Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI)

Gap Analysis and Action Plan – Scoping Report (Final)

February 2019

Angola

Report Number 1.1

GROUNDWATER MANAGEMENT INSTITUTE

This report emanates from the project Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States (GMI-PLI) commissioned by the Southern African Development Community Groundwater Management Institute (SADC-GMI), and executed by Pegasys.

SADC GROUNDWATER MANAGEMENT INSTITUTE (SADC-GMI)

Dean Street, University of the Free State
205 Nelson Mandela Drive,
Bloemfontein, 9300

South Africa

E-mail info@sadc-gmi.org Website www.sadc-gmi.org

Project team:

Derek Weston (Project Lead), Pegasys
Traci Reddy (Project Manager), Pegasys
Kevin Pietersen (Groundwater Management Expert), Pegasys
Deepti Maharaj (Project Coordinator), Pegasys

This report is accessible online through SADC-GMI website: www.sadc-gmi.org

Citation: SADC-GMI, (2019). *Gap Analysis and Action Plan – Scoping Report: Angola.* SADC GMI report: Bloemfontein, South Africa.

FOREWORD

The Southern African Development Community (SADC) Member States, through the support of International Cooperating Partners have gone through a series of Water Sector Reforms which varied in terms of policy, legal and institutional development. The focus of the water sector reforms has been on Integrated Water Resources Management and aimed at achieving sustainable and equitable distribution of water resources in the respective Member States. To a large extent, the water sector reforms did not comprehensively address the sustainable management of groundwater resources, yet 70% of the population in the SADC region depend on it. Climate change continues to negatively affect the availability of surface water, placing significance reliance on the use of groundwater for both urban and rural supply throughout the region. Human wellbeing, livelihoods, food security, ecosystems, natural habitats, industries and urban centres growth throughout the SADC Region are increasingly becoming more reliant on groundwater. The SADC region in general has an abundance of groundwater resources. However, due to several factors which include the lack of an enabling policy, legal and institutional environment, only an estimated 1.5% of the available renewable groundwater resources are currently being utilised.

It is estimated that there are about 30 Transboundary Aquifers (TBAs) and 15 transboundary river systems and that these systems are central to the water security of the region. There is therefore a need for Members States to establish and strengthen existing policy, legal and institutional frameworks to achieve equitable and sustainable access to water resources through joint management of the transboundary resources. It is in view of the above and in response to the need to strengthen the sustainable use of groundwater resources conjunctively with surface water at both the national and regional level, that the Southern African Development Community – Groundwater Management Institute (SADC-GMI) was established by the SADC Secretariat, on behalf of the Member States.

The vision of the SADC-GMI is, “to be a Centre of Excellence in promoting equitable and sustainable groundwater management in the SADC region”. The key focus areas of SADC-GMI are to 1)advocate, raise awareness and provide technical support in SADC around sustainable management through the dissemination of information and knowledge; 2) create an enabling environment for groundwater management through policy, legal and regulatory frameworks; 3) promote action-oriented research; 4) promote impact-oriented capacity building and training for groundwater management in the region; 5) lead and promote regional coordination for groundwater management; and 6) support infrastructure development for groundwater management.

In pursuance of the focus area of creating an enabling environment, SADC-GMI implemented the project entitled "Policy, Legal and Institutional Development for Groundwater Management in the SADC Member States, (GMI-PLI)". The methodology for said project included the development of the Desired Future State, conducting a baseline study of best practices, and description of policy, legal and institutional frameworks which promote sustainable groundwater management. Using an in-Country Experts model, a systematic analysis of the existing policy, legal and Institutional frameworks in comparison with the Desired Future State was conducted to identify gaps that required to be addressed in order to fulfil the SADC-GMI mandate – to achieve sustainable groundwater management in all 16 SADC Member States. The analytical assessment of the gaps identified at national level culminated in the production of 16 National Gap Analysis & Action Plan Reports and the higher-level Regional Gap Analysis Report. The latter summarises the findings across the SADC region.

This National Gap Analysis for Angola provides an overview of the existing gaps in policy, legislation, strategy, guidelines and the institutional frameworks and further suggests enablers required to unlock the identified gaps/challenges. The report provides a clear guidance for Angola to develop an implementation roadmap through a process of prioritising the Strategic Actions in close liaison and in consultations with all relevant stakeholders. It is hoped that these National/Regional Gap Analysis and Action Plan Reports will aid Angola to develop their own Roadmap which will ultimately advance the groundwater narrative and bring it at par with surface water in terms of policy, legal and institutional frameworks which will no doubt enhance sustainable groundwater management at a national and regional level in the SADC Region.

James Sauramba
Executive Director

ACKNOWLEDGEMENTS

The following individuals and organisations are thanked for their contributions to the project:

SADC – Ground Water Management Institute

Mr James Sauramba	Executive Director
Ms Nyakallo Khoabane	Administration and Finance Assistance
Mr Brighton Munyai	Technical Advisor
Mr Micah Majiwa	Governance and Institutional Consultant
Ms Mampho Ntshekhe	Grant Officer
Mr Thokozani Dlamini	Communications and Knowledge Management Specialist

Project Team

Mr Derek Weston	Project Lead and Institutional Expert
Ms Traci Reddy	Project Manager
Ms Deepti Maharaj	Project Coordinator
Ms Barbara Schreiner	Policy Expert
Dr Amy Sullivan	Knowledge Management Expert
Ms Jessica Troell	Legal Expert
Dr Kevin Pietersen	Groundwater Management Expert
Dr Pinnie Sithole	Cluster Lead
Ms Susan Byakika	Cluster Lead
Ms Pretty Ntuli	Project Administrator
Drã Maria João Pereira	In-Country Consultant: Angola

Stakeholders Engaged

The project team would like to thank all those stakeholders that contributed to the project from Government, Private Sector, Civil Society and Academia and Research.

The authors also like to express sincere appreciation to members of the **SADC Sub-Committee on Hydrogeology** for identifying the need for this project, following on the numerous challenges that they experience in their respective countries. Without the dedicated facilitation and support from the members of the SADC Sub-Committee on Hydrogeology, who also serve as focal points for groundwater development in their respective countries, this exercise would not have been accomplished.

In this regard, special thanks are given to:

Mr Manuel Quintino, Angola; Mr Kedumetse Keetile, Botswana; Mr Cyrille Masamba, Democratic Republic of Congo; Mr Trevor Shongwe, Kingdom of eSwatini, Ms Christinah Makoae, Lesotho; Mr. Luciano Andriavelojaona, Madagascar; Ms Zione Uka, Malawi; Mr Pokhun Rajeshwar, Mauritius; Ms Ana Isabel Fotine, Mozambique; Ms Maria Amakali, Namibia; Mr Frankie Jose Dupres, Seychelles; Mr Zacharia Maswuma, South Africa; Ms Mwanamkuu Mwanyika, United Republic of Tanzania; Mr Frank Ngoma, Zambia; and Mr Robert Mutepfa, Zimbabwe.

Additionally, the authors thank all other professionals from the Member States who contributed to the project by providing ideas and feedback, in particular, professionals from various organisations who contributed to the over-all project, and senior officials from the Member States. The contribution of all institutions and individuals who supported the project through ideas and comments and may not have been credited by name, is greatly appreciated.

DOCUMENT INDEX

Presented in the table below is a list of products developed during the GMI-PLI Project:

Phase	Document	Report No.
Country Reports	**Gap Analysis and Action Plan – Scoping Report: Angola**	**1.1**
	Gap Analysis and Action Plan – Scoping Report: Botswana	1.2
	Gap Analysis and Action Plan – Scoping Report: Democratic Republic of Congo	1.3
	Gap Analysis and Action Plan – Scoping Report: Kingdom of Eswatini	1.4
	Gap Analysis and Action Plan – Scoping Report: Lesotho	1.5
	Gap Analysis and Action Plan – Scoping Report: Madagascar	1.6
	Gap Analysis and Action Plan – Scoping Report: Malawi	1.7
	Gap Analysis and Action Plan – Scoping Report: Mauritius	1.8
	Gap Analysis and Action Plan – Scoping Report: Mozambique	1.9
	Gap Analysis and Action Plan – Scoping Report: Namibia	1.10
	Gap Analysis and Action Plan – Scoping Report: Seychelles	1.11
	Gap Analysis and Action Plan – Scoping Report: South Africa	1.12
	Gap Analysis and Action Plan – Scoping Report: Tanzania	1.13
	Gap Analysis and Action Plan – Scoping Report: Zambia	1.14
	Gap Analysis and Action Plan – Scoping Report: Zimbabwe	1.15
	Gap Analysis and Action Plan – Scoping Report: Comoros	1.16
	Tanzania GW-PLI Roadmap	1.17
	Kingdom of Eswatini GW-PLI Roadmap	1.18
Regional Reports	Regional Gap Analysis and Action Plan	2
Groundwater Management Guidance Documents	Development of a Groundwater Policy, Legal and Institutional Roadmap	3.1
	Operation and Maintenance of Groundwater Schemes	3.2
	Building Groundwater Resilience	3.3.
	Institutionalisation of Groundwater Management	3.4
	Strategic Approach to Financing Groundwater Management	3.5

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ACRONYM	DEFINITION
COBA	Engineering and environmental consultants
CIWA	Cooperation in International Waters in Africa
DNA	National Water Directorate
DNB	National Department for Biodiversity
DNTNA	National Directorate of Environmental Technologies and Regulate Matters.
DPEA	Provincial Directorates of the Waters
GABHIC	Cunene, Cubango and Cuvelai River Basins Authority
GEF	Global Environment Facility
GESI	Gender, equity and social inclusion
GMI-PLI	Groundwater Management Institute – Policy, Legal and Institutional
GW	Groundwater
IGEO	Geological Institute of Angola
IGRAC	International Groundwater Resources Assessment Centre
INRH	National Water Resources Institute
IRSEA	Regulatory Institute of Electricity and Water Services
MDGs	Millennium Development Goals
MINAGRIF	Ministry of Agriculture and Forestry
MINAMB	Ministry of Environment
MINEA	Ministry of Energy and Water
MoSCoW	Must, Should, Could, Won't
NGOs	Non-governmental organizations
OABH	Watershed Management Bodies
PAT	Programme Water for All
PGDURH	General plans of development and use of water resources
PLANIRRIGA	National Irrigation Plan for Angola
PLI	Policy, Legal and Institutional
PNEA	National Strategic Program for water
PNA	National Water Plan

ACRONYM	DEFINITION
REF	Economic and Financial Regime (Water Rights Fee)
SADC	Southern African Development Community
SADC-GMI	Southern African Development Community – Groundwater Management Institute
SEA	State Secretariat for Water
SDG	Sustainable Development Goal
Uíge	Regional Directions: Regional Directorate North

1. INTRODUCTION

1.1. Background to the GMI-PLI Project

The critical role of groundwater in building the region's resilience to climate change and improving water security is reflected by the World Bank in their June 2017 online article: *People in Southern Africa are largely dependent on groundwater shared between countries and communities for health and well-being, food production, and economic growth.* As climate variability alters the amount of surface water that is available, people in the region are increasingly turning to groundwater, a resource that is already challenged by threats of depletion and pollution.

The sustainable management of groundwater is a key part of the broader water security for the region, especially in understanding transboundary aquifers. The Southern African Development Community (SADC) has established the Groundwater Management Institute (GMI) to better understand the region's needs and improve their groundwater management capabilities.

The SADC Groundwater Management Institute (SADC-GMI) is the implementing agency of the World Bank funded Sustainable Groundwater Management in SADC Member States Project. This funding is secured through the Global Environment Facility (GEF) and the Cooperation in International Waters in Africa (CIWA) trust. Part of this funding has been dedicated by the SADC-GMI to respond to gaps in the existing policy, legal and institutional (PLI) frameworks for groundwater management in the region towards fulfilling one of four main components of the project –"Enhancing institutional capacity of governments in SADC Member states and transboundary organisations". The objective is to be met through a series of organised steps which broadly included the development of a benchmark document called the Desired Future State Document, a Gap Analysis and high-level Action plan for all SADC Member States and for the region, development of a suite of guidelines to strengthen groundwater management regionally. To inform the guideline on the development of a groundwater PLI Roadmap, Tanzania was selected as a pilot from which to draw lessons and develop the process.

This report analyses gaps and challenges in groundwater management in Angola. It is contributing to the overall objective of creating an enabling policy, legal, and institutional environment for effective groundwater management through identification of gaps at national level and development of action plans for addressing the gaps. It states the current status, gaps or challenges and what it would take to address the identified gaps and challenges.

The lack of specific regulation and the irregular use of groundwater constitutes a real threat to the security of public water security which if not managed sustainably may jeopardize Angola's progress towards achieving universal access to drinking water. Although the groundwater resources in Angola are not well-understood, groundwater is a fundamental source of water for some of Angola's population. Groundwater is a key source of water for a number of municipalities that are supplied and serviced by boreholes. Groundwater presents itself as a viable part of the solution to the water constraints of Angola. Angola is currently divided into 18 provinces, further subdivided into 164 municipalities and 557

communes. There is no updated information/live database on groundwater that can help estimate existing borehole numbers.

Groundwater is more and more a solution for surface water-scarce areas and serves as a viable alternative source especially given the need to expand water access to meet increasing demand in the face climatic variability.

