next week, and hopes to have water as a central pillar of the national development programme.

Experiences in MVWS – UNICEF, Dr. Sam Godfrey, Chief of WASH for Ethiopia

UNICEF has made presentation on its best experience of the MVWS construction across the different regions of the country. In his presentation Dr. Samuel Godfrey has highlighted the Service Delivery Models – Rural Water Utility and Turn Key approach which enables for the contractor and consultants to be accountable up until the complete prove of a project. With this approach they follow a method called Build Capacity Build and Transfer (BCBT) way of contacting to the private sector where the contractors are responsible to build the capacity of the institutions while doing the infrastructure. Dr. Sam has pointed that this approach has some benefits:

❖ **Benefits of the Three Phase Approach**

- ✚ **Secure the water source** - Identified large deep groundwater resources and reduced shallow groundwater geo-chemical contamination (e.g. Fluoride, Salinity)
- ✚ **Value for Money (Vfm)** – reduced loss investment through negative wells (UNICEF experience seen an increase a 40% increase in success rate)
- ✚ **Public Private Partnership** – investment in detailed studies provides assurance to drilling contractor which enables performance based contracts

❖ **Lessons learnt in implementation**

- ✚ **Design Documents:** Third party design work must be completed immediately to ensure ‘shelved’ projects (including groundwater mapping and deep well drilling campaign). Integrated CLIMATE into design.

- ✚ **Private Sector Engagement:** Cluster contracts to attract ICB and larger NCB contracts. Utilize turn-key (B-CB-T) contracts to increase involvement of the private sector in operations.
- ✚ **Contract Management:** Technical Assistance support required for Phase I of CR-WASH to accelerate both procurement and contract management at the regional levels.

❖ **Next Steps for Rural Water Utilities**

- ✚ CR-WASH O and M budget should move away from “rehabilitations” to Regional Capital Maintenance Fund
- ✚ Rural Water Utilities in each zone to be capacitated for MVS complex schemes
- ✚ Water pricing and regulation under GTP-2 to be initiated in CR-WASH locations

SNNP – Dr. Negash Wagesho, Regional Water Bureau Head,

The bureau head focused on the Climate Resilient WaSH –Practices & Challenges in SNNPR. In his presentation, the challenges in relation to CR-WaSH include but not limited to:

- Large population size – 20 million: Increasing demand of water for human, livestock and wildlife.
- Isolated settlements –difficult for WaSH interventions
- Pastoralist – significant water demand for livestock
- Poor water quality – Fluoride, iron affected
- Increasing evaporation rate and changing rainfall pattern: Insufficient moisture in lowlands (54 % of the total area)
- Low water access (50.6 % rural coverage)
- Ambitious GTP –II Targets and the SDG 2030 Agenda

As an advantage of the MVWS development in SNNPR it has:

- Addresses large size of community.
- Increases inter-village interaction.
- Share operation & maintenance costs.
- Effective solution for physically and economically water scarce areas
- Encourage watershed management practices.
- Wastage of scarce resources is minimized.
- Significantly contributes to meet the GTP-II plan

e.g Awada-Boricha MV Scheme

- Supplies 3-woredas (Awada, >Boricha – 28 Kebeles, Lok Abaya -19 Kebeles, Dalle- 9 Kebeles.
- 56 Kebeles served.
- The total beneficiaries are >250,000.
- Source: Spring - 110 l/s
- Multiple reservoirs (14) and (4) pump stations

- Main line length 43 km
- Total water points 320
- Total Cost = 81 M ETB = \$ 3.5m

The bureau head mentioned **Strategies to address key Challenges** including:

- Temporary humanitarian assistance to strategic and sustainable solutions
- Investing in water harvesting structures Harnessing flood water- Earth Dams, Sand Dams, ponds of sufficient size.
- Shifting from conventional to engineering solutions – investing in sustainable methodology.
- Rehabilitation of non-functional schemes
- De-Flouridization - Fluoride free and Integrated watershed management-

Oromia, Ato Asefa Kumssa, Head, Regional Water and Irrigation:

BORANA MULTIDISTRICT WATER SUPPLY SYSTEM (under construction): Enhancing climate resilience for pastoral community focussing on efforts, challenges & opportunities. As background the bureau head introduced that the area is:

- One of the 20 zones of Oromia regional State, located in the southern part of the country
- Has an estimated total human population of 500,000 (Borana zone) and 200,000 in Dugda Dawa of West Guji zone
- livestock population estimated at 3 million
- Characterized by lowland and arid to semiarid climate
- Average annual rain fall ranges from 450 – 550 mm, which is highly erratic and uneven in distribution
- Main source of livelihood is livestock production - *pastoralism*.
- but farming activities are gradually expanding into the rangelands.
- High degree of vulnerability to frequent drought (exacerbated by climate change)
- critical water shortage (water trucking), Mass livestock death, Persistent food insecurity.
- women and children spend more time by traveling long distance to fetch water (pond)
- together with drought, bush encroachment and rangeland degradation are serious problems

