

**BUILDING SIERRA LEONE'S
WATER SECURITY TO
SUSTAIN GENERATIONS:
THE ROLE OF THE
ENGINEERING FRATERNITY**

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Building Sierra Leone's Water Security to Sustain Generations: The Role of the Engineering Fraternity

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Introduction

I would like to thank you for inviting me to share my Ministry's thoughts on the occasion of your Biennial Conference, which quite rightly is themed around "Disaster Risk Management and Preparedness; an Engineering Perspective for resilience". The theme is appropriate because contemporary global and national events present us with no choice but to find solutions to the management of our natural resources in a manner that build our resilience to natural disasters. In this respect I would like to title my presentation:

"Building Sierra Leone's Water Security to Sustain Generations: The Role of the Engineering Fraternity in Sierra Leone"

This presentation is in 2 parts. The first addresses the question of water security and its importance for Sierra Leone's socio-economic development. It is discussed to make it relevant to the theme of the Biennial Conference. The second part narrows it to the management of our water resources and our water supply, and the role that is expected of the engineering fraternity.

Water Security and Socio-economic Development

To begin I would like to put the whole subject of "Water Security" into context. The term has been used by a number of practitioners to mean different things. In this presentation we will adopt the following as used by one renowned expert:

Water security is "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies. It is determined by many factors, including the hydrological environment, the institutional and governance environment, the socio-economic context, the geopolitical environment, and the future environment and uncertainties, particularly of climate change". [David Grey, 2008]

What this means is that even as we harness our water resources to contribute to our socio-economic development - and by inference our Gross Domestic Product (GDP) - we should also remember that the impacts of disasters such as

water-related diseases, droughts and floods can reduce our GDP as well. For example, the World Bank estimates that Sierra Leone will lose USD1.5 billion as a result of the ebola crisis. It is also estimated that a prudent management of a country's water resources could contribute as much as 4% to its GDP.

The management of our water resources should look beyond the narrow, albeit important, perspective of drinking water supply. Our water resources do, and should contribute to our Food Security through Water for Agriculture, Energy Security through Water for Hydropower, and Water Storage that spreads the benefits of water throughout the seasons and also assists in reducing the impacts of floods. A former Chairman of the African Minister's Council on Water (AMCOW) put the issue of water resources and economic growth in the following perspective:

African countries should have "an increased awareness of the contribution of water resources infrastructure to economic growth, beyond the narrow perspective of drinking water supply. That the latter is important is not in dispute. However achieving the continent's objectives in drinking water and sanitation is inextricably linked with faster economic growth, which in turn can be aided by prudent and socially-responsible water infrastructure development"

[Bruno Richard Jean-Itoua,
Minister of Energy and Water,
Congo Brazzaville, and
AMCOW Chair, 2008]

As a country, we have 2 choices in relation to ensuring our water security. The first is to use our water resources to drive our economic growth to appreciable levels that increase our ability to withstand unavoidable disasters when they arise. The second is to take measures that prevent or reduce the probability of these events happening, through responsible policy, institutional, regulatory and enforcement mechanisms. We need to take both!

How Far are we in Sierra Leone from Water-Related Disasters?

There are a number of water-related hazards that our water security agenda should help to address. These include incidences of:

- (i) **Biological, parasitic or viral hazards**, caused by either a lack of water and adequate sanitation and hygiene or the presence of it through contamination. Diseases such as cholera and ebola have caused untold misery to our population;
- (ii) **Coastal Erosion and coastal floods** cause temporary or permanent loss to our land mass and dislocates populations;
- (iii) **Droughts**, whilst not overly prominent, compared to some of our regional neighbours, can pose threats to our drinking water supply and our food production; these, in large part, can be exacerbated by human activities and water supply demands;
- (iv) **Floods and flash floods** are common to our environment with the almost perennial displacement of persons in Freetown and certain communities around the country. The impacts of the August 2015 flash floods continue to confront us as a Government;
- (v) **Landslides**, following heavy storms remind us of the poor planning and the uncontrolled rapid urbanisation which we live with; and
- (vi) **Seasonal variations** in the level of water in our dams and minor water sources, leaving large populations with little access to drinking water supply have all been too common in recent years.

