Development of Water Supply Infrastructure in Nigeria: Challenges and Prospects

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"There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people and the environment suffer badly"

World Water

Outline

Background: Context (1/2)

- Over 70% of planet earth, as well as over 70% of the human body, is water
- Water supply is critical to sustainable development and economic competitiveness of any nation
- Population surge, industrialisation and rising standards of living, have put water demand on the rise; though without corresponding increase in the quantity of the resource
- Inadequate infrastructure is holding back Africa's economic growth per capita by 2% each year and reducing firms' productivity by as much as 40%. Sub-Saharan Africa (including Nigeria) is also lagging behind the rest of the world in its level of infrastructure development
- First water corporation formed in the western region in 1966 and others, only in the 1970s

All the 36 States and the FCT now have Water Boards /Corporations

FGN got involved in the management of water resources in 1976 when it created the FMWR and RBDAs primarily to provide irrigation water, and also water for power supply

Background: Context (2/2)

- According to a study conducted by the University of Edinburgh, UK, and the Federal Polytechnic, Bauchi on the supply of water in rural communities in Taraba State, It is simply too expensive to provide a house-to-house water supply because homes are so widely scattered.
- The Food and Agriculture Organisation stated during the celebration of this year's World Water Day that 48 countries, including Nigeria, would face water shortage by 2025
- Water schemes need to be simple to operate, and cheap to construct and maintain if these schemes are to be successful in the long term.
- The Nigerian Minister of Water Resources, was also reported to have revealed that about 70 million Nigerians lacked access to potable water..
- In many European and several other countries around the world, municipal water supply is a fundamental human right

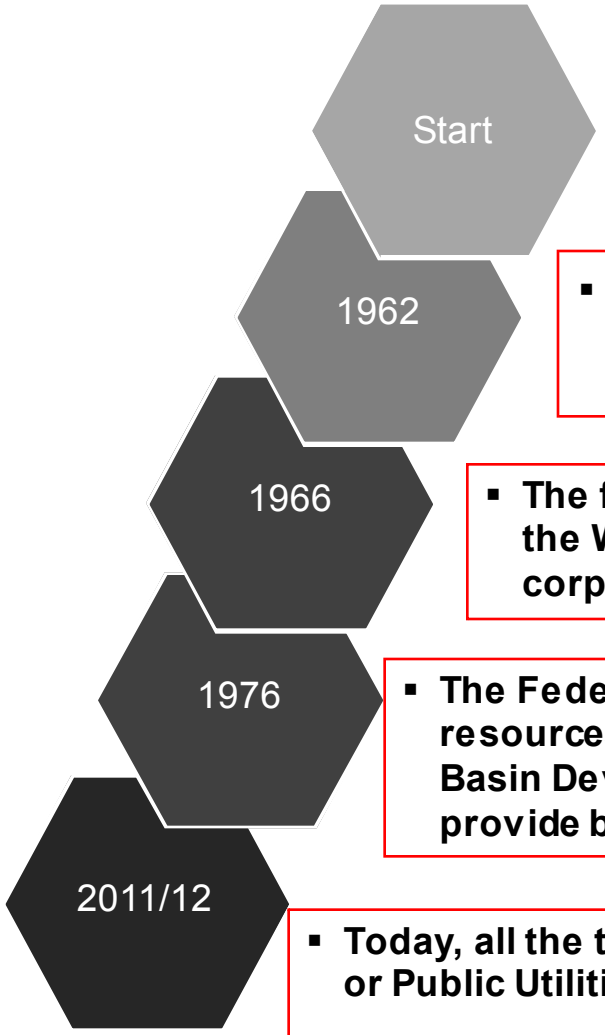
The office of the Senior Special Assistant to the President (OSSAP) on MDG, in an effort to achieve relevant targets of MDG 7, has embarked on the implementation of water supply projects in selected communities in Adamawa, Anambra, Cross River, Ekiti, Imo, Katsina, Kogi, Kwara, Ondo and Zamfara States since 2000. The effectiveness of the outcome of this effort is surely not common knowledge for now.

