An Overview on Drilling Operations in Sudan

Tyalla El Medani, National Coordinator, PWC

1. Back ground:

- Sudan lies between latitudes 04º-00''/ and 22 º -00'' N, and longitudes 22 º -00''/ and 36 º -30'' E, covering an area of 2.5 million Km2.
- Sudan lies mostly (60%) in the arid region which is characterized by extremely low rainfall,
- The economy of the country is largely agro pastoral depending mainly on rain fed cultivation, irrigated agriculture, and animal breeding. The recently discovered oil has positively impact on overall economy.
- According to 2008 census the population of Sudan estimated at 39.0 Million persons.
- The available water resources consisting of rainfall, the Niles and their tributaries, and groundwater. Rainfall varies from practically zero in the north to over 1,000 mm/annum in the south. River Nile system transects the country from south to north, and with an average annual discharge of 84 Billion m3/year is a perennial source of fresh water.
- The present access to sustainable improved water sources for North Sudan is 58.7% and 48.3% for South Sudan on average according to SHHS 2006.

2. Groundwater developments have the following aspect in Sudan:

- Its occurrence under more than 50% of the country ensures balanced rural development and sustainable water supply.
- Existence of rich aquifers in the desert e.g. Darfur Mega lake and development of desert aquifers in Egypt, groundwater is only available source.
- According to PWC records groundwater provides more than 47% of the daily Sudanese water supply for human and livestock and the rest is met from surface water sources.
- Generally groundwater recharge is far greater than the discharge that represents only about 52% annually.
- The problems encountered mainly in alluvial aquifers of Gash and Wadi Nyala in addition to basement complex rocks aquifer especially in Darfur.
- In Sudan groundwater, in most cases, is of good qualities and is used for domestic supply without any treatment.
- Deep aquifers in central, western and Nubian aquifer in the desert generally not affected by droughts and floods.