It is obvious from what has been highlighted above that building the water infrastructure platform for our growth, as well as addressing our resilience towards water-related disasters, cannot be the responsibility of the Ministry of Water resources alone. It has to be addressed in a multi-sectoral, multi-level, and multi-disciplinary manner, and our engineers in particular have a big role to play in this.

On its part, the Ministry, through a series of policy, institutional and regulatory reforms, is leading efforts to rationalise activities to ensure the country's water security.

The KEY MESSAGE from the above is that once we pursue rapid economic growth, then we should

have the capacity to withstand natural disasters when they occur. That growth can be achieved through the sustainable management

Linking engineering to policy and practice

Let me now shift my attention to a discourse on:

- The status of water supply and water resources management in Sierra Leone, with some analysis;
- Current ongoing water initiatives towards water security in Sierra Leone; and
- What practitioners and policy makers need to know

This will end with a call for ways to engender effective collaboration with the engineering fraternity to drive this agenda.

The message is that Engineering is an applied science, but it must be made even more accessible to practitioners and politicians in the water and sanitation sector.

Status of water resources management in Sierra Leone

Sierra Leone's water supply and water resources monitoring infrastructure was largely destroyed during the decade long civil war (1991-2002). The nation's population is now growing at a rapid rate, around 2.8% per annum, and even more so in Freetown and other cities as a result of rapid urbanisation. This means the population will effectively double every forty or so years. With our drive towards greater industrialisation there are now growing demands on our natural resources as a result of mining and agribusiness.

Generally it is assumed Sierra Leone has abundant water resources, because we receive high annual rainfall (average 2500mm nationwide). This provides the false notion that the resources are available and will always be available for all its competing uses.

There are many challenges in building new water supply and sanitation infrastructure. There are even more challenges in operating and maintaining infrastructure over time, so that it provides a permanent service to our people. We should not be complacent about our water and land resources. This requires us to build the professional capability of our national institutions, so engineers and scientists can influence politicians and policy makers in the sustainability agenda.

What we currently see is poor quality construction of water supply and sanitation services, abandoned or damaged infrastructure and a high percentage of non-functioning or seasonal water points. Of a total of 28,845 water-points mapped

in 2012, only 31% was known to provide water supply all year-round.

Sierra Leone has water surplus in the rainy season and water deficit in the dry season. The challenge therefore is how to capture high rainfall and surface runoff so we can use it in the dry season months, particularly between December and March. The clear implication from the data matched with the findings of seasonality of several water-points is that there is not enough retention to keep our water-points running all year round. This suggests that we need to dig our wells much deeper than we have been doing in the past, and avoid doing so in the wet season.

In Freetown the evidence is similar. The peninsula has a very high annual rainfall – in excess of 4000mm. But there is a high surface runoff, particularly in the months of June to September. It is understood that there are no major aquifers in Sierra Leone as much of the country is underlain by basement complex rock. This means that the high precipitation and runoff ends up in the Atlantic Ocean.

But the clear message in addressing our water security is that **we cannot manage what we do not monitor**. The onus of allocating water resources between livelihoods (drinking water supply) and other competing uses can only be effectively accomplished if we establish mechanisms for data collection, analysis and use in our decision-making. And such data need not only be scientific, but also socio-cultural, including monitoring irresponsible human activity, such as land encroachment in our catchment areas. One commentator had summarised this in the following telling comment:

“As water resources have never been a serious constraint to development in Sierra Leone, no base exists for their management (except for the water supply and sanitation sector).”

(Encyclopedia of the Earth,
Kundell 2008)

In recent years however, the Ministry of Water Resources has focussed on developing models of good practice to demonstrate how better water resources monitoring and management could be achieved, using the Rokel-Seli Basin as a pilot. Field experiences in the basin have been documented over a three year period and have led to the establishment of a repository for Sierra Leone’s hydrometric data - www.salonewatersecurity.com. The web-site now contains the first Sierra Leone Water Security strategy, guidelines on hydrometric monitoring,

historical and current data as well as details of new legislation. It is hoped that this website will inspire others to engage in water resources management and stimulate discussion about the importance of robust data for better decision-making.

