skat Swiss Resource Centre and Consultancies for Development

RWSN

Code of Practice for Cost-Effective Boreholes

Synthesis Report

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Contents

Abbreviations

CWSA	Community Water and Sanitation Agency
DGRA	Direction Generale de l'Approvisionnement en Eau Potable
PN-AEPA	Programme National d'Approvisionnement en Eau Potable et d'Assainissement à l'horizon 2015

1 Introduction

Progress in rural water supply is constrained by lack of capacity and insufficient investment, while sustainability of rural water supplies remains a major challenge. It has been estimated that about 35,000 boreholes per year need to be drilled in sub-Saharan Africa to meet the MDGs for domestic water supply. However, concerns have been raised about the high costs and variable construction quality of boreholes in sub-Saharan Africa. In this region particularly, the private sector is not always harnessed to its full potential. The Cost-effective Boreholes (CEB) flagship of the Rural Water Supply Network (RWSN) was set up to address these concerns.

The CEB flagship aims to reduce the cost of conventional drilling, maintain quality and increase the reach of very low cost manual drilling. The year 2007/8 witnessed the development of a Zero Draft Code of Practice for Cost Effective Water Well Construction, with UNICEF support. In 2009/10, UNICEF and USAID contracted Skat to undertake the second phase of the work, including field testing and finalisation of a Generic Code of Practice and development of national protocols for cost-effective boreholes for Burkina Faso, Ghana and Zambia.

It is anticipated that ultimately, the Generic Code of Practice will provide clear and systematic guidance for analysis, decision-making and implementation of programmes that support the cost-effective provision of drilled water wells. It is envisaged that development agencies which support the provision of drilled water wells would support national Government in their countries of operation to a develop country-specific protocol (or code of conduct) which take into account the guidance set out in the Code of Practice. Each protocol would be a national document for all stakeholders involved in WASH.

This report reflects on the methodology used for the field work and development of national protocols. It also provides a synthesis of the findings of field work undertaken in Burkina Faso, Ghana and Zambia in relation to the principles set out in the Generic Code of Practice. A recommended report structure for subsequent studies to examine the cost-effectiveness of borehole drilling in other countries is provides in Annex 1. In order to keep this synthesis report short and to the point, the full text of the Generic Code of Practice is not repeated. Readers can refer to the full document, as well as the country study reports should they require any further clarifications.

2 Methodology

2.1 Description

Interest in being involved in the Code of Practice work was expressed by the UNICEF offices in Burkina Faso, Ghana and Zambia. Subsequently, there was some liaison (via email and telephone) with the country offices and the overall project coordinator (and author of this report). Terms of Reference for National and International consultants were drafted and discussed, with feedback given by in-country stakeholders. Subsequently, international and national consultants were engaged to undertake work in Burkina Faso and Ghana, and an international consultant for Zambia. The international consultants had up to three weeks in-country plus some time for write up. In country support was provided by national consutlants. In the case of Zambia, the international consultant was in discussion with those involved in ongoing complimentary work, hence the lack of need for an additional national consultant.

2.2 Organisation and Implementation of the Country Studies

Although UNICEF offices in all three countries (Ghana, Zambia and Burkina Faso) expressed interest in their involvement in the COP country studies, the preparations for the field work in Ghana and Burkina Faso were not as comprehensive as expected. Much was left to the international consultant. In all three countries, there

was a lack of ownership prior to the commencement of the work, and in some cases a lack of knowledge of the COP work by key Government or other in-country organisations. Ensuring their involvement thus largely became the role of the consultants. Given the lack of in-depth understanding of the COP by UNICEF country offices, the expectation that they, together with in-country stakeholders should determine the main strengths and weakness of the drilling sector prior to the assignment was unrealistic.

However, it was noted by the consultants that an appreciation of the relevance of the COP, and interest in developing national protocols, codes of conduct and guidelines was high in all countries, particularly by national government institutions. However, there still remain major questions with respect to how these organisations can best drive forward the actions proposed by the studies. The recommendations included major as well as minor changes to current policies and procedures as well as significant skills development in some particular aspects.

All consultants noted that the duration of the studies was too short given the scope of the Terms of Reference, the fact that much of the arrangements for setting up meetings was left to the consultants themselves and the need for extensive dialogue with respect to the findings. Given this, the length of time in-country for the international consultants should be extended to four to five weeks, with more time also for the local consultancy support (4 weeks). It may also be advantageous to split the assignment into two visits. This would provide more time for feedback from the stakeholders on the key findings. In the case of Burkina Faso and Ghana, the involvement of highly respected national consultants was vital to the smooth running of the assignments and as a basis for building trust between the international consultant and in-country stakeholders.

