

# The Niger River Basin

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**An assessment of groundwater need**

**by**

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## Acronyms

<b>ABN</b>	<b>Autorité du Bassin du Niger</b>
<b>AGES</b>	<b>Appui à la Gestion des Eaux Souterraines</b>
<b>AGW-net</b>	<b>African Groundwater Network</b>
<b>AMCOW</b>	<b>African Ministerial Conference on Water</b>
<b>BGR</b>	<b>Bundesanstalt für Geowissenschaften und Rohstoffe</b>
<b>CT</b>	<b>Continental Terminal</b>
<b>GIRE</b>	<b>Gestion intégrée des Ressources en Eau</b>
<b>GW</b>	<b>Groundwater</b>
<b>HQ</b>	<b>Headquarter</b>
<b>IWRM</b>	<b>Integrated Water Resources Management</b>
<b>L/RBO</b>	<b>Lake/River Basin Organization</b>
<b>L/R/ABO</b>	<b>Lake/River Association of Basin Organizations</b>
<b>Mgt</b>	<b>Management</b>
<b>NBA</b>	<b>Niger Basin Authority</b>
<b>NE</b>	<b>North East</b>
<b>NFS</b>	<b>National Focal Structure</b>
<b>NIGER-HYCOS</b>	<b>Niger Hydrological Cycle Observation System</b>
<b>NIHSA</b>	<b>Nigeria Hydrological Services Agency</b>
<b>NW</b>	<b>North West</b>
<b>OSS</b>	<b>Observatory of the Sahara and the Sahel</b>
<b>SE</b>	<b>South East</b>
<b>SW</b>	<b>South West</b>
<b>SWOT</b>	<b>Strengths, Weaknesses, Opportunities and Threats</b>
<b>TBA</b>	<b>Transboundary Aquifer</b>
<b>UNDP</b>	<b>United Nations Development Program</b>

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## **1. Introduction**

The African Groundwater Network (AGW-net), the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and SPLASH have agreed on the need of bringing groundwater on the political agenda by promoting the integration of groundwater management into the mandate of Lake and/or River Basin Organizations (L/RBO). The idea is to assess by interviewing the staff of the L/RBO to what extent groundwater is taken into account and what kind of actions is needed to integrate groundwater in the activities of the respective L/RBO.

## **2. Objectives**

The general objective of the study is, based on the results of the consultations to selected L/RBOs, to develop targeted and prioritized recommendations for improving groundwater management in the L/RBOs. This report summarizes the physical, (hydro-) geological, socio-economic and environmental conditions of the Niger River Basin as well as the water governance policy of the Niger Basin Authority, which is one of the nine L/RBOs selected for consultations.

## **3. Topography, Climate and Hydrology**

The Niger River Basin stretches over great parts of the interior of West Africa. It covers parts of the national territories of nine states: Guinea, Cote d'Ivoire, Mali, Burkina Faso, Republic of Niger, Benin, Chad, Cameroon and Nigeria.

The Basin forms an elongated area - resembling roughly a crescent - that covers about 2,000,000 km<sup>2</sup>, of which some 1,500,000 km<sup>2</sup> form the active part basin (displayed in greyish colour in Figure 1), the rest is desert with virtually no drainage at present.



Figure 1. Location of the Niger River Basin in Africa /1/

The Niger River Basin is drained by the Niger River, which represents with its length of around 4,200 km the third-longest river on the African continent, spanning from Guinea in the basin's westernmost corner over Mali and the Republic of Niger to Benin and western Nigeria. By far the mightiest tributary is the Benue River, which rises from southwestern Chad, passing through northern Cameroon and eastern Nigeria, confluencing with the Niger River in south-central Nigeria, heading south. When reaching the southern coast of Nigeria, the Niger River flows into the Atlantic Ocean, splitting up into numerous rivers and creeks, forming with its sediments the Niger Delta.

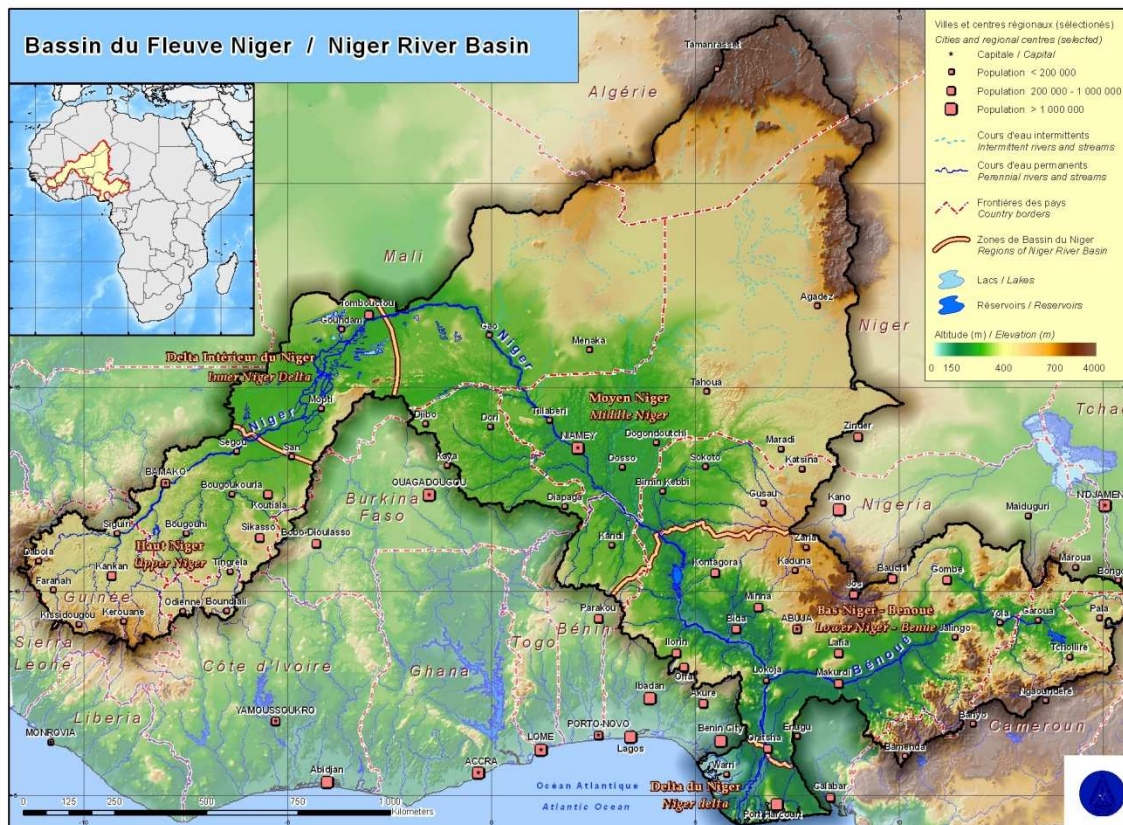


Figure 2. Topography of the Niger River Basin /1/

Geographically the Niger River Basin stretches between the meridians 11<sup>th</sup> West and 15<sup>th</sup> East and between the parallels 5<sup>th</sup> and 22<sup>nd</sup> North. It comprises 2,000 km from East to West and 3,000 km from North to South.

The surface height varies from 1,100 m above mean sea level at the Niger River's source in the Highlands of Guinea and from 1,300 m at the Adamawa Plateau in Northern Cameroon to 0 m at the river mouth, e. g. the tidal swamps of the southern Niger Delta. The inactive part of the basin rises up to 3,000 m in the Ahaggar Mountains in the Algerian Sahara.

Most of the basin area is flat-lying, so steep gradients are rare and almost exclusively restricted to the source regions in Guinea, Cameroon and central / eastern Nigeria. In central Mali the gradient becomes so low (< 2 cm/km) /2/ that the Niger River starts to split up in several rivers and form an inland delta with extended swamp areas, lakes and meandering waterways, which during prehistoric times might have been a great lake similar to Lake Chad. Downstream in eastern Mali and western Niger the gradient becomes steeper again, but the landscape remains mostly flat. In southern Nigeria, south of Onitsha, the gradient again becomes very small so that the mentioned Niger Delta could build up.

This somehow odd topography of the Niger River Basin led to the theory that once there were two separate Niger Rivers, the first one ending in what is now central Mali in the prehistoric lake mentioned above, and the second one draining the Air mountains in what is now the north of the Republic of Niger, when rainfalls were more abundant all over the region than they are nowadays.

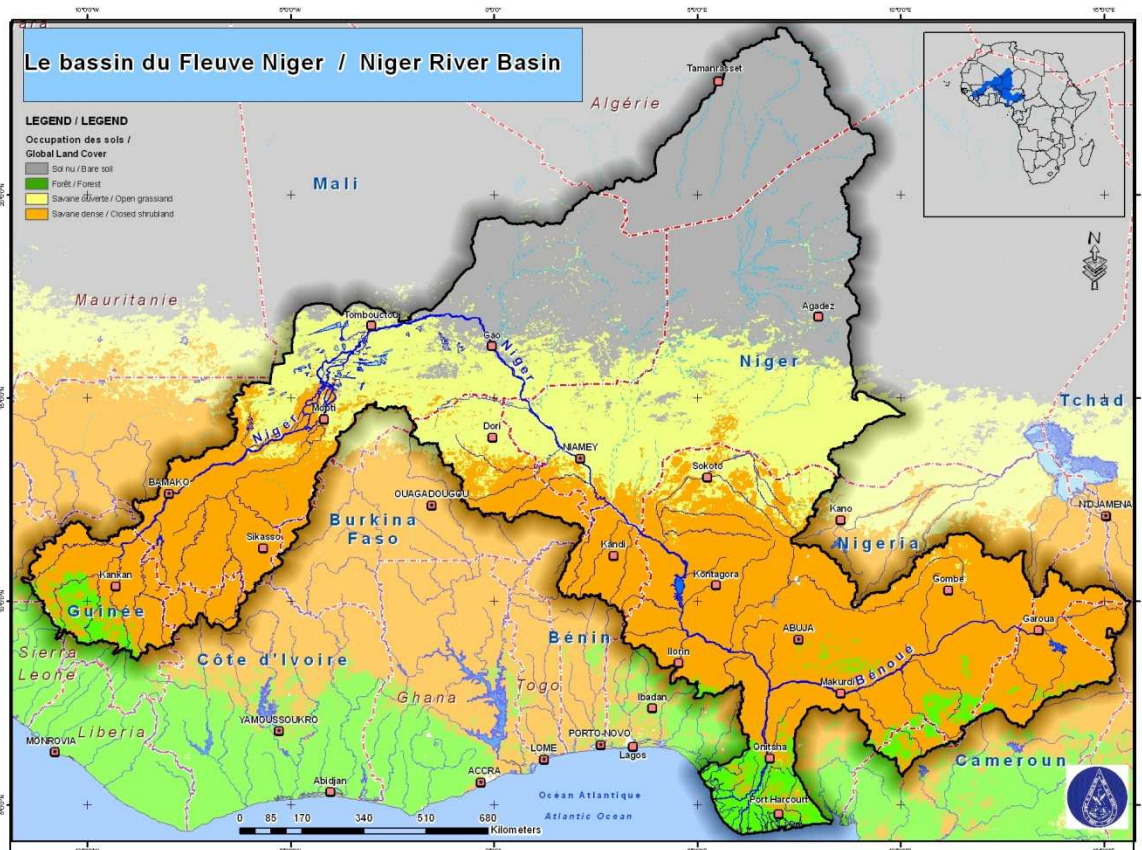


Figure 3. Land cover of the Niger River Basin /1/

Located between the equator and the Tropic of Cancer the climate is tropical in almost all parts of the basin. Climatic differences within the basin depend almost exclusively on the amount of annual rainfall. According to rainfall patterns the basin is characterized by five zones:

Tab 1. Climate zones in West Africa /2/

Annual Precipitation [mm]	Classification in West Africa	Common Classification
> 1200	Sudanic II and III	Full Tropical
750 - 1200	Sudanic I	Semihumid Tropical
300 - 750	Semi arid South	Semi arid Tropical
150 - 300	Semi arid North	Semi arid Desertic
< 150	Saharian	Desertic

The five climate zones mentioned above coincide with the land cover, which can be roughly divided into four natural zones: Bare soil (e. g. Agadez), open grassland (e. g. Niamey), closed shrubland (e. g. Kontagora) and forest (e. g. Port Harcourt) (See Fig. 3). The spatial distribution of those four zones is almost exactly from north (bare soil, Saharan desert) to the south (forest, full tropical), while going from west to east there is hardly any change.