Background: Conceptual Clarifications

…Operational Definitions

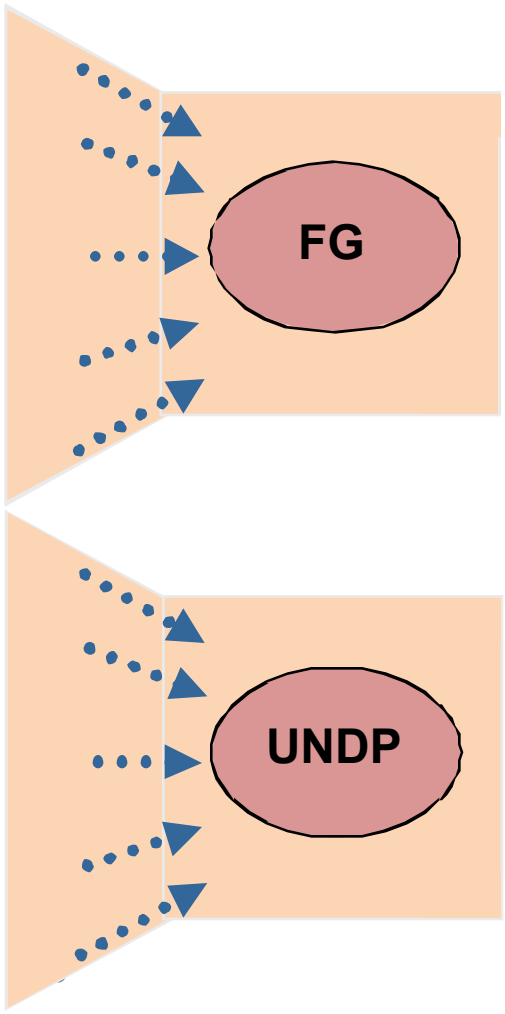
Challenges	A challenge is taken as those elements and circumstances that would tend to impede the provision of potable water in Nigeria.
Prospects	The possibility of future success; expectation: belief about (or mental picture of) the future,
Infrastructure	Infrastructure refers to the roads, cables, wires, pipes, bridges, canals, reservoirs, and sewers that support economy and society
Development	Development could be an act of improving by expanding or enlarging or refining; or a process in which something passes by degrees to a different stage (especially a more advanced or mature stage); or a state in which things are improving.

Water Supply In Nigeria: Status Report



- **In Nigeria, operation of public water supply systems commenced only early in the twentieth century in Lagos and a few towns like Calabar, Kano, Ibadan, Abeokuta, Ijebu Ode and Enugu**
- **The government's major intervention came during the first National Development Plan period (1962 – 1968) through the establishment of the River Niger and Lake Chad Basin Commissions.**
- **The first water corporation was formed in the western region in 1966 with the staff of the Water Division of the Ministry of Works constituting the nucleus. The next sets of corporations were formed in the 1970s.**
- **The Federal Government elevated its level of involvement in the management of water resources in 1976 when the 1976Federal Ministry of Water Resources and the eleven River Basin Development Authorities (RBDAs) were created. The purpose of the RBDAs was to provide bulk water, primarily for irrigation.**
- **Today, all the thirty six states and the Federal Capital Territory have Water Boards/Corporations or Public Utilities Boards managing their public water supply**

Water Supply In Nigeria: Status Report



The Federal Ministry of Water Resources Roadmap for Nigeria Water Sector (2011) estimates the water resources potential of the country as 267 and 92 billion m^3 of surface and ground water respectively.

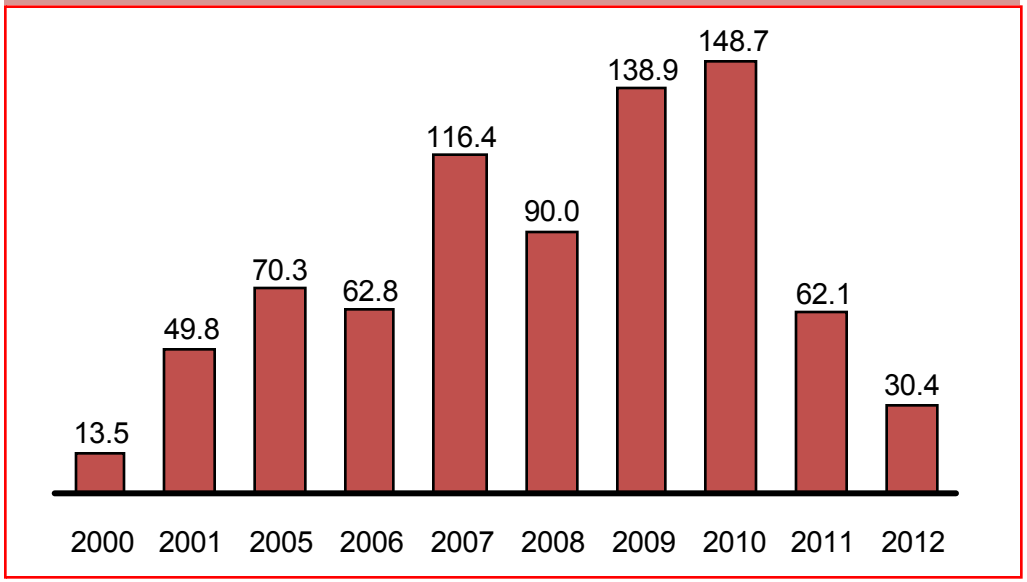
It also estimates the water supply and sanitation service coverage as 58% (87million) and 32% (54million) respectively.

The United Nations International Children Educational Fund (UNICEF) estimates are slightly lower at 47% water supply service coverage. Public perception is a lot lower though.

- Gombe Town water supply system derives its raw water from the Dadin-kowa Dam constructed by the Upper Benue River Basin Development Authority.
- In like manner, communities in the southern part of Kaduna State, and indeed other parts of the state, can now access irrigation water, and shortly, electric power too, from the Gurara dam constructed by the Federal Ministry of Water Resources initially for inter-basin raw water transfer to the Lower Usuma dam, and the water treatment plants in Abuja.