With the exception of Zambia, feedback on the reports and follow-up actions from the UNICEF country offices has not been slow. From the perspective of RWSN the studies generated useful information and key findings for the development of the Generic Code of Practice, but their usefulness to bring about change in-country has not yet been fully demonstrated (discussed further below). The studies and draft protocols should have been catalysing a much longer term process.

2.3 Prospective for long term change in the three study countries

Comprehensive study reports have been prepared for all three countries (see references). In the case of Ghana, a "*draft protocol and action points for the code of practice for cost-effective boreholes*" was developed. In Burkina Faso, a "*code of conduct and action plan for water well development*" was prepared. The Zambia case was slightly different as the study fed into other on-going work to develop "*standard procedures*" for borehole drilling which is being undertaken outside the realms of this RWSN COP project.

In Ghana since the studies were completed and the reports handed over has been no action. It has been pointed out that one of the challenges faced by Government is that this is one of many initiatives taking place in the country, and Government simply does not have the human resources to deal with all of them. It is also noted that the fact that the initialisation of the work came from outside the country may have contributed to the lack of uptake. However, UNICEF Ghana is currently in the process of trying to resuscitate this initiative. In Burkina Faso, a wider discussion of the recommendations and action plan is about to start – with the National Government taking the lead in this process. Work in relation to the Code of Practice continues in Zambia with development of the Standard Procedures.

In the original concept, it was envisaged that the work carried out in 2009 and early 2010 (Phase II of the Code of Practice) would lead to a subsequent phase whereby there would be follow-up of the three case study countries. Unfortunately the funding horizon for the work was short (just over one year), and at the moment there is no clear perspective of subsequent funding to continue by UNICEF or USAID for external support or

monitoring. This has been included in the Road Map for Cost-Effective Boreholes, which proposes a five-year project for cost-effective boreholes, including support and monitoring in up to ten countries. A combination of in-country leadership and champions combined with external support and peer to peer exchange would appear to be an ideal way to move forwards on changing policies and practices.

2.4 The Code of Practice

On a very positive note, the three country studies have provided excellent feedback for the development of the Generic Code of Practice for Cost-Effective Water Well Construction. This has been extensively enriched by the country studies, and reflects the realities faced in all three countries. Further, the fact that the three international consultants each brought a different bias to the work (i.e. hydrogeologist, driller and rural water supply specialist – each with extensive experience in different countries) has also enriched the document. A key question has been the extent to which the Code of Practice should emphasis the non-engineering and wider aspects of borehole provision such as investment planning, funding mechanisms and sustainability. The document has addressed this by including a brief discussion on some of the key aspects of the operating environment.

It was noted that the early drafts of the Code of Practice were overly oriented around UNICEF, which is not an ideal basis for the development of in-country protocols. There is a general consensus that the Code of Practice needs to be more generic and institutionally neutral so that it is better placed to draw in all the different in-country players, particularly national Government. This has been addressed in the final document.

Although the Code of Practice provides a fairly comprehensive framework for countries to asses the strengths and weaknesses of their respective drilling sectors, this is still far removed from bringing about change, e.g. through more transparent processes, institutional strengthening, training programmes and better licensing. These are changes which require considerable dialogue among stakeholders, the dedicated application of human and financial resources and take time. There is thus need for the in-country work on the adoption and implementation of national protocols to be firmly embedded within existing in-country institutions. This requires dedication over a number of years, with in-country funds. The work could also benefit from international coordination, advocacy, sharing of experiences and monitoring. These aspects are included in the road map.

In order to complement the national protocols and turn statements of intent into knowledge and action, there is need for specific in-depth training documents and manuals, simplified drilling contracts and training courses. As many countries have already developed very relevant materials, mining and compiling some of these documents would be a useful exercise. This would avoid duplication of efforts and enable countries to demonstrate where they have been particularly effective.

3 Adherence to Principles of the Code of Practice

This chapter reflects on the extent to which the nine principles set out in the Generic Code of Practice for Cost-Effective Water Well Construction are being '*adhered to*'[1] in Burkina Faso, Ghana and Zambia and summarises the actions proposed for each country. The chapter is structured according to the nine principles set out in the final version of the Code of Practice[2]. It should be noted that the findings of the country studies and peer review process resulted in amendments to the principles and further development of clear sub-principles. As a result of this iterative process, some data in relation to certain principles was not collected

[1] Note the use of quotations around adhered to is due to the fact that these principles have not as yet been taken up as requirements within the three countries.

