



Partners for Water and Sanitation

Note on project reports

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Partners for Water and Sanitation

Enugu: WaterAid EC Water Facility, Nigeria

**Report detailing project management and
implementation of fast-tracking support options**

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Abbreviations

WATSAN – Water and Sanitation
 WASH MC – Water, Sanitation and Hygiene Management Committee
 RUWASSA – Rural Water Supply and Sanitation Agency
 SSG – Secretary to the State Government
 STU – Small town Unit
 STWSSD – Small Towns Water Supply and Sanitation department?
 WCAs – Water Consumer Associations
 LGAs – Local Government Areas
 EUWF – European Union Water Facility
 PfWS – Partners for Water and Sanitation
 FMA&WR – Federal Ministry Agriculture & Water Resources

Executive Summary

Partners for Water and Sanitation (PfWS) is providing technical support to WaterAid Nigeria and Enugu small towns water supply and sanitation unit in the Enugu State European Commission Water Facility (ECWF). The ECWF support project is helping to improve access to water and sanitation in six small towns of three local government areas (LGAs) of Enugu state (Igbo-Etiti, Nkanu East, and Udenu). The visit forms the second part of the PfWS support in 2009; the first being a desk based technical review of the WaterAid commissioned hydrogeological survey (McWilliams and Merrin, 2009), which was completed prior to the visit to Enugu. Therefore, this document represents an overview of the in-country activities the team has been involved in; bringing together the recommendations from the hydrogeological survey together with the key aspects learnt from the Enugu visit as part of a redefined project plan.

The PfWS visit to Nigeria took place between 17 and 23 August 2009. During this time, workshop sessions and meetings were held between the Enugu state project team and the PfWS team. Presentations were delivered by the Enugu team on the existing project structure, the timetable for delivery and proposed actions to deliver the outputs. Subsequent workshops facilitated by the PfWS team highlighted key areas of concern, both relating to the overall project structure and the technical data and its analysis needed to underpin correct project management decisions.

A redefined project plan was suggested in which a four box model was outlined: Concept – Planning & Design – Implementation & Delivery – Operation & Monitoring. Existing actions from the Enugu project were included within these sections and the need to establish an overall project co-ordination role was highlighted as a requirement.

Some key data omissions that had been previously overlooked by the project team were also included in the workshop session outputs. In particular, the need for collection and analysis of reconnaissance data was highlighted, to include most importantly a thorough and detailed analysis of the hydrogeology of the three LGAs in Enugu state before any decisions were made to drill boreholes for water supply. Failure to recognise the importance of the reconnaissance activities is seen as a major factor that could result in project failure.

The structure of the first part of the report is chronological and details the meetings, presentations and workshops that took place within the first few days of the visit. The initial review of the project is then transposed into the suggestions for redefinition of the plan and the detailed recommendations set out in Section 5. These have been brought together based on the experiences the team has had in visiting Enugu, the information which they received and their own interpretation and professional opinions. It is hoped that these could now be used to guide the project and aid in the development of a robust action plan.

Ultimately the PfWS team believe that fast-tracking of the project is not the solution. Instead, redistribution of available resources to the right activities and tasks, to avoid delivering unsustainable assets or inaccurate data, should be given precedence.

There is still a good deal of work to be done in the interpretation of the 'right' task, which the team also believe has to be done in Enugu state with the right level of support and guidance. It is hoped that this activity will result in the production of an action plan and if done correctly, this will hopefully aid future projects which are managed in this way to avoid similar stagnation and wastage of valuable resources occurring in the future.

1 Introduction

1.1 Background and terms of reference

Partners for Water and Sanitation (PfWS) are providing technical support to WaterAid Nigeria and the Enugu small towns' water supply and sanitation unit (STU) as part of a European Commission Water Facility (ECWF) project. The ECWF support project is helping to improve access to water and sanitation in six small towns of three local government areas (LGAs) of Enugu state: Igbo-Etiti, Nkanu East, and Udenu.

Enugu state in south-east Nigeria is known for its very complex geological terrain and sourcing water for communities is a huge challenge. The ECWF support project is designed to achieve sustainable access to water and sanitation for over 200,000 inhabitants of the selected communities of Enugu state, and WaterAid Nigeria is the main implementing partner for the project.

Due to constraints, such as limited project resources and time, the ECWF team is determined to ensure effective investment of funds and timely delivery of infrastructure; Partners for Water and Sanitation is providing technical expertise to help this objective. The work of PfWS has been completed in two phases:

1. A review of a hydrogeological "baseline" survey of the three LGAs in Enugu state which was completed in 2009 by a Nigerian consultant (De-Hilcon International)
2. Appraisal of existing project management (PM) / implementation plans and recommendations for "fast-tracked" PM options leading towards delivery of the required infrastructure within the available time.

Phase one was completed in August 2009 (McWilliam & Merrin, 2009) and the report from phase one forms an important reference document that was used within the second phase of the work.

Two partners provided support for the second phase of work by visiting Nigeria from 17th to 23rd August 2009. During this time, an appraisal of the existing project management arrangements was made along with detailed discussions about the geological and hydrogeological setting for the three LGAs in Enugu State and necessary actions required to improve the conceptual understanding of the availability of water resources. Details of the various meetings and workshops that took place during this visit can be found in Appendix 1 of this document and a summary is included in section 1.3.

As set out in the terms of reference, the required deliverables for this visit were to deliver workshop sessions on:

- a. The project activities, considering the installation of infrastructure with regard to terrain, time and cost
- b. The project management structure and its effectiveness, in line with the results of activity a) detailed above
- c. A revised project management and implementation plan, in line with the results of activity a) above

A summary report is also a deliverable from this phase of work and this document presents the findings from the visit.

The UK Partners who made the visit to Nigeria to contribute to this process and summary documents are Phil Merrin (Groundwater Manager) & Neil Walker (Water Engineer) both of United Utilities (water, wastewater, and Power Company) and from hereon referenced as the Project Team, or by the abbreviations PDM and NW. Other key personnel that are referenced within this document are as follows, with the initials used hereon:

Gabriel Ekanem (GE) –Country Manager Nigeria, Partners for Water and Sanitation (PfWS)
Clement Chigbo (CC) – State Programme Manager (Enugu), WaterAid Nigeria
Oji Ogbureke (OO) – Head of Programmes, WaterAid Nigeria
Alaba Ogunsanjo (AO) – Programme Coordinator, Wateraid Nigeria
Joe Lambongang (JL) – Country Representative, WaterAid Nigeria
Rebecca Scott (RS) – Project Manager PfWs, WEDC
Nick Bundle (NB) – Wateraid, UK

Acknowledgements

Phil Merrin's former colleagues, Jeff Davies and Alan MacDonald of the British Geological Survey are thanked for their helpful discussions on the hydrogeology of SE Nigeria and also kind permission to use some of their figures and diagrams within this report.

1.2 Information and preliminary work prior to visit

A number of sources of information and data were collated by the Project Team prior to the visit to Nigeria. These were obtained both from colleagues at Partners for Water and Sanitation, Water Aid and also from references that were known of and that were found independently. Bibliographic references for reports and a summary of other reference information are listed in Appendix C.

In addition to collation of reference material, some activities were completed by the Project Team in order to facilitate the trip to Nigeria. These were as follows:

15 July 09 – Meeting between Rebecca Scott and the Project Team to outline the terms of reference and project needs, United Utilities, Warrington

23 July 09 – Project Team meeting (at UU offices, Penrith) to review terms of reference, define requirements of visit to Nigeria and understand the relationship between federal and local government departments, United Utilities, Penrith

28 July 09 – Teleconference between Neil Walker, Rebecca Scott, Gabriel Ekanem and colleagues from WaterAid. The aims and results of this teleconference are detailed in 1.3 below.

13 August 09 – meeting between Phil Merrin and Jeff Davies (at British Geological Survey offices, Wallingford) to review geological/hydrogeological data and information to assist with project requirements.

1.3 Summary of visit itinerary (provided by WaterAid)

A preliminary itinerary was provided by WaterAid prior to the visit. This identified that there would be two days of workshops (Tues 18th & Weds 19th August) in which the project plan and hydrogeological issues would be discussed. On the 19th August, it was expected for the Project Team to facilitate workshop sessions and to deliver recommendations for “project management and options for fast tracking”.

On Thurs 20th August, meetings with local Enugu State government officials were planned and a field visit to one of the small towns.

On Fri 21st August, further discussions were planned with WaterAid and the STU, followed by a project de-brief with the WaterAid Country Representative.

On Sat 22nd August, it was planned to conclude the visit with a debrief session with Partners for Water & Sanitation and devise a follow up plan for the project.

The exact itinerary did change from the original details described here and these can be found in Appendix A to this report.

1.4 Pre-Visit Teleconference

This took place on Thursday 28th July and allowed the Project Team to speak directly with those involved in the Wateraid EC Water facility project in Enugu state Nigeria.

Despite continual technical difficulties in maintaining connections with the participants there was a good deal of information transferred in this initial discussion. Those involved in the call were NW, GE, RS, CC, NB, & AO

The content of the call was steered towards questions which the Project Team had prepared. GE started by covering how he saw the involvement of the PfWs team, and the production of complimentary reports and an in country visit could provide the momentum required to re-start and focus the project, which had stalled for two Years.

NW then raised several requests and questions which included:

- Requested information to aid the teams understanding of the numerous Governmental and NGOs involved and how they interacted.
- What data are available for review and how confident are the group with the accuracy and reliability of such data. Also who has this information
- What implementation planning has been completed to date?
- Request better understanding of the role of the NGOs in delivering the project.
- How does the work in Nigeria feature as part of WaterAid's wider programme in sub-Saharan Africa

CC outlined a good deal in response to these requests providing an insight into where the project was in it implementation phase, and that some activities had actually been completed. He also gave comment on WaterAid threat to withdraw from the project which had placed greater pressure on the state to engage with its delivery and subsequently had seen increased support from the Federal Ministry of Agriculture and Water Resources.