This study aimed at assessing the shortfalls within Angola's groundwater management policies, strategies, legislative and institutional environment in order to identify the necessary actions to strengthen the existing groundwater management framework. As part of the analysis, a minimum effective groundwater management platform called the desired future state, was set to define the desirable minimum state for groundwater management.

Achieving effective and sustainable groundwater management standards of governance is necessary as it contributes significantly to achieving national and international standards for sustainable development (SDGs) including meeting the basic human needs of food, water and the protection of ecosystems.

1.2. Socio-economic drivers for Angola

In Angola, public water supply consists of urban, peri-urban and rural supply. The consumption of water is utilised for industrial and domestic purposes, trade as well as services. The water and sanitation sector in Angola is in the process of reform, for which there have been defined strategic guidelines, programs and executive plans, aligned with an important set of key instruments, in particular:

- The commitments of Angola in relation to the Millennium Development Goals-MDGS, related to the water and Sanitation Sector;
- Long-term development strategy, Angola 2025, which calls for clear targets for human development, which are of course a set of challenges for the Water Sector;
- The program of development of the Water Sector (2018-2022) and the program of the Government in relation to the Water Sector, were established towards fulfilling the mission to *"Act to provide the population with access to safe drinking water in urban and rural areas, as well as access to water for economic activities".* There were programs that included investment plans and established goals of expanding coverage, seeking to impact the neediest population.
- Plans have been developed for water supply and sanitation for 17 provincial capitals within the time horizon up to 2030.
- PAT (the water for all programme) which is a nationwide programme covered all the provinces in its initial stages (2007), with emphasis on the rural population. It is coordinated by a Technical Committee. Initially, the schedule for implementation was five years, but after eleven years, the Committee still stands- in-Office, an indicated of the failure to achieve the goals envisaged.

Hydroelectricity: In the last decade, the production of electricity in Angola was mostly water-borne. The country's extent of hydroelectrical development is a reflection of Angola's geographical characteristics, topography and climate, where it is favoured by the existence relatively good rainfall, coupled with abundant water flows and low temporal variability.

Industry: The industrial sector, and specifically the food processing industry accounts for the largest consumption of water in the country.

Angola's industry consists of various sub sectors/units that manufacture among other things, ceramic products, food products, the liquor industry, garment industry, wood industry, furniture and metal fabrications, as well as pharmaceutical products, etc.

The industrial sector contributes significantly to the development of Angola's various provinces. Notably, the economic and social development trends predict a sharp growth in water intensive industries that will result in an increased demand for water, hence the need to improve groundwater management as an alternative source to the growing demand.

Irrigation: The characterization of the use of water resources in irrigation sector requires a country-wide survey of existing areas, sources of water used, the types of cultures practiced, and of existing irrigation systems and their efficiencies. The PLANIRRIGA database, shows that, at present, most of the irrigated area focuses on the river Queve units (about 24.9% of the total irrigated area) and the Middle Kunene (23.5%), followed by descending order low Kwanza (11.2 %) and the watershed of Catumbela (9.2%). Angola needs to significantly increase agricultural production contributing to:

- Food security of the country.
- Exportation's decrease.
- Job creation and rural development.

Irrigation is one of the fundamental factors in agricultural development in various regions, in particular the Northwest, the Kwanza, the Midwest, the Cunene, in the Southwest, Cuvelai, Cubango and When. An important part of the annual water consumption of the agricultural sector takes place in the dry season, which may result in some situations of shortage in certain regions.

Livestock: Livestock plays an important role in the reconstruction of Angola and is a business priority for food security, ensuring the consumption of the rural population. According to the estimate of livestock by provinces, presented at the National Conference on Agriculture in 2016, almost all of the cattle are concentrated in the provinces of Huíla, Cunene, Namibe and Benguela, where live more than 60% of small ruminants. The livestock sector will be in the future, one of the major consumers of water in the vast majority of the hydrographic units.

1.3. Water resources

The Regulation of General Utilisation of Water Resources is provided for in the Presidential Decree No. 82/14, of 21 April. CHAPTER I on General provisions ARTICLE 1º defines the regime of general use of

water resources, including the planning, management and mechanisms of economic and financial remuneration. ARTICLE 2º (Framework application) sets which is applicable to surface and ground waters, including streams, lakes, ponds, swamps, springs, lakes, estuarine areas and other bodies of water, without prejudice of their beds, and vicinity.

1.3.1. Status of water resources (surface, groundwater and transboundary)

The existence of cross-border rivers (transboundary river basins), especially in situations of water scarcity, calls for cooperation in development of the resource between the riparian states, as a means of managing against conflict. Angola shares five of the major river basins in the region:

- Cunene (shared with Republic of Namibia)
- Cuvelai (shared with Republic of Namibia)
- Cubango/Okavango (shared with Botswana and Namibia)
- Zambêze (shared with 7 SADC countries more)
- Congo/Zaire (shared with over 10 countries of Central Africa)

For some international river basins shared by Angola, the plans are complete, as is the case of Cunene, Cubango, Zambezi and Cuvelai. The Executive of Angola attaches great importance to the issue of transboundary/shared water resources. This is reflected in the appointment in 2003 of an Inter-ministerial Commission to the international waters agreement coordinated by Minister of energy and water, which is no longer in charge. The agreements covered the Cuvelai (shared with Namibia); Cubango/Okavango (shared with Botswana and Namibia); the Zambêze (shared with 7 other SADC countries); and the Congo/Zaire river (shared with over 10 countries of Central Africa).

The Cunene, Cubango and Cuvelai River Basins Authority (GABHIC) has a function to oversee the development of the river for which it was created. Important to note is that groundwater management is included in river basin management under the territorial management unit. It should be noted that the aquifer systems in Angola do not necessarily align (perfectly) with the hydrographic basins. Cross border aquifers present a significant set of challenges for international policy different from those related to watersheds. Angola shares several aquifers with other countries (according to IGRAC, 2017). These include;

- Côtier Aquifer shared with the Republic of Gabon, Republic of Congo and the Democratic Republic of Congo;
- Dolomite aquifer shared with Democratic Republic of the Congo;
- Cuango shared with Democratic Republic of the Congo;
- Cuvelai-Etosha Aquifer, shared with Namibia;
- Caprivi Sub-basin Kalahari/Karoo Aquifer North, shared with Botswana, Namibia and Zambia; and
- Coastal Sedimentary Basin aquifer, which it shares with Namibia.

Water policies in Angola are based mainly on surface water resources. While groundwater is of significance in terms of the role it plays in meeting the demand in some municipalities, the focus on surface water resources development and management may be associated with lack of political will for development of groundwater resources, as well as the institutional and territorial configuration to operate in terms of surface water resources.

The lack of explicit reference to groundwater in existing water law, could have significance in the limited investment in groundwater specific developments compared to prioritized surface water projects in Angola. For Angola to achieve its goal in terms of drinking water, which is to increase rural coverage to 80% by 2026, groundwater should play a significant role. Effective groundwater development would require addressing existing knowledge and/information gap which is linked to insufficient data /research on groundwater. It would also require the consolidation of integrated management of water resources (conjunctive use that considers all viable water alternatives including groundwater). Furthermore, for Angola to take advantage of the true potential of underground water, including management, there is need to considerably strengthen institutional policies, which should address groundwater institutional capacity needs.

1.3.2. Groundwater environment and ecology

The determination and management of ecological conditions of water constitute a key factor for the sustainability of aquatic ecosystems, as well as the satisfaction of other uses. Currently, Angola does not yet have complete studies establishing the ecological flow, depending on the specifics of the hydrographic units.

There is a provision under PNA admitted book for Environmental Uses, which reflects on aspects of environmentally sustainable utilisation of water resources. It provides for a minimum annual average allocation of 15% of the total water is provided to cover natural values and conservation, providing a considerable safety margin with regard to the sustainable utilisation of all the river basins.

1.3.3. Status of groundwater infrastructure

The typical water infrastructure of Angola includes fields of groundwater boreholes, water supply schemes, dams, river water works, inter-basins and transfer channels. The estimates of renewable groundwater water resources in Angola points to about 58 km ^{3}/year. Although there are operational boreholes all over the country, groundwater reserves are not generally developed significantly due to easy availability of surface water. The most important aquifers are found in sedimentary deposits, whose depth vary between 10 and 30 metres, around Huambo; between 5 and 30 metres in the coastal areas and up to 200 m in the semi-arid areas of southern Cunene River basin.

The boreholes are designed primarily to meet the household needs. The aquifers recharge, in the pastoralist dominated semi-arid region in Angola is very low. According to results of groundwater models, prepared in 1996, the aquifers are vulnerable to overexploitation (LNEC 1996). Aquifers recharge decreases, generally from North to South and from East to West of the Cunene River basin. The aquifer

recharge is also influenced by the favourable hydrological properties of certain geological formations in the area, which provide more complexity to the general trend. Relatively low groundwater flows in the Cunene River area can be attributed to high rates of evaporation coupled with the low surface flows in the river. The southern region of Angola presents a highly variable climate with great irregularity in the distribution of rainy episodes over a hydrological year and between successive hydrological years. The low rainfall, high evaporation rates and relatively steep relief, are factors that result in a relatively low recharge which may provide the appearance of problems related to the depletion of the aquifer.

1.3.4. Groundwater supply and demand

Most of urban areas receive supply from surface water sources, but the provincial capital of Malange, Benguela, Lubango and Namibe, as well as the urban areas of Tombwa and Lobito, depend on groundwater, to a greater or lesser extent. According to data from the National Strategic Program for the water 2013-2017, the southern and southwest parts of Angola have the majority of available groundwater information. This information indicates that many boreholes have been drilled and registered in these areas. In the remaining provinces, there is inadequate information on groundwater sources (boreholes). An important network on groundwater is located in the provinces of Cunene (40%), Namibe (30%) and Huíla (15%) for a total of 85%, and also in Malange (5%) Benguela (7%) and Cabinda (3%).

In general, the use of groundwater is concentrated in coastal areas and in southern Angola, where conditions are more arid and surface water available are on a smaller scale. In rural areas with higher incidence, particularly of groundwater obtained depend on the yield of bore holes, hand-dug wells and springs. It is common for farmers and livestock keepers, to build their own boreholes.

2. METHODOLOGY

2.1. Overview

The methodology for the gap analysis included conducting a desktop review of available literature. This was coupled with the development of a desired future state to provide a baseline for groundwater management and is discussed in more detail below. Key stakeholders were also identified during the early stages of the gap analysis and multiple engagements were held whereby a questionnaire was administered to evaluate the current state of groundwater management in the country. Based on the desktop review, stakeholder engagements and results from the questionnaire, a draft gap analysis report and action plan was developed which was then validated at Validation Workshops. These workshops involved key groundwater actors from the Member State and provided an opportunity to obtain buy-in and support for the gap analysis reports as well as obtaining further inputs. The draft report was also circulated to broader stakeholders i.e. Water User Associations, Water Service Providers etc. whereby written comment was received. The draft gap analysis report was then finalised based on the comments received from the Validation Workshops and broader stakeholders. The methodology outline is illustrated in the figure below.

Figure 1: Methodology Outline

Literature was collected and is made available in **Appendix A**. The review of existing information was based on different white and grey literature collected from various researchers, government departments, NGOs, donor reviews and reports, research theses and consultant reports.

Several individuals/institutions (**Appendix B)** were engaged for data collection using the structured questionnaire, based on the Desired Future State, elaborated on below.

The desired future state has been contextualised for the SADC region, taking into account:

- The high levels of groundwater dependency in many SADC countries, in rural areas in particular;

- The variety of geohydrological contexts;
- High levels of poverty, gender disparities, social exclusion and pollution; and
- Relatively low levels of state capacity – skills, infrastructure and finance.

It sets out the ***minimum*** requirements that support the delivery of national, regional and international developmental goals, including the Sustainable Development Goals, meeting basic human needs to water, energy and food (the WEF nexus), and the protection of ecosystems that are dependent on groundwater.

The sections below describe, at a high level, what is considered to be the minimum best practice for policy, legislation and subsidiary legislation, regulations and standards for effective groundwater management. For a more detailed description of the desired future state, see **Appendix C**.

The **minimum policy requirements** that should be in place are:

- A long-term policy to protect groundwater by preventing pollution and overuse.
- The social, economic and environmental values of groundwater are all recognised.
- The human right to water is recognized and a rights-based approach to groundwater management is taken.
- Groundwater is recognised as a highly important source of domestic and agricultural water supply and a key resource for poverty alleviation, food security, and the sustainable economic development of rural areas.
- The biophysical and ecological linkages between ground and surface water for their use, protection and management are recognised, including land use zoning for groundwater protection and recharge (conjunctive use).
- The importance of the maintenance of the ecological integrity of wetlands in groundwater management is recognised (recharge zones).
- Intersectoral collaboration is promoted and facilitated.
- The need for adaptive management is recognised.
- The roles of various stakeholders and water users in groundwater management is recognised and participation of stakeholders is promoted and facilitated.
- An apex body that is responsible explicitly for GW management and playing the role of custodian/trustee on the part of the state is clearly defined.
- Effective institutional arrangements are coordinated at transboundary, national and local levels.
- Public access to geohydrological data held by the state is promoted and facilitated.
- Additional environmental principles necessary to protect and sustain groundwater are mandated, including: the precautionary principle, the principle of gender equity and social inclusion (GESI), the principle of subsidiarity, and the principle of intergenerational equity.