Water Supply In Nigeria: Status Report

Federal Ministry of Water Resources Capital Budget (N'bn)



Factors responsible for low access to safe drinking water

- Poor water supply infrastructure
- Poor technical capacity of communities to maintain water supply facilities
- Lack of appropriate regulatory framework on potable water supply

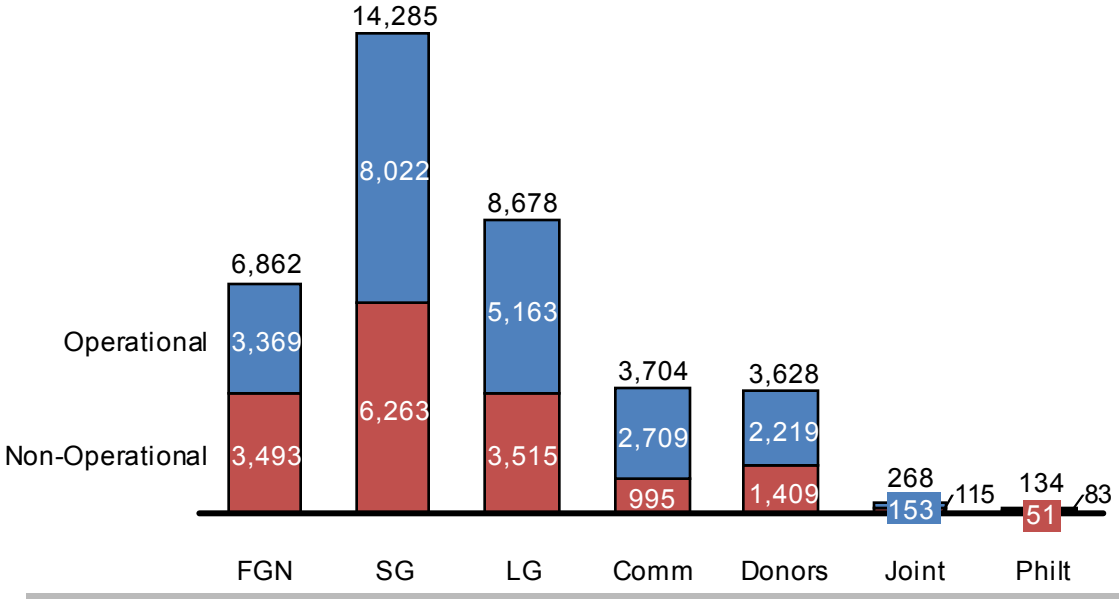
YEAR	CAPITAL PROJECTS	REMARKS
2000	13,5524,868,540	
2001	49,800,000,000	
2005	70,323,457,333	
2006	62,783,462,843	
2007	116,394,899,159	
2008	89,952,014,445	Combined budget for Fed Ministry of Agric & Water Resources
2009	138,929,000,000	-do-
2010	148,715,672,952	-do-
2011	62,052,000,884	
2012	30,400,000,000	
Total	782,875,376,156.00	

Comments

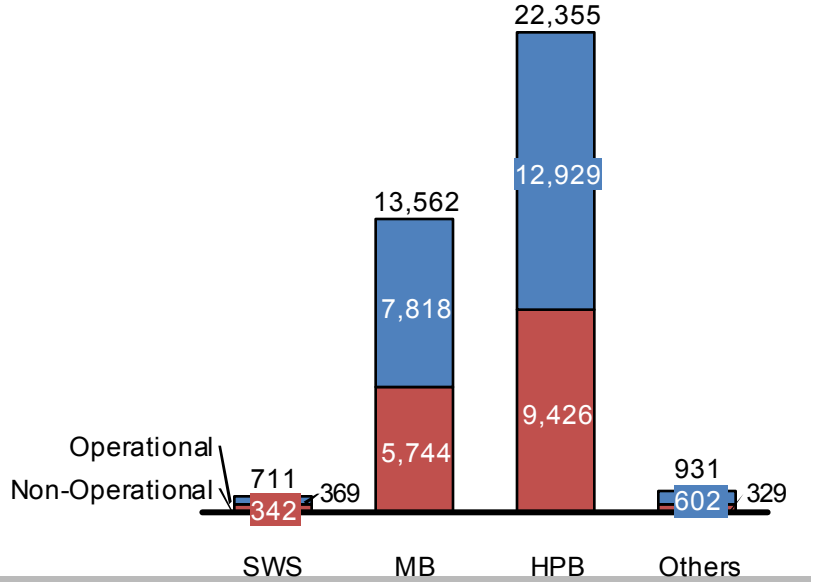
- **At the disputable 58% coverage, 51 years after independence, with an endowment of over 30,000 qualified indigenous engineers among other professionals in the sector, and a Federal Government capital expenditure profile of well over N800b in the last twelve years alone, access level is pretty low, but even more worrisome is the triviality of the problem by other tiers of government.**

Water Supply In Nigeria: Status Report

Summary of Results of Nationwide Survey per Implementing Entities



Summary of Results of Nationwide Survey per Infrastructural Types



Comments

- **Clearly, this result is by no means cheering, as it leaves so much room for improvement.**
- **The models commonly used in Nigeria for Industrial, Commercial and Domestic Water supply include Surface extraction, treatment and distribution; Surface water extraction and distribution; Groundwater extraction, treatment and distribution; Groundwater extraction and distribution; and Rain Water Harvesting.**

Abuja Water Supply System: The Gurara – Usuma Dam

…Abuja Water Supply System

…Gurara Dam

- Initially funded by the Petroleum Trust Fund (PTF), later transferred to the Federal Ministry of Water Resources.
- Dam has composite earth rockfill
- Has a reservoir capacity of 850million m3
- It is being used for irrigation, power generation (Phase I: 30MW; II: 360MW), and water transfer to the lower usuma basin and the water treatment plants.