After CC had provided comment on the requests, others involved the in call notably NB and GE afforded support with obtaining information and available data which RS noted and agreed to follow up.

Overall the value in this call was not purely beneficial in highlighting information which would be useful pre-visit, but provided perspective for the Project Team and enabled them to formulate an approach to the project prior to arrival. It may have been difficult to orchestrate but it was certainly useful.

1.5 Structure of the report document

This report is presented in the following format:

- Section 2 provides a review of the existing project management and implementation activities. The information discussed in this section was obtained primarily from the workshop session held in Enugu on Tues 18th August. A summary of the presentations delivered by WaterAid and the STU Coordinator are outlined, the perceived expectations of the outcome of the workshop presentations from the attendees and a review of the further discussions that were held later on the same day.
- Section 3 provides an outline of the workshop sessions delivered on Weds 19th August in Enugu: Project management suggestions and reconnaissance techniques for finding water were outlined by the Project Team.
- Section 4 highlights the key considerations for the revised project implementation & management plan (PIMP).
- Section 5 provides details of recommendations that have been made following the visit by the Project Team.

2 Review of existing project management plans & implementation activities

2.1 Sectional Overview

This section summarises the relevant meetings and workshop sessions that took place on Tues 18th August in Enugu. These are as follows:

1. Meeting between Project Team, Partners for Water and Sanitation, WaterAid – WaterAid offices, Enugu
2. Presentation by Clement Chigbo - State Programme Manager, WaterAid - Workshop session with STU representatives
3. Presentation by STU Co-ordinator - Workshop session with STU representatives and other local government officials

Therefore, the purpose of Section 2.2 of this report is to document the relevant points and discussion that took place on this day. Section 2.3 details the expectations from the workshop attendees that were acquired from a round table question session. Section 2.4 summarises the entire day of discussions and raises some pertinent questions that were taken forward into the next workshop session on the following day.

2.2 Meetings and presentations discussed

2.2.1 Meeting: Partners for Water and Sanitation, Project Team, WaterAid (WaterAid office, Enugu)

GE introduced the Project Team to WaterAid.

The main details from this meeting that are relevant to this report are as follows which includes some key WaterAid objectives. Comments by WaterAid staff are made with the relevant abbreviations of CC and OO as appropriate.

- Partners for Water and Sanitation are the strategic partners for this project
- De-Hilcon consultants have already completed geophysical surveys in the three LGAs within this project and this consultancy work is available
- WaterAid/STU now need to understand how the objectives can be delivered within the timescale
- There have been significant delays within this project, some of which are related to slow release of funding streams from within the Enugu State government.
- Consequently, the project now needs to aim for completion within the next two and a half years (i.e. by March 2012)
- The baseline survey on the population for the three LGAs has been completed, including an appraisal of the existing sources of water within the communities. The rate of growth in the population is assumed to be between 2.8 and 3%.
- The project funding availability is likely to constrain the water supply schemes that are expected to be completed within this project.
- It is intended that this project will demonstrate a water supply scheme model that can be replicated by state/federal government; the processes to deliver water supply and sanitation schemes in Enugu State are considered very important by WaterAid. Therefore, the effectiveness of this project in Enugu state is critical.

- OO: This is a relatively simple project and WaterAid's main responsibility is to act as a facilitator with the STU as the main implementer of the activities. WaterAid co-ordinate relationships to ensure that what needs to be done is completed.

Relevant Questions

NW: if sufficient water was not available to meet the required demand scenarios, what are the implications for WaterAid?

OO: this would not be considered a failure as efforts could then be focussed on bringing water from other areas further afield, for example, using pipeline transportation.

GE: Are there likely to be any political ramifications with the EU if the project did not deliver infrastructure?

OO: It is better to achieve a project that defines needs and feasibility rather than build infrastructure.

Following this meeting and the subsequent meeting with the Hon. Commissioner for Water Resources of Enugu State, the workshop session commenced at the hotel.

2.2.2 Clement Chigbo - State Programme Manager, Enugu (WaterAid)

At the workshop, GE introduced the members of the Project Team to members of the STU, LGA WASH, and State Ministry.

Summary of presentation by CC

The objectives of the project were outlined:

- Access to water and sanitation (WATSAN) as part of Millennium Development Goals
- Improved capacity of small town WCAs in water resources management
- Increase funding for water and sanitation services
- Provide an inclusive approach in water and sanitation services, e.g. for the visually impaired.

A short history of the project so far was outlined:

- Inception workshops were held in September 2008
- Budget tracking and monitoring held for state representatives
- Some training to STU/LGA staff was given in November 2008
- Strengthening of the LGA WASH structure took place – to make it more effective/efficient
- A baseline survey of six small towns was completed – examining facilities and social structure of the communities
- The capacity of the STU has been built and a steering committee for the project has been set up
- Ongoing activities include: training of WCAs, improving the capacity of teachers to deliver WATSAN training
- Future challenges to the project include: Funding/payments and a lack of office space to work with by the Project Team
- Next steps include: scheme design, environmental impact assessment, construction, monitoring and evaluation of the project

A copy of the full presentation delivered by Clement Chigbo (CC) in this workshop can be obtained from WaterAid.

2.2.3 STU Coordinator

- STU was formed in March 2008 with the appointment of key officers. Its main objective is to achieve WATSAN for small towns in Enugu state.
- WaterAid have provided funds to implement projects
- The WASH was established by the STU
- The hydrogeological baseline survey was commissioned by the STU
- The geophysical survey was completed between 01-20 June 2009
- The design of the water supply scheme was completed between 22 June and 16 July 2009
- GPS units were purchased in June 2009
- Contract awards are due to take place in July and August 2009
- Review of the Local Development Plan (LDP) data is due to take place between July and September 2009
- A three month period of deep borehole construction is scheduled between September and November 2009

Questions/Discussion

OO: What is the purpose of the WASH co-ordinators and how can they influence the schemes? There is frustration from WaterAid that the WASH unit coordinators do not appear to be contributing to or facilitating projects. WaterAid also want to see the methodology of how the design was achieved and from what available data.

2.3 Workshop expectation from LGA and STU

Prior to the presentation by CC, the members of the LGA WASH, STU, and state Ministry staff outlined what they hoped to achieve from the workshop. These objectives are summarised as follows:

- A concrete plan of action for the project
- Information on water treatment
- What is the STU's involvement in this project as stakeholders?
- Implementation plans for the project
- Fix a date for the commencement of borehole drilling
- Plan and scale up activities
- More focus on activities to supply water and protect the environment
- Details on sustainable water supplies
- The feasibility of the project plan
- A summary of the work completed thus far on the project
- Understand the geophysics/hydrogeology and the implications for the project
- A better understanding of project management
- How to find solutions to problems within the project

These expectations will be discussed in more detail later within this report.

2.4 Summary & preliminary recommendations following first workshop session

The workshop sessions provided useful background information on the structure, timescales and actions that have been completed or that are planned. The main conclusions reached by the Project Team are summarised as follows which also include some preliminary recommendations:

1. **PROJECT STATUS.** It is apparent from the project structure and timescales that were outlined that some work has already been completed on the design elements of the WATSAN scheme (e.g. geophysical surveys) but that the interpretation has not been completed. This is a potentially dangerous position in that the success or failure of the water supply schemes (for groundwater solutions) will depend on a sound understanding and interpretation of the results of both the baseline hydrogeological report and the geophysical report.
2. **PROJECT COORDINATION.** No one person in the Enugu team is taking responsibility for leading and coordinating the project. Consequently, actions within the existing project plan are being pursued and completed without thought for what other actions in the project plan still need to be completed (e.g. contract awards for drilling of boreholes were due to be tendered in July and August 2009, but it was evident that the interpretation of the hydrogeological potential of the three LGAs had not been completed)
3. **SCHEME DESIGN.** There is a general feeling amongst the Enugu state team that the significant delays that have been incurred thus far can now be overcome by moving rapidly at pace to achieve the project deliverables. Consequently, attention to the technical detail that underpins the success or failure of the project (see 1. above) may be overlooked or not assessed in adequate detail. Furthermore, it was detailed in the workshops that the next steps within this project are to: conclude the design of the scheme and carry out an environmental impact assessment prior to construction of the infrastructure. No details could be provided on what impacts the EIA would be targeted at and without this attention, there is the potential for this activity not to achieve the desired outcome.
4. **SCHEME CONSTRAINTS.** The design of the water supply element of the Enugu WATSAN scheme is focussed on development of groundwater sources in the three LGAs. Whilst the possibility of groundwater sources is likely in two of the three LGAs (McWilliam & Merrin, 2009), there is a high probability that within Nkanu East LGA, suitable groundwater resources may not be available. However, a potential drilling site in Nkanu East has already been selected from the results of the geophysical surveys, (Alnaok Nigeria Ltd, 2009) but without consideration of other possible groundwater supply locations or technologies that may need to be progressed simultaneously. However, it is recognised that surface water options are being considered in this area (Clement Chigbo, *pers. comm.*)