The **minimum legislative requirements** that should be in place are those that explicitly address the use, management, and protection of groundwater and provides the necessary tools for the state to regulate, manage, control, protect and develop groundwater resources in conjunction with surface water resources. At a minimum, legislation and/or subsidiary regulations should:

- Provide the status of groundwater noting that all water has a consistent status in law, irrespective of where it occurs, and there is explicit reference to groundwater and conjunctive use management; and recognise the human right to water recognized in groundwater legislation, facilitating prioritization of drinking water and basic human needs, as well as small-scale users.
- Regulate groundwater quantity by providing conditions for accessing groundwater through water use authorisations system that does not discriminate (especially against the rural poor), is not tied exclusively to land tenure and enables effective compliance monitoring and enforcement.
- Provide groundwater protection mechanisms that includes regulating pollution (point source and non-point source), regulates depletion, regulates abstraction and recharge (usually via permitting) and provides for the sustaining wetlands;
- Enables integrated planning through specifying the need for long term plans (at catchment or basin level) to ensure the sustainable use of groundwater, including drought management plans and cross-sectoral coordination.
- Make provision for institutional arrangements including the mandate, competence and power of the relevant authorities, enabling the integrated management of groundwater and surface water resources, engaging in the arbitration of competing demands and diverging interests regarding groundwater abstraction and use, and support the collaborative engagement with other sector authorities, competent for public health, land-use planning, soils management, and waste management.
- Support effective stakeholder engagement through specifying when and how stakeholders, the public and/or other water users are to be engaged in the development of laws and regulations, planning, decision making and self-management regarding groundwater and should specifically address the issue of the involvement of women and youth in decision-making and the implementation of groundwater supply schemes.
- Provide for Monitoring and data collection to support regulation including protocols for data collection, management, exchange and dissemination, including standardization and harmonization of data, as well as national monitoring and information systems for the management of data and information.
- Regulate to ensure water conservation and efficiency of use.
- Support compliance and enforcement through clear mechanisms for promoting compliance with groundwater regulations through enforcement provisions that enable inspections, the imposition of fines and/or additional administrative penalties and other instruments to address failure to comply with the law.
- Conflict resolution mechanisms and/or the right to appeal.
- Enable the development of regulations on any relevant matter in the legislation to regularise aspects of groundwater management and incentivise appropriate use of groundwater resources.

The actual **requirements for subsidiary regulation** will differ from country to country, according to their own National Legislation. However, it is important to understand the extent to which critical issues

around groundwater management have been translated into regulations. Below are some examples of how this could look.

- Subsidiary legislation or regulations pertaining to use, protection including on-site sanitation, borehole drilling, and appropriate financial and economic regulatory tools e.g. water pricing.
- Clear protocols and standards on data collection and storage.
- Templates for municipal by-laws.
- Community management of groundwater and community participation in groundwater management.

From an **institutional perspective**, it is critical that countries have as a minimum, a dedicated Ministry for water resource management, which is also the custodian for ground water management. Noting that the groundwater is a localised resource, decentralised institutions at trans-boundary, catchment and local government level are crucial, where groundwater management fits into overall mandate for water resource management.

3. POLICY

3.1. Evolution

The Ministry of energy and water has an organic structure defined in the Presidential Decree No. 24/18 of 31st January (2018) where he approves the respective Organic Statute. Article 1 of the Organic Statute of MINEA States that this is the Ministerial Assistant Department of the President of the Republic which aims to propose formulating, driving, implementation and control of the Executive policy in the fields of energy, water and sanitation. The Presidential Decree No. 253/10, of November 16, (2010) sets the Organic Statute of the National Institute of water resources.

The National Institute for Water Resources (INRH) is the institution in charge of planning and management of water resources at national level. It was established as per the Presidential Decree No. 253/10 and updated to the new Organic Statute stipulated by Presidential Decree No. 205/14 of 15 August indicates that the functions of the INRH are: a preparation of national water resources Policy, planning and ensure the management of water resources, with a view to the efficient and sustainable use of water resources. It holds the responsibility over general plans for the development and use of water resources of each river basin, including a sub-programme inventory. It ought to keep a record in the public domain, with regards to the watercourses, lakes, ponds, swamps, springs, and estuarine areas as well as other bodies of water. The purpose of the General Development Plans is to provide at national level, plans such as the safety planning of dams. Therefore, INRH fills an important space in the management of water resources of the country. TMAR, taking over many water resource management functions, is provided for in the legislation which provides for the creation of Regional Directorates and offices of basin management Catchment areas. This gives them the responsibility for the economic and financial regime, to manage a conservation area in the hydrographic network, and to manage impacts and environmental risks and their proximity relationship with users. Currently, in accordance with article 118 of the General regulations governing use, the INRH is responsible for planning activities and management of water resources at the level of river basins. It is also responsible for the effective creation and installation of watershed management bodies (OABH). Currently there is only the office which deals with the integrated management of water resources of the watershed of the rivers Cunene, Cubango and Cuvelai, GABHIC. The INRH provides for the creation of the following Regional Directorates: Regional Directorate North (Uíge), Regional Directorate East (City of Luena), and the Regional Centre (Benguela City or city of Huambo).

3.2. Policies to support groundwater management

With the creation of the National Institute for water resources, was initiated the process of normative and institutional development of the water sector in Angola. The purpose of this agency is the planning of water resources at national level, with the aim of implementation of a national water resources policy, to instill a new dynamic in the management of both surface water and the groundwater.

The preliminary draft of the General regulations governing use of water resources which defines the general regime, attaches to this organ the national water resources Plan that includes groundwater. The INARH offers a service as an administration office for river basin, responsible for management. This fits among other functions, such as the development and implementation of the General Plan of development and use of water resources of the basin. In addition to the Ministries in Water catchment areas, Provincial Governments also have competence in monitoring the implementation of economic programmes and plans of government investment and assignments in the preparation of their reports. Regarding the regulation on water quality, the Presidential Decree No. 261/11, of 6th October, assigned to the Ministry of Environment, the responsibility for Coordinating the Water Quality Monitoring Commission (Article 16). Among other powers contained in the Organic Statute of the Ministry of the environment, is the coordination of strategies and policies for the protection, preservation, environmental management and preservation and rational use of renewable natural resources.

3.3. Gaps and challenges identified

a) No policies exist specifically for groundwater. There are only general regulations for water resources in general, law No. 6/02, of 21 June 2002 (water Law), as described in article 2 "the present law applies the inland waters, both surfaces, constituting part of the hydrological cycle.

b) There are no specific policies that highlight biophysical and ecological linkages between groundwater and surface water the law does not specify policies for groundwater protection, under article 110 (Presidential Decree No. 82/14). However, the zones defined refer only to the protection of surface water resources. It is recommended to have a definition of protection zones for groundwater resources.

c) There is hardly any recognition/uptake of the roles of various actors and water users in the management of groundwater (Government, private sector, research bodies, civil society, etc.) This despite the Presidential Decree No. 76/17, of 20th April establishing the National Water Council (C) and approver its regulation. The CNA is a permanent advisory body of the Power of Attorney (President), of coordination and articulation between the different Ministerial Departments, directly and indirectly linked to the planning, management and use of water resources, national or shared by the Angolan State, including the water user and local communities (Article 1). The CNA works under the coordination of the Vice-President of the Republic (Article 2).

d) Weak or hardly existent cross-sectoral collaboration between the Ministry of Energy and Water, Ministry of Agriculture and Forestry and the Ministry of Natural Resources and Oil, which is necessary to promote and facilitate better coordination in groundwater management.

3.4. Enablers required to unlock these gaps/challenges

Table 1: Enablers required to unlock policy gaps and challenges

Groundwater gap/challenges	Enablers
a) No policies exist specifically for groundwater. There are only general regulations for water resources in general, law No. 6/02, of 21 June 2002 (water Law), as described in article 2 "the present law applies the inland waters, both surfaces, constituting part of the hydrological cycle.	▪ Promote effective groundwater management, contributing to the sustainability and rational use of general water availability; better to concentrate on groundwater as an alternative water source (conjunctive uses) rather than seek explicit groundwater laws. This promotes integrated WRM ▪ Integrate set of administrative actions that control the policies on an aquifer system, in order to satisfy water resources policy;
b) There are no specific policies that highlight biophysical and ecological linkages between groundwater and surface water the law does not specify policies for groundwater protection, under article 110 (Presidential Decree No. 82/14). However, the zones defined refer only to the protection of surface water resources. It is recommended to have a definition of protection zones for groundwater resources	▪ Promote the adoption of public policies specifically aimed at protection of groundwater resources, aiming to integrate from multiple uses of the watershed and reservoir, assuring appropriate balance between the withdrawal of groundwater and aquifer recharge
c) There is hardly any recognition/uptake of the roles of various actors and water users in the management of groundwater (Government, private sector, research bodies, civil society, etc.) This despite the Presidential Decree No. 76/17, of 20th April establishing the National Water Council (C) and approver its regulation. The CNA is a permanent advisory body of the Power of Attorney (President), of coordination and articulation between the different Ministerial Departments, directly and indirectly linked to the planning, management and use of water resources, national or shared by the Angolan State, including the water user and local communities (Article 1). The CNA works under the coordination of the Vice-President of the Republic (Article 2).	▪ Integrated water resources management requires incentives to promote role playing and a sense of responsibility and accountability among all users and actors especially in the municipalities that depend heavily on groundwater. e.g. municipalities having to report on groundwater status say on a quarterly basis and developing a database for to start record keeping.
d) Weak or hardly existent cross-sectoral collaboration between the Ministry of Energy and Water, Ministry of Agriculture and Forestry and the Ministry of Natural Resources and Oil, which is necessary to	▪ Enlarge the geological knowledge to support the implementation of an integrated management system between groundwater and the surface water, since currently the management is focused on the component of surface water, the fact that

Groundwater gap/challenges	Enablers
promote and facilitate better coordination in groundwater management.	this greater visibility and greater availability of data and studies. It is necessary to undertake detailed studies in order to determine the geological potential of each province; and, identifying their potential cross-border, availability, water quality, vulnerabilities and risks, in order to propose a sustainable use and management of this complex watersheds.

4. LEGISLATION

4.1. Evolution

The Constitution of the Republic of Angola (2010) is the highest legislative document that reflects on elements of groundwater management. In the Constitution, the following laws are relevant to the water sector in general.

- Law No. 05/98 of 11 June 1998 – Law of Environment.
- Law No. 06/02 of 21 June 2002 – Water Act.
- Law No. 9/04 of 9 November 2004 – Land Act.
- Law No. 51/04 of 23 July 2004, Law on Environmental impact assessment.

In addition, over the years the following instruments have been developed to address key water resources and environmental issues for environmentally sustainable water resources management:

- Presidential Decree No. 59/07 of 13 July 2007– Environmental Licensing.
- Presidential Decree No. 261/11, 06 October 2011 – Regulation of Water Quality.
- Presidential Decree No. 09/13, 31st January 2013 – National Strategic Plan for Water-PNEA (2013-2017).
- Presidential Decree No. 82/14, of 21 April 2014 - Regulation of General Utilization of Water Resources.
- Presidential Decree No. 83/14, of 22nd April 2014 – Regulation of Public Water Supply and Sanitation of Waste Water; and
- Presidential Decree No. 126/17, of 13th June 2017 – National Water Plan (PNA).

a) The management of water resources in Angola is based on a set of laws (Acts) including the Law of waters, of 21 June 2002. The Act applies to inland waters (including both surface and groundwater). It contains 80 articles across six chapters including: I) General Provisions; II) General principles of water management; III) general use of water; IV) protection of water; V) Offences and VI) transitional and final provisions. One of the fundamental aspects of this law is enshrined in Article 5 which highlights that natural resources are state property and are part of the public domain. Notably this right is "inalienable and imprescriptible". The political and social scope of this principle is emphasized more in the chapter concerning the "general use of water", in particular with the "classification of uses" (article 22). The principle aims to satisfy household needs, including the basic water needs of individuals and their family members, as well as water for domestic animals and irrigation, provided that they are not for commercial purposes (article 23). Private uses of water may only be granted subject to license or grant (article 24) and are always de-prioritised in favour of common uses, since article 33 emphasizes priority of water for the population, water supply and sanitary needs, over other private purposes. The same article stipulates that conflicts resulting from

lack of water to meet different objectives will be weighted on the basis of the "socio-economic profitability and environmental impact of their uses." It is incumbent that the institutions responsible for the management of water resources, establish priorities at the level of the basin. The general management principles constitute a fundamental part of the legal framework which aims to frame a policy choice in the field of water resources, since it is these principles that will achieve the objectives. The law enshrines the principle of integrated resource management and adopting the river basin as the geographical unit of management of water resources. User participation on the obligation of intersectoral coordination resulted in the expression of a need to ensure the "compatibility of water management policy with the general policy of regional planning and environmental policy" (article 9) and the need to respect obligations resulting from international commitments. These are regarded as fundamental recommendations for the management of water resources.

b) **Presidential Decree No. 82/14 of 21 April 2014** approves the General regulations governing use of water resources which include regulating public water supply and wastewater sanitation. Without prejudice to legislation in force, this decree applies to private water supply systems and wastewater sanitation, with respect to the licensing of activity, technical requirements of the respective facilities and their safety, complementarity of systems, the quality of drinking water and wastewater treatment standards and to comply with the standards of public health and environment.

c) **The Presidential Decree n° 261/11-on regulation on water quality.** This decree assigns to the MINAMB the responsibility for coordinating water quality. Among other powers contained in the Organic Statute of the MINAMB, is the coordination of strategies and policies for the protection, preservation, environmental management and preservation and rational use of renewable natural resources.

d) **Presidential Decree No. 9/13 – Approval of the National Strategic Program for Water- 2013-2017 (PNEA).** This presidential decree approved the National Strategic Program for Water (PNEA), 2013 - 2017. The PNEA was a multi-thematic programme, which uses all the existing information collected from various institutions with the relevant elements, namely: Ministry of Territorial Planning and development, Ministry of energy and waters, Ministry of agriculture, Ministry of fisheries, Ministry of industry, Ministry of Petroleum and Mineral Resources, through the Geological Institute of Angola, Ministry of environment and the COBA (an engineering consulting company). The process was reliant on knowledge generated by this company (COBA) from numerous studies and has been preparing these studies/reports for Angola, for more than 30 years, in the field of water. Among relevant documents prepared by COBA are, the national irrigation plan of Angola-PLANIRRIGA, master plans for water supply and sanitation in many province capitals and smaller localities, and Hydroelectric potential assessment studies for several river basins.

e) **Presidential Decree No. 126/17, of 13th** – approval the National Water Plan (PNA).