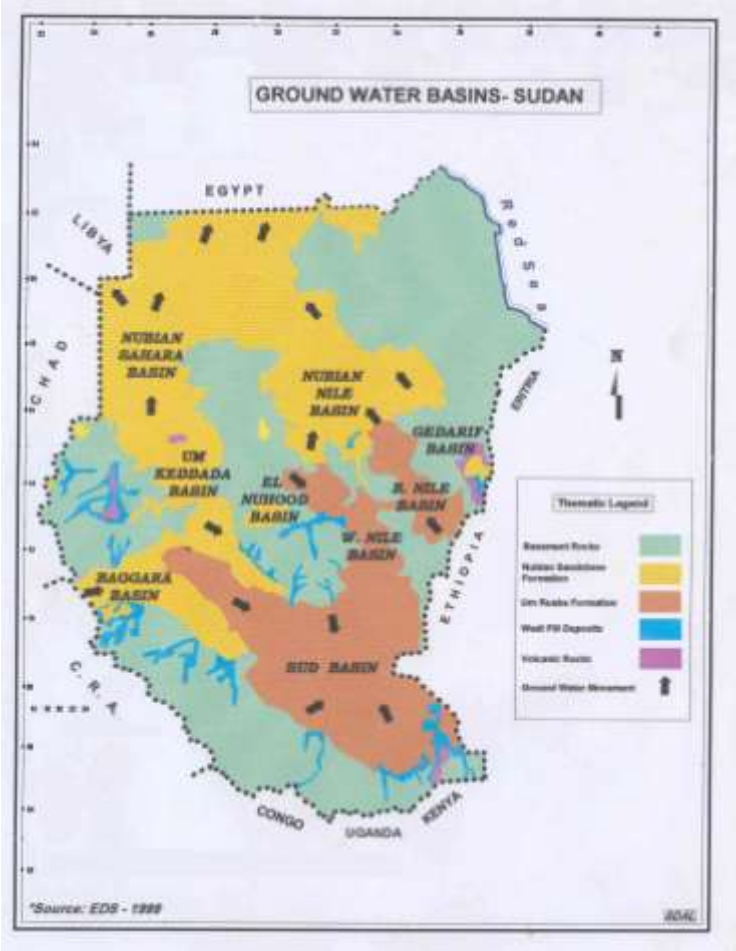

GROUND WATER BASINS- SUDAN
EGYPT
LIBYA
CHAD
C. A. R.
ERITREA
ETHIOPIA
KENYA
UGANDA
CONGO
NUBIAN SANDSTONE BASIN
NUBIAN NILE BASIN
GEDAREF BASIN
UM RUWABA BASIN
EL NUBOOD BASIN
R. NILE BASIN
W. NILE BASIN
BAGGARA BASIN
BUD BASIN
Thematic Legend
Basement Rocks
Nubian Sandstone Formation
Um Ruaba Formation
Wadi Fill Deposits
Volcanic Rocks
Ground Water Movement
N
*Source: EDS - 1999

Table indicating general Status of groundwater resources in Sudan:

Basin	Areal Extent Km^2	Depth to water (m)	Storage Billion m^3	Annual Recharge Million m^3/annum	Existing Development Million m^3	Groundwater Salinity ppm
A. Nubian Basins:						
Nubian Nile	274,000	0-50	16,440	1,200	1,000	150-800
Nubian Sahara	324,000	0-50	19,440	20	4	200-800
Um Keddada	55,000	20-140	1,650	20	8	200-1,500
Wadi El Ku	3,500	30-90	210	40	6	400-800
Atbara	45,000	5-100	2,700	30	20	200-1,000
El Nahud	7,000	60-120	420	13	6	500-700
Gedarif	28,000	0-75	840	12	6	500-2,500
Sub Total	736,500		41,700	1,335	1,050	
B) Um Ruwaba Basins						
Bara-Um Ruwaba	68,000	2-120	2,040	45	8	80-3,000
Baggara	120,000	30-110	5,400	40	12	250-1,000
Blue Nile	76,000	5-100	4,560	800	400	200-2,000
Sudd	300,000	10-100	4,500	80		
Sub Total	564,000		16,500	965	420	
C) Alluvial Aquifers						
	50,000	1-25	100	1,200	400	200-800
D) Basement Rocks						
	200,000	5-50	30	200	30	200-3,000
Grand Total	1,550,500		58,330	3,700	1,900	

After Eisa & Abdel Razig

3. Water Wells Drilling background:

- Seasonal shallow wells in alluvial sediments deposited along the seasonal streams courses locally known as Jamam/ Meshish providing very limited water.
- Hand dug wells lined with bricks and stones are oldest well known water technique.
- The first deep borehole in Sudan was drilled in 1919 at Um Ruwaba using a steam driver percussion rig.
- Rotary drilling rigs were introduced in early fifth of last century. Down the hole hammer rigs (DHH) were introduced by Unicef in 1978 for drilling of slim boreholes .

4. Drilling systems in Sudan:

A. Down The Hole drilling using air drilling system.

B. Rotary drilling system using liquids – mainly bentonite.

C. Percussion drilling system.

D. Manual digging using experiences of local skilled people.

5. Drilling modalities in Sudan:

A. Drilling by cost sharing mechanism with partners.

B. Drilling by using private sector.

C. Drilling by using State based enterprise

D. Drilling by own force (in some States).

6. Drilling operations can be divided into two parts based on history of PWC:

6.1. Before decentralization of NRWC/PWC (1992):

- ✓ Most of drilling operation done by the government.
- ✓ Technical specifications applied and quality considered and data well organized.
- ✓ Most of the drilling and installation projects were depending on external support.
- ✓ Private sector has very limited role.
- ✓ Most of big projects done through overseas private companies.
- ✓ Despite that no water policy and strategy was in place but NRWC & UWNC well organized through water acts that identified roles and responsibilities of all actors and partners in term of resources management, implementation, monitoring and quality control.
- ✓ Environmental issues were considered and incorporated in the system.

- ✓ The major achievements were done during this period (Anti -thirsty campaign 1969 – 1974 total of about 1000 wells drilled complete all over Sudan.