5. **LINK BETWEEN POPULATION AND WATER AVAILABILITY.** When planning a WATSAN scheme such as in Enugu, a clear link needs to be made between population census data and the availability of water for supply. This forms an important part of the demand-responsive approach that WaterAid adopt. It became apparent from the discussions that this link had not been made and that the number of proposed boreholes required had not been referenced to the hydrogeological interpretation and had been taken directly from the EU grant application report submitted at the inception stage of the project. Without a defined understanding of the hydrogeological potential of each of the LGAs, it is impossible to state the number of water supply boreholes that would be required in order to deliver the required volumes of water. Furthermore, it is important to recognise that the level of service requirements and the decisions on the most appropriate technology for achieving the Enugu WATSAN objectives need to be made from within the Enugu team rather than through an external partner (such as Partners for Water and Sanitation) determining the need. Making this decision can only occur if the Enugu team are adequately trained (see 6 below).
6. **TRAINING.** It is not clear what training was delivered to STU/LGA staff in November 2008. The possibility of expanding any existing training programme to encompass project management, baseline survey data acquisition, geological and hydrogeological concepts, understanding the link between borehole performance, yield and community requirements which could form part of this or future projects for WATSAN in Nigeria and within WaterAid.
7. **PROCUREMENT OF EQUIPMENT & CONSULTANCY SUPPORT.** Numerous activities have been completed that have necessitated purchase of external consultancy support and equipment (such as GPS units). It is not clear for what purpose the GPS units were purchased, and procuring an equipment such as GPS needs to have a clearly defined need (e.g. locating existing water sources, geological mapping) which must be accompanied by full operator training. It is evident from the review of the hydrogeological baseline report (De-Hilcon, 2009) and the geophysical report (Alnaok Nigeria Ltd, 2009) that the available data has not been fully interpreted by the consultants employed by WaterAid. Data is expensive to collect and needs to be used to its maximum potential. From the reports that have been provided thus far, the Project Team remain concerned that sourcing water in parts of Enugu state (particularly Nkanu East) has not been appreciated. Without full interpretation and detailed analysis of the data, it is possible that some critical issues may get overlooked or ignored leading to project failure.
8. **WORKSHOP EXPECTATION.** The round table discussion showed that the Enugu team were expecting a wide range of outcomes following the visit of the Project Team. Some of the expectations were outside the remit of the terms of reference that were provided to the Project Team, which indicates that the objectives of the Partners for Water and Sanitation involvement had not been fully understood by the Enugu team. It was clear that there was an anticipated element of training that was due to be delivered by the Project Team (e.g. on water treatment) rather than the transfer of knowledge and skills as per the original terms of reference.

These issues will be brought together into the redefined project plan.

3 Presentations Workshops & Discussion Sessions

3.1 Sectional Overview

This section essentially covers the presentations by the partners and workshop sessions that took place on Wednesday 19th August in Enugu. Following on from the introductory sessions held the previous day which provided the team with a more in depth understanding of the project, allowing time overnight for them to prepare. This was the teams opportunity to respond to a lot of the questions they had, whilst still in country and in response to the information which they had received. The agenda for the day was as follows;

AGENDA:

AM - Presentations

1. Introducing the Partnership – GE
2. Project Management – NW
3. Sourcing Water & Reconnaissance Techniques– PDM

PM – Group Session and Discussions (lead by Partners)

4. Redefining the project against a phased plan - NW
5. What is the plan of action? – NW
6. Hydro geological & Geophysical feedback – PDM
7. Road map Discussion and Development 'Lets Thrash it out' – NW

To this end, each of the sub sections in Section 3 of this report will document the relevant points from each activity on the agenda of the day.

3.2 outline the introductory presentation on the partnership delivered by Gabriel Ekanem.

Section 3.3 details the presentation given by Neil Walker which was specifically aimed at addressing the Project plan, with section 3.4 outlining the workshop headed by Phil Merrin demonstrating a wide range of techniques used in sourcing water. Section 3.5 covers the various question and answer sessions which took place during the afternoon, culminating in the road map discussions. The latter part of section 3 is a summary to extrapolate the key points.

3.2 Introducing the Partnership

The content for this presentation included:

- The Partnership
- The Challenge
- The Capacity Building Pyramid
- Our Objectives
- Partner Interest
- Lessons to Date

3.3 Project Management

This presentation was in direct response to what items had been raised during the workshop on the 18th August during the review of existing project management planning and associated activities. And a simplistic project methodology was introduced to the group.

The outline for the presentation was as follows;

1. Coordination of the EUWF project
2. Redefinition of the project
3. The Project Model
4. Role definition & Accountability

The overall coordination of the EUWF was brought into question and the suggestion made that it may be necessary that improvements be made at this level in the coordination of project delivery. This implies that the issue may actually not be in the implementation of the project in Enugu but in fact with the high level coordination.

Even so, it was also stressed that there is the need for overall coordination and management at a state level of the project and that as a general rule projects should have various tiers of control, with an overall coordination role at its head.

A Phased approach to delivering projects was then introduced and discussed. The phased approach is highlighted in Figure 1.

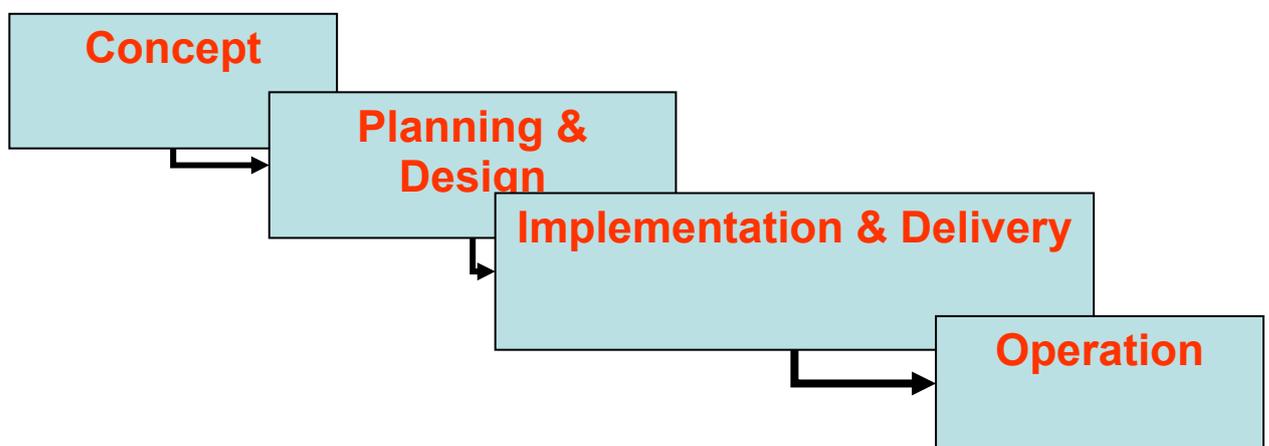


Figure 1 – A Basic illustration of suggested project phases

The slides which followed then covered each item under the following headings.

Conceptualisation

- Outline the objectives of the project
- Establish the terms of reference (TOR's)
- Identification of interacting groups
- Proposed timeline
- Coordination

Planning & Design

- Data gathering & Analysis
- Decision making
- Task Definition
- Detailed design
- Funding applications

Implementation & Delivery

- Resource allocation
- Procurement
- Process adoption & initialisation
- Appointment of contractors
- Monitoring

Operation

- Adopt standard operating procedures
- Training
- Monitoring
- Feedback & Further consultation
- Asset defects

Task categorised against the phase plan will lead to...

- Better coordination
- Clearly defined relationships between activities
- The development of guidelines
- Demonstrated Performance
- Data capture and Exchange

What Are Resources?

- Tools
- Expertise
- Funding
- Labour
- Vehicles
- Other equipment
- Time

Outcomes....

- Apply the four box concept
- Redistribute activities against phases
- Confirm ownership and roles

Essentially this presentation was aimed at trying to highlight some fairly rudimentary project skills which could be applied to this (and other) projects to steer and aid success.

3.4 Overview of reconnaissance techniques, finding water, hydrogeology concepts, project activities

The workshop sessions titled "*Sourcing Water*" focussed on a number of key requirements for developing a successful groundwater water supply project in Enugu state:

1. Reconnaissance activities as a fundamental part of development of a conceptual model
2. An appreciation of different types of hydrogeological environments found in Enugu state
3. The concept of triangulation for sourcing of water
4. Examples of how geophysics can lead to an understanding of the hydrogeological environment
5. The importance of pumping tests to ascertain the sustainability of the groundwater resource
6. Discussion of the recommendations relating to the baseline hydrogeological survey report (McWilliam & Merrin, 2009) for the Enugu state project.

RECONNAISSANCE

Providing good topographical, geological and hydrogeological maps, some of which may already be available in country or that may require construction from first principles where data does not exist

1. Utilisation of existing data sets (e.g. from previous projects, institutional data and expertise from within Nigeria) that can be transferred into the Enugu project. Such data could be borehole drilling logs, pumping test analyses/reports, seasonal water level data, information on similar geological environments (e.g. Davies & MacDonald, 1999) and these could be sourced from universities, Geological Survey of Nigeria, NGO's, consultancies, borehole drilling companies and possibly organisations from further afield such as the British Geological Survey.
2. Collection and interpretation of geophysical data sets (remote sensing, EM34, resistivity) as part of the baseline data collection to make informed decisions about the groundwater potential of the LGAs
3. The need to consider alternatives to groundwater (particularly in Nkanu East) where the success of boreholes delivering the required yields is uncertain

A series of maps were presented to illustrate this process and each was explained showing the type of information and data that could be collected as part of reconnaissance activities. One such map is illustrated in Figure 2 which shows the groundwater potential of a study area.