S/N	Description	Dimensions
1	Crest Level	629.5masl
2	Foundation Level	576masl
3	Maximum Dam Height	53.5m
4	Dam Crest Length	2,280m
5	Top Crest Width	6m
6	Upstream Slope	1:1.7
7	Downstream Slope	1:1.5
8	Total Volume of Embankment	6.4M m^3
9	Volume of Earthfill	2.2M m^3
10	Volume of Rockfill	3.82M m^3
11	Volume of Filter and Transition	0.38M m^3
12	Full Supply Level	624masl
13	Max. Water Level (Highest Supply Level)	626.6masl
14	Net Freeboard	2.9m

Abuja Water Supply System: Lower Usuma Dam

…Abuja Water Supply System

…Lower Usuma Dam

- An earth-fill dam across River Usuma, with open channel spillway
  - Reservoir capacity - 100 million m3
  - Commissioned – 1987
  - Initial treatment plant capacity - 5,000m3/hr
  - Present Capacity – 10,000m3/hr
  - On-going expansion – 20,000m3/hr
- Located at an elevation higher than any of the settlement areas in the FCT

S/N	Description	Dimensions
1	Dam Crest Elevation	579masl
2	Stream Bed Elevation	533masl
3	Maximum Height of Main Dam	46m
4	Maximum Height of Saddle Dam	18m
5	Full Supply Level	575masl
6	Maximum Water Level	576masl
7	Minimum water Level (for gravity flow)	568masl
8	Storage Capacity	105M m^3
9	Live Storage	88M m^3
10	Free Board	4m
11	Total Crest Length	1,320m
12	Crest width	10m
13	Upstream Slope	1:3&1:3.25
14	Downstream slope	1:2&1:2.5
15	Earthwork Volume	5M m^3
16	Reservoir Surface Area	8km^2
17	Catchment Area	200km^2

Abuja Water Supply System: Jabi Dam

…Abuja Water Supply System

…Jabi Dam

- Jabi Dam and the water treatment plant constructed in 1981, as the first source of water supply to the Capital City
- An earthfill hydraulic structure
  - Length - 850m
  - Spillway - 30m
  - Reservoir Capacity - 6 million m3
  - Plant Capacity - 360m3/hr
  - Transmission main - 15km - 450mm diameter, Ductile Iron (DI)
- Provided comfort to the Shagari Administration's cabinet (FEC) meetings and important national events in the City
- No longer economical to operate

Abuja Water Transmission System

5 out of the 10 reservoirs designed for a projected 3.2million Federal Capital City (FCC) population fully constructed