The Sierra Leone Water Security project advocated four core principles that can guide better water resources management in Sierra Leone:

1. Focus on solving real water management problems that people experience.
2. Adopt the principle of subsidiarity and manage water resources at the lowest most appropriate level.
3. Ensure that hydrometric monitoring data is validated, analysed, published and leads to appropriate follow up action.
4. Avoid an artificial disconnect between water supply and water resources management, as is often the case in WASH programming.

What do we need to know?

Given the increasing demands on water resources as well as past over-estimation of the country’s renewable water resources, there is an imperative for evidence to be collected by engineers and hydro-geologists to inform our decision making.

On water availability, we need to have:

- (i) information on rivers, stream and spring flows, groundwater levels.
- (ii) how fast and how far they decrease in the dry season;
- (iii) whether or not they dry up completely;
- (iv) why the flows and water levels decrease as they do;
- (v) whether there are significant changes over time, and
- (vi) the balance between supply and demand.

On water quality we need information on:

- (i) current discharges to surface water and groundwater sources.
- (ii) flow paths to our water resources becoming contaminated.
- (iii) how we protect these water resources; and
- (iv) who will analyse and interpret monitoring data

To address these and other major water resources challenges, a National Water Resources Management Agency will soon be established to manage the country’s water resources in a sustainable manner.

Status of drinking water supply

On drinking water supply, nationwide we were unable to meet the national policy targets or the Millennium Development Goals (MDGs) by 2015. As of 2015 it is estimated that **1,973,000 (37%) and 2,732,000 (51%)** of the population respectively still lacked access to improved water and sanitation services (UNICEF-WHO, JMP 2015). The situation is particularly bad in remote rural areas of Sierra Leone. But even in Freetown we have also experienced some difficult times as a result of the dry season water deficit. Invariably the worst affected are the poor, living in slums and low income communities.

This said, there has been acceleration in the rate of delivery of access, particularly for improved water supply, due in large part to increases in funding to the WASH sector from Government and its partners for both rural and urban water supply. In addition, significant institutional, regulatory and service delivery reforms are taking place. These reforms have in turn led to increased funding into the sector.

I am delighted to indicate here that as much as £38 million is to be pumped into renewing obsolete production and storage infrastructure for the Guma Valley Water Company over the next 18 months under the President's 24-Month Post Ebola recovery Programme. The Guma improvements will provide an additional 600,000 people with reasonable access to improved water supply. Government is currently seeking funding for a long term solution to Freetown Water Supply, through the Rokel River Water Supply Project.

In addition several projects in rural and small towns' water supply are under way to provide increased access to close to 1 million people over the next 2 years. To ensure water supply systems as well as service delivery can be sustained on a permanent basis the Ministry and its agencies, in collaboration with Local Councils, are focused on establishing small town water supply management and financial viability structures.

What issues do we need to collectively address?

As a country we need to address the following:

- (i) **Engineering design and construction:** Engineering standards are well established and numerous texts exist. But how do we apply them in our day to day work?
- (ii) **Feasibility studies:** Adequate feasibility studies are not being undertaken. Infrastructure works because it is designed well using analysed data.
- (iii) **Design:** Water supply and treatment systems are not always being

adequately designed to national and international standards.

- (iv) **Detailed design:** Designers and contractors do not review designs together to understand how infrastructure can be built efficiently.
- (v) **Construction:** Construction is often poorly supervised, which means it can be sub standard.
- (vi) **Contracts** may not always incentivise all parties to provide a good service.

We also need to address the issues of **post construction attrition, including:**

- **Operation and Maintenance:** often there is inadequate routine O&M to sustain services. Management burden in rural areas is placed on communities.
- **Revenue generation:** Inadequate revenue is generated through tariffs to cover recurrent operating costs.
- **Environmental issues:** Services are not designed to cope with water surplus in the wet season and water deficit in the dry season.

What knowledge do practitioners need?

The prospect of a booming water supply sector is not in doubt. What may be in doubt is the preparedness of our engineers and other disciplines to join and be part of this renaissance. What can we expect of the engineering fraternity, and what do they expect of their government?