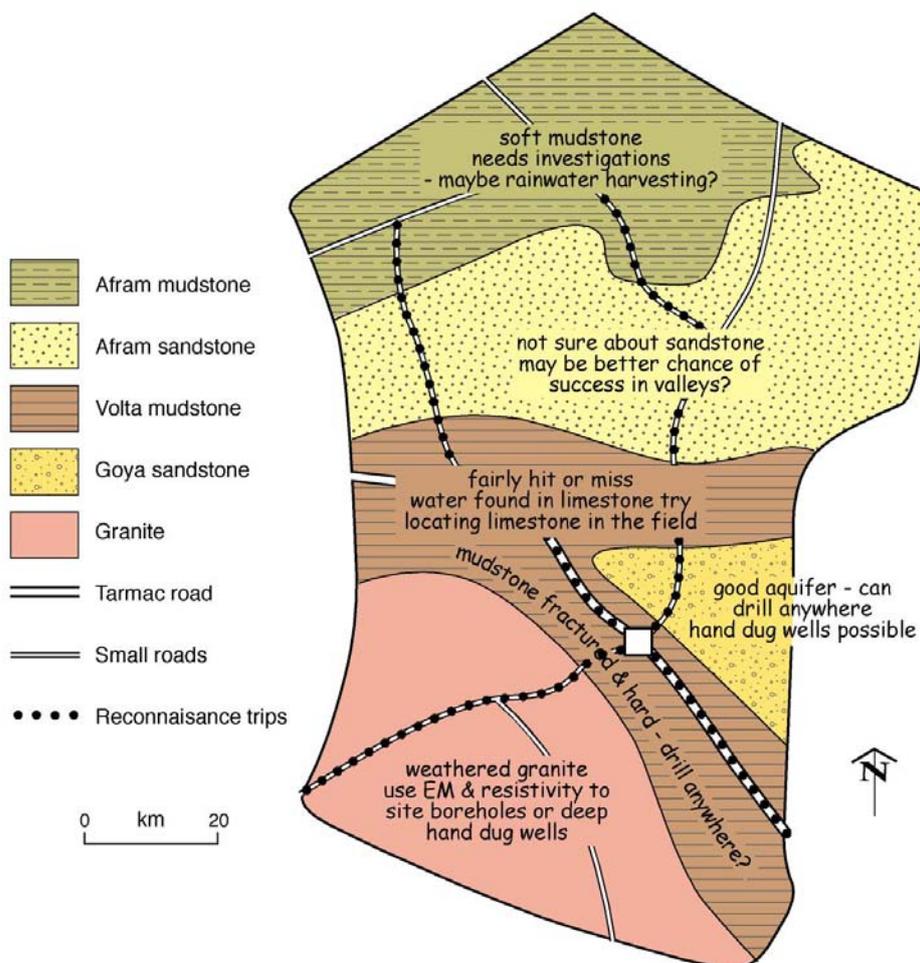


Figure 2 – Indication of groundwater potential following reconnaissance activities across a study area (from MacDonald, Davies et al, 2005)

HYDROGEOLOGICAL ENVIRONMENTS

Concepts of geological environments and their hydrogeological significance were explained to the group using generic examples and also making strong reference to the work that was carried out in Benue State (Davies & MacDonald, 1999). The link between the hydrogeology and the level of detail required for siting boreholes was made.

For example, in Udeno and Igbo Etiti LGAs where the hydrogeology is fairly well understood (Ajali Sandstone), complex siting techniques involving detailed geophysical surveys may not be necessary once the reconnaissance activities and data collection/analysis exercise are complete. However, there are some significant gaps in the understanding as highlighted in McWilliam & Merrin (2009) and these still need to be addressed.

In Nkanu East LGA, the complex geology which mainly comprises strata of low permeability mudstones with possible igneous intrusions, means that groundwater storage potential is low and hence has limited potential for resource exploitation. This means that simple siting techniques alone are not enough in order to secure usable quantities of groundwater. If resource development is to take place, using a sequence of techniques will be necessary in order to make accurate decisions and this will involve more than just simple reconnaissance methods. More detailed fieldwork, including interpretation of remote sensing data (aeromagnetic), geophysical surveys and possibly coupled with test boreholes will be required. Successful examples of locating groundwater in low permeability rocks from the Benue Trough sequence can be found from the work carried out by the British Geological Survey in at Oju/Obi, Davies & MacDonald (1999), MacDonald *et al* (2001), MacDonald, Kemp *et al* (2005) and these processes and techniques are valid here.

Figure 3 illustrates a range of possible scenarios that were discussed at the workshop when deciding on the scale of investigation required. The issues were discussed during the workshops, using examples from the geological sequence of Enugu State.

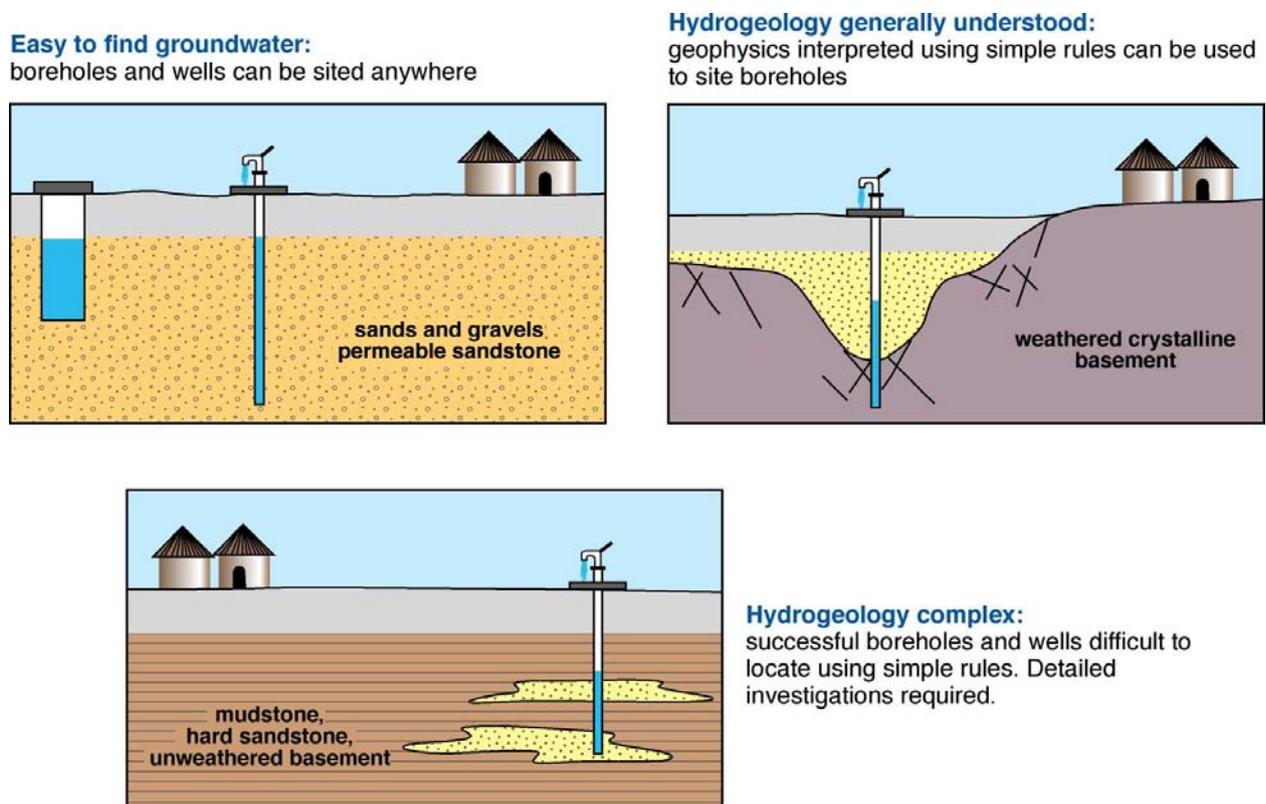


Figure 3 – Examples of different geological environments and siting techniques required (from MacDonald, 2001)

DATA TRIANGULATION

The workshop was introduced to the concept of data triangulation and the benefits that this approach would have on the quality of the survey work. Figure 4 illustrates this approach of the need to have good maps, data collected from field surveys through observation and also the geophysical method survey results to corroborate the existing evidence. Removing any one side of the data triangle makes assessing the groundwater resource potential difficult in geologically complicated areas.

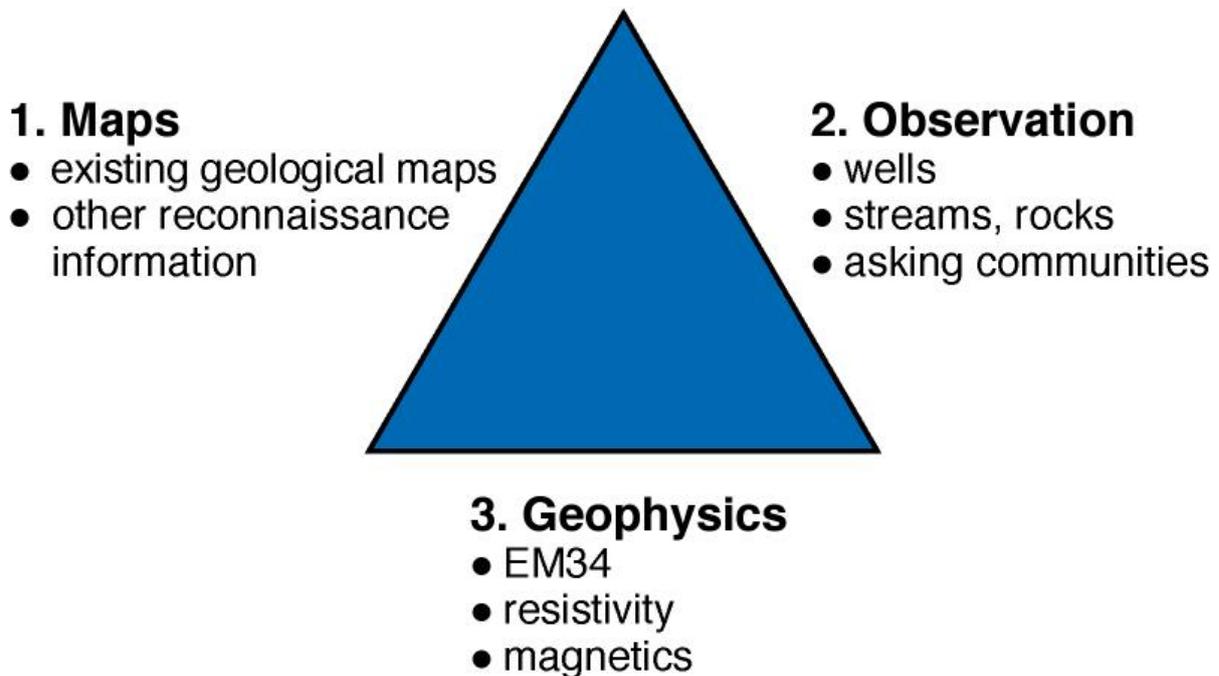


Figure 4 – The concept of triangulation using geological data (from MacDonald, Davies et al, 2005)