Tanks 3 and 4 for Phase I loops, while Tanks 2 and 5 to feed Phase II loops

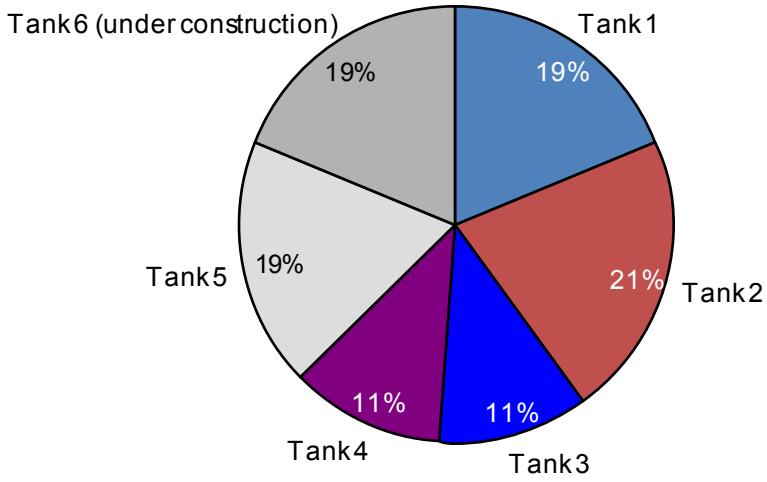
Abuja Water Transmission System

The 6th is under construction together with the associated trunk mains

Tanks 1 and 6 are the feed tanks for Phase III loops

Abuja Water Transmission System

Capacity Distribution of Completed FCC Water Reservoirs



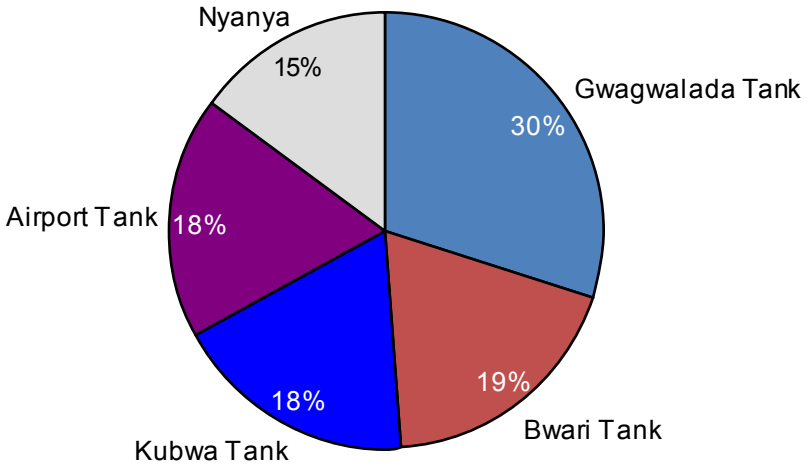
Highlights

S/N	Description	Capacity
1	Tank 1	40,000
2	Tank 2	45,000
3	Tank 3	24,000
4	Tank 4	24,000
5	Tank 5	40,000
6	Tank 6 (under construction)	40,000

Comments

- The reservoir and associated trunk mains currently available would have been adequate to meet the water requirements of residents of the FCC, but for the distortions to the water master plan as with the FCT global master plan, in relation to physical development and population control.

Capacity Distribution of Completed Satellite Towns Water Reservoirs

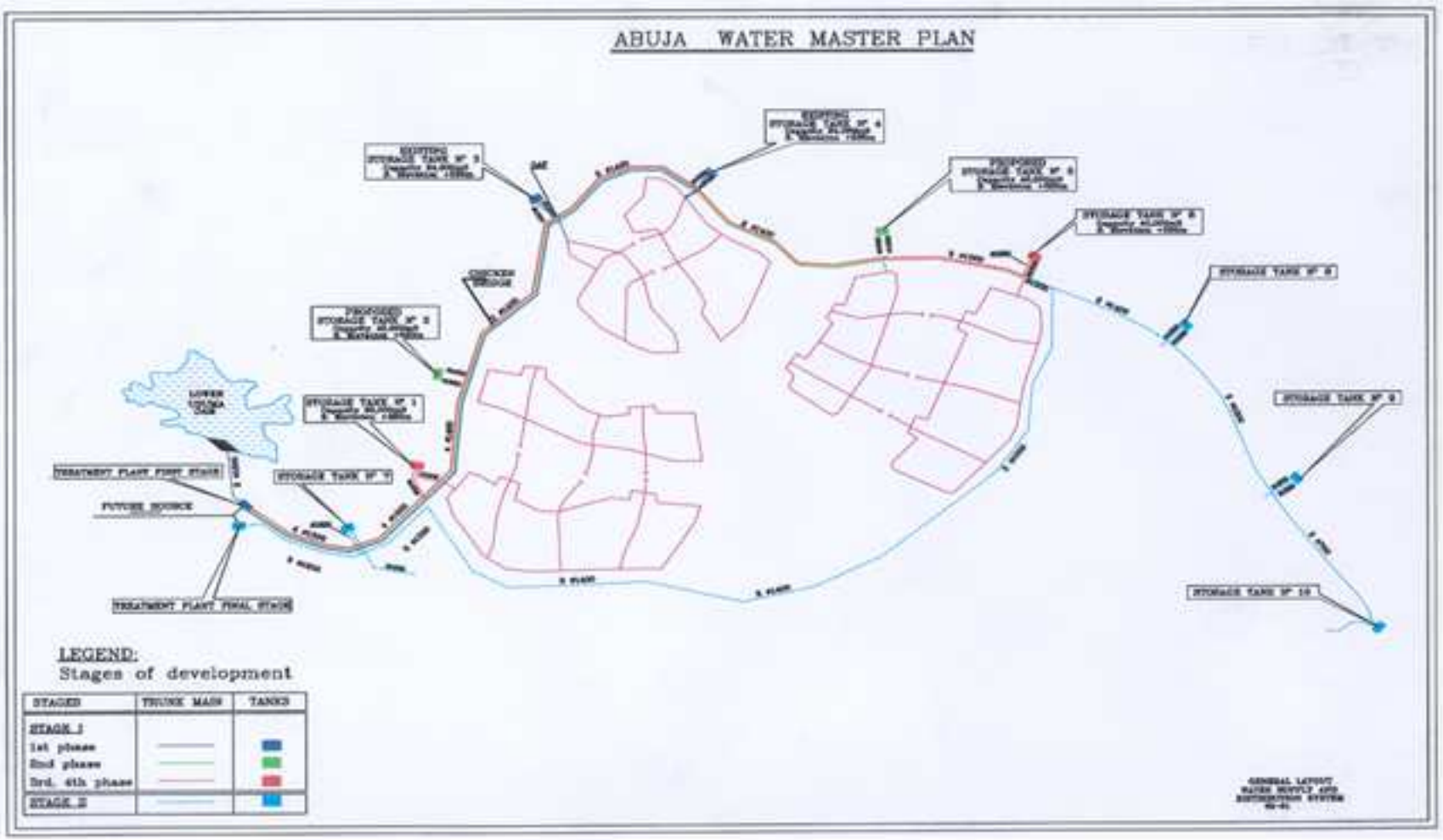


Highlights

S/N	Description	Capacity
1	Gwagwalada Tank	20,000
2	Bwari Tank	12,500
3	Kubwa Tank	12,000
4	Airport Tank	12,000
5	Nyanya	10,000