The rainfall pattern all over the basin area is sharply seasonal. During the rainy season (June – November) the monsoon winds coming from the tropical Atlantic blow from the SW, bringing moisture and rain, especially in coastal areas and in mountainous regions like the Guinean highlands or the Adamawa Plateau. During the dry season (December – May) the

so-called Harmattan winds blow constantly from the NE, bringing dry air masses and dust from the Sahara desert. The rainy season is longer and more intense in the south of the basin and in the highlands. In the north the rainy season is shorter (north of the 13<sup>th</sup> parallel only from July/August to September), and even during this period rainfall events are not frequent.

In consequence, Guinea, situated in the full / semihumid tropical zone has a mean annual runoff of 36 Billion km<sup>3</sup> to the Niger River, though Guinea's part of the basin covers only 5 % of the basin area. In contrast, Mali hosts 29 % of the basin area (more than half of it in the semiarid / desertic zone) but has a mean annual runoff of about minus 15 Billion km<sup>3</sup>, because it contributes 15 Billion km<sup>3</sup> with its affluents in the semihumid south of the country, but loses 30 Billion km<sup>3</sup> in its northern, semiarid desertic, part - almost everything by evaporation – before the Niger river leaves Malian territory /2/.

When the Benue River meets the Niger River at Lokoja in central Nigeria it contributes about 107 Billion km<sup>3</sup> annually, while the Niger River itself supplies only about 83 Billion km<sup>3</sup>. In southern Nigeria, between Lokoja and the river mouth, the Niger River receives another about 50 to 60 Billion km<sup>3</sup> per year, most of it by abundant tropical rainfalls, so that the whole Niger River system releases around 250 Billion km<sup>3</sup> annually in the Atlantic Ocean /2/.

One can conclude that some member states, such as Guinea and Cameroon “produce” the bulk of the ground- and surface water supplying the aquifers and rivers, some other member states, such as Mali and Niger “consume” water but do not contribute water (by rainfall or discharge of groundwater) in significant quantities to the Niger River System.

Nigeria, as the downstream state, located in the semihumid tropical to full tropical zone, is a great “producer” and consumer at the same time /2/.

## 4. Geology

The geology of the upstream areas is characterized by igneous (e. g. granitic) and metamorphic (e. g. gneissic) rock formations of Precambrian and Panafrican (> 550 million years) age. In West Africa they are generally known as “basement” (le “socle” in French). In the western part of the basin this comprises the mountainous and hilly areas of southern and eastern Guinea, NW Cote d'Ivoire, southernmost Mali and the areas of Burkina Faso close to the border with Mali and Niger. In the eastern part of the basin most of the Chadian and Cameroonien areas consist of these rock formations e. g. the Adamawa Plateau (that also hosts some younger volcanic intrusions) in northern Cameroon bordering Nigeria. The higher areas of the Nigerian part of the basin are also built up by these rock formations.

Adjacent to these there are sometimes found sandstones of Paleozoic and Panafrican age, for example in southern and eastern Mali (e. g. the Bamako sandstone). They are typical for the western part of the Niger River Basin but hardly found in the eastern part.

The great flat lying areas of the midstream and downstream regions of the Niger River Basin are composed of huge sedimentary basins. They are the result of almost uninterrupted continental, sometimes marine, sedimentation from the Paleozoic to the Quaternary. They

consist of mostly sandstones and mudstones. Great parts of central and northern Mali are part of the Taoudeni Basin (See Fig. 5), one of the great continental basins on earth that extends far beyond the borders of the Niger River Basin up to Morocco. Another huge continental basin, called the Iullemeden (See Fig. 5), extends over NE Mali, great parts of the Republic of Niger and the NW of Nigeria (where it is called Sokoto Basin). Those two great sedimentary basins have an almost circular shape. The sedimentary basins in the east of the Niger River Basin, e. g. the Bida Basin in western Nigeria and the Benoue Basin in northern Cameroon / eastern Nigeria, are smaller, narrower and geologically younger. Their sedimentation started in Cretaceous time and spans into Quaternary. Most of the sedimentary cover is of Cretaceous age. The last sedimentary basin to mention is the Niger Delta, which is somehow the southern continuation of the Benoue Basin. The uninterrupted sedimentation of thick layers of sands and clays of mostly Tertiary age have moved the coastline about 150 km southwards during the last 50 million years or so /3/ /4/ /5/ .

## 5. Hydrogeology

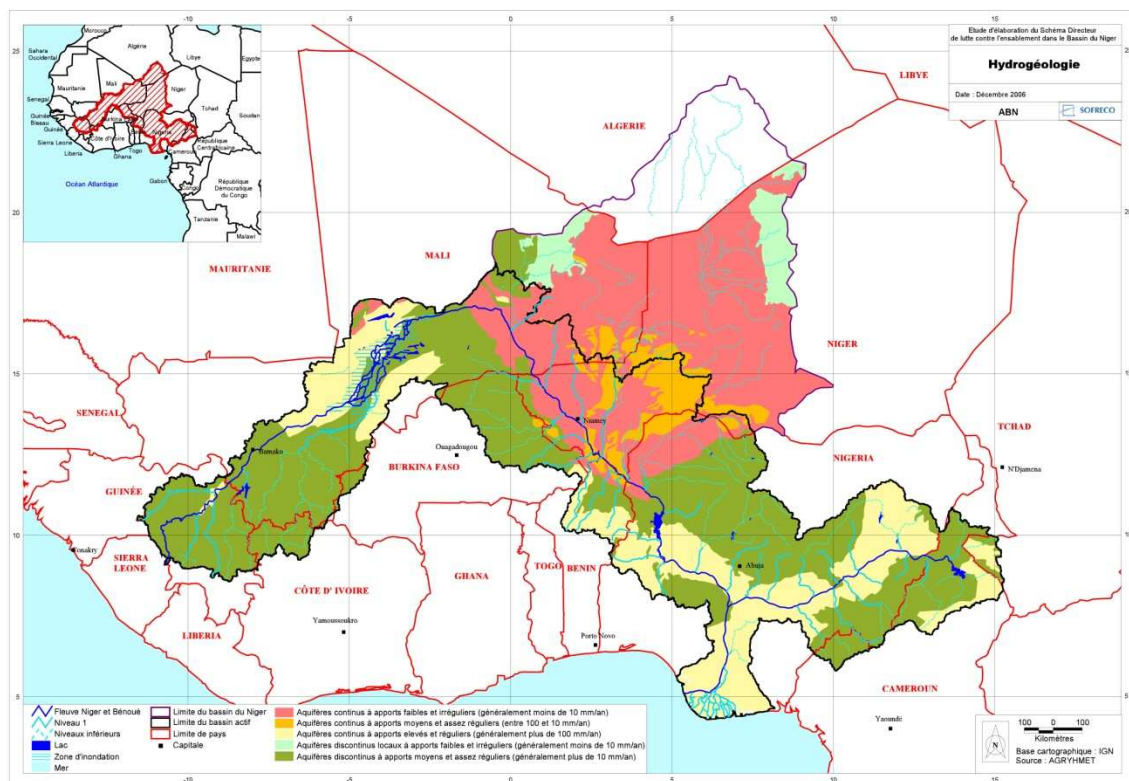


Figure 4. Hydrogeology of the Niger River Basin /1/

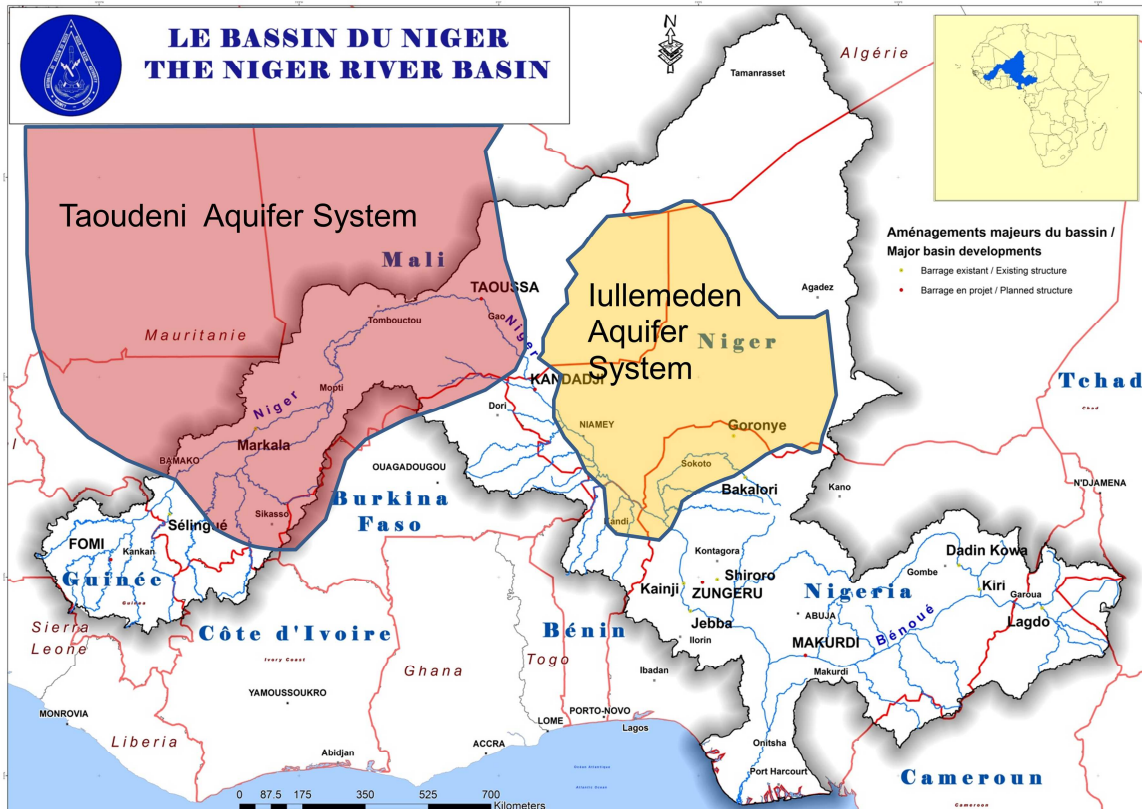


Figure 5. The two major Aquifers of the Niger River Basin /1/

The aquifers found in the Niger River Basin can generally be classified into two different types:

- Fractured aquifers (“aquifères discontinus” in French)
- Intergranular aquifers (“aquifères continus” in French)

### The fractured aquifers

The fractured aquifers have their name derived from the fact that the groundwater does not move through pores inside the rock body but through fractures and fissures, generally due to the absence of passable pores. Consequently, fractured aquifers are found generally in consolidated rocks as igneous and metamorphic rocks as well as strongly consolidated sandstones.

These aquifers are typical for the areas geologically characterized by the basement. They are also found in the sandstones of Precambrian and Panafrican age. Usually the groundwater moves inside the weathered zone, because there are enough fractures and fissures. Generally spoken, the thickness of the aquifer does not exceed significantly beyond the thickness of the rock’s altered zone, which in the basement rocks of West Africa might be a few ten meters. Consequently the aquifers are of small scale and they do not extend much laterally either. Their specific yield is relatively small (e. g. 0.4 m<sup>3</sup>/h/m in the basement in Niamey) /5/.