The current project under construction is implemented in different phases and project areas. With this project area – I will have features of:

- at least 4 weredas
- >230,000 humans
- nearly 1.4 livestock
- 17500m³/day
- 111 water points
- About300 cattle/camel troughs

CHALLENGES faced in the ongoing project include:

- Source of finance
- Supply (pipes, fittings and EM)
- Power supply

- Capacity/efficiency of contractor (civil work and drilling)
- Operation and management
- Design and construction
- Understanding the essence of the project itself

Plenary Discussion

Harar WASH Coordination Office: Welcomed these excellent presentations. Request the Ministry to use MVWS approach in smaller regions – Harar is very happy to be part of this sub program.

Stockholm International Water Institute: Welcome the Minister’s approach on prioritising disaster risk reduction (DRR) to reduce the need for disaster management. Keen to hear the plans for the next four year period on integrating DRR into local plans, and how capacity will be built in this area.

Somali Regional Water Bureau: MVWS can be suitable for pastoralists if they can use different water points and allowance is made for livestock. We need more boreholes in areas far from highland areas where the need is greatest. There are 15 woredas where there is only 1 borehole/no boreholes and we only have shallow water supplies.

Our experience is that there with very deep boreholes there are great challenges around operation and maintenance. Stainless steel pipes are often not available, but other pipes must be changed every three months due to the salinity. We need mobile maintenance teams for each zone who have the necessary equipment.

UNICEF: Agree that the financial allocation formula of Ministry of Finance needs to be revisited. Low population woredas may have a large CAPEX need for infrastructure. This will require a coordinated approach to persuade Ministry of Finance that change is needed.

Dr Gete – AAU - EIWR Clear definition of resilience at household and village levels is needed, with relevant indicators devised.

Ato Teferi Menkir (AfDB) Coordination is key between Ministries, and not only at Federal level but also at regional level. Microfinance institutions and banks should be involved in the strategy- they can reduce the pressure for financing on government. Regional authorities should be supportive of individuals taking loans to access water and sanitation.

Ato Gulilat Birahane – WB: We need a consultation of different sectors on the document. We also need to ensure this becomes part of the ongoing OWNPN review process, its critical this document is fully endorse in advance of that process.

Dr Geremew Sahilu - EIWR at Addis Ababa University (AAU): There should be a parallel research initiative which can document and record various experiences of CR WASH Approach and ensure good Knowledge Management. Our approach should be based on the best quality evidence and research. AAU is happy to provide graduate and PHD students to work on this.

Getachew Abdi (Coffey Int Dev't Ltd): suggest the need to involve ministries not currently part of the OWNP steering committee such as agriculture, urban development, livestock etc. Also call for universities to put climate resilience on their curricula so that we are building capacity of future generations.

Ministerial Response: Welcomed the many excellent suggestions from participants.

Stakeholders should see this sub component as enhancing the OWNP. It is not a replacement for OWNP – it is a core part of OWNP.

Minister agreed on the management challenges mentioned – the UNICEF study on operational management which developed a rural implementation O&M manual is an excellent resource to guide our approach on this. I know UNICEF are happy to support this work further.

The State Minister is coordinating the DRR strategy overall – but it is a coordinated effort which heavily involves our Ministry providing support particularly on hydrology and meteorology.

Minister agreed with the need to definition of Climate Resilience at different levels. Also agreed on the need to involve other Ministries in the OWNP Steering Committee. Also agreed with the need for a knowledge/research group that could undertake practical field-based research to support implementing partners and the regional ministries. Also agreed with the need to involve microfinance institutions and banks and look forward to working with partners to ensure this.

Ministry is very keen to build partnerships to get expert technical assistance, particularly on Remote Sensing approaches, hydrogeology and groundwater specialists. Strongly support the development of design capacity of these complex schemes so that rapid progress can be made – at present design capacity is far too low.

The Minister also highlighted some challenges that need to be considered further, particularly on water quality issues and the challenges of illegal connections to water schemes. These require further evidence-gathering as they are significant risks to the Sub Program that must be addressed.

The Minister closed the event by underlining the importance of partnership, not top-down solutions to ensure Climate Resilient WASH. He offered his personal guarantee that he will work to ensure other Ministries buy into the program, and cited the forthcoming Ministerial Council as a key opportunity to embed Climate Resilient WASH as a core feature of the national development agenda.

Meeting adjourned at 05:20 pm

.....END.....