This presidential decree approved the National Water Plan (PNA), represents a new a multisectoral water resources planning instrument. The PNA is a document that defines guidelines, strategies and strategies related to the water resources management, in a technical, social, economic and environmentally sustainable way, the definition of planning scenarios and the definition of short, medium and long-term measures and actions for the "cluster". Of water in Angola.

The development of the PNA was carried out taking into account the following fundamental axes of action and intervention:

- Integrated Water Resources Planning for the country in the short (2017), medium (2025) and long-term (2040);
- Establishment of a National Infrastructure Investment Program, supporting the development of the adequately sustained technical, social, environmental and political water cluster;
- Reinforcement of research and development related to the various aspects of water use, seeking the adequacy of technical and scientific development to the reality of Angola and ensuring the necessary training of technicians of central and provincial bodies through the link to educational institutions and research centres of recognized credibility;
- Strengthening and Modernization of the Institutional, Legal and Regulatory Framework related to the Water;
- Creation or reinforcement of economic and financial mechanisms to support public, private investment and resulting from models based on public-private partnership.

Finally, the National Water Plan was developed in an integrated manner and articulated with the River Basin Plans and several existing Sector Plans, with a special emphasis on the issue of water as a "good" economic, scarce, lacking in parsimonious management, not forgetting the other aspects, namely of social and environmental nature, framed and developed in a political and institutional matrix of water resources.

4.2. Legislation to support groundwater management

At national level there is no specific legal framework that addresses groundwater management explicitly. However, the article 06/02 of 21 June 2002 makes some reference to groundwater resources, in certain sections and articles, although a few points are not clear. Sections and articles that apply to groundwater in particular are as follows:

SECTION II inventory of resources, water balance and registration, article 11 (General Inventory and water balance) specifies the following:

1. The supervisory body is responsible for the General inventory of water resources in quantity and quality aspects and their periodic update, in order to support planning and integrated management.
2. The water balance provides the balance between surface and underground water resources, including currently available and potential resources, and their present and future demand.
3. Rules and techniques of conducting the inventories and balance of water resources are set out in the regulation itself.

SECTION III coordination and institutional organization, Article 14. (Institutional unit) specifies the following:

1. The main unit upon which rests the management of water resources is the water catchment area.
2. The institution responsible for the management of water resources of the basin has its powers set out in government regulation**,** Article 26 (Use the right to exploit the Earth), which sets out the following in points 1. (a), (b) and (c) below:

1. The holders of the right to the use and exploitation of the Earth, in order to meet their household needs and the normal and foreseeable needs of agriculture, can, without licensing and free of charge, in accordance with the regulation, use:

a) The waters of lakes, ponds and marshes inside of their plot, except for cases in which by their size or importance, require use or license granting access;

b) The waters of the springs, running freely, that no crossing the boundaries of its plot or cast on a chain;

c) Groundwater not included in protected areas, provided they do not disturb their regime, nor the possibility to their quality.

SECTION II Uses subject to licence or concession, article 41 (Subject) states:

1. The private use of water depends on the licensing when such use does not significantly alter the quality of the water and the environmental balance, in accordance with the procedure established in regulation.
2. Also depends on the licensing:
   a) The prospecting, extraction and use of groundwater, except as provided in subparagraph (c) of article 26. of this law.

Article 26. (Use the right to exploit the Earth)

1. The holders of the right to the use and exploitation of the earth, in order to meet their household needs and the normal and foreseeable needs of agriculture, can, without licensing and free of charge, in accordance with the regulation, use:

   a) The waters of lakes, ponds and swamps, existing within its site, except in the cases in which, by their size or importance, such use or license granting access;

   b) The waters of springs, running freely, that no crossing the boundaries of its plot or cast on a chain;

   c) Groundwater not included in protected areas, provided they do not disturb their regime, nor their quality; and

   d) Rainwater.

2. The uses referred to in the preceding paragraph may not affect pre-existing common uses, when traditionally established, or the rights of any third party.

SECTION III, article 64 (search, capture and use), sets:

1. The research, collection and use of groundwater, wants to sprout naturally or not, shall be subject to the general regime for use of the waters set out in this law.
2. The technical requirements to meet the research, collection and use are fixed by government regulation.
3. The preceding paragraph of this article shall not apply to common uses regulated in article 22. º When carried out outside the urban perimeters or in urban areas that don't have public water distribution network, or the supply is inadequate.
4. The exception provided for in paragraph 1 is drawn up on the basis of the estimated potential of groundwater or of their importance.

Article 65 (restrictions on the use of underground water)

Under this article, the use of groundwater is guided by the following conditions:

a) The maintenance, in aquifers, balancing between the renewal of the freshwater and extractions, to ensure a continuous use under the same physical, chemical and biological conditions ;
b) Optimization of aquifers being used sustainably, while extracting only the maximum benefit possible;
c) The creation of water protection zones for booking and maintenance of aquifers;
d) The integrated management of surface and groundwater**.**

CHAPTER IV protection of water, Common Provisions section I, article 66 (protection) provides for the protection of public domain waters against pollution and aims to:

a) Achieve and maintain an adequate level of water quality;
b) Prevent the accumulation of toxic or dangerous compounds capable of polluting groundwater;
c) Avoid anything that might cause degradation of the water table.

Article 67 (Prohibited Activities): In general, the following activities shall be prohibited:

a) Carry out evictions directly or indirectly beyond the ability to debug auto bodies of water;
b) Accumulating solid waste, waste or any substance in sites and conditions that contaminate or create a risk of contamination of water;
c) Engage in any activities that involve or may involve a risk of pollution or degradation of the public water domain;

d) Any amendment to the scheme, quality and use of water, which can jeopardise public health, natural resources, and the environment in general or the security and national sovereignty. Article 68° (prevention and control) provides for financial considerations necessary for the fulfilment of the obligations laid down in the respective concession contracts and or license.

4.3. Gaps and challenges identified

a) Although there is some sections and specific articles for groundwater, still, some points are not clear. Section 1 common provisions, article 66 (protection). Article 110 (Presidential Decree 82/14), define zones of protection of water resources however; the areas defined refer only to surface water resources.

b) There is no specific legal framework that addresses explicitly the use, management and protection of groundwater, and that provides tools needed for the State to regulate, manage, control, protect and develop the groundwater resources in together with surface water resources,

c) On the regulation of the quality of groundwater, the Presidential Decree No. 261/11 Adopted water quality standards in General. However, as regards the definition of water quality goals for different underground sources, the above-mentioned Presidential Decree, is missing does not define the legislation is silent.

d) It is not clear in the legislation the relationship the classification of storage quantity nor the quality of surface water chemistry and their interaction with groundwater.

Article 66 provides that the protection of the public domain waters against pollution aims to:

- Achieve and maintain an adequate level of water quality;
- Prevent the accumulation of toxic or dangerous compounds capable of pollute groundwater;
- Avoid anything that might cause degradation of groundwater

e) The legislation does not specify the need for drought monitoring systems that extend beyond the precipitation, surface water and food security to the State of the groundwater supply, including the appropriate forecast hydrogeological conditions-future.

f) The legislation does not include clear mechanisms to promote compliance of groundwater, there are no uniform rules, administrative procedures and technical specifications for the preparation of contracts execution of holes, there are no regulations requiring hiring companies or supervisory teams

g) Although a complex set of agreements regulate the transboundary river basins in southern Africa, there is a gap in relation to treaties and agreements about the groundwater, which may be a potential cause of future conflicts.

h) water law, is characterized by a large scope that extends to the entire hydrological cycle, including surface and ground waters, which advocates and encourages intersectoral articulation, the main watershed planning and management unit, which clarifies the public ownership of all waters, while recognizing and prioritizing the common uses, in particular associated with traditional practices, which endows the State of essential tools for planning and management of water resources, including the national plan and the plans of the basin, the granting of licences and concessions and financial arrangements based on taxes and tariffs, calling for the participation of communities and stakeholders to listening and that assumes the international commitments resulting from the sharing of cross-border basins (art. 76). However, this law refers to a very high number of diplomas to regulate, while they are not in force do not allow your full implementation and consequent final evaluation of their potential and limitations.

Table 2: Frames 1-articles of the law of waters that lack of regulation (PNA, 2017)

Article and paragraph	Subject	Form of regulation
Art. 8, no. 1	Spills and drainage of waters	Regulation
Art. 11, n.º 3	General inventory and water balance	Government Regulation
Art. 12º n.º 6	Records	Government Regulation
Art. 14º, n.º 2	Institutional management unit	Government Regulation
Art. 16º, n.º 3	Institutional consultation	Government Regulation
Art. 18º, n.º 2	National Fund of water resources	Government Regulation
Art. 25º, n.º 7	Conditions and purposes allowed in private use	Government Regulation
Art. 26º, n.º 3	Use the right to exploit the Earth	Regulation
Art. 29º, n.º 3	Calamities	Government Regulation
Art. 31º, n.º 2	Easements	Regulation
Art. 32º, s/n.º	Rainwater drainage and residual liquid sanitation	Regulation
Art. 34º, s/n.º	Methodology and applications procedures	Ministerial diploma of guardianship
Art. 42º, s/n.º	Assignment of license	Regulation
Art. 62º, s/n.º	Training fees	Government Regulation
Art. 63º, n.º 3	Rates	Own degree
Art. 64º, n.º 2	Research, collection and use	Government Regulation
Art. 68º, n.º 2	Disease prevention and control	Regulation
Art. 71º, n.º 1	Protection zone	Regulate diploma
Art. 73º, n.º 2	Sanctions	Regulation

General regulations governing use of water resources were recently presented as a proposal. This general regulation makes many legal provisions contained in the law of waters, following precisely the broad guidelines set out in this law. The General provisions are presented in more detail containing content and requirements of the general plans of the development and use of water resources within various river basins and the national water resources plan. This legislation (art. 2) is shallow with regards to the purpose of all the waters that are underground. The scope is also thematic in nature with regard to water resources plans, since they (devem Art. 6º, alínea a) are "based on a joint approach and linked the technical aspects, cultural, institutional and environmental use of water resources". In subparagraph (d)) of the same article is the obligation to involve all stakeholders in the management and use of water resources. This involvement and participation is the responsibility of the National Councils of water and Watersheds.

The intersectoral nature of the plans referred to in subparagraph (e)) of the same article stipulates that the plans must be read in conjunction with the planning of the sectors of use. With the planning is the provision for creating (Art. 10th) of the National Council for water and watershed councils. This reaffirms the watershed as the basic unit of management (article 12, paragraph 1) and the establishment of river basin Administration offices (article 12, paragraph 2).

Title II, on general use of water resources, contains quite detailed policies and procedures for the assignment of use of water resources, including permits and concessions. It specifies what uses of water are not subject to title, namely "common uses", "uses arising from the right of use of land", "navigation, floating, recreation and sports", "fishing" and "communal and aquaculture research ". The subject uses the title are "water", "rejection of effluents", extraction of inert "and" economic "aquaculture.

The title III, on Economic and financial Regime of general use of water resources, sets out fairly detailed way to determine the rates and tariffs for the use of hydraulic infrastructure and water, respectively. This considers water rates and wastewater. There are various methods for the calculation of the tariff values and way of charging. Title IV deals with Eviction, Expropriation and servitude, while title V deals with the discipline, including supervision and misdemeanors and, finally, title VI transitional and final provisions.

Within these titles, two aspects deserve special mention. Firstly, Art. No. 117 stipulates that "the activities of planning and management of watersheds that do not have administration offices corresponding watersheds are ensured, on a transitional basis, by provincial governments, through the respective agencies with jurisdiction over waters, observing, to this end, the standards, guidelines and recommendations of a general nature or from specific national water resources Institute.