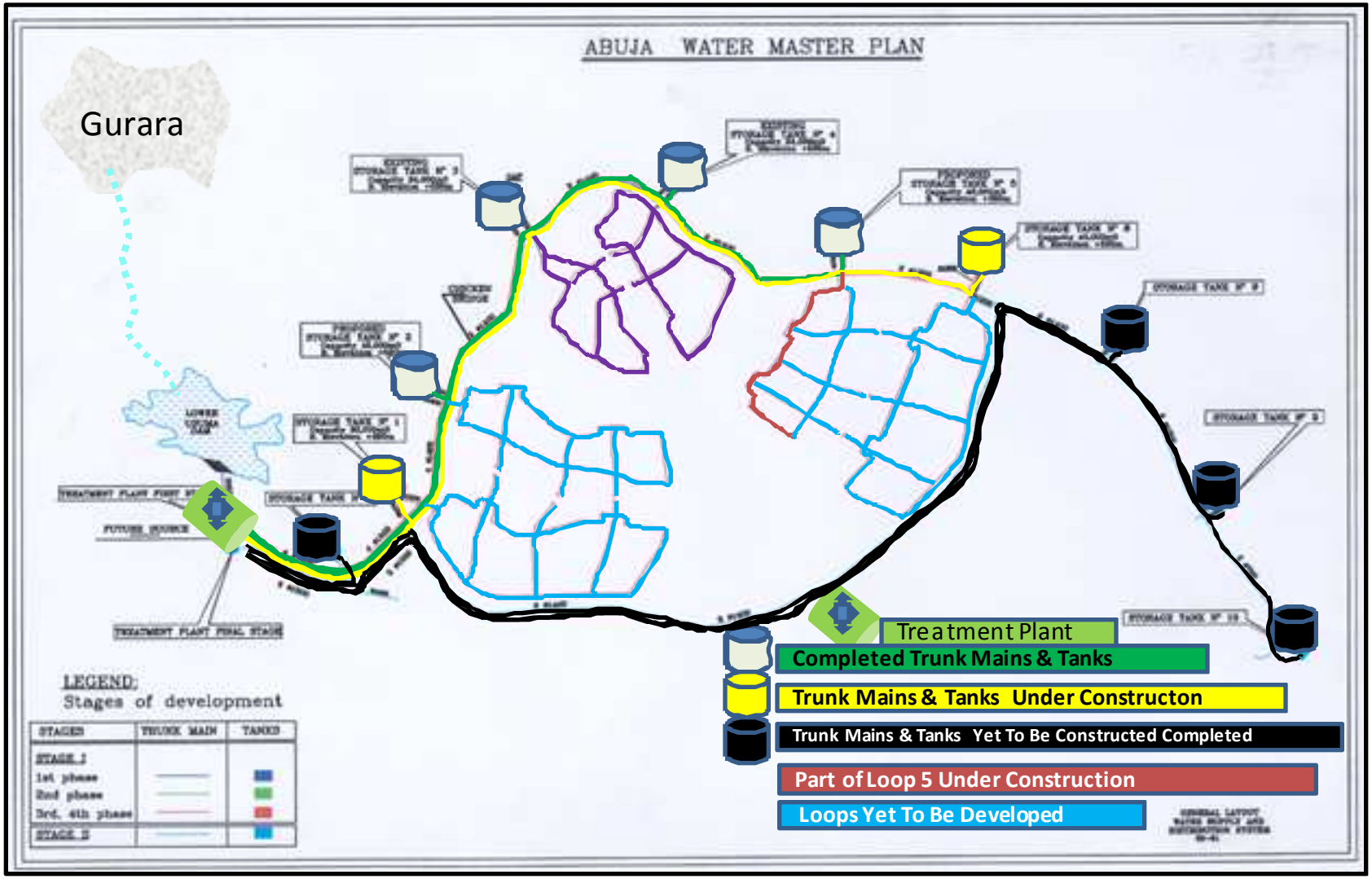
FCC Water Supply Plan

The Blueprint …



FCC Water Supply Plan

Progress To Date…



Gurara – Usuma Basin Water Transmission Line

Background

- The initial design choice for this transmission system was a 3300mm diameter Prestressed Concrete Cylinder Pipe (PCCP). However, after an evaluation of PCCP indicated abysmal performance, the pipe material was changed to steel.
- Then came the problem of sourcing, because the size required was not available anywhere in Europe, and importation from US would be very expensive. That is the origin of the steel pipe factory in Abuja.
- The complexities of importing 74km of spiral welded steel pipe and placing, necessitated the setting up of the factory on site by the contractor. Production commenced in March 2003, of thin walled steel pipes in line with the design specifications, after due analysis of possible deflection due to various load modes like: Gravity, Working Pressure, Surge pressure, Vacuum Pressure.