In my considered view, and in all humility, we need our practitioners to understand the following:

- Simplified guidance on how to design and construct water supply and sanitation services. Useful, practical, simplified but accurate information.
- Understanding of hydrology and hydrogeology, including: (i) volumes of rainfall and spatial variation; (ii) recharge mechanisms and rates; (iii) responses of groundwater and surface water to rainfall; and (iv) rates at which groundwater recedes after the peak rains end.
- Guidance regarding practical matters such as: (i) planning and designing water supply infrastructure; (ii) construction methods and temporary works; (iii) supervision of contractors; (iv) procurement and contract management; (v) costing and pricing; (vi) health and safety; (vii) operation and maintenance; and (viii) information that is generalised and can be adapted at local and national levels.

What do policy makers need?

For us as policy-makers we need:

- Clear guidance on our water and land resources, including: (i) understanding of availability, and how the water balance is altering; (ii) the ability of our water resources to act as a buffer during the dry season when variability occurs; and (iii) the quality of our water resources and how it is changing.

We also need to have:

- (i) An understanding of water storage, renewable water resources and safe levels of abstraction. We have abundant rainfall, but this will only benefit us if we have adequate surface water storage.
- (ii) relative demands from different industries – mining, agriculture, energy;
- (iii) The economic value of long term monitoring;
- (iv) Causes of post construction attrition;
- (v) Operation and Maintenance costs, as there is often inadequate routine O&M to sustain services;
- (vi) Revenue generation, given the need to generate sufficient revenue through tariffs to cover recurrent operating costs; and
- (vii) Environmental issues, as services are not designed to cope with water surplus in the wet season and water deficit in the dry season.

So how can engineers help us?

I would argue that you give us more of what you are good at – good science, research and design, high quality design and construction, but with a greater focus on building individual and institutional capability. You also need to provide clear guidance to non-specialists, implications of your recommendations. You need to involve practitioners and policy makers in the science of your field, working with others so they understand the importance of good engineering and its value to Sierra Leone.

You need to produce clear relevant publications that demonstrate the importance of engineering, but also the importance of **inter-disciplinarity**.

There is no doubt that to deliver water supply and sanitation services, engineers will need to work closely with many others – economists, financial experts, hydro-geologists, environmentalists and non-specialists.

For example, there is no point in building new water supply infrastructure if it is not economically viable. This could also suggest that we are redesigning for communities ‘Rolls-Royces’, when all they may need are ‘Toyota Corollas’, simply because we did not consult the people to know their preferences for supply and payment options, and their abilities to operate and maintain the facilities.

Freetown requires multiple options studies to be undertaken to identify the most viable engineering solutions for the future. Engineers will need to design these options and economists will need to cost them so decision makers have the best information available

Some important Do's for our Engineers

Lastly let me propose the following to you as principles that should guide your work in the WASH sector:

1. Engage stakeholders early when planning and designing new infrastructure. Talk to the people that will use the services;
2. Build trust with your stakeholders, so they understand the infrastructure they will receive and are willing to pay for it;
3. Use appropriate communication methods;
4. Build relationships between designers and contractors. Projects will more likely be delivered on time and on budget if both groups collaborate;
5. Ensure professional standards of design and construction throughout; and
6. Plan post construction requirements from the outset. Do not wait until infrastructure has been constructed.

It is only when you observe these principles that your work will have been done and your contributions to the sector will drive our water security agenda.

Conclusion

This presentation has been shared in 2 parts. The first addressed the question of water security and why it is important for Sierra Leone's socio-economic development. A key message is that Sierra Leone's water resources can be harnessed for our socio-economic development. This will in turn improve our resilience to, and ability to deal with, natural disasters when they unavoidably arise.

The second part narrowed it to the management of our water resources and our water supply and the role that is expected of the engineering fraternity. It is only through a more positive approach to project design, construction, supervision and post construction support that engineers can

contribute to improved livelihoods and our collective development.

I have no doubt that there are many here who will throw the ball back to Government. I intend to lead that challenge. In line with the National Water and Sanitation Policy's intent of increased local participation, and the National Local Content Policy, I will soon engage my Colleagues in Cabinet on the need to include local firms in all water supply projects, as partners to international firms. This is the surest way to build local capacity and internalise some of the benefits of our water supply and sanitation interventions.

I warmly welcome your own suggestions on how as a nation we can help build the capacity of the engineering fraternity to meaningfully participate in the many projects that are coming up in the water sector. **We will do our part; it's your turn!**

I thank you and wish you successful outcomes from this Conference, and look forward to suggestions to my Ministry.