### The intergranular aquifers

In contrast to the aquifers mentioned above in the intergranular aquifers the groundwater flows mainly through passable pores. Intergranular aquifers are found generally in unconsolidated rocks such as younger sandstones and unconsolidated clastic sediments (e. g. sands, gravels). Because of the fact that water can move continuously through the granular structure, the aquifers are of greater extension. Also an unconsolidated sandstone can carry several aquifers above each other, separated by impermeable layers.

Those aquifers are found in the great sedimentary basins, such as the Taoudeni, the lullemeden and the Benoue Basin.

The lullemeden hosts several aquifers above each other. In its shallowest formation, the so called "Continental Terminal" (CT) there are found three different aquifers (CT1 – CT3) with CT3 being the shallowest and CT1 being the deepest of the three.

CT3's unconfined groundwater table is met at a depth of a few meters in the Wadis and up to 60 m on the lateritic plateau in the region of Nord-Dosso, southwestern Niger. The CT3 shows a maximum thickness of 100 m in the region of Dogondoutchi, SW Niger, its average thickness is about 56 m throughout the southern lullemeden Basin /6/.

The specific yields are significantly higher than in fractured aquifers:

CT3: specific yield of 3,5 m<sup>3</sup>/h/m close to Dogondoutchi

CT2: specific yield of 7,2 m<sup>3</sup>/h/m in Kiessé, SW Niger /6/.

The underlying formation called "Continental Intercalaire / Hamadien" hosts an aquifer, too. Its water table is found in about 300 m depth in SW Niger, it stands under weak artesian pressure. Little is known about this deep lying aquifer.

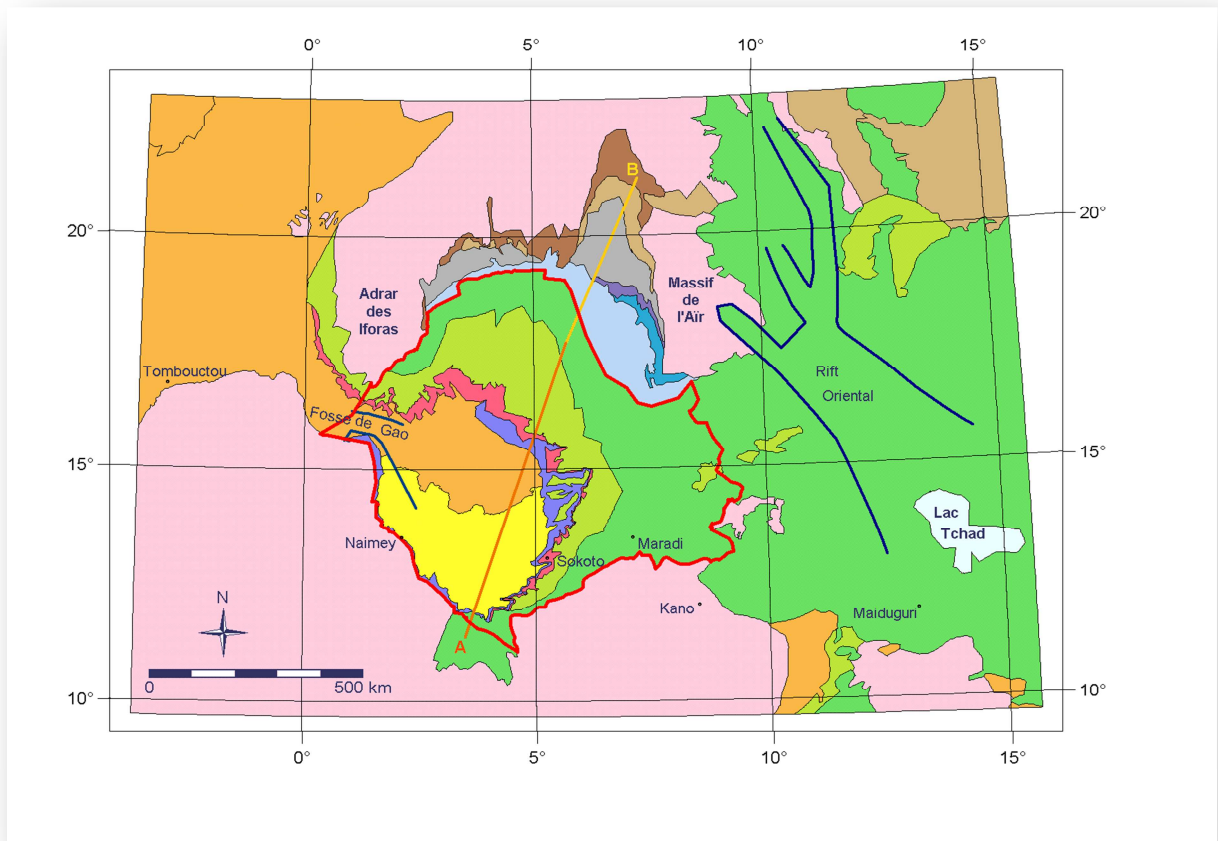


Figure 6. Geology of the Iullemeden Basin /1/ (bright pink is Precambrian, other colors see legend of Fig. 7)

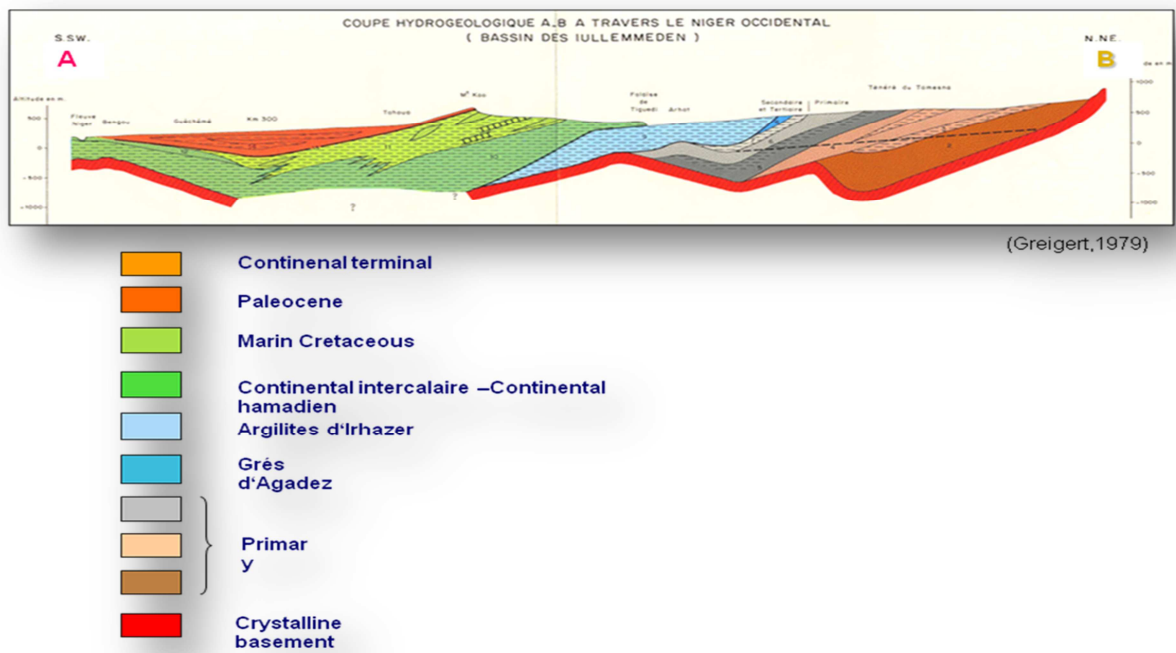


Figure 7. Geological cross-section of the Iullemeden Basin /1/

## 6. Socioeconomic and Environmental Conditions

There are between 100 and 110 million people living in the Niger River Basin at present.

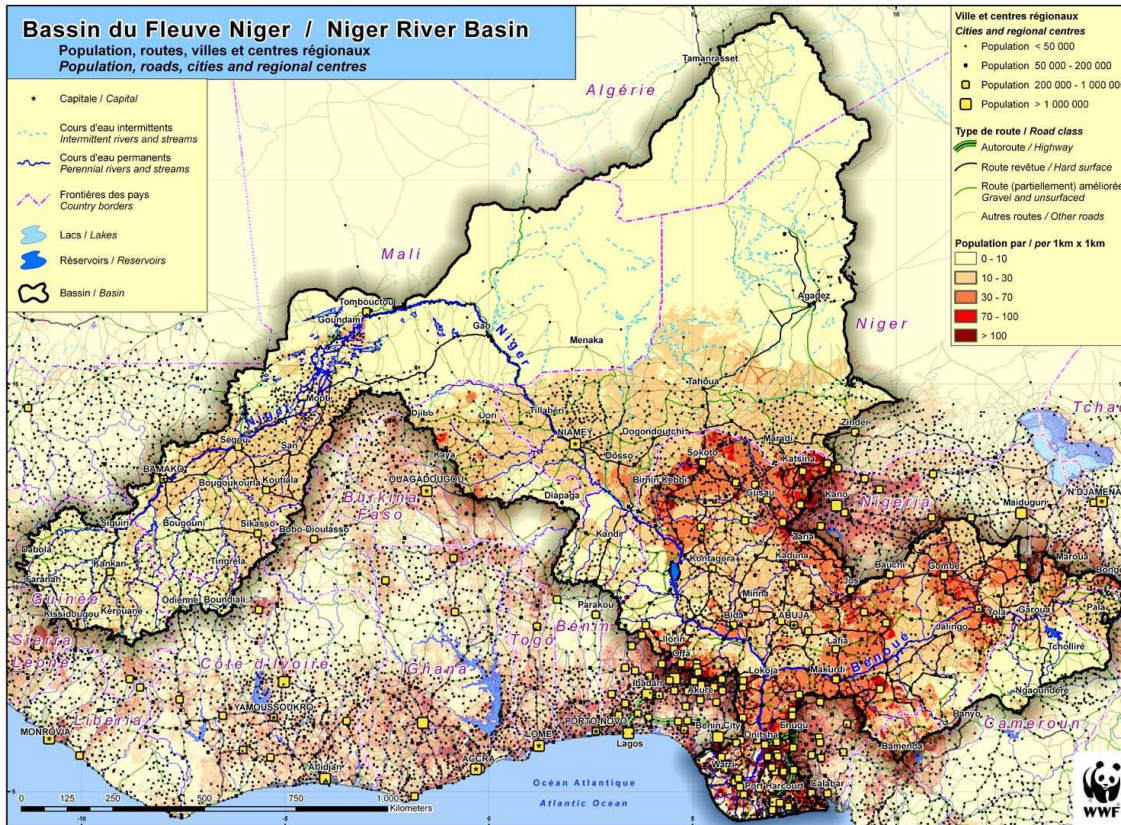


Figure 8. Population of the Niger River Basin /1/

As displayed in Fig. 6 the distribution of the population is quite unequal throughout the area. While in the western and northern two thirds of the basin the population density is less than 30 persons/km<sup>2</sup>, in great parts even less than 10 persons/km<sup>2</sup>, in the southeastern third of the basin (Nigeria and northern Cameroon) population density is often more than 30 persons/km<sup>2</sup>, in the areas alongside waterways and in the Niger Delta more than 70 persons/km<sup>2</sup>. A look at the distribution of the nationalities of the people living in the Niger River Basin shows the differences very clearly: Mali covers 29% of the basin area, but hosts only 5 % of the basins population while Nigeria covers 32% but hosts 83% (!) of the basins population /1/. That means that more than 4 out of 5 inhabitants of the Niger River Basin are Nigerians.

Seven out of the nine member countries are among the 20 least developed countries (Human Development Index) in the world according to the UNDP /2/.

Access to safe drinking water is a problem especially in rural areas, where most of the water is taken directly from ponds ("marés" in French) during the rainy season and from hand dug wells during the dry season. The sanitary conditions are generally very poor in the member countries. Water borne diseases as diarrhea, hepatitis and typhus are widespread and the Malaria is a major problem throughout almost all of the Niger River Basin, especially during the rainy seasons when Anopheles breeds in standing water bodies.