4.4. Enablers required to unlock these gaps/challenges

Table 3: Enablers required to unlock these gaps and challenges

Groundwater gap/challenges	Enablers
a) - Although there is some sections and specific articles for groundwater, still, some	▪ Development of groundwater specific implementable plans/actions in alignment with

Groundwater gap/challenges	Enablers
points are not clear.	already existing general water laws that can easily be interpreted with respect to groundwater
b) -There is no specific legal framework that addresses explicitly the use, management and protection of groundwater, and that provides tools needed for the State to regulate, manage, control, protect and develop the groundwater resources in together with surface water resources,	▪ Development of Normative and regulatory tools and instruments for planning, managing and regulating groundwater source use/exploitation.
c) - On the regulation of the quality of groundwater, the Presidential Decree No. 261/11 Adopted water quality standards in General. However, as regards the definition of water quality goals for different underground sources, the above-mentioned Presidential Decree, is not specific on groundwater quality.	▪ Improve water quality regulations to include aspects unique to the sustainable maintenance of good groundwater quality ▪ Establishment of regulations and standards requiring the certification of companies, based on technical criteria for setting; and standardization, administrative procedures and technical specifications for implementing contracts and supervision of holes.
d) -It is not clear in legislation the relationship between the classification of storage quantity and the quality of surface water chemistry and the interaction with groundwater.	▪ Create a body responsible for hydrogeological data storage of projects implemented, with up-to-date records and information freely available and used in the preparation of subsequent studies specifications
e) The legislation does not specify the need for drought monitoring systems that extend beyond the precipitation, surface water and food security to the State of the groundwater supply, including the appropriate forecast hydrogeological conditions-future.	▪ Develop Set national guidelines for monitoring of groundwater for future integration of monitoring networks and information systems. These guidelines are important in order to reconcile and normalize the common procedures among the provinces, in order to build the foundations for the definition of the network design in river basins, hydrogeological or local, according to their specificities.
f) The legislation does not include clear mechanisms to promote compliance of groundwater, there are no uniform rules, administrative procedures and technical specifications for the preparation of contracts execution of holes, there are no regulations requiring hiring companies or supervisory teams	▪ Create regulations that require the hiring of companies or teams of supervision during the construction. Because surveillance is essential to ensure that the contractor obey specifications and the quality of construction, as well as all the necessary information.
g) Although a complex set of agreements regulate the transboundary river basins in southern Africa, there is a gap in relation to treaties and agreements about the	▪ Create joint regulations of international agreements and treaties on groundwater with the same degree of sophistication with surface waters, which could avoid a potential cause of future conflicts.

Groundwater gap/challenges	Enablers
groundwater, which may be a potential cause of future conflicts.	

5. STRATEGY AND GUIDELINES

5.1. Evolution

In view of the definitions of PNEA, generating an adequate response to the problems and possibilities that were carried out, the water balance between availability and water requirements is based on the values of the current needs to be met and projected /future needs for 2017 and assessment of (current and projected) water availability. This assessment is performed by hydrographic unit, to obtain a spatial vision of critical situations of existing or planned water shortage for the country. In general, groundwater resources are retained in this study as a strategic reserve for use in exceptional situations of drought, which may be primarily used in water supply to rural population and sporadically, in some regions, to meet the needs of small irrigation schemes.

The underlying assumptions for simulating the current and future water balance are sufficiently conservative and therefore ensure greater robustness in the face of uncertainty factors that are always associated with the estimates related to the quantification of water resources, whether surface or underground. Little is known regarding water quality in the country, in the absence of a national network of water quality.

Regulatory and institutional aspects of water resources management.

With the approval of the law of 2002 and with the creation of the National Institute for water resources, was the introduction of the process of normative and institutional development of Angola. These first two instruments were just the start of a long way go to create conditions in Angola for the better management of water resources in general including groundwater. In addition to a wide range of legislative documents missing in various aspects of management of water resources, which must be formulated and approved, institutional aspects are especially highlighted in the management of water resources in general. In the units in the Southwest and Cuvelai, where surface water resources are very scarce and should be allocated as a priority to the supply of water to people and livestock, the groundwater resources could assume greater importance in these units in particular populations, for livestock supply and irrigation.

5.2. Strategies and guidelines to support groundwater management

The National Water Plan (PNA) presents a structure outlined to provide a practical tool for careful analysis and Integrated Water industry in Angola, which is inherently general, and comprehensive in nature, in order to ensure the necessary adaptability to the specific characteristics of the various regions of the country. The PNA, is especially focused on groundwater with the following strategies;

- Characterization of groundwater resources in quantity and quality, the national and regional level.
- - Realization of the water balance of the availability and uses of water;

- -Identification and characterization, spatially and temporally, of the major problems, such as floods, droughts, erosion, etc., as well as current and potential conflicts of use of water;
- -Identification of measures and actions;
- -Definition of a physical and financial program.

In this document are the diagnosis of the current situation of water resources, are balanced socio-economic development scenarios and their relationship with the water resources in the context of the application are set out objectives, measures PNA and proposal for a physical and financial programming for a temporary 20-year horizon, framed by a set of action programmes in the field of construction of infrastructure (sanitation and irrigation) and the implementation of actions necessary to compliance with environmental objectives. The implementation of the programmes of action represents an investment Estimated (2015-2040): 110 000 Million USD (MINEA).

PNA programming was based on investments in the following components: Direct investment in infrastructure (including studies, projects, supervision and technical assistance) in the following sub-sectors: water supply and sanitation, livestock, irrigation and other; Strengthening of knowledge (planning studies, research and development ...); Strengthening and modernization of the Institutional, Legal and Regulatory Framework of the Sector of water, creating economic and financial mechanisms to support investment in the water sector. Gaps and challenges identified

- The national strategic plan (PNA) has a maximum duration of 15 years and General plans of development and use of water resources (PGDURH) has a maximum duration of 10 years. The PNEA does not determine the period from which the review before the expiry of the plans.
- There are no mechanisms for strong connection between user sectors and provincial governments and in General to all stakeholders (stakeholders and affected)
- Within the framework of the National Strategic Plan for water (PNA), no assessment of underground resources considering the problem of global climate change since the same will have a key role to suppress the needs of populations. Mainly in southern Angola.
- The (PNA) doesn't make an analysis or sets policies, proactive actions, and insightful accompanying the rapid growth of the areas and the impacts on groundwater resources.
- The regulation on the quality of water, approved by Presidential Decree No. 261/11, establishes standards, the Regulation is incomplete and outdated water quality in the water is a little known in the country, not there is a national network of water quality.

5.3. Gaps and challenges identified

- Need for stronger liaison mechanisms between the users and the provincial governments and in General to all stakeholders
- Need for sustainability strategy in terms of integrated water resources management

- Limited hydrogeological knowledge on inter-provincial and cross-border aquifers,
- Poor Monitoring of groundwater which heightens/promotes unregulated groundwater pollution through unmonitored/unregulated activities.

5.4. Enablers required to unlock these gaps/challenges

- Create strong liaison mechanisms between the users and the provincial governments and in General to all stakeholders (stakeholders and affected
- Ensure sustainability required an integrated water resources management
- Expand and consolidate the hydrogeological knowledge on inter-provincial and cross-border aquifers, identifying their potential, availability, water quality, vulnerabilities and risks, in order to propose the planning, the management and sustainable use.
- Create mechanisms for qualitative and quantitative Monitoring of groundwater is one of the most important instruments to support strategies, preventive actions and policies of use, protection and conservation of the resource underground water.

Table 4: Enablers required to unlock these gaps/challenges

Groundwater gap/challenges	Enablers
Need for stronger liaison mechanisms between the users and the provincial governments and in General to all stakeholders	▪ Create strong liaison mechanisms between the users and the provincial governments and in General to all stakeholders (stakeholders and affected
Need for sustainability strategy in terms of integrated water resources management	▪ Ensure sustainability required an integrated water resources management
Limited hydrogeological knowledge on inter-provincial and cross-border aquifers,	▪ Expand and consolidate the hydrogeological knowledge on inter-provincial and cross-border aquifers, identifying their potential, availability, water quality, vulnerabilities and risks, in order to propose the planning, the management and sustainable use.
Poor Monitoring of groundwater which heightens/promotes unregulated groundwater pollution through unmonitored/unregulated activities	▪ Create mechanisms for qualitative and quantitative Monitoring of groundwater is one of the most important instruments to support strategies, preventive actions and policies of use, protection and conservation of the resource underground water

6. INSTITUTIONAL FRAMEWORK

6.1. Evolution

The institutional development of the water sector, in Angola, is based on the legal framework and the policy instruments adopted, based on the following institutional matrix:

- Consultation bodies, including the National Water Council and the Councils Regional Watersheds;
- Direct central administration Organ of the State of the Water Conservancy Ministry of energy and water; among the various tasks of this Ministry which are relevant for the water sector, enshrined in Article 2 are:

a) propose and promote the implementation of the policy pursued by the energy sector and water;

b) strategies, promote and coordinate the exploitation and the rational use of energy and water resources, ensuring sustainable development;

c) draw up, within the framework of the general planning of economic and social development of the country, sectoral plans related to their areas of activity;

d) Propose and promote the national policy of electrification, the general use of your water resources protection and conservation, as well as the policy of water supply and wastewater sanitation.

e) Propose the institutional model for the implementation of the activities of collection, adduction, transmission, distribution and commercialization of drinking water, in the areas of water and wastewater sanitation and promote your implementation;

f) Define, promote and ensure the quality of public service in your area;

g) License, supervise and inspect dams and water supply systems and sanitation;

h) Collaborate with the Local Government bodies of the State in the elaboration and implementation of programs of electrification, water supply and support for rural development, urban and peri-urban areas; more general public policy of water resources has positive virtues.

- Indirect State administration bodies, including the National Institute of water resources and river basin management;
- Sectoral technical committees of International river basins;
- Organ of economic regulation in the field of water services (Governor);
- Public water and sanitation Companies.

In accordance with the principles laid down in the law, the institutional context consists of the following structure:

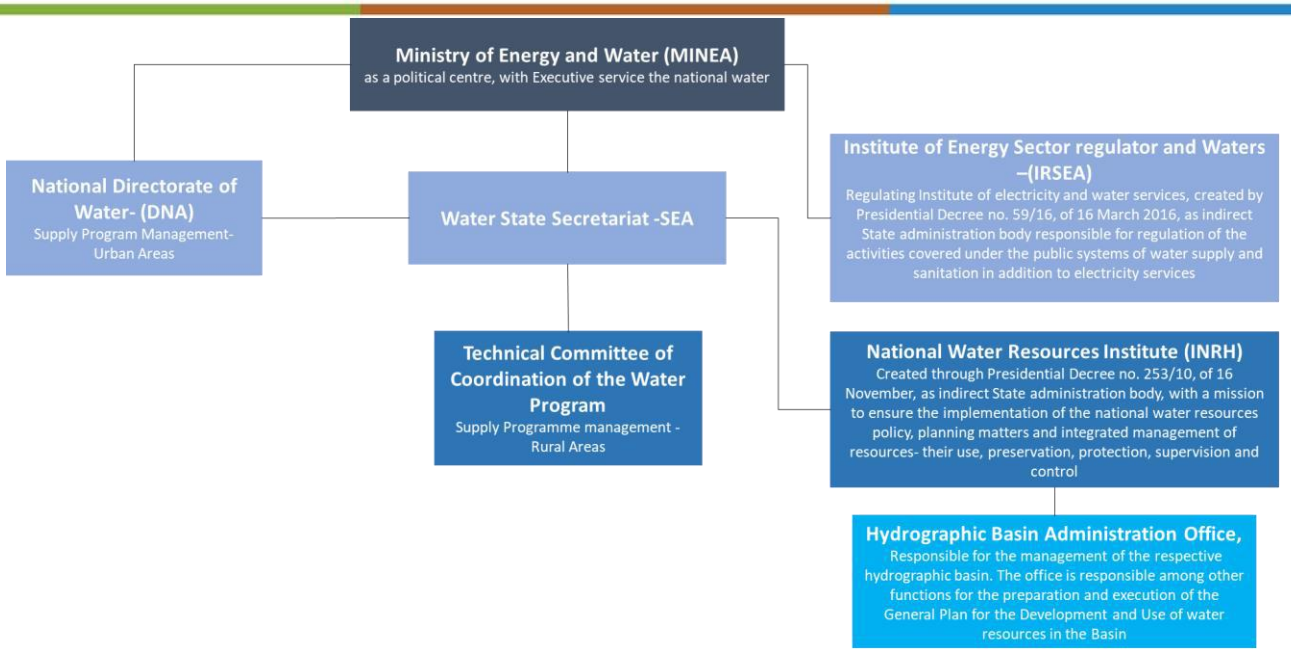

Figure 2: General institutional framework of the water sector in Angola

6.2. Institutional arrangements to support groundwater management

According to the legal and institutional framework of Angola, the Ministry of energy and water (MINEA) assumes the responsibility of the management of water resources.

The general policy assigns the management and development of water resources, as well as the skills development to state institutions.