GEOPHYSICS

The workshop discussed using geophysics in order to understand the geological setting and hydrogeological potential. Examples were given of both resistivity and electromagnetic survey results and what these results would mean in the context of water supply investigations in Enugu State. Particular emphasis was given on the use of the EM34 technique and interpretation of aeromagnetic data to identify fractured zones within the bedrock and the location of igneous intrusions within the Awgu Shale. Here, borehole yields are likely to be highest and shows the importance of geophysics within the overall reconnaissance exercise.

A good example of the usefulness of geophysics data is given by MacDonald, Kemp et al (2005). They analysed the hydraulic properties of boreholes in the Oju/Obi area and found that the boreholes with the highest transmissivity were located where dolerite igneous bodies were present within the shale host rock; hence the importance of detecting such strata prior to drilling boreholes.

During this session, the results of the geophysical survey that had recently been completed by the project (Alnaok Nigeria Ltd, 2009) were discussed. This report had been made available to the Project Team on the previous day and a rapid assessment of its content had been made.

The report summarises a series of six resistivity (VES) surveys that were completed in the three LGAs; two surveys in each. The locations of each survey were highlighted, the results of the survey activity and the interpretation of the results. The report also details the borehole depths that should be aimed for at each of the locations, other than at one of the locations in Nkanu East.

In Udenu and Igbo-Etiti, boreholes depths of between 200 and 240 metres were recommended. For Nkanu East, only one location for drilling was highlighted and a borehole depth of 60 metres proposed.

The Project Team have a number of concerns with the survey results and recommendations made:

- a) No topographical, geological or hydrogeological maps were presented in the report and so it is impossible to understand where and why the locations for the VES surveys were selected.
- b) It is apparent that only six surveys were completed across the three LGAs. This means that the potential for locating usable groundwater resources has been restricted to these six points only. No justification for the criteria used to select these drill sites is given and therefore these results cannot be used to indicate usable groundwater resources. The geophysics must form part of the geological triangulation principle identified above because by themselves, the results presented in effect become meaningless. Potential locations for drilling of boreholes must be informed by the collation and interpretation of baseline data which has not been presented here.
- c) VES surveys cannot locate the presence of vertical fractured areas within the sub-surface and these are important water bearing horizons in the Nkanu East. VES is a suitable technique for Udenu and Igbo-Etiti LGAs but the results of the geophysics must be presented alongside the other reconnaissance data to inform decision.
- d) The results of the VES surveys must be coupled with other techniques (such as EM34 profiling) in order to establish a better understanding of the geology of the area again in conjunction with the reconnaissance data and observations.
- e) On the available data and information, the proposed borehole depths of 200-240 metres (Udenu/Igbo-Etiti LGAs) and 60 metres (Nkanu East) cannot be endorsed as part of this review. The data collection exercise must be improved in order to inform the decision to drill any borehole and the geology and hydrogeology must be given more credence.

PUMPING TESTS

A short section of the workshop was given to understanding the yield of groundwater sources and how important this is for predicting the sustainability of the resource. Figure 5a shows how water levels change during pumping (dependent on the rate of pumping and the physical properties of the aquifer) and Figure 5b illustrates how groundwater levels can vary seasonally and may lead to a false impression of the sustainability of a groundwater resource without a detailed understanding of the hydrogeology.

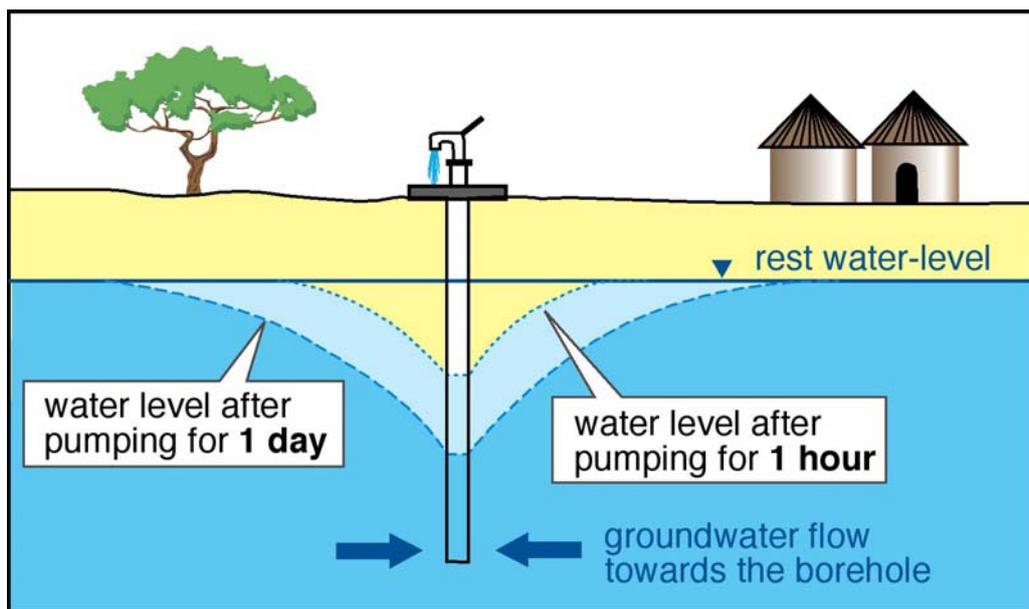


Figure 5a – Understanding how water levels can change during a pump test (from MacDonald, Davies et al, 2005)

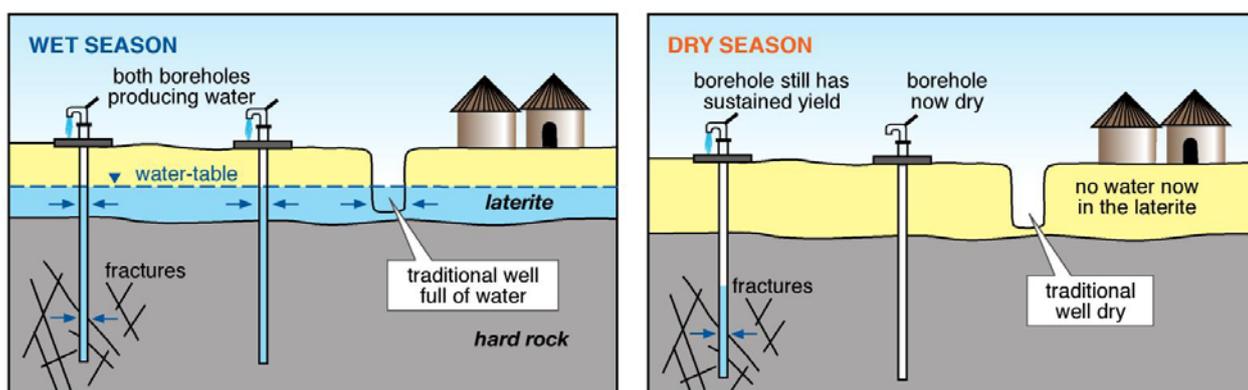


Figure 5b – Seasonal variations in water tables and implications for sustainability (from MacDonald, Davies et al, 2005)

3.5 The Q & A and Road Map Workshop

During the lunch break NW spent time realigning the current PIMP into a phased approach which would be used to prompt discussion in the later part of the day,

This was a lively and difficult session for all parties. The objective of the session was to consider the benefits of adopting the phased plan methodology which had been introduced earlier in the day. This was hoping to guide the group back towards more planning and design activities. The next goal of the day was to try and appoint specific ownership from the attendees in completing the currently listed tasks and agree some timescales. After some deliberation and assertion from key individuals in the room a 'Road Map' version of the PIMP was produced. (Appendix E).

3.6 Sectional Summary

The workshop session delivered by the Project Team provided suggestions for redefining the project plan and lead to a list of further activities that needed to be completed as part of the design phase before any implementation activities could commence.

The importance of collection and interpretation of data were introduced using hydrogeological concepts and these were illustrated within the context of examples relevant to the Enugu state project.