[2] The findings of the three country studies, coupled with peer review of the COP resulted in the original ten principles for Cost-Effective Boreholes being condensed to nine.

through the country studies. Despite this fact, this chapter is extremely valuable in setting out a way in which country realities can be benchmarked, compared and contrasted in a clear manner.

The chapter is structured so that each principle and its sub-principles are clearly stated, followed by a table which summarises the status for the three study countries. The colour coding in the table is green for adherence (yes), pink for lack of adherence (no), and orange for cases where there is partial adherence or processes have commenced relatively recently. Where data is missing, it is shown as a blank space in the table. A concise paragraph describing the status in each country with particular nuances is provided after each table.

Figure 1 Drilling in Burkina Faso

1 Professional Drilling Enterprises and Consultants

Principle 1 Construction of drilled water wells and supervision is undertaken by professional and competent organisations which adhere to national standards and are regulated by the public sector.

This breaks down into the following sub-principles:

- Construction of drilled water wells and installation of pumps should normally be undertaken by local private sector firms (or NGOs) rather than by Government or donor agencies.
- Subsidised drilling by public/state drilling enterprises and NGOs should be avoided. If considerable drilling is undertaken directly by the public sector or the private sector drilling capacity is weak, stakeholders should develop a strategy for achieving local private sector involvement in a time-bound manner.
- Similarly, the siting and design of water wells and supervision of construction should normally be undertaken by local private sector consultancy firms. Subsidised consultancy services by public/state enterprises and NGOs should be avoided. If considerable work is undertaken directly by the public sector or there is limited capacity within private sector consultants, stakeholders should develop a strategy for improving local private sector involvement.
- Drilling enterprises and consultants should be registered and issued with a licence or permit, or be recognised by a national or international engineering board, council or institution. They should be registered as a company with the relevant authorities, including for tax purposes. The permit should be renewed annually (or every 2 to 3 years) provided that conditions are met, including the submission of drilling completion reports as specified, and even successful completion of further training. Consultants will also need to demonstrate their experience and competence.
- A national drillers association should exist and be active in discussing and expressing drillers' concerns.

Table 1 Summary of Status of Adherence to Principle 1 - Professional Drilling Enterprises and Consultants

Sub-principle	Burkina Faso	Ghana	Zambia
Competent Local Private Sector Drilling	Yes	Yes	Yes
Avoid subsidised NGO Drilling Enterprises	Yes	Yes	
Avoid subsidised State Drilling Enterprises	Yes	Yes	No
Registration and Licensing of Drilling Enterprises	Just started	Just started	No
Registration and Licensing of Consultants			
Drillers Association	Yes	No	No

In **Burkina Faso**, drilling for government, NGOs and institutions is undertaken by private drilling enterprises. About 40 of these enterprises are members of the *Association Nationale des Professionnels du Secteur de l'Assainissement et de l'Eau Potable du Burkina Faso* (ANP-SEBAP), which was able to provide information on the drilling companies, including equipment for the study. There are practically no foreign drilling contractors. Currently, the capacity of the private drilling enterprises in terms of human resources and equipment outstrips the demand for drilled water wells, which does not encourage investment in more efficient equipment. A licensing process for the drilling industry was due to commence in 2010. It has been pointed out this needs to be undertaken in a transparent manner, by an independent body and ensure that there are mechanisms for license renewal as well as sanctions for poor performance and mechanisms for ensuring that new drilling companies also have opportunities.

Ghana has a long history of drilling, dating as far back as 1946, when a percussion rig was acquired by the old Ghana Water and Sewerage Corporation. In 2009 there were an estimated 20 private drilling enterprises in the country, of which eight were registered by the Water Resources Commission (which started to register in 2008). According to the Community Water and Sanitation Agency (CWSA) about 80% of the drilling market in Ghana is served by Chinese contractors. Of 15 companies listed by CWSA six are Chinese, one German and the remaining nine Ghanaian. Several NGOs are involved in drilling with three of them (World Vision, Church of Christ and Rural Aid) owning rigs and using them to drill under their own projects as well as to UNICEF, the EU and WaterAid but not for Government programmes. There is no drillers association.

In **Zambia** the Department for Water Affairs (DWA) is vigorously active in borehole drilling, and recently acquired a number of rigs from the Japanese. In addition to programmes under JICA, DWA also effectively

drills private boreholes at non-commercial rates, which includes a percentage charge for "wear and tear" of the equipment. There are numerous private drilling enterprises in the country, but as there is no register (or formal licensing), the exact number is not clear. It has been noted that many "brief case consortia" are formed specifically in response to calls for international pre-qualification and bidding. Private sector drillers tend not to discuss with each other or cooperate in any way and there is no drillers association.