The institutional organization around water resources management involves the participation of various institutions which include; ministries responsible for major uses of water such as supply of stocks; industrial supply; sanitation; energy; and irrigation.

The Ministry of environment (MINAMB) is characterised by very transversal skills and water is an environmental component. As a result, the mission of this Ministry is to lead, run and control the Executive policy relating to the environment in perspective of protection, preservation and conservation of environmental quality, pollution control, conservation and enhancement of the natural heritage, as well as the preservation and rational use of natural resources. Water resources are not mentioned explicitly, but only implicitly as a natural resource.

The relevance of the Ministry of agriculture and forestry (MINAGRI) on water resources- It is clear that agriculture is the biggest user of water resources. The unit of this Ministry that relates most closely with water management, is the National Directorate of Rural Engineering. This unit is responsible for the following assignments:

a) develop and promote programmes, studies and projects related to the agricultural exploitation and rural engineering;

b) accompany the management, maintenance and operation of infrastructure, agricultural facilities, as well as the facilities and equipment of surface and ground water within the Sector;

c) to study and promote the use of low-cost intermediate technologies; and

d) Control, check and approve the use of hydraulic equipment and agricultural mechanization.

The Ministry of natural resources and oil has relevance on groundwater resources. The Ministry keeps geological records on formations and the phreatic aquifer. But nothing in the organic law of this Ministry assumes/considers the management of groundwater resources. It should be noted that these considerations are based just on theory/reading.

Currently in Angola, there are several bodies that operate in the field of groundwater, but in practice do not have effective coordination between them. The major players in the sector and their interlinkages are represented in the schematic institutional structure below:

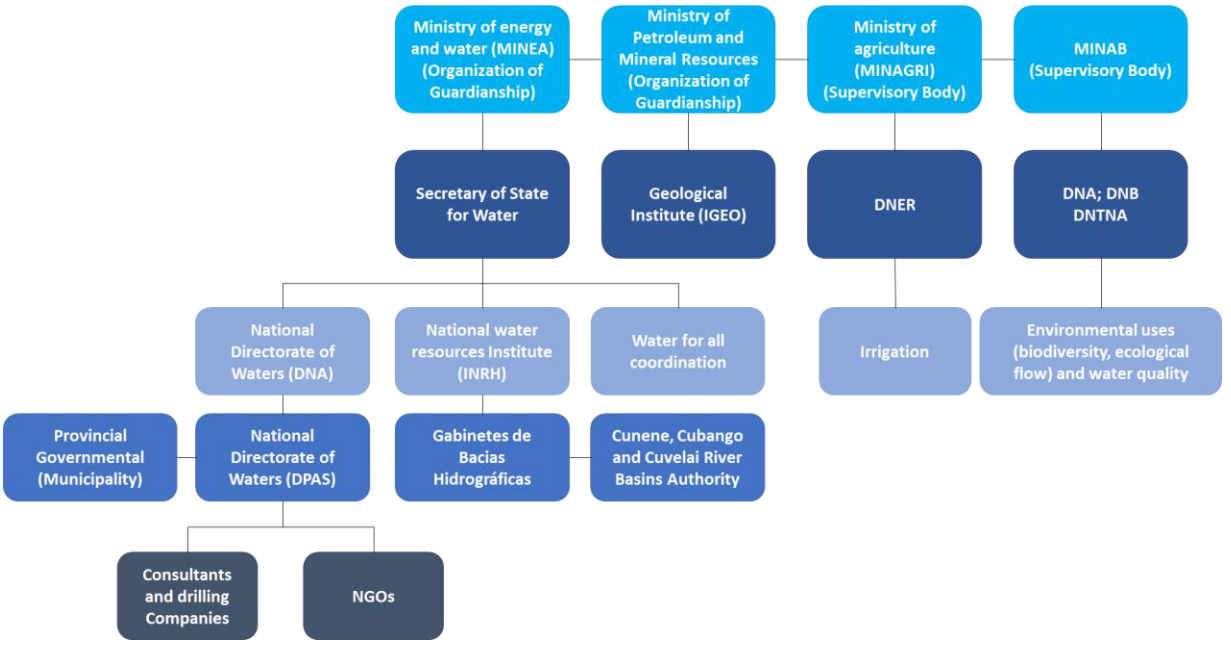

Figure 3: Different bodies involved in the groundwater sector in Angola[1]

6.3. Gaps and challenges identified

The institutional framework connected directly to the Ministry of energy and water sector, comprises two subsectors, namely:

- The Sub-sector of water supply and sanitation **(DNA)**
- The Subsector connected to planning of water resources, including surface and ground waters **(INRH)**

[1] MINEA - Ministry of energy and water. MINADERP - Ministry of agriculture and Rural Development. MINAMB - Ministry of environment. INRH - National Water Resources Institute. DNA - Directed national of water. DNER Site - Direction National agricultural and Rural Engineering Hydraulic. DNA - Directed Environmental National. DNB - National Directorate of Biodiversity DNTNA - National Directorate of Environmental Technologies and Regulate Matters.

- **National Directorate of Waters (DNA)**

This is an organ of the direct administration of the Angolan State, which deals with issues related to the policies and strategies of the Sector of water supply and sanitation on the urban cycle, inside the structure has an area for groundwater, in Currently, though, from the point of view of specialized technique, the Department has only one hydrogeologist.

For a few years, this Department has benefited from technical assistance of Cuban advisers, but, due to financial crisis, cooperative relations have been disrupted. In their structure, DNA has the in (Groundwater) – a company formally legalized, but that has equipment donated by Japanese cooperation and sounders operating for more than 20 years in the drilling sector. Among the information requested include the following limitations: there is a pre-defined service relationship between the DNA and the DPEA's Provincial Directorate of water and sanitation), in practice, the technical assistance occurs often in time the DNA projects implementation at provincial level, the provinces do not have technical autonomy, procedures have fewer specialists to the sector.

There is no database of drilling companies, nor a regulation requiring the certification of it. There is no definition and standardization of procedures for the execution of holes in most part of the contracts is not preceded by studies of Hydrogeology or geophysics. There is no practice of conserving samples resulting from drilling, for lack of a mandatory regulation, conditions and appropriate structures for conservation, as well as an institution linked to the water sector, with records up to date and information available.

- **National water resources Institute (INRH)**

Represents an indirect State administration body, attached to the Ministry of energy and water; does the planning and management of water resources, in General, including groundwater as part of the public domain. However, for the groundwater Sector, has a Department of registration, licensing, water quality and environment constituted, from a technical point of view, by a few skilled technicians. In General, the INRH works with a team under 20% of its overall human resources needs.

Among the information requested during the interview, the following limitations:

a) The INRH) does not have a database of existing holes, or the drilling companies register;

b) The INRH) is taking ongoing registration of existing borrowings from the country, with the purpose of license;

c) The Presidential Decree 82/14, of 21 April, provides for, among other things, the establishment and functioning of the economic and financial Regime (REF) water resources (the REF involves the recording and the monitoring of uses), which summarizes a work that is developed by the Department of registration of the INRH, which, due to the lack of human resources, cannot respond to supervision of large number of underground water catchment in the country. The main difficulties of the sector are the lack of human resources for research and exploration of

groundwater; the weak intersectoral coordination (energy and water/Ministry of natural resources, through the Geological Institute of Angola (IGEO).

d) Version of MINEA in 2014, there is a "direct Executive service", the DNA, which deals with both water resources and water supply and sanitation and another body under the same auspices, the INRH, which is of indirect State administration, but that if occupies only of water resources.

Paradoxically, the DNA assumes a leading role in the formulation of policies and the INRH arises fundamentally in terms of implementation of such policies, there some organized in this formulation, which is likely to create situations of blocking or conflict. In addition, the junction in DNA of assignments aimed at "cross" management of water for various purposes with assignments aimed at a specific use (supply and sanitation) does not seem prudent and resembles the join in the same organism functions of regulator and regulated entity. Indeed, the management of water resources, in your cross-strand all uses, has strong analogies with a regulatory function to the extent that you must resolve conflicts between uses and ensure your integration, while the supply and sanitation.

- **Coordination of the program "water for all"**

The program "water for all" was a Government initiative, whose implementation began in 2007.This program had as its principal objective to ensure access to clean water in adequate conditions to at least 80% of the rural population of Angola, coordinated by a technical Committee, the schedule for implementation was five years old, but after eleven years, the Committee still lies in the exercise of its functions and failed to achieve the goals envisaged. Among the information requested during the interview, the following limitations:

Most of the projects of the program "water for all" were coordinated and carried out by provincial and municipal Governments; during execution there was no local teams training for service and maintenance of the systems; hydrogeological studies were carried out in not more than 3000 holes run; was not performed an inventory of data holes (available and easy to access); on most of the holes run did not exist any kind of supervision.

The DNA, which is responsible for water supply for rural populations, it has not been integrated during the elaboration phase, nor during the implementation phase. There is no technical information of more than 3000 holes (lithological description, database of fully georeferenced holes).

- **Office for River Basin Management,**

Office for River Basin Management, Sectoral technical committees of International river basins, are indirect State administration body, with a mission to ensure the management and integrated water resources management of river basins, in this context due to the easy availability of surface water the underground waters are not in General, developed significantly and integrated into water resource management by these organs, currently the management is focused on the component surface water relegating groundwater to a second plan.

- **Institution of higher education (Academy)**

a) With objective to evaluate the process of integration of the academic community, the courses linked to the water sector, we conducted a survey to 20 students and submitted to the questionnaire a faculty expert in Hydrogeology at the Agostinho Neto University, for over 20 years existing, where are Given the discipline of Hydrogeology and water resources management, respectively on the fourth and fifth years in the Department of geology of the requested information during the interview, the following limitations:

b) Non-existence of training protocols with public or private institutions that operate in the field of groundwater.

c) The non-involvement of students as trainees in the various projects implemented by the Government.

d) The lack of funding to carry out the field lessons, equipment and specific laboratories for the development and practical studies of topics related to groundwater.

6.4. Enablers required to unlock these gaps/challenges

Table 5: Enablers to address institutional gaps and challenges

Groundwater gap/challenges	Enablers
Lack of consolidation between institutions	▪ Consolidation of a network of institutions dedicated to integrated management of surface and underground water resources with projects related to the protection of groundwater quantity and quality.
Poor distribution and sharing of information	▪ It is necessary to produce didactic materials and make them widely publicized and distributed as well as offering formative nature courses for those professionals and informative to the general public on education in groundwater.
Limited power of the State	▪ The supervisory power of the State is limited and only a broad awareness of the population expected to produce the effects necessary for the conservation of groundwater resources, in this sense, the link of the universities should be strengthened.
Lack of clarity regarding borehole drilling and maintenance	▪ A project to encourage settlement of boreholes, should be a top priority, is to build a site user to user support of boreholes, operating as a public information service, and contemplating: guidance for drilling and regularization; typical project well; location of future well regarding existing boreholes (and present the award)
The current national water plan is not well implemented	▪ The implementation of the recommendations of the national water Plan is necessary in order to make the definition of borders and competences between the National Water Board (DNA), the

Groundwater gap/challenges	Enablers
	national water resources Institute (INRH) and the provincial directorates of Waters (DPEA)
Lack of relevant education and training in the groundwater industry	▪ It is necessary the qualification and training of cadres for the groundwater industry
Absence of effective water planning to cater for the different needs	▪ With the increasing needs of water, not only due to agricultural growth, industrial, irrigation and livestock, but also due to new living standards of urban and rural populations, we need to think proactively in the utilization of water resources underground, whether domestic or cross-border. To this end, it is necessary to go for a water planning seriously for the benefit of the populations.
Lack of meaningful stakeholder engagements	▪ Consolidation of active participation of the water resources civil organizations in the decision-making process. These organizations may provide the following groups: (i) inter-municipal consortia, (ii) river basin associations, (iii) regional, local or sectoral associations of water users, (iv) organizations, academic and research techniques, (v) non-governmental organizations (NGOs).
Weak cross-sectoral collaboration	▪ Strengthen cross-sectoral collaboration between the Ministry of energy and water, Ministry of agriculture and forestry, Ministry of natural resources and Petroleum and the Ministry of the environment.

7. CHALLENGES TO IMPLEMENTATION

POLICIES

- Sectoral fragmentation of various tasks related to groundwater policy formulation, your management and use.
- Produce and disseminate basic information about groundwater.
- Map the underground water resources, cross-border and National rank in terms of hydrogeological characteristics and future requirements
- Promote policies of drawing up plans of development of groundwater resources directed by the Ministry of energy and water, through the national water resources Institute.
- Promote research and development
- Integrated management of surface and underground water resources

LEGISLATURE

- Total water law regulations
- Improve the legal and regulatory Framework of groundwater
- Framing the national water Program (NAP), in physical and financial programming of government forms to establish real and concrete deadlines and implementation of measures and actions envisaged, taking into account the Executive nature of short, medium and long term of the respective program.
- Revision of the legal framework accompanied by reforms in institutional management and administration model of underground water, adapting to new requirements.
- Regulate the use and management of underground water resources for different purposes.
- Encourage drilling practices as well as the legalization of boreholes

INSTITUTIONAL

- Intentional information asymmetries between the different protagonists that are relevant to the formulation of policies of underground water, for your management and use.
- The lack of motivation and the political will to get involved in the groundwater industry organization.
- Territorial differences between hydrographic and administrative borders that can lead to a decoupling between availability and sources of supply.
- Insufficient scientific, technical training, infrastructural and of the various protagonists to formulate and implement policies on groundwater.
- Unstable or insufficient financial deposits which hamper effective implementation of responsibilities particularly the sub-sector of groundwater level
- Difficulty in ensuring the transparency of the proceedings before the various users, often as a result of lack of commitment, concern, awareness and participation of those users.
- Limited interaction research/academia with groundwater practice.