In particular, it was emphasised that:

- Decisions made throughout the project need to be made based on robust scientific observations, data and interpretation rather than qualitative discussion and assumptions.
- The proposed investment in water supply and sanitation projects in Enugu should be prioritised based on least cost/most benefit criteria.
- The suggestions for revisions to the project plan indicate that resources that were previously ascribed for implementation activities should be put back into the project in the design phase

It was suggested that there is a need to carry out simple cost analysis of the recommendations that have been put forward. Some assessment needs to take place by the Enugu project of what activities need to be carried out within the timescales and funds available. There is an increasing scale of cost of various levels of techniques used to locate groundwater resources:

- RECONNAISSANCE ACTIVITIES requires a significant time element to locate data sets, carry out activities and complete survey work, especially if specialist skills required (e.g. for the interpretation of remote sensing data). However, this phase of activity within the project is critical to understand the groundwater resource potential.
- FIELDWORK (data collection/geophysical surveys). Both of these activities require significant amount of time for experienced staff to carry out and interpret, and there may be a need for some training requirements. However, corroborating the conclusions of the reconnaissance survey is a necessary step in order to make accurate decisions about the availability of groundwater in a particular area.
- EXPLORATION BOREHOLES. The results of reconnaissance activities and fieldwork evidence that indicate groundwater resource potential can only be verified with the development of test boreholes. However, in geologically difficult environments, the probability of developing a successful borehole that will deliver the required/expected output is much more likely for a borehole than has been accurately sited using detailed reconnaissance and fieldwork data as opposed to one that has been sited without due consideration of the groundwater resource potential and so the costs of drilling become more justified (see Figure 6). The level of expectation from drilling test boreholes should be communicated to the Enugu project team prior to construction by WaterAid and their advisors.

Comprehensive guidelines relating to the activities required for reconnaissance, data collection and analysis which in turn form part of the overall concepts and principles relating to project planning, development and implementation can be found in Ockelford & Reed (2002). In particular, reference is made to the following sections in this book which it is considered are relevant within the context of this report to identify types of data that should be collected and how they can be used.

- 1.3 Background information and statistical analysis (relating to map data, water resources management data).
- 1.5 Survey information gathering for water resources, considering in particular the need to understand seasonal aspects of the availability of water and the types of features present
- 1.6 Surveys on settlements, e.g. gathering information on water points, types of water sources, water quality, pollution pathways, seasonal availability of water (sustainability indicator), successful/dry borehole locations, maintenance problems from pumped groundwater supplies, sanitation surveys
- 2.2 Information & data analysis (including 2.2.3 – Coverage targets and implementation capacity, 2.2.5 Water resources assessment). Within this, some key ideas are presented for derivation of conceptual models and what data are required.

MacDonald, Davies *et al.* (2005) also provides useful tools and advice for collection and analysis of water resources data to support the design of water supply projects.

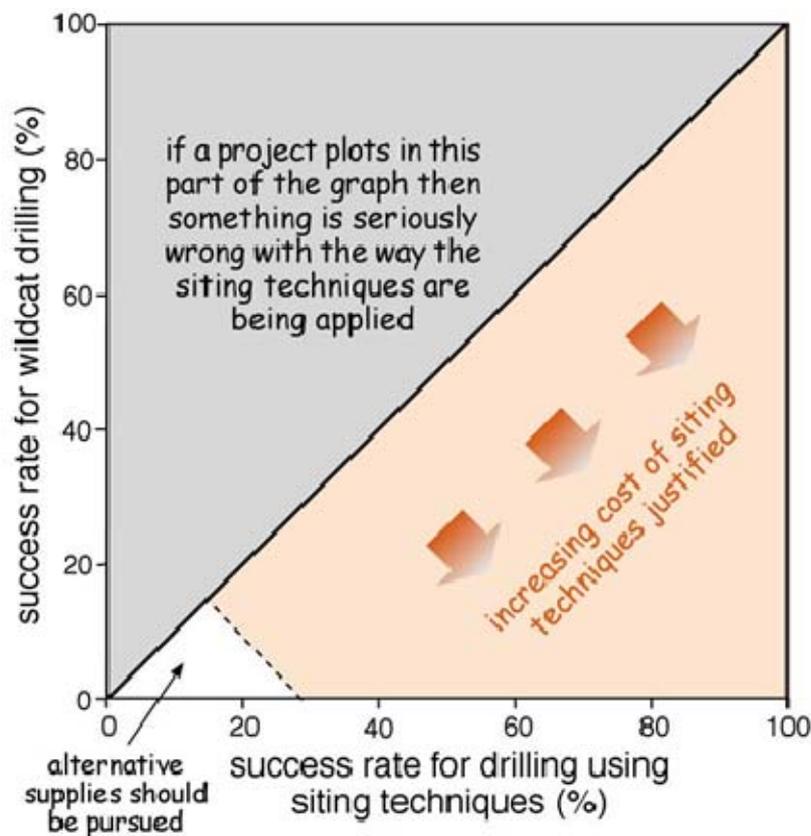


Figure 6 – Justification for borehole drilling using reconnaissance and siting techniques (from MacDonald, Davies *et al.*, 2005)

The workshop session on the preceding day in which expectations from the Enugu project team were discussed, indicated that there was a belief that the borehole development scheme could continue with the available information and data. The need for more detailed reconnaissance and interpretation of data in order to inform an accurate conceptual model was reinforced throughout the workshop session with a particular emphasis of the *sustainability* of the final scheme. In the context of this WATSAN scheme, sustainability relates to not only the community aspects (such as management of the infrastructure once the scheme is complete) but also whether the water quality and quantity is suitable for the required needs over time which is particularly important to recognise in areas with complicated hydrogeology such as parts of Enugu State

4 Redefinition of the Project Implementation Plan (PIMP)

4.1 Overview

Following on from the in-country element of support and guidance afforded by the PfWS team whilst in Enugu, this report also aims to provide some steer in aiding the redefinition of the PIMP. Section 4 will focus on this. However rather than regurgitate the vast amount of readily available material which exists on effective project management and implementation it will instead target specific areas which appeared to be in deficit within the project sphere and make suggestions for their remediation.

Section 4.2 makes constructive suggestions for the revised PIMP and highlights the failure modes of a project. Section 4.3 considers the factors governing the allocation of resources. Section 4.4 illustrates by means of flow diagram the minimum steps which need to be taken to avoid chronic failure, with section 4.5 illustrating the stakeholders of the Project coordinator and the interface with overall management structure. Section 4.6 is a brief summary.

4.2 Suggestions for the revised Project Implementation Plan

There is a need to ascertain exactly what the concept of the project is aiming to deliver. The following will dwell fairly heavily upon this point. If the primary objective is to construct boreholes and try and find water, the suggestions for the implementation plan would be to mobilise resources in the most effective manner with the available funding and drill boreholes. However, what is apparent is that with the complexities of the geology in Enugu state, this will not be the most effective use of those resources. This point has been highlighted many times by the need for an assessment of the geology/hydrogeology as part of reconnaissance activities. This is a reference to the preliminary recommendations in section 2.4.

It is suggested that this point be agreed with all parties prior to the furtherance or 'fast tracking' of any activity on the project.

It may also be prudent to note the following key reasons for failure on a project which includes:

- Insufficient attention to quality at the outset and during development
- Insufficient attention to the required outcomes, leading to confusion over what the project is expected to achieve
- Lack of communication with stakeholders and interested parties, leading to products being delivered that are not what the customer (consumer) wanted
- Inadequate definition and lack of acceptance of project management roles and responsibilities, leading to a lack of direction and poor decision making.
- Poor estimation of duration and costs, leading to projects taking more time and costing more money than expected.
- Inadequate planning and co-ordination of resources, leading to poor scheduling.
- Insufficient measurables and lack of control over progress, so that projects do not reveal their exact status until its too late
- Lack of quality control, resulting in the delivery of products that are unacceptable or unusable.

Considering the status of the EUWF project, many of these modes are present and perhaps exacerbated by political factors in the state.

Nevertheless, to avoid the realisation of the majority of the above failure modes, it is highly beneficial that a clear project management methodology be adopted which will only aid in the delivery of the outputs in line with the concept of the project. In this instance, it should be primarily focused toward data gathering, interpretation to inform decisions for borehole locations.

The revised PIMP should consider all the above failure modes and ask if suitable controls are in place to prevent them.

4.3 Resource Allocation and Cost Benefit Analysis - Ongoing Support

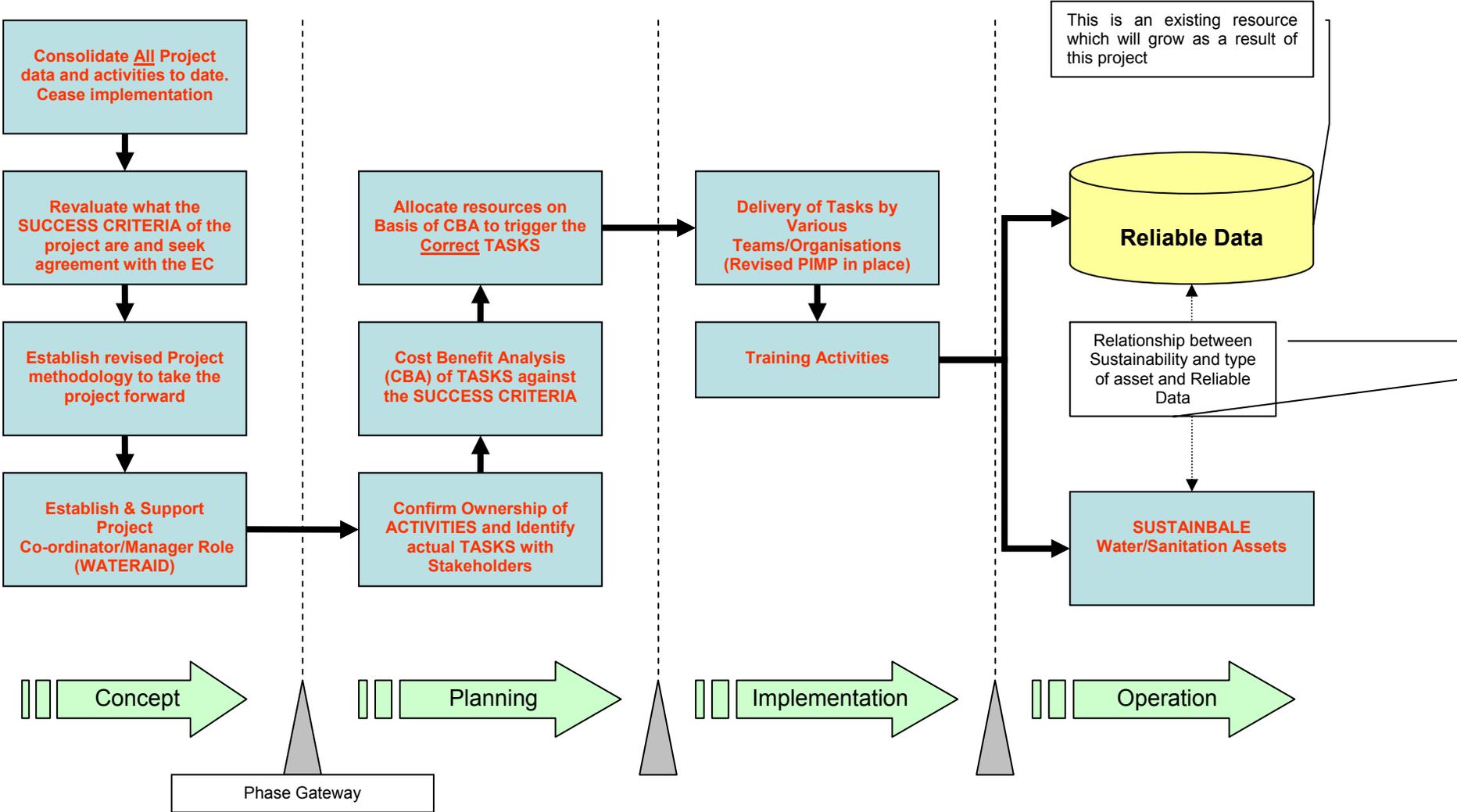
Whilst in country the development of a resource allocation tool was discussed. The basis of which would be the analysis of identified tasks and activities which have been identified on the project against their perceived benefit to the overall project which in turn can be presented as a proportion. This can be applied to all the tasks once identified and is a simple formula. It will invariably aid coordination of resources available to the project team, and can be appended as a single value which can be sorted on the PIMP.