The main activity in the region is agriculture, mostly rain-fed in the wetter south or recessional in the flooded areas. Mostly millet and mais are grown for self-catering, but also cash crops like cotton, groundnut and rice along the water courses, especially alongside the Niger River and the Benoue River. Groundwater irrigation is increasing in Sahelian areas off the vicinity of the Niger River, which might be of concern due to low irrigation efficiency and salinisation. Groundwater pollution problems (e. g. Nitrate) are reported from intensively cultivated areas. There is also cattle breeding in the semiarid areas and there are seasonal migrations of cattle breeders with their livestock, that sometimes, in dry years, leads to conflicts with the sedentary population depending on agriculture.

With an average growth rate of about 3 % per year the population in the Niger River Basin is one of the fastest growing in the world /2/. In addition to that there is a significant migration from rural areas to the cities in the region. Because of these factors the pollution problem Agriculture concerning groundwater and surface water in urban areas are increasing.

During the last decades some dam projects have been realized in order to produce hydroelectric energy and to have a water reservoir for the dry season: The Lake Lagdo in northern Cameroon, the Lake Kainji in western Nigeria and the Lake Sélingué in southern Mali. Hydroelectric energy is being produced at the Lagdo and Kainji dams. While the produced energy at Lake Lagdo exceeds the local needs and can be exported, the hope of being independent from the seasonal changes of the Benoue River's water level did not fulfill the expectations made in advance, navigation on the Benoue at Garoua remains limited in the dry season /2/. Other dam projects like at Tillabéri in the Republic of Niger and close to Gao in Mali are being planned, but construction works did not start yet.

## 7. Groundwater Governance

In 1964 the Niger Basin Commission was founded by the nine member states. This Commission established rules on how to manage water resources and how to proceed on an international scale between the member states. In 1980 the Niger Basin Commission was renamed in Niger Basin Authority (“Autorité du Bassin du Niger (ABN)” in French) and gave itself a new legal framework. The goal was announced to promote the cooperation between the member states and to assure an integrated development of their resources in particular in the domains of energy, water, agriculture, forest exploitation, transport, communication and industry. The overall goal of the renaming was to strengthen the ties between the member countries and to give the organization more power. The absence of financial support by the member states led to a deterioration of credibility which had in consequence a disengagement of development partners. The situation continued until in 1998 the ministers of the nine states met in Abuja, Nigeria, to identify institutional problems and to discuss environmental problems. In 2002 the heads of governments met in Abuja to reinforce the political engagement /2/.

Until recently the focus concerning the water resources of the Niger River Basin was on the surface water. Groundwater is now becoming a new focus. Especially the member states in the semiarid areas are looking forward to exploit and to manage their groundwater resources in a sustainable way /1/.

## 8. Interviews

The interviews in the HQ of the NBA as well as with the country representatives of the Republic of Niger were oral interviews and took place in the premises of the NBA in Niamey.

The interviews with the NFS of Mali and Nigeria were made via e-mail.

Unfortunately, the NFS of the remaining member countries did not answer the questionnaires.

The transcripts of the interviews can be found in Appendix 2.

A list of the interviewed personnel can be found in Appendix 3.

## 9. SWOT-Analysis

### 9.1 Strengths

*What are the internal strengths of the Lake / River Basin Organizations (L/RBO) that can enhance the integration of groundwater into the mandate of the L/RBO?*

The NBA has a permanent executive secretariat based in Niamey.

The political agenda in the member countries includes groundwater. There already exists groundwater-related information in the member countries.

The water charter that constitutes the water policy of the riparian countries clearly defines a judicial and institutional framework.

There is an investment plan that foresees the conduct of projects.

There is a significant experience in the management of surface water inside the NBA.

On an organizational level there is a plan for sustainable development and investment in the Niger Basin. Member states and organizations have trust in the NBA. The NBA has a relatively strong mandate (see NBA Convention), a legal framework to operate and also the possibility to mobilise human resources at least for monitoring purposes.

There is a regular collecting and update of data at least in some member countries, namely Nigeria.

There is a will to realize groundwater-related pilot projects on the regional level that means in the HQ in Niamey as well as on the level of the National Focal Structures (NFS) in the member states.

## 9.2 Weaknesses

*What are the major inherent deficiencies in the L/RBO in addressing appropriately groundwater in its mandate?*

The resources, both human and material, are insufficient throughout the NBA. This is especially true for the hydrogeologically skilled personnel (e.g. hydrogeologists). In addition to this the financial resources are scarce especially on the level of the member countries. In general, but namely in Nigeria, complaints have been heard about irregular policies.

In general, groundwater monitoring activities are weak in the Niger Basin. Hence there is only a weak knowledge of groundwater resources throughout the Niger Basin.

Until now the resources (human, material, financial) provided for the exploitation of water resources are incomparable higher than those ones provided for the management of these water resources.

## 9.3 Opportunities

*Which present opportunities or drivers exist to support the groundwater mandate of the L/RBOs?*

Overall, there seems to be a political will on continental level (see AMCOW) to put a new focus upon groundwater-related issues. Especially the member countries in the Sahelian part of the Niger Basin (e.g. the Republic of Niger) are shifting their focus on groundwater, forced by the everlasting threat of drought, worsened by climate change, in combination with very fast growing populations. In addition to that the main donors are also becoming more and more aware of the topic. There is hope, that new funding and financing of groundwater-related projects and activities in the Niger Basin will be on the way in the near future.

The necessity to integrate groundwater to establish a complete water balance has already been perceived by many inside the NBA.

For example there is hope that artificial groundwater recharge can build an alternative to the construction of surface water dams.

The support of the BGR-project AGES based inside the NBA's headquarter in Niamey shows starting activities.

In the Sahelian context a cooperation between the BGR and the OSS should be possible.

## 9.4 Threats

*What are the major external threats that inhibit the L/RBO from taking upon it sustainable groundwater management.?*

In general the relatively high abstraction of groundwater increases the pressure on the resource as well as its growing pollution.

The danger exists that the initiatives for an integration of groundwater management into the regular activities of the NBA will fail because of lack of financing.

The lack of hydrogeologically skilled personnel leads to extremely limited possibilities for groundwater-related education in the member countries. What concerns funding, there is a threat that some member countries do not pay their contributions.

The fact that the number of member countries is relatively high (they are 9) bears the danger, that because of the dependency on agreement in between the member countries, decision making processes concerning groundwater-related issues (e.g. about a transboundary aquifer) will be significantly delayed, problems will not be solved in an appropriate time span or even solution processes will never be put on the way. This is also true for an interdependency over the same issue between a member state (e.g. Mali) and a non-member state (e.g. Mauritania) sharing one aquifer (the Taoudeni aquifer in this particular case).

The non-standardization of data between the member countries, or even in between different agencies within one country, can lead to the fact, that groundwater-related data, which already exist, will not be exchanged, will not be known or even evaluated by other member states or agencies. The danger of data loss and of duplication would be the threatening consequence. In general, the poor attitude to the collecting and handling of data in many member countries threatens the process of recognition and progress.

## 10. Conclusions

Up to date the focus of NBA's activities has been clearly on surface water. Groundwater issues are just coming to the staff's mind at this moment. There are only few hydrogeologists at the NBA's HQ, and those who are there are in a high leading position so that they have to care about many things but groundwater. The situation in the member countries might be the same (although we couldn't prove this yet).

The staff mostly complains about a lack of financial and technical resources. Especially on the level of the NFS the financial resources seem to be extremely scarce in most member countries.

The conscience that groundwater is a precious resource and needs to be regarded with at least the same intensity like surface water is just beginning to develop.

The staffs themselves say that there is a lack of knowledge about the groundwater resources of the Niger River Basin (e.g. the relation between surface water and groundwater is still unknown).

Some staff complains about a weak attitude on data collection and distribution in some member countries.

The vast majority of the data collected regularly in the member countries is surface water data.

The will to integrate groundwater management into the regular activities of the NBA is there.

It still seems to be a long way to shift the emphasis from exploitation of the Niger Basin's water resources, also groundwater, more towards an emphasis on a sustainable management of those resources.

Apart from some personal and cooperational links to the OSS there seem to be no ties or exchange with other similar organizations in the region.

## **11. Recommendations**

### **11.1 Groundwater monitoring**

There is no regular monitoring of groundwater levels or water quality from the side of the member countries. The reasons are limited understanding of the importance of groundwater monitoring as well as limited financial, technical and also human resources (skilled personnel) at institutional level. The creation of a network of referential groundwater monitoring stations at least for the hot spot areas with groundwater-related problems and major aquifer systems within the Niger River Basin is strongly recommended.

### **11.2 Capacity building**

The NBA staff needs capacity building (equipment and formation of experts) in order to be able to elaborate groundwater – related recommendations that can be used by decision makers of the member states. The ongoing NBA/BGR project called AGES is taking care of this question.

## 12. References

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/6/ Guero, A., 2003: „Étude des relations hydrauliques entre les différentes nappes du complexe sédimentaire de la bordure sud-ouest du bassin des Iullemeden (Niger): Approches géochimique et hydrodynamique“, Paris

## Appendix 1: Tables of basic data for the L/R/ABO

**Table 1: Basic data on riparian states**

River Basin	NIGER BASIN	
Major tributaries	Milo, Sankarani, Bani, Sokoto, Kaduna, Benoué	
Riparian states	1. Guinea _____ 2. Côte d'Ivoire _____ 3. Mali _____ 4. Burkina Faso _____ 5. Niger _____ 6. Benin _____ 7. Chad _____ 8. Cameroon _____ 9. Nigeria _____	
Upstream riparian states	Guinea, Côte d'Ivoire, Mali, Burkina Faso, Chad, Cameroon	
Midstream riparian states	Mali, Burkina Faso, Niger, Benin, Nigeria	
Downstream riparian states	Nigeria	
Total basin area (km <sup>2</sup> )	Ca. 2,000,000 km <sup>2</sup>	
Mean annual runoff (mill. M <sup>3</sup> /year)	250,000 (= 250 km <sup>3</sup> )	
Total population (mill.)	Ca. 107	

## Appendix 1: Tables of basic data for the L/R/ABO

Riparian state	Share (%) of basin area	Share (%) of population	Mean annual runoff (million M <sup>3</sup> /year)	Average rainfall in riparian basin part (mm/yr)	Primary land uses/cover in basin part	Primary water uses in basin part	Major cities in basin part (Mill. pop.)	Protected areas, national parks in basin part	Major water transfer schemes between states	Transboundary conflicts over rivers
1. Guinea	4.9	1.5	36,000	1,635	Extensive agriculture/savanna	Domestic	Kankan (0.2)	PN du Haut Niger		
2. Côte d'Ivoire	1.2	0.2	4,000	1,466	Ext. agr. / savanna	Domestic	Odienné (0.1)	-		
3. Mali	29.0	5.2	-15,000	440	Ext. agr. / savanna, desert, inner delta: swamps	Irrigation, domestic	Bamako (2.0), Segou (0.13), Mopti (0.11), Tombouctou (0.05), Gao (0.08)	Reserve d'Ansongo - Menaka		
4. Burkina Faso	4.2	2.1	1,000	655	Ext. agr. / savanna	Domestic	-	PN du W		
5. Niger	21.4	2.0	0	280	Ext. agr. / desert and dry savanna	Irrigation, domestic	Niamey (0.8)	RNN Aïr, PN du W		
6. Benin	2.3	2.4	3,000	1,055	Intensive agr. / savanna	Domestic	-	PN du W, PN Pendjari		
7. Chad	1.0	0.7	1,600	975	Ext. agr. /	Domestic	-	-		