Notes Taken from the Basin High Council 5th Regular meeting on CR – WaSH Program Initiative

Venue : Hilton Hotel

Date: 10th October 2017

Time: 1:30 – 05:00

Chair: H.E Ato Demeke Mekonen, Deputy Prime Minister and Co – Chair H.E Dr. Eng. Seleshi Bekele, Minister, MoWIE

Attendees: Member of the BHC, invited Ministers, Regional Presidents and commissioners

The presentation was made on the program document of the Climate Resilient WaSH to arid and semiarid areas by H.E Dr. Eng Seleshi Bekele in Amharic. Following the presentation reflections have been made by participants: The following points are taken as notes from the meeting as an input to the program:

H.E Ato Demeko Mekonen, Deputy PM, FDRE thoughts on the presentations:

- The Climate Resilient WaSH (CR-WaSH) strategy is very basic and fundamental for all other development programs. In other words, water is central to all other sustainable development programs.
- Therefore this initiative need to be linked/harmonised to the Green Growth development principle.
- We also need to look in to lasting way outs from the challenging drought situation in the country with such type of long term programs.
- In doing so the Deputy Prime Minister also underlined that we need to ensure that the arid and semi-arid areas of the country are vulnerable to drought prone when we look in to the last 10 years of trend analysis.
- For this to happen, it is highly recommended to first work out for the development of infrastructure, power supply as priority needs and bringing on board all other possible stakeholders exceptionally with regard to combating the drought effect in the country.

The meeting has continued in the afternoon under the chairmanship of: H.E Dr. Kasu Elala and Dr Eng Seleshi Bekele.

H.E Ato Mitiku Kassa (National Disaster Risk Leadership Institute Commission Commissioner):

- The link between the drought and water resource development and management need to be carefully managed as water is central to all development agendas. With this I encourage MoWIE to conduct mapping exercise before program implementation.

- The boreholes drilled across the country especially around the drought prone areas need to ensure sustainability and focussed Sustainable development needs.
- We suggest the Urban Development and housing ministry be member of the steering committee and key stakeholders with others as the situation is also affecting the urban dwellers.

H.E Ato Kebede Chane: (Minister, Ministry of Federal and Pastoralist Development Affairs)

- We need to agree and act that water is very central to all development and view it broadly beyond for the domestic and livestock consumptions.
- There are different programs both by federal and regional government yet we need to integrate and devise a mechanism to coordinate the efforts so that the MoWIE can ground all this in to the user communities. This is directly linked to the development of infrastructure facilities.

H.E W/o Misrak Mekonen: (State Minister – Ministry of Livestock and Fishery)

- The WaSH program need to critically take in to account of water for livestock as well.
- I strongly agree with the direction given by the deputy prime minister that we need to carefully look the Water Sector as central to all development programs and all stakeholders need to share their responsibilities accordingly.

Once participants have reflected on the program document H.E Dr. Eng. Seleshi has summaries the comments as follows:

Regarding 1st presentation:

- The ministry will take care of all the constructive comments given on how to go about it and some considerable advises as an input to the program.
- Regarding CR-WASH, system, we need to build capacity on resilient program with special emphasis on water for drinking purpose as well as water for drought prone areas for the purpose of domestic use, for pastoralists and semi-pastoralists, agro-processing, fodder production, etc. with this we need to critically think about it.
- Ethiopia has 3 faces: dry, adequate rainfall and wet lands. CR-WaSH is urgently and highly need for the drought affected areas covering from the north east to south west of the country.
- We need to professionally analyse the data available on the sector for effective program implementation.
- There need to have linkage with the infrastructure development and integration for the program.
- Withregard to the power supply we will be considering the off-grid systems including wind, solar and hybrid of both as source of power for areas which are hard to reach.

- We have expensed a total of 1.6 billion USD to respond to the drought as an emergency response and the irrigation program budget is very huge in 2016. This is almost a full budget for one big region with the thinking of this CR- WaSH program as lasting and sustainable solutions for the supply of water. Therefore, if we truly committed water should be the very serious investment for government in any case so that we can strategically transform the country.
- As the budget required for the program is very huge, we need to look in to different possible modalities of financing strategies and mechanism. A good example could be the blended financing mechanism which UNICEF is currently trying to propose to the ministry which will give chance for bringing financiers abroad the country both with loan and grants is highly important.
- On top of these, the different financing sources across the different ministries need to be well coordinated and managed carefully for optimum investment.
- In doing so we will also be careful about knowing the demand analysis aspect as water is not only for domestic use but also for livestock, irrigation and other development programs.
- For the sector to know about the mapping, the ministry will be trying to deployed the cutting age technologies which will ease the solution and increase dependability of the sources and program quality. With this we are currently starting to work with UNICEF and USGS regarding this.
- Water source assessment is being conducted by MoWIE: identifying reliable water source
- Integrating the WaSH program in the arid and semiarid areas is a non- negotiable agenda.

Meeting was adjourned at 05:47

.....END.....