This requires further work and could form part of further support which may be afforded to the team to allocate resources on this basis.

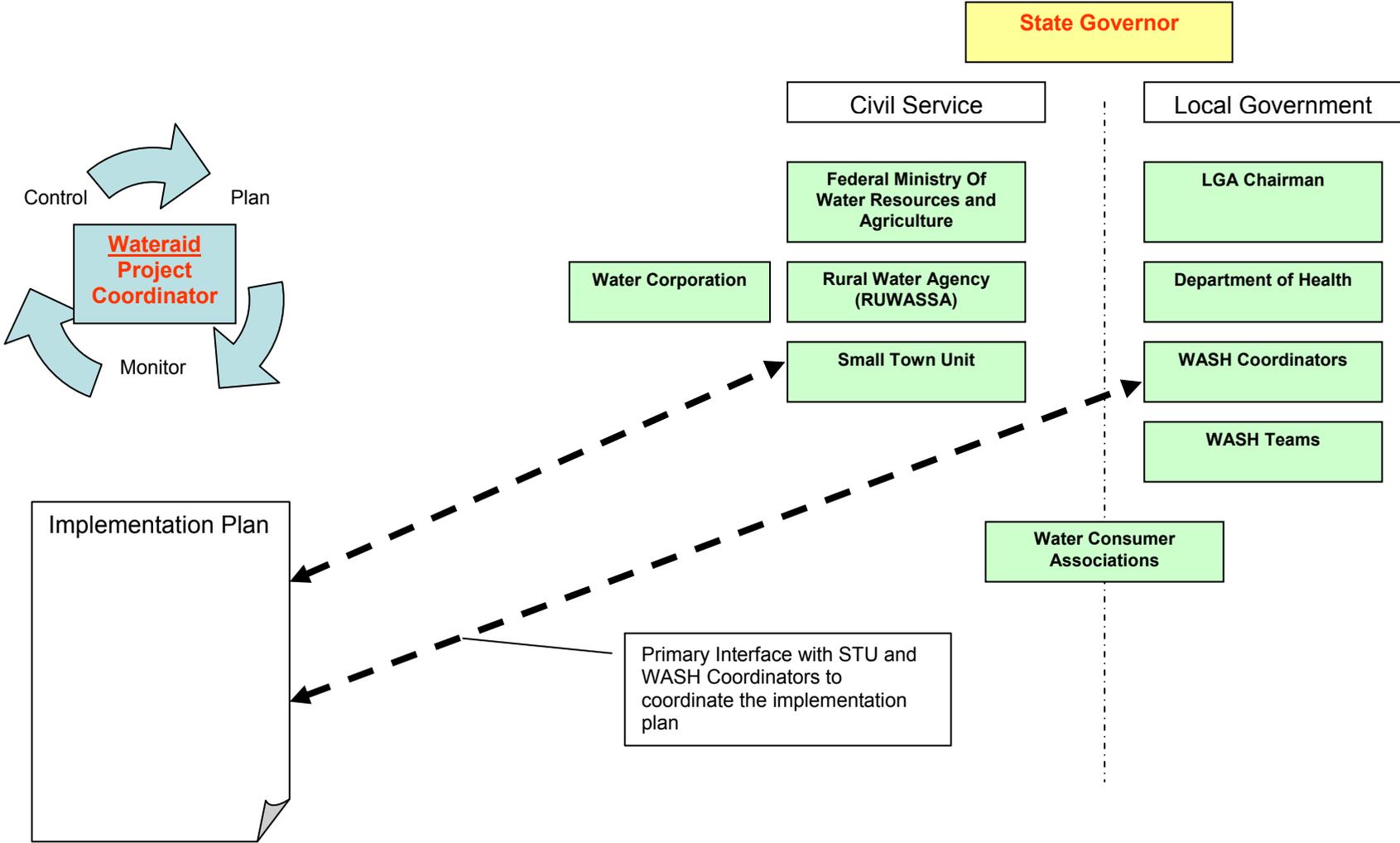
What is required is better definition of specific tasks under activities which in turn need to be agreed by the stakeholders. The PfWS team covered this whilst in Enugu as part of the 'Road Map' discussions and highlighted the need to appoint ownership to activities from the various organisations involved and in turn list tasks against them, and what resources are required to deliver them.

Once this has been completed and the success criteria for the project confirmed, the team will be able to develop a tool which will help in this area.

4.4 Key Steps flow diagram for project coordination using revised methodology



4.5 Project Management structure – With WaterAid (CC) allocating resources – people/ownership



4.6 Summary

Section 4 proved more difficult to produce than initially anticipated. The intention had been to give a good deal of project management information, and guidance around a proposed strategy to get the project back on track. But what soon came to light is that this information is readily available and can be accessed on-line and even from existing library sources which could give this advice. So on that basis the overall content was reduced to try and focus specifically on the project in Enugu and by doing so not mask the real message with generic mechanisms.

The section does begin to lead into the development of an action plan, which should really be the next stage and may well be where the partners can continue in it's development (especially with the analysis of tasks against the project)

5 Recommendations

The principal recommendations from the Partners for Water and Sanitation Project Team for the project are as follows.

DEFINE “WHAT IS PROJECT FAILURE?”

Whilst in country this answer would differ depending on who was being asked. This is a concept which needs to be agreed and is linked right back to the beginning of the project. If the project is about delivering a number of boreholes irrespective of whether or not they will produce a sustainable yield of water, then all resources should be directed as such to construction. However it is clearly not preferential to produce assets which hold no longevity for water supply purposes. Fast-Tracking of activities on planning and design will **not** aid this project. It appears to have stalled because of institutional issues and possibly lack of overall coordination and accountability. **Bypassing essential planning should not be an option when considering the real objective which is sustainable watsan schemes.** The fast tracking of implementation and delivery activities in this instance (for example, not gathering enough data to fully appreciate water resources potential) is likely to result in chronic failure of the project to deliver ‘sustainable water’ and squander precious resources in doing so.

REDEFINE THE PROJECT BASED ON WORKSHOP RESULTS

The workshops session clearly identified the project status and it was obvious at that stage the project needs new definition. Understanding the relationship between tasks and the delivery of activities is essential. It is recommended that a phased approach be taken to the project, and rather than trying to complete a long list of activities and tasks, aim to complete each phase in progressing the project along this phased plan, thereby adopting a sound management process to enhance the overall coordination of the project.

ESTABLISH AN OVERALL ‘PROJECT CO-ORDINATOR’ ROLE

There needs to be overall coordination of the project. It is essential that activities, tasks and resources are coordinated against a plan with a nominated person taking the lead in communication and direction of resources. It is suggested that this role sits with WaterAid.

PUT RESOURCES BACK INTO PROJECT PLANNING/DESIGN FROM IMPLEMENTATION

On the basis of the survey results and what has been agreed as the real failure of the project if it continues on this path, it is imperative that resources be directed back into planning and design. Time may have been consumed, but it is feasible to complete the majority of those activities outlined aiding to the success of the project.

IMPROVE THE BASELINE SURVEY INFORMATION AND CARRY OUT FURTHER RECONNAISSANCE ACTIVITIES AS REQUIRED

There is an **urgent need** for further data collection and analysis to support the decisions made within this project. Recommendations from McWilliam & Merrin (2009) relating to the hydrogeological baseline report should be progressed alongside the further suggestions made in this report.

PROVIDE FURTHER GEOPHYSICS TO CORROBORATE BASELINE SURVEY RESULTS

The use of geophysical surveys to investigate the potential for groundwater resource exploitation in difficult hydrogeological terrains is well documented. Particular emphasis should be given to interpretation of existing geophysical data (e.g. remote sensing/aeromagnetic surveys) in Nkanu East where the probability of drilling successful water supply boreholes is low. Further data collection, using EM34, is also advised to support the decisions to drill boreholes. Whilst the costs of geophysical data collection and analysis may be significant, boreholes drilled without using this technique are likely to fail. It is recommended that a specialist contractor is used for these activities.