**Appendix 1: Tables of basic data for the L/R/ABO**

					sav.					
8. Cameroon	4.4	2.7	33,000	1,330	Ext.agr. (intensive at Lake Lagdo) / savanna	Domestic, production of hydroelectric energy	Garoua (0.3)	Reserve de Faro, PN de Benoué, PN de Bouba Njida		
9. Nigeria	31.6	83.3	186,000	1,185	Ext.agr. (intensive at Lake Kaindji and along parts of Benue ) / savanna. Forest and swamps in the delta	Irrigation, generation of hydroelectric power, domestic	Sokoto (0.6), Kontagora (0.1), Ilorin (0.8), Kaduna (1.5), Abuja (2.5), Gombe (0.25)  Makurdi (0.3), Onitsha (1.1), Port Harcourt (1.4)	Reserve de Borgou, Yankari Game Reserve		
10. Total	100.0	100.0	250,000							
Year of formal recognition of Lake/Basin Org.	1964 as Niger Basin Commission 1980 as Niger Basin Authority									
Primary mandate of Lake/Basin Org.										
Type of Lake/River Org.?	River Basin Authority									

**Appendix 1: Tables of basic data for the L/R/ABO**

(see /2/)	
Name of treaties or legally recognized agreements governing water mgt. in the basin	

**Table 2: Key data on transboundary aquifers**

River Basin		NIGER BASIN									
Major shared aquifers in the basin	1. Taoudeni _____ 2. Iullemeden / Sokoto _____ 3. Bida Basin _____ 4. Benue Trough _____ 5. Niger Delta Basin _____										
Aquifer no.	Shared between which riparian states	Approximate area (km <sup>2</sup> )	Geological formation of aquifer (e.g. sandstone, karst, limestone, volcanic, sedimentary)	Depth location of aquifer: Shallow (0-20 m), Intermediate (20-100m), Deep (>100m)	Estimated storage (mill. M <sup>3</sup> )	Estimated annual recharge volume (mill. M <sup>3</sup> )	Primary recharge mechanism (rainfall, irrigation, river/lake, pre-historic)	Principal use/users of aquifer (Give order: agriculture, domestic, industry, mining)	Primary GW management issue(s)	Are there already known transboundary conflicts over this aquifer?	Level of TBA mgt. Note: A, B, C, D, E, F <sup>a</sup> acc. to what has been achieved
1.	Mali, Mauritania,	1,500,000 (only)	Sediments, mostly	Intermediate			River/lake, prehistoric,	Domestic	Insufficient GW		A

**Appendix 1: Tables of basic data for the L/R/ABO**

	Guinea, Burkina Faso,	200,000 within Niger Basin)	sandstones, of late Proterozoic to Quaternary, most of them of Tertiary / Quaternary	and deep			rainfall		survey/knowledge, pollution		
2.	Mali, Niger, Nigeria (Sokoto and Kebbi States), Bénin	600,000	Continental sediments, mostly sandstones, of Tertiary (Paleocene to Pliocene)	CT3: Intermediate (shallow in Wadis), CT2: Deep, CT1: Deep			Prehistoric, rainfall	Domestic, agriculture	Continuous monitoring, pollution		C - D
3.	Nigeria (Niger and Kwara States)	40,000	Continental sandstones with clay lenses and pebbly grits of Cretaceous				Rainfall	?	Insufficient GW survey/knowledge		A
4.	Cameroun (Nord), Nigeria (Adamawa, Taraba, Plateau,	100,000	Massive continental sandstones with intercalations of shale/ marine lime-	Intermediate and deep			Rainfall	?	Insufficient GW survey/knowledge		A - B

**Appendix 1: Tables of basic data for the L/R/ABO**

	Benue and Nassarawa States)		stones of Cretaceous								
5.	Nigeria (Delta, Bayelsa, Rivers, Imo, Abia and Akwa Ibom States)	30,000	Sands, gravels and clays of Tertiary (Miocene/Pliocene) to Quaternary	Shallow			Rainfall, River/Lake	Domestic, mining	Pollution, insufficient GW survey/knowledge		A
6.											
7.											
8.											

<sup>a</sup>A. Identification, B. Delineation, C. Diagnosis, D. Conceptual/numerical model, E. Allocation principles, F. Implementation of joint infrastructure project

## Appendix 2: List of interviewees

No.	Title	Name	Position	Interview schedule	Place of interview	Representation / Organization	Nationality	E-Mail	Telephone
1	Mr	Abdou Guéro	Technical Director	1	Niamey, Niger	NBA HQ	Niger	<a href="mailto:abdou.guero@gmail.com">abdou.guero@gmail.com</a>	+227-20315239; +227-96994610
2	Mr	Bréhima Coulibaly	Coordinator of GIRE 2, NIGER-HYCOS	1	Niamey, Niger	NBA HQ	Mali	<a href="mailto:bremacoul@yahoo.fr">bremacoul@yahoo.fr</a>	+227-90507756
3	Mr	Robert Dessouassi	Leader of the Niger Basin Observatory (NBO)	2	Niamey, Niger	NBO within the NBA HQ	Benin	<a href="mailto:dessouassi@abn.ne">dessouassi@abn.ne</a> ; <a href="mailto:dessouassi2003@yahoo.fr">dessouassi2003@yahoo.fr</a>	+227-93934557
4	Mr	Garba Radji	Assistant Director of Water Resources	3	Niamey, Niger	Water Ministry of Niger, NBA, NFS Niger	Niger	<a href="mailto:garbaradji@yahoo.fr">garbaradji@yahoo.fr</a>	+227-20722363; +227-20203031
5	Mr	Sanoussi Rabé	Chief Hydrogeologist	4	Niamey, Niger	Water Ministry of Niger	Niger	<a href="mailto:rsanoussi2001@yahoo.fr">rsanoussi2001@yahoo.fr</a>	+227-20203848; +227-96592204
6	Mr	Karaba Traoré	Hydrogeologist	5 & 6	Bamako, Mali	NBA, NFS Mali	Mali	<a href="mailto:karabatraore@hotmail.com">karabatraore@hotmail.com</a>	+223-66782926; +223-78108818

**Appendix 2: List of interviewees**

7	Mr	Godwin O. Usifoh	Director of Hydrogeology Department	7 & 8	Nigeria	Nigeria Hydrological Services Agency (NIHSA)	Nigeria	<a href="mailto:ohumaobi@yahoo.com">ohumaobi@yahoo.com</a>	+234-8037041510
8	Mr	Dr. Benjamin Chibuzo Aneke	HOD (Hydrology and Hydrogeology/Meteorology)	9 & 10	Nigeria	Anambra-Imo River Basin Development Authority	Nigeria	<a href="mailto:ifcan2004@yahoo.com">ifcan2004@yahoo.com</a>	+234-8036664302

## Appendix 3 : Transcripts of interviews

<b>Reply from NBA HQ</b>
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### Questionnaire for the L/RBO HQ team

Questionnaire for which L/RBO: \_\_\_\_\_ **Niger Basin Authority\_(NBA)**\_\_\_\_\_

Name: \_\_ **Abdou Guéro, Bréhima Coulibaly** \_\_\_\_\_

Institution (if different from L/RBO): \_\_\_\_\_ - \_\_\_\_\_

Function - please let us know your job title, role and main responsibilities:

Title: \_\_\_\_\_ **Leader of technical department, Coordinator of GIRE II/ Niger HYCOS Project**\_\_\_\_\_

Role and responsibilities:

**Coordinate the implementation of the basin development planning, Coordinate activities of the GIRE II and Niger HYCOS project**

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How many years in present position: \_\_\_\_\_ **3 years, 5 years**\_\_\_\_\_

Background education: \_**Hydrogeologist with PhD at French University (Paris 11ième), Hydrologist with education in Mali and Moscow;**

Country: \_\_ **Niger** \_\_\_\_\_

E-mail address: **abdou.guero@gmail.com, bremacoul@yahoo.fr;**\_\_\_\_\_

Gender: Female: \_\_\_\_\_ Male: \_\_\_\_\_ **x** \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

Telephone number for possible follow up phone call: **+227 20315239, (Mobil) +227 96994610, Coulibaly (+22790507756);**

Date of Interview: 28.11.2011

Interview performed by: Martin Jaeger

Place of interview: NBA-office, Niamey

Or if done by telephone: \_\_\_\_\_

### Questions:

#### 1. Governance:

a. What is the principal and legal role/mandate of your L/RBO **wrt. groundwater**:

- i. To allocate GW: **Yes x** No
  - ii. To oversee GW mgt.: **Yes x** No
  - iii. To monitor TBAs in basin: **Yes x** No
  - iv. To advise riparian states on issues related to GW **Yes x** No
  - v. To implement joint GW development projects: **Yes x** No
  - vi. Other. Specify: **Allocation of GW-resources in collaboration with member countries.**
- 

b. Does your L/RBO have a staffed permanent Secretariat? **Yes x** No

## Appendix 3 : Transcripts of interviews

- c. Does the constitution/agreement establishing your L/RBO specifically/explicitly address GW and groundwater issues? Yes  No

- d. If yes, how?

The NBA convention refers to water resources. \_\_\_\_\_

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- e. Which water management instruments/schemes do you use? (e.g. management plans, action programs, monitoring and information systems, etc.)

- Hydrologic monitoring network
  - Niger HYCOS Program / IWRM-Program
  - Modelling of surface flow and prediction (e.g. with Mike Basin)
  - Environmental Information system
  - Plan for durable development in the Niger basin (PADD)
  - Component 3d of the PADD foresees capacity building
  - NBA Water Charta stipulates legal framework for harmonisation of water policies (GW is explicitly mentioned)
- 
- 

- f. To what extent is groundwater already considered in your water management structure and what actions/initiatives/programmes are you using to foster groundwater management within your organisation? (e.g. groundwater working group at ORASECOM)

\_\_\_- The BGR-project AGES constitutes the first initiative. \_\_\_

- The Niger HYCOS Project (supervised by the WMO) intended also to integrate a GW-component.

## Appendix 3 : Transcripts of interviews

- g. Do you collaborate with organisations/programmes/institutes/projects that have a groundwater component? (African networks, policy decision makers (e.g. AU, AMCOW, AGWC, etc.) and international donors)

Yes, the OSS (Observatory of the Sahara and the Sahel), LCBC, OMVS (river basin organisation for the Senegal River), African Groundwater Commission, CCRE (Department of West-African Union responsible for water resources), VBA, IRD (French Development research institute);

- h. Are you aware of the AMCOW work plan? **Yes x** No

- i. If yes: Are there any activities you have taken on board due to the AMCOW work plan?

**\_Yes, we are carrying out activities to integrate rainfall and GW into the IWRM.**

- j. Do you know about the existence of the UN resolution on transboundary aquifers?  
**Yes x** No

Comments:

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### 2. Society/collaboration/inclusion:

- a. What are the major uses of groundwater within the basin?

**No answer**

## Appendix 3 : Transcripts of interviews

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- b. What are the main water challenges your basin/lake is confronted with? (e.g. groundwater pollution, (ground-) water shortage, institutional, etc.)

   **No answer**

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- c. Are there great disparities between the water conditions and challenges in the riparian states?

     **No answer**

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- d. Also in the level of groundwater development and management?

**No answer**

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- e. How is the exchange of knowledge/data and cooperation between the L/RBO and the riparian states' water mgt. structures?

## Appendix 3 : Transcripts of interviews

No answer

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f. Do you find the commitment of the riparian states to include GW on the political agenda sufficient? **Yes x** No

g. Does this influence your functionality?

\_\_\_-The political will is there/ GW is one of the special concerns in the Sahel region.  
\_\_\_- The development of potable water provision is interlinked with GW-exploitation.

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h. What are you doing to strengthen the participation of the riparian states? (e.g. are formal structures, like stakeholder forums, in place with clear roles and responsibilities in water resources management and in the decision making process, are regular meetings taking place, etc.)?

- Carrying out of common rounds and conferences (Annual regional steering committee, Annual Council of Ministers, Summit of head of state every 2 years)

- A technical committee shall prepare technical matters for the annual Council of ministers in future

i. Do you exchange knowledge, experience with other L/RBOs? **Yes x** No

j. If yes, which?