6.2. After decentralization of NRWC (current PWC)

- ✓ Water policy and strategy were still not in place.
- ✓ Quality of work not up to expectations.
- ✓ Limited external and internal funding for water sector.
- ✓ Private sector stepped up and has better role and capacities.
- ✓ Well data and information scattered over, states, private sector and others.
- ✓ Water sector has better drilling capacities and skills.
- ✓ Over 1,000 bore wells were drilled per annum in the last 5 years.
- ✓ Technical standards/manuals have been established, published and used

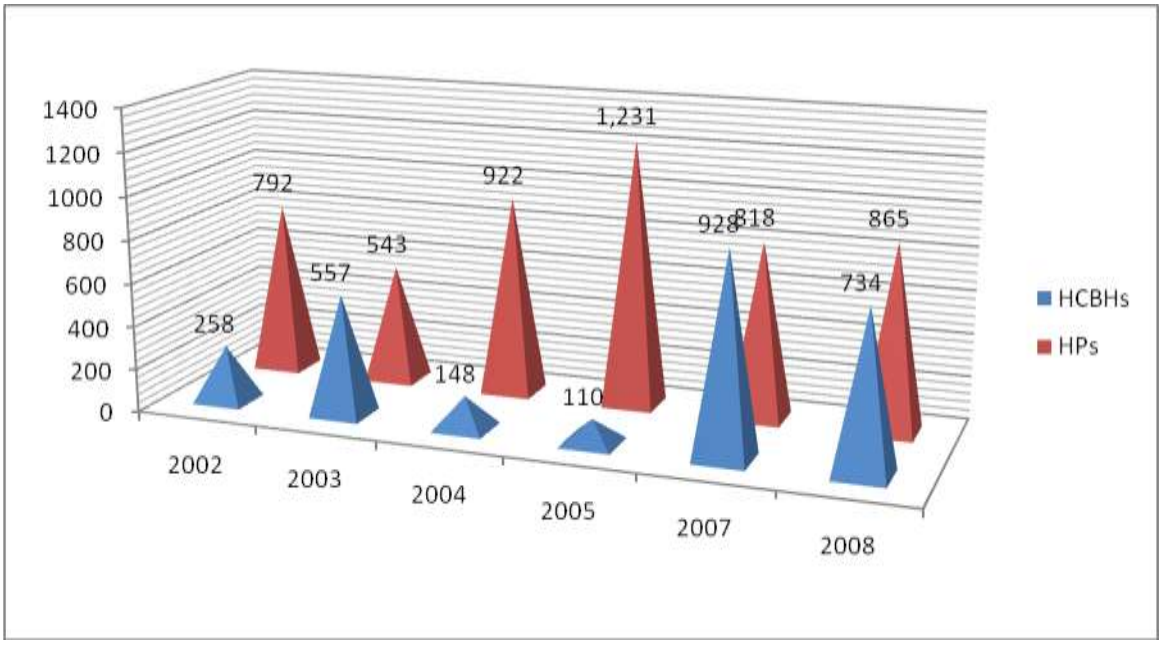
7. Key achievements in water well drilling:

- ✓ The drilling of water wells improved over the last two years, which indicating better investment, funding and improving sector drilling capacities.
- ✓ Up to date and according to PWC records 7,439 deep wells were drilled some of them drilled recently were not installed out of them 30% in Gezira State. In the same way total of 21,055 wells were drilled and installed out of them 23% in South Kordofan State.

Table indicating achievements of drilling over the last seven years:

No	Year of drilling	High capacity wells	Slim BHs for HPs
1	2008	734	865
2	2007	928	818
3	2006	-	583
4	2005	110	1,231
5	2004	148	922
6	2003	557	543
7	2002	258	792

Diagram indicating achievements of drilling over the last seven years:



8. Drilling Operations Challenges:

- Limited sector capacities in term of drilling operations and resources.
- Support and facilitate private sector role and enhance enabling environment.
- Introduce appropriate technologies and work quality.
- Transparent water sector policy/system in all aspects.
- High cost of drilling in deep aquifers.
- Adequate internal and external investment in water sector
- Strengthening operation and maintenance system, including tariff system and supply-chain system