CEASE ALL ACTIVITIES RELATING TO BOREHOLE DRILLING UNTIL BASELINE ACTIVITIES ARE COMPLETE

The results of the geophysical surveys, Alnaok Nigeria Ltd (2009) indicate that there is sufficient evidence to construct water supply boreholes in all three LGAs. Whilst the probability of accessing a suitable groundwater resource in Udenu and Igbo-Etiti LGAs is good, the decision to drill any borehole needs to be preceded by a thorough evaluation of the existing and newly collected reconnaissance data in order to decide on the correct borehole locations, numbers, dimensions (diameter/depth), construction, and required yield. Drilling of boreholes in Nkanu East LGA is ill-advised until analysis of reconnaissance and geophysical data is fully complete.

UNDERSTAND THE LINK BETWEEN BOREHOLE YIELDS AND POPULATION SERVED

Pumping test and operational data from water supply boreholes provides useful indications of the yield and the sustainability of the source. Hydrogeological properties, such as aquifer Transmissivity¹, where calculated can then be used to indicate the probable yield of a borehole supply and importantly, how many people this borehole could then serve. MacDonald, Kemp et al (2005) found that boreholes that intercepted dolerite intrusions within the Awgu Shale of Benue State had Transmissivity varying between 1 and 60 m²/day and so could yield favourable quantities of groundwater. However, some clear hydrogeological guidance on the link between borehole yields and population needs to be made.

TWIN-TRACK OTHER WATER SUPPLY OPTIONS ALONGSIDE GROUNDWATER DEVELOPMENT

This is particularly relevant for Nkanu East LGA where the probability of finding usable quantities of groundwater is low. Given this fact, the possibility of finding sustainable water from other sources needs to be prioritised and investigated.

KNOWLEDGE TRANSFER WITH OTHER ORGANISATIONS

Donor and aid organisations seeking sustainable water supplies have been actively working in the Benue Trough geological sequence of Nigeria for many years. A significant amount of data and information exists that would be easily transferrable into the Enugu project from these sources even though this work may have been completed in neighbouring states (e.g. Benue). Other sources of such information could be from: government departments, universities, NGOs, consultants, drilling companies and also from within the communities themselves. Using these data and knowledge transfer into the Enugu project would save significant amounts of time and also alleviate the pressure on the project finances.

There is a need for WaterAid to seek out these organisations and capitalise on the existing knowledge base that exists within Nigeria and overseas and it is recommended that this work is completed by a water resources specialist.

Examples of how data can be used and possible sources are listed in Table 1 below.

¹ Transmissivity is measured in units of m²/day and quantifies how easily water can flow through a rock to a borehole and is measured from data collected during pumping tests.

Suggested Task	Source of Data
Source accurate topographical maps Compile accurate geological and hydrogeological maps	Nigerian Government, NGOs Geological Survey of Nigeria, Ministry of Water Resources, NGO reports, British Geological Survey, general literature
Quantify the numbers of boreholes (both successful and unsuccessful) that have been drilled by various organisations in the Benue Trough sequence	Ministry of Water Resources, NGOs, drilling company records
Capture geophysical data (e.g. aeromagnetic surveys, field survey data) Variability in borehole yields – test pumping data and water user data	Geological Survey of Nigeria, WaterAid, NGOs, British Geological Survey NGOs, water resources consultants, communities, government water supply departments
Utilise WaterAid work that has been completed in SE Nigeria on previous projects (e.g. Oju/Obi, Benue State)	WaterAid offices (London, Abuja), British Geological Survey

Table 1 – List of suggested tasks required to support the reconnaissance activities in Enugu state

6 Appendices

Appendix A – Itinerary Details

Date	Activities
Sunday 16 August	Depart Heathrow T5 for Abuja (1030)
Monday 17 August	Arrive Abuja (0530); transfer to Rock View Hotel; (1330) First meeting with Gabriel Ekanem to review and discuss project requirements, understanding local issues, health & safety, proposed itinerary (1505) Transfer from Rock View hotel to airport for internal flight to Enugu (1630) Arrive Enugu, transfer to hotel. (1800) Meeting with Clement Chigbo at hotel
Tuesday 18 August	(0930) Drive to WaterAid offices, Enugu, for discussions with CC, OO, GE; meeting with Enugu State Minister of Water Resources to introduce project partners, outline itinerary and reinforce project needs. (1200) STU workshop session, presentations by WaterAid, STU, Ministry of Water Resources, Q&A session (see section 2) (1800-2300) Discussions between GE and Project Team and presentation of workshop material for delivery on next day
Wednesday 19 August	(1000) Workshop sessions facilitated by Project Team highlighting the need for improved project management activities and baseline data collection (see section 3). Group activity in the afternoon to redefine project plan
Thursday 20 August	Meeting with SSG and Minister for Economic Development to reaffirm project objectives and WaterAid's commitment. SSG was not available for this meeting. (1200) Review session with WaterAid staff to understand how well the workshop sessions were received and what could have been improved.
Friday 21 August	Further discussions with WaterAid staff examining project development and supporting tools (e.g. resource allocation tool) Transfer to airport for return flight to Abuja Meeting with WaterAid Country Representative at Abuja offices for project de-brief, transfer to Rock View Hotel
Saturday 22 August	Leisure time (am), meeting with GE and WaterAid Country Representative (pm)
Sunday 23 August	Depart Abuja International Airport (0830), arrive Heathrow T5 (1430) and onward transfers home

Appendix B – State Key actors met during the visit

Honourable Commissioner Water Resources (Enugu)	18 August
State Secretary to the Governor, Government House	20 August
Executive secretary to the planning commission	20 August

Appendix C – References

Adelana SMA, Olasehinde PI, Bale RB, Vrbka P, Edet AE & Goni IB (2008) An overview of the geology and hydrogeology of Nigeria. In: Applied Groundwater Studies in Africa, International Association of Hydrogeologists Selected Papers, pp 171-197.

Alnaok Nigeria Ltd (2009) A final report on hydro-geophysical survey in Udenu, Igbo-Etiti & Nkanu East Local Government Areas of Enugu State. Carried out for STU, En-Ruwassa, Enugu State.

Cranfield University in association with Enugu State Ministry of Public Utilities (2006) Geology, hydrogeology and borehole location maps.

Davies J & MacDonald AM (1997) An annotated bibliography of the geology and hydrogeology of the Oju area, Nigeria. BGS Technical Report WC/97/8.

Davies J & MacDonald AM (1999) The groundwater potential of the Oju/Obi area, eastern Nigeria. BGS Technical Report WC/99/32.

De-Hilcon International Ltd (2009) A final report on hydrogeological survey in Udenu, Igbo-Etiti & Nkanu East local government of Enugu State

MacDonald AM (2001) Geophysics – taking the magic out of black boxes. *Waterlines*, **20**(2), 12-14.

MacDonald AM, Davies J & Peart RJ (2001) Geophysical methods for locating groundwater in low permeability sedimentary rocks: examples from southeast Nigeria. *Journal of African Earth Sciences*, **32**, 115-31.

MacDonald AM, Davies J, Calow R & Chilton J (2005) Developing Groundwater: A guide for Rural Water Supply, ITDG Publishing, 358pp.

MacDonald AM, Kemp SJ & Davies J (2005) Transmissivity Variations in Mudstones. *Groundwater*, **43**(2), 259-269.

McWilliam & Merrin (2009) Hydrogeological survey report analysis and recommendations. Partners for Water & Sanitation report, August 2009.

Ockelford J & Reed RA (2002) Guidelines for planning and designing rural water supply and sanitation programmes, WEDC, Loughborough University, UK, 400pp.

Duhig, Berry, WS Atkins Et al (2005) Managing Successful Projects with Prince2

1. Partners for Water and Sanitation, Enugu WaterAid EC Water Facility, Nigeria – Terms of Reference document
2. Enugu small towns institutional framework document – provided by Nick Bundle at WaterAid
3. Closing the gap: Improving water supply and sanitation provision for small towns in Nigeria – European Commission grant application form (EuropeAid/122979/C/ACT/ACP)

4. Cranfield University (2007) Geology, hydrogeology, water resources and water schemes maps for Enugu state, scale 1:250,000. These maps were produced for a 2006-07 DFID supported study by Cranfield University in association with Enugu State Ministry of Public Utilities (Cranfield University 2006).
5. Geological Survey of Nigeria (2004) Geological and Minerals map of Enugu State, hand drawn, scale 1:250,000
6. Geological Survey of Nigeria – index sheet for individual geological maps for whole of Nigeria

Appendix D – List of Workshop participants in Enugu

S/N	Name	Organisation
1	Chukwudi Aguchigwe	WaterAid
2	Charles Isaac	WaterAid
3	Oji Ogbureke	WaterAid
4	Okeke, F.U.N	Ministry of Water Resources
5	Sir Herbert Eze	Ministry of Water Resources
6	Zulike Rita	Small Towns Unit
7	Nebo Festus	Small Towns Unit
8	Ogbu Chris	Small Towns Unit
9	Nnemuchi J. O.	Igbo-Etiti LGA
10	Ezeme, P. E.	Udenu LGA
11	Nnamani Christiana	Nkanu East LGA
12	Oguejiofor A. N.	Ministry of Water Resources
13	Obinna Ejike	EnRUWASSA
14	Phil Merrin	United Utilities
15	Gabriel Ekanem	Partners for WATSAN
16	Neil Walker	United Utilities
17	Clement Chigbo	WaterAid