\_ OMVS ( river basin organisation for the Senegal river), VBA, CICOS, ORASE, NBI, Association of River Basin Organisations (ARBO);

## Appendix 3 : Transcripts of interviews

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### 3. Science/data/capacity building:

- a. Is there a good understanding to which extent groundwater-surface water interaction determines water balance and water quality in your basin and across riparian territories?      Yes  **No**

Comments:

The principle of exchange between the two resources is known, but detailed information about the quantities in exchange is missing.

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- b. Where are you in the process of managing TBAs (also fill in Table 3 for individual TBAs)?
- |  |                          |   |   |
|--|--------------------------|---|---|
| i. Identification (in general)                               |                          | x |   |
| ii. Delineation (for Taoudeni Aquifer)                       |                          | x |   |
| iii. Diagnosis (for Lullemeden Aquifer, by OSS)              |                          |   | x |
| iv. Conceptual/numerical model (for Lullemeden Aquifer, OSS) |                          |   | x |
| v. Allocation principles                                     | <input type="checkbox"/> |   |   |
| vi. Implementation of joint infrastructure projects          | <input type="checkbox"/> |   |   |

- c. Which data, if any, do you collect related to groundwater in the basin?

\_\_\_\_ Currently none. There is the idea to develop a basin wide network of reference stations for GW-monitoring.

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### Appendix 3 : Transcripts of interviews

- d. What data bases, information portals, and monitoring networks exist in your organization, where groundwater is (or could simply be) added?

\_\_\_- databases and information portals developed in line with the Niger HYCOS project.

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- e. What is the process/mechanism for data sharing with the riparian states' national groundwater dept.?

\_\_\_-GW-data sharing happened during the conduction of the first phase of the project SAI (lullemeden Aquifer System research) which was initiated by the OSS. Member countries of the SAI contributed with their GW-data to the development of a regional database held by OSS.

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- f. How many hydrogeologists, or staff with hydrogeologic background, are working in your organization? Are all allocated posts filled?

\_\_\_None\_\_\_\_\_

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- g. Do you find your present capacity (in terms of human and financial resources) sufficient to address groundwater management appropriately? Yes  No

- h. How is prioritisation made in your organisation to meet the limited resources (e.g. human, financial, technical resources)?

## Appendix 3 : Transcripts of interviews

\_\_\_ - The NBA budget is being used to cover the operational costs. It is expected that the member countries (or donors) cover the costs arising in line with project activities.

\_\_\_ - We are now starting to put in place the competences and equipments needed for GW-management in the basin. \_\_\_\_\_

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- i. What capacity building on groundwater is ongoing or planned?

\_\_\_ - Activities in line with the BGR-Project AGES.

- j. What in particular is lacking regarding capacity on GW management

\_\_\_ - Human resources and equipment.

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## Appendix 3 : Transcripts of interviews

### Questionnaire for the L/RBO HQ team

Questionnaire for which L/RBO: \_\_\_\_\_ **Niger Basin Authority\_(NBA)** \_\_\_\_\_

Name: \_\_ **Robert Dessouassi** \_\_\_\_\_

Institution (if different from L/RBO): \_\_\_\_\_ - \_\_\_\_\_

Function - please let us know your job title, role and main responsibilities:

Title: \_\_\_\_\_ **Leader of the Niger Basin Observatory**  
**(NBO)** \_\_\_\_\_

Role and responsibilities:

**Administration, management and coordination of the development of the Observatory,  
monitoring the building of the network for acquisition of environmental knowledge;**

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How many years in present position: \_\_\_\_\_ **6 years** \_\_\_\_\_

Background education: \_\_ **Diploma in civil engineering with specialisation in the field of  
hydraulic infrastructure**

Country: \_\_ **Benin** \_\_\_\_\_

E-mail address: **dessouassi@abn.ne; dessouassi2003@yahoo.fr**

## Appendix 3 : Transcripts of interviews

Gender: Female: \_\_\_\_\_ Male:  x

Telephone number for possible follow up phone call: **(Mobil) +227 93934557**

Date of Interview:  28.11.2011

Interview performed by:  Martin Jaeger

Place of interview:  NBA-office, Niamey

Or if done by telephone: \_\_\_\_\_

### Questions:

#### 4. Governance:

a. What is the principal and legal role/mandate of your L/RBO wrt. **groundwater**:

i. To allocate GW (**in collaboration with member countries**):

## Appendix 3 : Transcripts of interviews

- Yes x No
- ii. To oversee GW mgt.: Yes x No
- iii. To monitor TBAs in basin: Yes x No
- iv. To advise riparian states on issues related to GW Yes x No
- v. To implement joint GW development projects: Yes x No
- vi. Other. Specify: \_\_ \_\_\_\_
- 

- b. Does your L/RBO have a staffed permanent Secretariat? Yes x No
- c. Does the constitution/agreement establishing your L/RBO specifically/explicitly address GW and groundwater issues? Yes x No
- d. If yes, how?

According to the NBA convention water resources shall be developed, thus groundwater is included as well.

- e. Which water management instruments/schemes do you use? (e.g. management plans, action programs, monitoring and information systems, etc.)

- Existing tools/systems for monitoring the major hydraulic infrastructure and management of hydrologic data. Therefore conditions for the durable development in the basin and for its infrastructures are set.

- Data base for abduction of water / water needs

- Data base for water quality in the basin

- f. To what extent is groundwater already considered in your water management structure and what actions/initiatives/programmes are you using to foster groundwater management within your organisation? (e.g. groundwater working group at ORASECOM)

- The BGR-project AGES constitutes the first initiative. \_\_\_\_

## Appendix 3 : Transcripts of interviews

- g. Do you collaborate with organisations/programmes/institutes/projects that have a groundwater component? (African networks, policy decision makers (e.g. AU, AMCOW, AGWC, etc.) and international donors)

Yes, the OSS (Observatory of the Sahara and the Sahel), LCBC, OMVS (river basin organisation for the Senegal river), African Groundwater Commission, CCRE (Department of West-African Union responsible for water resources), VBA, IRD (French Development research institute);

- h. Are you aware of the AMCOW work plan? **Yes x** No

- i. If yes: Are there any activities you have taken on board due to the AMCOW work plan?

- The last development of African and Niger basin initiatives in the water resources sector was also based on the West African Water Vision 1999 (supported by GWP) which also built the base for the later formulation of the Plan for durable development in the Niger Basin (PADD)

- NBA orients her programmatic planning also along lines expressed in the AMCOW work plan.

- j. Do you know about the existence of the UN resolution on transboundary aquifers? **Yes x** No

Comments:

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### 5. Society/collaboration/inclusion:

## Appendix 3 : Transcripts of interviews

a. What are the major uses of groundwater within the basin?

- domestic (provision of potable water)
  - agriculture (livestock and cultivation of vegetables)
  - small scale irrigation schemes
- 

b. What are the main water challenges your basin/lake is confronted with? (e.g. groundwater pollution, (ground-) water shortage, institutional, etc.)

- weak knowledge about water resources (especially GW) and e.g. following parameters: potential, availability, recharge rate...etc..
  - lack of institutional support for the monitoring of water resources
- 

c. Are there great disparities between the water conditions and challenges in the riparian states?

- the disparities are linked to the differing climatic conditions in the basin:

(1) Niger-Mali- Burkina-Faso and Tchad constitute the relatively dry soudano-sahelian zone

(2) while for Nigeria and Benin only the northern part is concerned by water deficits

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d. Also in the level of groundwater development and management?

Yes:

### Appendix 3 : Transcripts of interviews

- coastal zones receive high rainfalls which will recharge the permeable coastal aquifers

- according to the geologic nature: a) fractured aquifers in the zones of outcropping crystalline basement b) sedimentary basins with intergranular aquifers of high potential

- according to the depth of the aquifer\_\_\_\_\_

- e. How is the exchange of knowledge/data and cooperation between the L/RBO and the riparian states' water mgt. structures?

- The National Focal Structure (NFS) delegated by its Ministry in charge of NBA affairs in the respective member country exchanges data with the NBA head quarter in Niamey

- The Observatory of the Niger basin (ONB) is installing a network of holders and producers of environmental and socio-economic data along 28 indicators for the environmental development in the basin defined in 2010. \_\_\_\_\_

- f. Do you find the commitment of the riparian states to include GW on the political agenda sufficient? **Yes**  **No**

- g. Does this influence your functionality?

\_\_\_ **No answer**

---

- h. What are you doing to strengthen the participation of the riparian states? (e.g. are formal structures, like stakeholder forums, in place with clear roles and responsibilities in water resources management and in the decision making process, are regular meetings taking place, etc.)?

## Appendix 3 : Transcripts of interviews

The ONB is installing a network of holders and producers of environmental and socio-economic data along with its 28 indicators for the environmental development in the basin defined in 2010. \_\_\_\_\_

i. Do you exchange knowledge, experience with other L/RBOs? **Yes x** No

j. If yes, which?

\_ OMVS ( river basin organisation for the Senegal river), VBA, CICOS, ORASECOM, NBI, Basin organisation for the Limpopo River;

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### 6. Science/data/capacity building:

a. Is there a good understanding to which extent groundwater-surface water interaction determines water balance and water quality in your basin and across riparian territories? **Yes x** No

Comments:

- Understanding that the low flows are being supported by GW
- The quantification of the exchange between surface and groundwater lacks
- The location of zones of infiltration or entry into the river are more or less known.

b. Where are you in the process of managing TBAs (also fill in Table 3 for individual TBAs)?

i. Identification **x**

## Appendix 3 : Transcripts of interviews

- ii. Delineation
- iii. Diagnosis
- iv. Conceptual/numerical model
- v. Allocation principles
- vi. Implementation of joint infrastructure projects

c. Which data, if any, do you collect related to groundwater in the basin?

\_\_\_\_ Currently none.

---

d. What data bases, information portals, and monitoring networks exist in your organization, where groundwater is (or could simply be) added?

\_\_\_\_ - hydrologic and environmental databases \_\_\_\_\_

e. What is the process/mechanism for data sharing with the riparian states' national groundwater dept.?

\_\_\_\_ The National Focal Structure (NFS) delegated by its Ministry in charge of NBA affairs in the respective member country exchanges data with the NBA head quarter in Niamey.

f. How many hydrogeologists, or staff with hydrogeologic background, are working in your organization? Are all allocated posts filled?

\_\_\_\_ 2 personal with experience and knowledge in hydrogeology, 1 Hydrogeologist

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## Appendix 3 : Transcripts of interviews

- g. Do you find your present capacity (in terms of human and financial resources) sufficient to address groundwater management appropriately? Yes  **No**
- h. How is prioritisation made in your organisation to meet the limited resources (e.g. human, financial, technical resources)?

Activities in line with surface water development have first priority: (1) large infrastructures like dams, (2) larger scale irrigation schemes

---

- i. What capacity building on groundwater is ongoing or planned?

\_\_\_ - Activities in line with the BGR-Project AGES.

- j. What in particular is lacking regarding capacity on GW management

Hydrogeologic service linked to the ONB with the major task to monitor quantity and quality of GW. \_\_\_\_\_

<b>End of interview with NBA HQ</b>
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## Appendix 3 : Transcripts of interviews

<b>Reply from the Republic of Niger</b>
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### Questionnaire for L/RBO country representatives in the riparian states

Questionnaire for which member country: Niger

Name: Garba RADJI

Institution (if different from L/RBO): Directorate for Water resources under the Water Ministry

Function - please let us know your job title, role and main responsibilities:

Title: Assistant Director of Water Resources

Role and responsibilities:

-

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How many years in present position: 3 years

Background education: Senior Hydrologist

## Appendix 3 : Transcripts of interviews

Country:   Niger  

E-mail address:   garbaradji@yahoo.fr  

\_\_\_\_\_

Gender: Female: \_\_\_\_\_ Male:   x  

Telephone number for possible follow up phone call:   +227 20 72 23 63/ 20 20 30 31  

Date of Interview:   16.02.2012  

Interview performed by:   Martin Jaeger  

Place of interview:   Directorate of Water Resources in the Water Ministry  

Or if done by telephone: \_\_\_\_\_

### Questions:

- a. What is your position in the principal government water management structure(s) in the riparian state where you reside?