Gurara – LUD Trunk Mains Configuration

Tunnel	Stretch	Length (m)
Intake Tunnel	Ch. 0+028 – 2+855	2,827
Terminal Tunnel into LUD Reservoir	Ch. 73+950 – 74+330	380
Intake Tunnel – Reservoir	Ch. 2+855 – 73+950	71,095
	Ch. 70+960 – 73+635	2,675
Total Pipeline Length		73,770

Critical Considerations

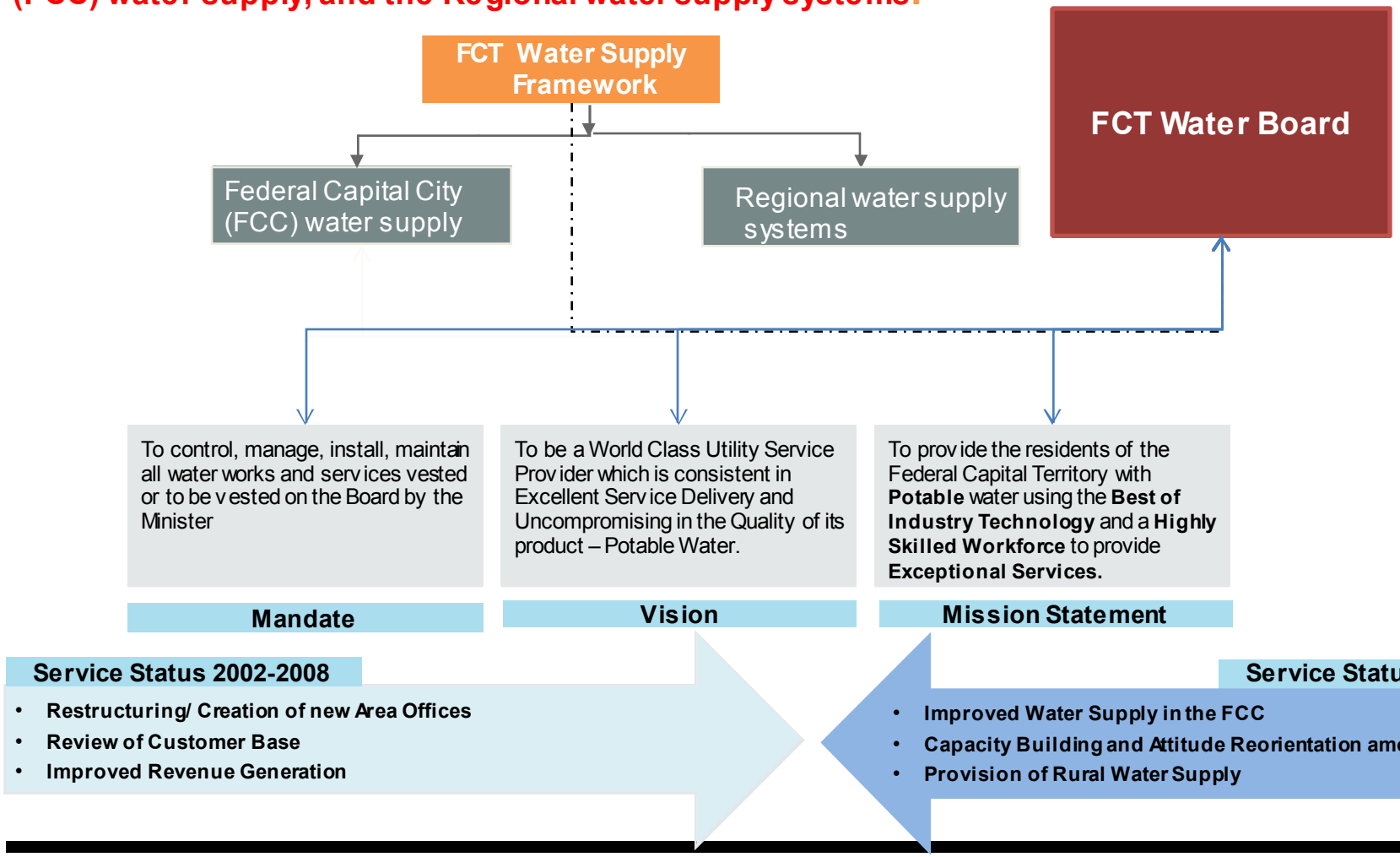
- Minimise the number of bends as much as possible and to keep the bends within standard types (900, 450, 221/20, 111/40) except under unavoidable circumstances;
- Avoid short vertical rises and falls;
- Minimise excavation in rock;
- Minimise number of stream and river crossings;
- Keep pipeline route away from built-up areas;
- Maintain minimum burial cover of 1m over pipeline;

Gurara Inter-basin Water Transfer Project

- … in Pictures…

Status Of Water Supply In The FCT

The FCT water supply system was designed to have two broad frameworks, namely the Federal Capital City (FCC) water supply; and the Regional water supply systems.