- Limited institutional capacity / Clarify and operationalize effectively and efficiently the institutional framework for the management of groundwater resources.
- Implement an integrated management model taking into account not only the water catchment area but also the hydrogeological basin, whereas the aquifer
- Definition of boundaries between the national water Board (DNA), national water resources Institute (INRH), provincial directorates of the waters (DPEA) and the Geological Institute (IGEO).
- Spread knowledge about groundwater addressed to representatives of different Ministerial Departments, provincial governments, representatives of professional and economic organisations, users and representatives of the community.
- Update periodically the information sector, through Biophysics and articulation between various entities responsible (INRH, DNA, MINEA, MINAGRI, etc).

8. ACTION PLAN

The MoSCoW method of prioritisation has been used to develop the action plan. This method identifies the *Must have*, *Should have*, *Could have*, and *Won't have* elements for the Groundwater Management Regulatory Framework.

Table 6: Action Plan _ 'Must Haves'

Prioritisation	Element	Description
Must have: ***those elements of the regulatory framework that are critical***	**Policy**	▪ Consistently coordinate the policies of GW with other areas ▪ Recognition of groundwater as strategic resource ▪ Awareness campaigns: Dissemination of technical information on groundwater through workshops, publishing reports, briefing book on the internet and in mass media etc. ▪ Inventory recovery program on abstraction of groundwater in the country through public policies especially focused on protection of groundwater resources. ▪ Expand the geological knowledge to support the implementation of an integrated management system between groundwater and the surface water
	Legislative	▪ Approve specific regulations for the groundwater subsector ▪ Create regulations and standards requiring the certification of companies which act in the groundwater sector, based on technical criteria ▪ Standardize administrative procedures and technical specifications for implementing contracts and supervision of holes ▪ Raise awareness and encourage users of groundwater resource for the legalization of the boreholes. ▪ Set national guidelines for monitoring of groundwater for future integration of monitoring networks and information systems. ▪ Create joint regulations of international agreements and treaties on groundwaters with the same degree of sophistication with surface water.
	Institutional	▪ Implement an institutional framework with a clear assignment of responsibilities ▪ Separate clearly GW management the management of user sectors ▪ Give the necessary attention to financial sustainability and the role of fees ▪ Involve all stakeholders in the decision-making ▪ Develop the training to all levels of Government and users ▪ Check out institutional stability to the management model of groundwater resources ▪ Improving integrity and transparency ▪ Adopt mechanisms for the definition and promotion of regional and cross-border aquifers management; ▪ Discussion, strengthening of institutional structures and application of instruments for groundwater management at national level. ▪ Definition or creation of an institution responsible for

		hydrogeological data storage of projects implemented, with up-to-date records and information that can be freely available.
	Strategy/ Guidelines	▪ Develop regulations and standards for the use and protection of aquifers which consists in carrying out surveys and basic studies needed to support data base in Angola. ▪ Encourage drilling practices as well as the legalization of boreholes in Angola there are a large number of irregular boreholes, drilled indiscriminately, without authorization and without technical Manager enabled. ▪ Implement an integrated management model taking into account not only the water catchment area but also the hydrogeological basin, whereas the aquifer. ▪ Promote research and development that aims to foster studies priority lines of research, in order to generate in-depth knowledge on fundamental themes for the protection and management of aquifers. ▪ Plan of groundwater quality monitoring that the law does not define aimed at compliance with the presidential decree 261/11. ▪ Adopt mechanisms for the definition and promotion of regional and cross-border aquifers management; ▪ Discussion, strengthening of institutional structures and application of instruments on groundwater management at national level. ▪ Define a department responsible for hydrogeological data storage of projects implemented, with up-to-date records and information that can be freely available.

Table 7: Action Plan _ 'Should Haves'

Prioritisation	Element	Description
Should have	**Policy**	▪ Establish policy for the development of plans of development of groundwater resources by the Ministry of energy and water, through the national water resources Institute. ▪ Expansion of hydrogeological knowledge base to support the implementation of a truly integrated management system. ▪ Protocols between companies operating in the sector of ground water and higher education institutions. ▪ The involvement of newly formed in projects implemented by the Government. ▪ Policies for implementation of a national plan for compiling all information produced in the sector (scanned files with scientific and technical specifications of the holes made at the level of provinces, NGOs, data companies ´ drilling etc.
	Legislative	▪ Development of other legal instruments in the form of ministerial-level executive decrees or ministerial orders suited the groundwater ▪ Guidelines and Regulations in order to harmonize and standardize common procedures among those involved in the management of groundwater resources, in order to build the foundations for the definition of the network design in river basins, hydrogeological or local, according to their specific needs
	Institutional	▪ Preparation of integrated plans for use of surface and groundwater resources Strengthening the knowledge, planning studies, research and development of groundwater ▪ Promote the integration of groundwater resources component in other sectoral policies ▪ Elaborate programs of awareness of the population about the efficient use and conservation of groundwater
	Strategy/ Guidelines	▪ Integrate a set of administrative actions of the organs that control the policies in General, in order to regulate and create a specific legal framework that satisfies the groundwater resources. ▪ Develop awareness campaigns on the costs and benefits of groundwater management aimed at the general public ▪ Inventory and delimit the public domain of groundwater ▪ Integrate into case studies of the watershed managers having regard to the aquifer. ▪ Adapt and refine criteria for grants and oversee the use of underground water resources in Angola. ▪ Establish criteria of adequacy of construction technique of groundwater Create a national registry of groundwater resources and subsequently perform the registration and integrating all groundwater users

Table 8: Action Plan _ "Could Haves'

Prioritisation	Element	Description
Could have	**Policy**	▪ Develop political, legal and institutional aspects for the sub-sector of groundwater ▪ Formulate and implement policies on a scale suitable for the subsector GW ▪ Climate change related studies adapted to local projects to scale with priority to the South of Angola. ▪ Coordinate and execute public policy arising from the agreements and conventions ▪ Ensure the implementation of the Strategic action programme of National water resources adapted to climate change ▪ Generate management models that are able to deal with the problems associated with specific hydro-geological characteristics of resources.
	Legislative	▪ Drawing up legal instruments, regulations and regulatory (use, protection, quality, license, pollution and environment) for the planning, operation and management of groundwater. ▪ Proposal to create joint regulations of international agreements and treaties on the transboundary Aquifers. ▪ Strengthening and modernization of the Institutional, Legal and Regulatory Framework of groundwater ▪ Guideline for developing information systems to access data on the groundwater resources in parallel with the implementation of monitoring systems.
	Institutional	▪ Implementation of structuring projects for scientific knowledge to the training, a possible water shortage context, as a result of climate change, mainly in the South of Angola. ▪ Coordination and preparation of plans, programmes and national projects concerning groundwater and monitor the development of its activities, within the principle of integrated management of water resources; ▪ Promote technical and scientific cooperation with national and international entities in the area of their mission;
	Strategy/ **Guidelines**	▪ Biophysical, socio-economic characterization, land use planning and heritage. ▪ Reconstruction of the historical series. ▪ Evaluation of Underground Water Deposits and general characterization of groundwater users Sectors. ▪ Comprehensive assessment of groundwater resources in southern Angola. ▪ Analysis of hydrological variation and rapid growth because of new environmental problems, such as floods and droughts.

Table 9: Action Plan _ "Won't Haves'

Prioritisation	Element	Description
Won't have	**Policy**	▪ The uncertainty of implementation of policies related to underground waters by decision makers. ▪ The uncertainty of producing management plans that are able to deal with the problems associated with specific hydro-geological characteristics of resources as well as their classification in terms of hydro-geological characteristics and future requirements.
	Legislative	▪ Uncertainty of the adequacy of the legal, political and institutional framework in relation to groundwater resources in Angola ▪ The uncertainty of implementation of policies related to underground waters by decision makers. ▪ The uncertainty of producing management plans that are able to deal with the problems associated with specific hydro- geological characteristics of resources as well as their classification in terms of hydro-geological characteristics and future requirements.
	Institutional	▪ Consolidation in the organizational domain, weak bureaucratic barriers and technical incompetence in groundwater governance on the part of the organs of guardianship.
	Strategy/ **Guidelines**	▪ Doubt in accept and implement proposals for revising policy, legal, regulatory and institutional national instruments for strengthening the management of groundwater resources

9. REFERENCES

Angola Alliance Partners. 2002. Estudo Planagua: Sudoeste de Angola - Projecto de abastecimento de agua para as areas rurais. Available online.

GWP 2002 – Introducing Effective Water Governance. Global Water Partnership, mimeo, Stockholm, Sweden

Havekes H., M. Hofstra, A. Kerk, B. Teeuwen 2013 – *Building Blocks for Good Water Governance*. Water governance Centre, The Hague, Netherlands

GoA. 1998b. Lei de Bases do Ambiente (Lei 5/98). Luanda.

LNEC. 1996. Eight volumes of background assessment towards the "Plano para a Utilizacao Integrada dos Recursos Hidricos da Bacia Hidrografica do rio Cunene". Laboratorio Nacional de Engenharia Civil, Departamento de Hidraulica, Lisboa.

INBO e GWP 2012 - *The Handbook for Integrated Water Resources Management in Transboundary Basins of Rivers, Lakes and Aquifers*. International Network of Basins Organisations and Global Water Partnership, ISBN:978-91-85321-85-8

Pereira, A. 2010 – *A Governação da Água em Angola – Riscos e Oportunidades.* Informação Técnica ITECS 35, Laboratório Nacional de Engenharia Civil, Lisboa ISBN 978-972-49-2190-7

PNEA 2012 – *Programa Nacional Estratégico imediato para a Água – Resumo Executivo*. Ministério da Energia e Águas, Instituto Nacional de Recursos Hídricos, Luanda

Plano Nacional da Água (PNA) Volume I - Caracterização da Situação de Referência Tomo 11 – Aspectos Institucionais e de Governança e Rios Transfronteiriços.

Rocha (Ed.). 2001. Plano para a Utilizacao Integrada dos Recursos Hidricos da Bacia Hidrografica do rio Cunene – Angola. Laboratorio Nacional de Engenharia Civil, Departamento de Hidraulica, Lisboa.

SWECO Grøner AS. 2005. National Water Sector Management Project. Activity C: Rapid Water Resources and Water Use Assessment of Angola. Final Report.

WFP (World Food Programme). 2005. Vulnerability Analysis and Mapping Branch (ODAV). Angola: Comprehensive Food Security and Vulnerability Analysis (CFSVA).

Wilk et al 2006. Estimating rainfall and water balance over the Okavango river basin for hydrological applications. Journal of Hydrology (2006) 331. pp. 18-29.

World Bank 2008. Angola: Water Sector Institutional Development, project P096360. Washington DC.

APPENDIX A: LITERATURE INVENTORY LIST

Year	Title of document	Author	Publisher	Report number	Link(if it is a website document)
1998	Lei n.º 05/98, de 11 de Junho – Lei de Bases do Ambiente.	Assembleia Nacional	Diário da República	I Série N° 2004. Lei Bases do Ambiente	Link
2002	Lei n.º 06/02, de 21 de Junho – Lei de Águas.	Assembleia Nacional	Diário da República	I Série N° 49. Lei de Águas.	Link2
2004	Lei n.º 51/04, de 23 de Julho, Lei sobre a Avaliação de Impacte Ambiental.	Assembleia Nacional	Diário da República	I Série — N.º 75	Link3
2007	Decreto n.º 59/07, de 13 de Julho – Licenciamento Ambiental.	Government of Angola	Diário da República		Link4
2011	Decreto Presidencial n.º 261/11, de 06 de Outubro – Regulamento sobre a Qualidade da Água.		Diário da República	Iª Série n.º 22 d	Link5
2013	Decreto Presidencial n.º 09/13, de 31 de Janeiro – Plano Nacional Estratégico para Água (2013-2017).	Government of Angola	Diário da República	Iª Série n.º 22	Link6
2014	Decreto Presidencial n.º 82/14, de 21 de Abril - Regulamento de Utilização Geral dos Recursos Hídricos.	Government of Angola	Diário da República	I Série-N.0 74	MINEIA - Ministério da Energia e Águas. Plano de Acção do Sector de Energia e Águas 2013-2017
2014	Decreto Presidencial n.º 83/14, de 22 de Abril - Regulamento de Abastecimento Público de Água e de Saneamento de Águas Residuais e o Plano Nacional da Água – 2017-2025;	Government of Angola	Diário da República	I Série-N.0 75	Link7
2014	Decreto Lei nº 181/14 de 28 de Julho	Government of Angola	. Diário da República	I Série Nº 138	Link8
2016	Resolução n.027/16 de 22 de Julho	Government of Angola	Diário da República	I Série - N." 122	Link9