  Assistant Director of Water Resources  

\_\_\_\_\_

## Appendix 3 : Transcripts of interviews

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- b. Are decisions taken within these structures first ratified by the L/RBO board at HQ before they are implemented?    **Yes x**   No
- c. Do you find that groundwater management is strongly and adequately addressed and integrated into overall water management of your country?    **Yes x**   No

Comments:

- In the same manner like surface water
- The master plan for the development of water resources includes as well GW
- Project "SAI" (Iullemeden Aquifer System) carried out by member countries and OSS
- There is a GW-monitoring network
- We elaborate an annual water balance including GW \_\_\_\_\_

- d. What is the level and effectiveness of cooperation between the L/RBO and the national groundwater management authorities?

\_ - It is a hierarchical structure as the chief hydrogeologist is a subordinate co-worker under the Director of water resources (WR)

- The relation to the NBA therefore is quite direct

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## Appendix 3 : Transcripts of interviews

- e. Is there an operational protocol between the L/ RBO and the countries on GW data/information sharing? Yes  **No x**

Comments:

\_\_We are starting the development of these protocols.

- f. What are the procedures and costs involved in groundwater data sharing between the national groundwater management authority and the L/RBO?

\_\_\_\_\_ **No answer**

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- g. Do you acknowledge/value the work done by the L/RBO in terms of groundwater management? **Yes x** No

Comments:

We appreciate the new initiative to integrate GW into IWRM (BGR-Project).

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- h. Are there cooperative activities between the L/RBO and national groundwater authorities, for instance monitoring activities? **Yes x** No

Comments:

\_\_We are starting to cooperate in this area at the moment (BGR-Project).\_\_

## Appendix 3 : Transcripts of interviews

i. What are your key concerns with regards to transboundary groundwater issues?

- Pollution
- Overexploitation
- Climate change (its impact on the resource was also shown by the project SAI)

In order to cope with these challenges it will be necessary to create a proper framework for concerted management of the resources

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j. How important, in your professional opinion, is the interaction between surface water and groundwater in terms of i) transboundary water balance and ii) transboundary water quality?

\_\_\_\_It is of high importance. Therefore

- i) a model was developed to estimate the contribution of GW to surface water flow of the river Niger. Sometimes it is very visible where GW enters the surface water.
- ii) Pollution can have a serious impact on the resource like e.g. probable pollution brought upon the resource by wells in areas of vegetable farming (with strong usage of fertilizers).

## Appendix 3 : Transcripts of interviews

### Questionnaire for chief government hydrogeologist or gw focal point in the riparian states

Questionnaire for which L/RBO: NBA

Name: Sanoussi Rabé

Institution (if different from L/RBO): as above

Function - please let us know your job title, role and main responsibilities:

Title: Chief Hydrogeologist

Role and responsibilities:

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How many years in present position: - \_\_\_\_\_

Background education: PhD in Hydrogeology (French University)

Country: Niger

E-mail address: rsanoussi2001@yahoo.fr

Gender: Female: \_\_\_\_\_ Male: x

## Appendix 3 : Transcripts of interviews

Telephone number for possible follow up phone call: [+227 20 20 38 48/ \(mobil\) 96592204](tel:+22720203848)\_\_\_\_\_

Date of Interview: \_\_\_\_\_ [16.02.2012](#)\_\_\_\_\_

Interview performed by: \_\_\_\_\_ [Martin Jaeger](#)\_\_\_\_\_

Place of interview: \_\_\_\_\_ [as above](#)\_\_\_\_\_

Or if done by telephone: \_\_\_\_\_

### Questions:

- a. Do you share national groundwater data with the L/RBO? Does the L/RBO also share groundwater data from the other parts of the basin with your department?

\_\_\_\_ [No. Currently only surface water quality.](#)\_\_\_\_\_

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- b. What are the procedures and mechanism of data sharing and funding?

\_\_\_\_ [see above \(interview with Mr. Radji\)](#)\_\_\_\_\_

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## Appendix 3 : Transcripts of interviews

- c. Are there joint programs and activities with the L/RBO in terms of groundwater management and protection?      Yes  **No**

Comments:

\_\_Only in the field of surface water quality up to now.

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- d. In terms of national groundwater allocation, at what level are you required to obtain L/RBO approval?

\_\_We do not need the NBAs approval. \_\_\_\_

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- e. Is the linkage to surface water flows, surface water quality and environment considered when you allocate groundwater both internally (within the country) and in the transboundary situation? Internally:      Yes  **No**   
Transboundary:      Yes  **No**

Comments:

- but we participate in environmental studies

- but we follow the ministerial decision for interdisciplinary work

- We dispose of a database for potable water. Other uses are prohibited if they affect the water reserved for domestic use.

- f. What is the formal relationship between your groundwater department and the country representative of the L/RBO?

### **Appendix 3 : Transcripts of interviews**

- All activities are being carried out on behalf of the NFS with Mr. Radji as its superior.

- The NFS has access to all other state services even if they belong to other Ministries (referring to exchange of information even if the respective service is not located under the responsible Ministry for NBA)

**End of interview with the Republic of Niger**

## Appendix 3 : Transcripts of interviews

<b>Reply from Mali</b>
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### Questionnaire for L/RBO country representatives in the riparian states

Questionnaire for which member country: \_\_\_\_\_ **Mali** \_\_\_\_\_

Name: \_\_\_\_\_ **Karaba Traore** \_\_\_\_\_

Institution (if different from L/RBO): \_\_\_\_\_ **National Focal Structure (« NFS ») / Niger Basin Authority (« NBA »)** \_\_\_\_\_

Function - please let us know your job title, role and main responsibilities:

Title: \_\_\_\_\_ **Hydrogeologist, Specialist in Groundwater** \_\_\_\_\_

Role and responsibilities:

**Engineer – Hydrogeologist, in the NFS responsible for questions concerning studies, mobilisation, exploration and management of groundwater resources of the Niger River Basin**

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How many years in present position: \_\_\_\_\_ **33 years of professional experience in the DNH/MEE** \_\_\_\_\_

Background education: \_\_\_ **Superior studies at the National School of Engineers of Bamako** \_\_\_\_\_

Country: \_\_\_\_\_ **Mali** \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

E-mail address: karabatraore@hotmail.com

Gender: Female: \_\_\_\_\_ Male: Yes

Telephone number for possible follow up phone call: +223 66782926 /+22378108818

Date of Interview: Feb 27th, 2012

Interview performed by: \_\_\_\_\_ e-mail \_\_\_\_\_

Place of interview: \_\_\_\_\_ at the NFS / NBA in Bamako

Or if done by telephone: No

### Questions:

1. What is your position in the principal government water management structure(s) in the riparian state where you reside?

**The NFS is at this moment a department within the Division of Water Management of the National Department of Hydraulics**

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2. Are decisions taken within these structures first ratified by the L/RBO board at HQ before they are implemented? Yes  **No**

## Appendix 3 : Transcripts of interviews

3. Do you find that groundwater management is strongly and adequately addressed and integrated into overall water management of your country? **Yes**  No

Comments:

**The needs of groundwater are immense in Mali. Many projects have been realized or are being realized. However the financing of groundwater studies for a better understanding of these resources are rare and isolated. This situation must be corrected.**

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4. What is the level and effectiveness of cooperation between the L/RBO and the national groundwater management authorities?

**The taking into account of the groundwater management in the NBA is in its beginnings, one can only wish that it will materialize in concrete actions in the field. From my point of view it seems necessary that meetings concerning this subject take place in the member countries**

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5. Is there an operational protocol between the L/ RBO and the countries on GW data/information sharing? Yes  **No**

Comments:

## Appendix 3 : Transcripts of interviews

As far as I know there is no convention yet concerning the exchange of groundwater data between my country and the NBA, all things about groundwater have not been taken into account yet.

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6. What are the procedures and costs involved in groundwater data sharing between the national groundwater management authority and the L/RBO?

No idea. These procedures and costs have to be defined on future meetings.

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7. Do you acknowledge/value the work done by the L/RBO in terms of groundwater management?      Yes  No

Comments:

As far as I know no action concerning groundwater has been made in Mali by the NBA. But if it is true that surface water is the visible and accessible face of the resource, it is no less true that groundwater holds a big part in the needs of the population living in the Niger River Basin.

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8. Are there cooperative activities between the L/RBO and national groundwater authorities, for instance monitoring activities?      Yes  No

## Appendix 3 : Transcripts of interviews

Comments:

**As far as I know, No ! As already mentioned above, the activities are to be defined and to be realized following clear and precise frameworks.**

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9. What are your key concerns with regards to transboundary groundwater issues?

- **Ignorance of the characteristics of the aquifers and hence of their potential in quantity as well as quality**
  - **The risk of overexploitation and hence risk of conflicts between users**
  - **Ignorance of the possibilities of a rational exploitation**
  - **Ignorance of the fluctuation of groundwater levels**
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10. How important, in your professional opinion, is the interaction between surface water and groundwater in terms of i) transboundary water balance and ii) transboundary water quality?

1. **The transboundary water balance can only be determined and managed by multisectoral, meteorological, hydrological, hydraulic and hydrogeological studies which will take into account all the elements of the balance (pluviometry, evapotranspiration, runoff, infiltration, recharge and discharge, etc...)**
2. **Concerning the water quality all overexploitation of groundwater upstream will have disastrous effects for the water quality further downstream. So it is not rare to see – among others - the rise of salinity**
  - **Especially in the Sahelian countries crossed by the Niger River, the decrease of precipitation has led to a dry out of many springs**
  - **The dry up of water ponds that were perennial in the past**

## Appendix 3 : Transcripts of interviews

- The dry up of all kinds of wells
- The groundwater levels in some places are so deep that they are inaccessible by the population with their limited techniques. For that they would need modern techniques of which the costs are much higher

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## Appendix 3 : Transcripts of interviews

### Questionnaire for chief government hydrogeologist or gw focal point in the riparian states

Questionnaire for which L/RBO: \_\_\_\_\_ **National Focal Structure (« NFS ») / Niger Basin Authority (« NBA »)** \_\_\_\_\_

Name: \_\_\_\_\_ **Karaba TRAORE** \_\_\_\_\_

Institution (if different from L/RBO): \_\_\_\_\_

Function - please let us know your job title, role and main responsibilities:

Title: **\_Hydrogeologist, specialist in groundwater** \_\_\_\_\_

Role and responsibilities:

**Engineer - Hydrogeologist**

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How many years in present position: \_\_\_\_\_ **33**  
**years** \_\_\_\_\_

Background education: **I am graduate of the National School of Engineers in Bamako**

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Country: \_\_\_\_\_ **Mali** \_\_\_\_\_

E-mail address: \_\_\_\_\_ **karabatraore@hotmail.com** \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

Gender: Female: \_\_\_\_\_ Male: Yes \_\_\_\_\_

Telephone number for possible follow up phone call: +223  
66782926 /+22378108818 \_\_\_\_\_

Date of Interview: Feb 27<sup>th</sup>, 2012 \_\_\_\_\_

Interview performed by: \_\_\_\_\_ e-mail \_\_\_\_\_

Place of interview: \_\_\_\_\_ at the NFS / NBA in  
Bamako \_\_\_\_\_

Or if done by telephone: No \_\_\_\_\_

### Questions:

1. Do you share national groundwater data with the L/RBO? Does the L/RBO also share groundwater data from the other parts of the basin with your department?

Not yet

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2. What are the procedures and mechanism of data sharing and funding?