Initiatives

Below are some of the Board's on- going Initiatives:

Type of Project	Location	Objective	Status
▪ Construction of two new 10,000m3/h water Treatment Plan	▪ Lower Usuma Dam Water Works	• To increase capacity of our water works from 10,000 m^3/h to 30,000 m^3/h	▪ To be completed by August 2007, but still on-going
▪ Provision of water supply infrastructures to the University of Abuja.	▪ University of Abuja Permanent site.	▪ Provision of water storage and transmission facilities	▪ Completed

Initiatives

Below are some of the Board's on- going Initiatives:

Type of Project	Location	Objective	Status
▪ Automated Meter Reading (AMR) System	▪ 30,000 Properties in the City	▪ Improvement of Board's services in accurate billing and leak detection.	▪ Contract awarded, still on-going
▪ MDGs/DRG Rural Water supply schemes to Health and Educational Institutions	▪ 6 Pry Sch (1 in each Area Council) ▪ 6 JSS(1 in each Area Council) ▪ 6 Health Centres (1 in each Area Council) ▪ -2 Orphanages (Lugbe & Gwagwalada)	▪ To extend water supply to Phase 3 of the City	▪ Contract awarded, still on-going

Initiatives

Below are some of the Board's on- going Initiatives:

Type of Project	Location	Objective	Status
▪ Construction of Tanks 1 & 6 and Associated Trunk Mains	▪ Water reservoirs for Phase 3 of FCC	▪ To extend water supply to Phase 3 of the City	▪ Contract awarded, still on-going
▪ World Bank Intervention ▪ Densification of Water Supply to Gwagwalada, Karu/Nyanya, Games Village, Gwarinpa II District and Gudu District	▪ Gwagwalada, Karu/Nyanya, Games Village, Gwarinpa II District and Gudu District	▪ Improved water supply to Karu/Nyanya, Gwagwalada and also for water supply to Games Village, Gwarinpa II and Gudu Districts	▪ Contracts awarded, still on-going

Initiatives

Below are some of the Board's on- going Initiatives:

Type of Project	Location	Objective	Status
▪ DFID Intervention	▪ FCT Water Board	▪ Service Improvement in the Water Board	▪ Review of Data Management and Financial practices concluded

Challenges

The initial obvious challenges could be segmented into various categories as follows:

Commercial

- The need to determine the accurate customer data base
- Substantial debts owed by powerful customers, especially the Nigerian

Administrative

- Inadequate office accommodation

Challenges

Technical

- Aging Distribution Infrastructure

Key Points to Note/Conclusion (1/1)

- United Kingdom commenced development of basic water supply infrastructure as far back as the 16th century, but for Nigeria, only in the 20th century
- There are 11 RBDAs covering all zones of Nigeria, but unfortunately no requisite infrastructure for optimal utilisation of the water resources for domestic, industrial, agricultural and power generation purposes
- The Abuja water master plan has been substantially implemented in terms infrastructure provision for the FCC
- Failure to develop FCT regional water schemes however, has led to sharing of the resources for the FCC. Eg. Bwari, Nyanya/Karu, Kubwa, Airport, and Gwagwalada

Key Points to Note/Conclusion (1/2)

- Approximately 80% of households have less than 30 litres of water per person per day.
- A collaborative study by the University of Edinbugh, UK and the Federal Polytechnic Bauchi noted that in the wet season 35% of rural inhabitants in NE Nigeria depend on wells for water and in the dry season the figure rises to 69%.
- The alarming population growth is placing undue burden on existing infrastructure and operational tools of the FCT Water Board
- The timely completion of the Gurara dam project and associated works indicate responsiveness on the part of government

Next Steps/Recommendations (1/1)

Recommendations	Implementation Strategies
1 **Government at all levels should ensure continuity of people-oriented public policies especially in a critical sector like Water Supply.**	• Federal and State Governments to articulate new polices only after having made wide consultations with all relevant stakeholders • Federal, State and Local Governments to develop realistic implementation plans and time lines for all existing water policies
2 **The Federal Government should streamline the functions of the Federal Ministry of Water Resources**	• Federal Executive Council to review and clearly delineate the functions of all policy making and implementing institutions to minimise usurpation of roles and ensure effective service delivery • The Office of the Secretary to the Government of the Federation in conjunction with the National Planning Commission and relevant Professional bodies to produce a comprehensive job analysis of Boards of RBDAs to ensure only appropriate persons are appointed.
3 **Local Government Authorities should be empowered to provide mini-water schemes in their areas of jurisdiction while two or three local governments could also collaborate to provide large water schemes**	• Federal and State Governments to release all statutory appropriations for rural water supply and sanitation schemes to the respective Local Government Authorities. • RBDAs to build capacity of resident 'out of school' youths in the Operation and Maintenance of Rural Water supply and sanitation schemes in their communities to ameliorate unemployment and ensure sustainability of such schemes.

Next Steps/Recommendations (1/1)

Recommendations	Implementation Strategies
4 **The Federal Capital Development Authority should urgently review the FCT water master plan to accommodate current realities resulting from several years of distortions.**	• FCDA Department of Engineering Services to procure consultants to carry out the study and production of a new water master plan • National Assembly to appropriate funds for this onerous assignment that will give Abuja the befitting status it deserves.
5 **The FCT Administration should vigorously promote and solicit investments in water infrastructure in the FCT**	• FCT Water Board to outsource the retail end of their operations starting with projects with subsisting World Bank loan debts • FCT Administration to encourage multinational contractors to Build, Operate and Own/Transfer water treatment plants, transmission and distribution infrastructures in the FCT

Thank You