APPENDIX B: STAKEHOLDER LIST

Full list of Stakeholders

Title	Name	Surname	Affiliation	Role	Sector Group	Cell Number	Email:	Priority (yes/no)
Mr	Pedro	Silva	DNA-MINEA	Engineer	National Government	244 923 523 330	dombelas@hotmail.com	yes
Mr	Helder	Martins	Agostinho Neto University	Hydrogeologist	Academia	244 923 241 050	hnobriga72@gmail.com	yes
PHD	Gabriel	Miguel	CTN/MINESCTI	Director	National Government	244 924 360 200	gabrielctangola@gmail.com	yes
Mr	Narciso	Ambrosio	INRH-MINEA	Head of Department of Water Resources Planning and Hydrology - National Government	National Government	244 923 647 899	narciso.ambrosio@inrh.gov.ao	yes
Mr	Pinto	Fiel	UNICEF	Engineer	ONG	244 923 571 954	pintofiel@hotmail.com	yes
Mr	Manuel	Quintino	INRH-MINEA	Director	National Government	244 924 986 232	manuel.quintino@inrh.gv.ao	yes
Ms	Mónica	Cipriano	INRH-MINEA Technical Assistance - Consultant	Cosultora	National Government	244 935 521 881	monica.cypriano@gmail.com	no
Ms	Maida	Gomes	INRH-MINEA Head of Department of	Department boss	National Government	.....	maida.gomes@inrh.gv.ao	no

			Water Resources Licence - National Government					
Mr	Francisco	Ferreira	INRH-MINEA	Deputy Detector - National Government	National Government	.....	Franciscoferreira@inrh.gv.ao	no

Stakeholders consulted to respond to the questionnaire

Name	Position	Stakeholder Group
Mr Pedro Silva	Institution, Designation	Government
Mr Pedro Silva	NATIONAL WATER DIRECTORATE (DNA)	Academia
Mr Manuel Quintino	National Institute for Water Resources (INRH))	Government
Mr Narciso Ambrosio	INRH-MINEA - Head of Department of Water Resources Planning and Hydrology - National Government	Government
Mr Pinto Fiel	UNICEF Consultant	NGOs

Validation Workshop and Broader Stakeholders

Name	Position	Stakeholder Group
Mr Narciso Augusto Ambrosio	Chefe do Departamento de Planeamento dos Recursos Hídricos e Hidrologia, INRH	Government (Validation Workshop)
Mr Afonso Cupi Baptista	Programme Manager of the Water and Sanitation for the Development Workshop Angola	NGO (Validation Workshop)
Mr Evangelisto Kamati	Technical DIrector of the Cunene Water and Sanitation Company	Government (Validation Workshop)
Mr Allan Cain	Director: Development Workshop Angola	NGO (Broader Stakeholders)

Appendix C: Desired Future State

SUMMARY of groundwater status in Angola on the basis of the assessment of policies reviewed and compared with the minimum Need for effective implementation of the instruments of National Policy of water resources in the management of groundwater requirements for the desired future.

Reflection of Policy Framework as per the minimum requirement for the Desired Future State

Minimum requirement for the desired future	Status	Comment
Need for effective implementation of the instruments of National Policy of water resources in the management of groundwater	Partially achieved	Strengthening and coordination between the organs, water resources managers support the management of national and transboundary aquifers. Expand and consolidate the hydrogeological knowledge on national and cross-border aquifers, identifying their potential, availability, water quality, vulnerabilities and risks, in order to propose the planning of management and use sustainable.
Formulate and implement policies to an appropriate scale of groundwater	Partially	The analysis about water policies in Angola is based strictly on the surface water, being an essential factor to governance of water resources which you can't dissociate the political, institutional and territorial configuration, affecting between other aspects, the insignificance of groundwater by "law" in view of the importance attributed to surface resources
The social, economic and environmental values of groundwater are all recognized;	achieved	Although it is included in general these values are recognized as much surface water as well as the underground
The involvement of women and youth in decision-making and in the implementation of underground water supply schemes	Partially achieved	The Angolan society is matriarchal; the women is a figure responsible for taking care of the family. The great distance between the water collection points and communities are made by women and young people would be important be involved in the definition of community policies relating to groundwater
A long-term policy to protect groundwater by preventing pollution and overuse. This policy is comprehensive, implemented at all appropriate levels, consistent with other water management policies and be duly taken into account in other sectoral policies;	Not achieved	The policy makes a clear reference to the groundwater and the implementation at the appropriate level is not satisfactory
An institutional framework with a clear assignment of responsibilities	Not Achieved	Sectoral fragmentation of the various tasks related to the formulation of policies of groundwater and with their management and use, especially with regard to various agencies and ministries, with individualist attitudes

Consistently coordinate policies of groundwater and with other sectoral policies and involve all stakeholders in the decision-making	Partially	Although not a decree specifically to groundwater, but the Presidential Decree No. 09/13 of 31 January, created the national water Council and the Councils of river basins, which are manage by representatives of different Ministerial departments, Governments, Provinces, representatives of users or users, professional and economic organizations and representatives of the community.
Produce and make public data and quality information on groundwater	Not Achieved	Intentional information asymmetries between the different protagonists that are relevant to the formulation of policies for groundwater management and their use
Institutional stability of the management model of water resources	Partially achieved	Insufficient scientific capacity, technical training, infrastructural and of the various protagonists to formulate and implement water policies and to define the best strategies for groundwater
Social and institutional management policies adapted to climate change	Not reached	It is as relevant to the existence of policies and procedures that, internally, leading to better management and use of groundwater and, externally, to concerted administration of transboundary groundwater resources.

Reflection of Legal Framework as per the minimum requirement for the Desired Future State

Minimum requirement for the desired future	Status	Comment
Total water Law regulations, and the preparation of regulatory and normative instruments of planning of groundwater	Partially achieved	16 Years after approving the water law, the same has not been fully regulated, However, this law refers to a very high number of diplomas to regulate, while they are not in force does not allow their full application and consequently, the assessment end of their potentialities and limitations.
Approval of regulations and standards for groundwater management	Not achieved	At national level, there is no specific legislation that addresses explicitly the use, management and protection of groundwater, which can provide necessary subsidies to regulate, manage, control, protect and develop water resources underground in conjunction with surface water resources
Institutional and regulatory aspects of the management of groundwater resources	Not achieved	The current legislation for water resources in general do not fit with the current with new scientific and technical demands on groundwater need to update the legislation and create a legal and institutional framework, whose general law establishes the fundamental principles that guide the conduct of all actors in the management and use of underground water
Recognition of groundwater as an important	Partially	The law provides for the recognition of

Minimum requirement for the desired future	Status	Comment
source of domestic supply and rural areas agricultural	achieved	groundwater as an important source of domestic and agricultural supply and a crucial resource for poverty reduction, food security, and sustainable economic development of rural areas, since the South of Angola uses groundwater.
Specific national legislation on water quality	Not achieved	The lack of specific national legislation on water quality makes the classification and the framework for a particular purpose. In Angola, relating to the quality of water, the legislation is silent.
Provide legal and regulatory instruments for qualitative and quantitative monitoring of groundwater	Not achieved	Aims to subsidize planning and stock control, as well as enable preventive maintenance activities; Evaluation of connection between groundwater and the surface water and the relationship with the associated terrestrial ecosystems; Mitigating the effects of drought and climate change with the water resource plans Perform water management aimed at water and food security and access to water as a human right in the face of climate change scenario and its reflections on the issue population migration and health. Evaluation of impacts of multiple uses and application of standards, economic recovery and public environmental accounting as a grant to the development of scenarios. Create standards for regulating and defining areas of recharge and groundwater upwelling of support of groundwater boreholes. -Check the spatial and temporal changes in quality and quantity of groundwater, trying to emphasize trends;
Drilling practices as well as the legalization of boreholes	Partially achieved	Despite the legal requirements, there are a large number of irregular boreholes, drilled indiscriminately, without authorization and without technical Manager enabled. Actions will be necessary in relation of the awareness of the resource's users to encourage them to the legalization of the boreholes.
Regulations relating to vulnerability and the risk of contamination, especially in areas where the groundwater is an important source in the public water supply	Partially	Is a tool that should support, public bodies, users, teaching and research institutions, in local studies projects for the development of the sub-sector of groundwater, to the development of various measures towards:-drawing up maps of exploitation of aquifers in order to subsidize the granting of groundwater; -Regulation on protection of recharge areas and perimeters of protection of borrowings; -Regulations related to overshoot to salines and wedges of contention control of salinization processes in coastal regions

Minimum requirement for the desired future	Status	Comment
Rules of use and protection of aquifers	Not reached	Strengthening the capacity of response and exercise of authority on the part of government bodies and the proper articulation of monitoring and surveillance systems
Legal, regulatory and normative instruments that may ensure the HR governance underground in Angola	Not reached	Instruments needed to ensure governance and shared management of aquifers in National/provincial and International Directions; -Contribute to the design of the planning, implementation and maintenance of basic networks of qualitative and quantitative monitoring of groundwater, of a regional nature; The preparation of guidelines for the implementation, maintenance preventive and recovery for works of water uptake; -Subsidize actions of protection and conservation of groundwater; -Promote the knowledge and maintenance of the ecological function of groundwater and surface water; -Identify water use conflicts-Propose guidelines for the zoning of soil use and occupation.
Promote research and development	Weak	Objective promote studies priority lines of research, in order to generate knowledge and to fill in existing gaps in fundamental themes for the protection and management of aquifers. Such knowledge should be developed inter-institutionally to facilitate the exchange of experiences, duplication of efforts and at the same time promote training of professionals and dessimination of qualified technical information .
Standardization of HR management underground	Not reached	Uniformity of rules for drilling of groundwater deployment. Preparation of studies on the groundwater management of the various regional aquifers prioritizing the southern Angola.
Legislation that enables the classification of storage quantity, quality of surface water chemistry and their interaction with groundwater.	Not reached	The need to adapt the legislation allows the classification of storage quantity, quality of surface water chemistry and their interaction with groundwater.

Reflection of Institutional Framework as per the minimum requirement for the Desired Future State

Minimum requirement for the desired future	Status	Comment
Fragmented institutional framework and organisational management (surface and groundwater)	Partially	Implement an integrated management model taking into account not only the water catchment area but also the hydrogeological basin, taking into account the aquifer
Creation of data Base	Partially	Information management and preparation of an inventory of water points on primarily the

Minimum requirement for the desired future	Status	Comment
		transboundary groundwater resources.
Training, communication and Social Mobilization	Not reached	Is the need for training in groundwater, because the information, courses and works in the field of Hydrogeology are scarce. The little society meets and discusses the issue and initiatives are rare for mobilization and environmental education that incorporate the theme. Regarding to groundwater management, difficulties and the lack of integration are even bigger, with the need to make efforts to promote the integration of activities and thematic activities related to integrated water resources management
Intersectoral collaboration is promoted and facilitated for the needs and the impacts of different sectors (for example, land, agriculture, mining, energy, and environment) are taken into account in the management of groundwater.	Partially achieved	Weak inter-sectoral collaboration between the Ministry of energy and water, Ministry of agriculture and forests and the Ministry of natural resources and Oil.
Produce and disseminate basic information on groundwater	Partially	Aims to overcome the barrier of ignorance "about the occurrence, circulation and supply potential for groundwater and intends to reach a diverse audience including, among others, organs that deal with some aspect of the water resource and users of groundwater in General.
Capacity-building in the area of groundwater in Angola	Partially	Highlights the lack of human resources with appropriate training to all levels of the institutions in the sector. This lack of appropriate professionals, clearly represents a major limitation for the implementation of both the national strategy of regional initiatives
Instruments to ensure shared governance between the central Governments provincial governments, users and civil society	Partially achieved	Collaboration between the institutions in the water sector and the different actors (stakeholders) within a certain area. Survey of training needs, monitoring and evaluation: survey and approach to new requirements of capacity-building. General public awareness about pressing issues of management and use of underground water. Sharing of experiences of best practices and lessons for review of future programmes.
Give the necessary attention to financial sustainability and the role of fees	Partially achieved	That trust is a precondition for the social and political sustainability of the institutions in the sector. This theme gains special relevance in the field of water resources management, given the cross-cutting nature and the fact that their being an essential resource for all economic activities without exception, as well as to the socio-economic development and for the well-being of

Minimum requirement for the desired future	Status	Comment
		the populations.
Financing	Not achieved	The stability and continuity of the budgets available for the underground water sector, are essential for an efficient structuring of the sector and to achieve sound management of water resources, the costs on the basis of fees for use of water resources, whether captures are rejections of effluents
Seek partnership and support universities, research centers, technical associations of users in carrying out studies, works, publications focusing on groundwater	Not achieved	On mobilization of universities and research centers for the development of studies and research on focusing on groundwater allows to promote technology transfer in the area of operation and management through partnerships and cooperation agreements technique with technical associations and users of groundwater

CONTACT DETAILS:

205 Nelson Mandela Drive
University of the Free State, Dean Street
Bloemfontein, South Africa

Tel: +27 51 401 7734
E-mail: info@sadc-gmi.org

SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
SADC
TOWARDS A COMMON FUTURE

GROUNDWATER MANAGEMENT INSTITUTE