### Appendix 3 : Transcripts of interviews

There are no procedures or mechanisms of data sharing and funding. The future meetings about groundwater issues should allow to find the best way in that sense.\_

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3. Are there joint programs and activities with the L/RBO in terms of groundwater management and protection?      Yes  **No**

Comments:

**\_\_\_ Not yet.**

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4. In terms of national groundwater allocation, at what level are you required to obtain L/RBO approval?

**\_\_\_ Not at this moment.**

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### Appendix 3 : Transcripts of interviews

5. Is the linkage to surface water flows, surface water quality and environment considered when you allocate groundwater both internally (within the country) and in the transboundary situation? Internally: Yes  No

Transboundary: Yes  No

Comments:

**It's not about allocation. But rather the use for the profit of the rural population over project financing. These projects generally do not take into account realized studies concerning groundwater and they do not ensure any observation / supervision either.**

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6. What is the formal relationship between your groundwater department and the country representative of the L/RBO?

**Question not understood.**

**End of interview with Mali**

## Appendix 3 : Transcripts of interviews

Reply from Nigeria (NIHSA)
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### Questionnaire for L/RBO country representatives in the riparian states

Member Country: Nigeria

Name: Godwin Ohumaobi Usifoh

Institution (if different from L/RBO): Nigeria Hydrological Services Agency (NIHSA)

Function - please let us know your job title, role and main responsibilities:

Title: Director, Hydrogeology

Role and responsibilities:

Oversee Groundwater resources assessment, Monitoring and Management.

How many years in present position: Four (4) years Background education: BSc Geology; MSc Hydrogeology.

Country: Nigeria.

E-mail address: ohumaobi@yahoo.com

Gender: Female: \_\_\_\_\_ Male: yes

## Appendix 3 : Transcripts of interviews

Telephone number for possible follow up phone call: +\_\_2348037041510

Date of Interview: \_\_\_\_\_

Interview performed by: \_\_\_\_\_

Place of interview: \_\_\_\_\_

Or if done by telephone: \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

### Questions:

- k. What is your position in the principal government water management structure(s) in the riparian state where you reside?

*Director in-charge of the Hydrogeology Department in the Nigeria Hydrological Services Agency (NIHSA)*

- l. Are decisions taken within these structures first ratified by the L/RBO board at HQ before they are implemented? [Yes](#)  No
- m. Do you find that groundwater management is strongly and adequately addressed and integrated into overall water management of your country? [Yes](#)  No

Comments:

*Several Agencies are involved in groundwater resources development in Nigeria. However, NIHSA a national coordinating body for groundwater monitoring, data collection, dissemination and related services in Nigeria.*

- n. What is the level and effectiveness of cooperation between the L/RBO and the national groundwater management authorities?

*Cooperation and decision making is at the level of National Council of Water Resources made up of the Federal Minister of Water Resources , all state commissioners responsible for water resources and stakeholders in water resources development.*

- o. Is there an operational protocol between the L/ RBO and the countries on GW data/information sharing? [Yes](#)  No

Comments:

## Appendix 3 : Transcripts of interviews

Data is freely shared by the stakeholders

- p. What are the procedures and costs involved in groundwater data sharing between the national groundwater management authority and the L/RBO?

All States and stakeholders collect data and forward them to NIHSA through the NIHSA zonal offices in the States. About N10 million is cost in transmission of data to stakeholders.

- q. Do you acknowledge/value the work done by the L/RBO in terms of groundwater management?      Yes     No

Comments:

Acknowledgement by expression through letters and phone calls but not valued in monetary terms.

- r. Are there cooperative activities between the L/RBO and national groundwater authorities, for instance monitoring activities?      Yes     No

Comments:

Cooperation, by having a uniform and standardized borehole data reporting format.

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- s. What are your key concerns with regards to transboundary groundwater issues?

Not enough logistics to monitor the entire transboundary basins and monitoring wells are inadequate for effective and reliable monitoring

## Appendix 3 : Transcripts of interviews

- t. How important, in your professional opinion, is the interaction between surface water and groundwater in terms of i) transboundary water balance and ii) transboundary water quality?

*Very significant*

## Appendix 3 : Transcripts of interviews

### Questionnaire for chief government hydrogeologist or gw focal point in the riparian states

Questionnaire for which L/RBO: Nigeria

Name: Godwin Ohumaobi Usifoh

Institution (if different from L/RBO): \_\_\_\_\_

Function - please let us know your job title, role and main responsibilities:

Title: Director: Hydrogeology Department

Role and responsibilities:

Oversee Groundwater assessment, monitoring and management.

How many years in present position: Four (4) Years

Background education: BSc Geology, MSc Hydrogeology

Country: Nigeria

## Appendix 3 : Transcripts of interviews

E-mail address: [\\_ohumaobi@yahoo.com](mailto:_ohumaobi@yahoo.com)\_\_\_\_\_

Gender: Female:\_\_\_\_\_ Male: [Yes](#)\_\_\_\_\_

Telephone number for possible follow up phone call: [+\\_2348037041510](tel:+2348037041510)  
\_\_\_\_\_

Date of Interview: \_\_\_\_\_

Interview performed by: \_\_\_\_\_

Place of interview: \_\_\_\_\_

Or if done by telephone: \_\_\_\_\_

### Questions:

- g. Do you share national groundwater data with the L/RBO? Does the L/RBO also share groundwater data from the other parts of the basin with your department?

## Appendix 3 : Transcripts of interviews

Yes

- h. What are the procedures and mechanism of data sharing and funding?

Data sharing is done through E-mail and postage of hard copy as well as through workshops, Serminars and other media.

- i. Are there joint programs and activities with the L/RBO in terms of groundwater management and protection? Yes  **No**

Comments:

Attention by NBA Proposals for joint activities is yet to materialized and is most likely is receiving

- j. In terms of national groundwater allocation, at what level are you required to obtain L/RBO approval?

No decision on that yet

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- k. Is the linkage to surface water flows, surface water quality and environment considered when you allocate groundwater both internally (within the country) and in the transboundary situation? Internally: Yes  **No**   
Transboundary: Yes  **No**

Comments:

## Appendix 3 : Transcripts of interviews

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- I. What is the formal relationship between your groundwater department and the country representative of the L/RBO?

[Collaborate and operate jointly](#)

**End of interview with Nigeria (NIHSA)**

## Appendix 3 : Transcripts of interviews

Reply from Nigeria (Anambra - Imo River Basin Development Authority)

### Questionnaire for L/RBO country representatives in the riparian states

Member Country: NIGERIA

Name: DR BENJAMIN CHIBUZO ANEKE

Institution (if different from L/RBO): ANAMBRA-IMO RIVER BASIN DEVELOPMENT AUTHORITY

Function - please let us know your job title, role and main responsibilities:

Title: HOD (HYDROLOGY AND HYDROGEOLOGY/METEOROLOGY)

Role and responsibilities:

DEVELOPMENT OF SURFACE AND GROUNDWATER FOR WATER SUPPLY AND

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IRRIGATION

How many years in present position: 3 YEARS

### Appendix 3 : Transcripts of interviews

Background education: [B.SC \(GEOLOGY\) M.SC \(HYDROGEOLOGY\) PHD \(HYDROGEOLOGY\)](#)

Country: [NIGERIA](#)

E-mail address: [ifcan2004@yahoo.com](mailto:ifcan2004@yahoo.com)

Gender: Female: \_\_\_\_\_ Male: [YES](#)

Telephone number for possible follow up phone call: [+08036664302](#)

Date of Interview: \_\_\_\_\_

Interview performed by: \_\_\_\_\_

Place of interview:

\_\_\_\_\_

Or if done by telephone: \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

### Questions:

1. What is your position in the principal government water management structure(s) in the riparian state where you reside?  
**A PARASTATAL UNDER THE FEDERAL MINISTRY OF WATER RESOURCES**
2. Are decisions taken within these structures first ratified by the L/RBO board at HQ before they are implemented? Yes  No
3. Do you find that groundwater management is strongly and adequately addressed and integrated into overall water management of your country? Yes  No

Comments:

**THE ENABLING POLICIES SHOULD BE PUT IN PLACE FOR EFFECTIVE GROUNDWATER MANAGEMENT**

4. What is the level and effectiveness of cooperation between the L/RBO and the national groundwater management authorities?

**THERE IS NEED FOR STRONGER COOPERATION**

## Appendix 3 : Transcripts of interviews

5. Is there an operational protocol between the L/ RBO and the countries on GW data/information sharing? Yes  No

Comments:

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6. What are the procedures and costs involved in groundwater data sharing between the national groundwater management authority and the L/RBO?

**THERE IS NO COST INVOLVED IN GROUNDWATER DATA SHARING**

7. Do you acknowledge/value the work done by the L/RBO in terms of groundwater management? Yes  No

Comments:

**MONITORING OF GROUNDWATER WITH RESPECT TO POLLUTION AND DEPLETION.**

## Appendix 3 : Transcripts of interviews

8. Are there cooperative activities between the L/RBO and national groundwater authorities, for instance monitoring activities?

Yes  No

Comments:

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9. What are your key concerns with regards to transboundary groundwater issues?

**CONCERNS WITH RESPECT TO ENABLING POLICIES,  
MONITORING AND POLLUTION QUALITY.**

10. How important, in your professional opinion, is the interaction between surface water and groundwater in terms of
1. transboundary water balance and
  2. transboundary water quality?

## Appendix 3 : Transcripts of interviews

VERY IMPORTANT BECAUSE THE INTERACTION IS INTERWOVEN

## Appendix 3 : Transcripts of interviews

### Questionnaire for chief government hydrogeologist or gw focal point in the riparian states

Questionnaire for which L/RBO: \_\_\_\_\_

Name: DR BENJAMIN CHIBUZO ANEKE

Institution (if different from L/RBO): ANAMBRA-IMO RIVER BASIN DEV. AUTHORITY

Function - please let us know your job title, role and main responsibilities:

Title: HOD (HYDROLOGY AND HYDROGEOLOGY / METEOROLOGY )

Role and responsibilities:

**DEVELOPMENT OF SURFACE AND GROUNDWATER FOR SUPPLY AND IRRIGATION**

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How many years in present position: 3 YEARS

### Appendix 3 : Transcripts of interviews

Background education: BSC (GEOLOGY) MSC (HYDROLOGY) PHD (HYDROGEOLOGY)

Country: NIGERIA

E-mail address: ifcan2004@yahoo.com

Gender: Female: \_\_\_\_\_ Male: YES

Telephone number for possible follow up phone call: +08036664302

Date of Interview: \_\_\_\_\_

Interview performed by: \_\_\_\_\_

Place of interview:  
\_\_\_\_\_

Or if done by telephone: \_\_\_\_\_

## Appendix 3 : Transcripts of interviews

### Questions:

1. Do you share national groundwater data with the L/RBO? Does the L/RBO also share groundwater data from the other parts of the basin with your department?

**OUR PARENT MINISTRY- FEDERAL MINISTRY OF WATER RESOURCES COORDINATES THE SHARING OF DATA FROM ONE BASIN TO ANOTHER BECAUSE DATA FROM THE BASINS ARE SENT TO THE FEDERAL MINISTRY OF WATER RESOURCES.**

2. What are the procedures and mechanism of data sharing and funding?

**THE FEDERAL MINISTRY OF WATER RESOURCES COORDINATES THE SHARING OF DATA AND THE FUNDING IS THROUGH BUDGET PROVISION.**

3. Are there joint programs and activities with the L/RBO in terms of groundwater management and protection? **Yes**  **No**

Comments:

### Appendix 3 : Transcripts of interviews

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4. In terms of national groundwater allocation, at what level are you required to obtain L/RBO approval?

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5. Is the linkage to surface water flows, surface water quality and environment considered when you allocate groundwater both internally (within the country) and in the transboundary situation?

Internally: Yes  No

Transboundary: Yes  No

Comments:

## Appendix 3 : Transcripts of interviews

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6. What is the formal relationship between your groundwater department and the country representative of the L/RBO?

**CORDIAL RELATIONSHIP**

**End of interview with Nigeria (Anambra - Imo River Basin Development Authority)**