2 Water Well Siting

Principle 2 Appropriate siting practices are utilised.
This breaks down into the following sub-principles:

- Water well siting should be undertaken by competent personnel.
- Prior to preparing any well construction contract, a hydrogeological desk study and field reconnaissance need to be carried out and the method of siting the wells agreed upon, based on expert opinion.
- The risk of drilling an unsuccessful borehole should be categorised. In proven areas where the geology is well understood and borehole success is high (say over 70%), it may not be necessary to site wells using geophysical survey techniques.
- Geophysical surveys should only be undertaken where the costs of drilling an unsuccessful well may justify the expense.
- The site selection needs to take into account community preferences with respect to convenience.

Table 2 Summary of Status of Adherence to Principle 2 – Water Well Siting

Sub-principle	Burkina Faso	Ghana	Zambia
Competent siting personnel	Not always		
Hydrogeological desk study and field reconnaissance	Yes		
Categorisation of risk	Yes		No
Use of geophysical survey technique only where appropriate.		Yes	
Community preference considered for site selection	Not always		Yes

In **Burkina Faso**, generally, aerial photo interpretation is used in combination with geophysics for water well siting. The country has been divided into three risk categories with respect to drilling a dry borehole. Officially, water users are consulted with respect to borehole location, which should be within a distance of 1km of the community. The hydrogeologist agrees the final location with the community. However, prices of siting are very low, and the consultants are not always able to assure quality. Field work is sometimes undertaken by untrained technicians.

In **Ghana**, geophysical techniques are always used (with the exception of some NGOs which use water divining) due to the geology of the country. Success rates vary considerably from 75% in the Birrimian sandstones and on the crystalline granite complex to 40% the shales and mudstones of the Voltaian formation. UNICEF plans to engage the British Geological Survey to undertake a survey and review siting procedures in the challenging northern terrains. Although UNICEF and CWSA pay contractors for dry holes, the siting consultants (who also undertake supervision) are not paid if this is the case.

Current procedures in **Zambia**, (as stated in the Ministry of Local Government DISS Supplementary Module 2f Borehole Standard and Construction Details, 2002) state that the community selects areas from which a hydrogeologist identifies the actual drill site. There is no systematic categorisation of the risk of drilling a dry borehole.

3 Procurement

Principle 3 Procurement procedures ensure that contracts are awarded to experienced and qualified consultants and drilling contractors.

This breaks down into the following sub-principles:

- Procurement should be undertaken through national government systems rather than those of the donor or support organisation. If national government systems are particularly slow or weak, a mix of approaches should be used in order to improve the national systems, at the same time as achieving results in the field. There will also be cases where procurement is best undertaken directly by the end-user of the well (e.g. community or institution).
- The engagement of consultants and construction companies for water well provision should be through a national (or local) competitive bidding process, involving pre-qualification. Engineers' estimates and recent tenders for similar works or services should be used for comparison against the tender prices. This should avoid contracts being awarded to tenders that are significantly below the estimated cost price.
- Procurement should be for a multi-borehole package, in a fairly close geographic area, with similar depth and hydrogeology. Lots could be for a reasonably high number of water wells, depending on the need to provide opportunities to smaller drilling companies in order to build in-country capacity.
- In order to draw upon and build in-country capacity, and enable smaller enterprises to compete with larger companies, mechanisms of awarding roll-over packages should be considered. Alternatively, a framework or term contract which spans a number of years (subject to clear performance measurement) should be considered.

Table 3 Summary of Status of Adherence to Principle 3 – Procurement

Sub-principle	Burkina Faso	Ghana	Zambia
Using national government systems	Sometimes	Sometimes	Sometimes
Local competitive bidding process	Yes	Usually	Yes
Pre-qualification		Yes	Sometimes
Multiborehole packages	Mostly	Yes	Sometimes
Roll-over package for more than one year	No	No	No

In **Burkina Faso**, most drilling projects and programmes request for tenders for the construction work. However, there tend to be considerable delays in the procurement process with the result that works end up being carried out during the unfavourable rainy season. Most drilling contracts are issued in lots with relatively homogeneous work in geographically close proximity. However some lots are tendered out for a very small number of wells which is not attractive for some of the more competent enterprises. The latter is likely to increase as the decentralisation process progresses.

Procurement law in **Ghana** states that all projects must be advertised, with contractors pre-qualified, a request for proposals followed by a technical and financial evaluation. However, different donors have particular conditions which can exclude the local private sector. CWSA contracts tend to be packaged in lots of 20 to 100 boreholes with lots often based on a particular district or contiguous districts in specific regions. There are no roll-over packages for more than one year.

Currently, tendering processes between the different agencies in **Zambia** are not aligned and national partner systems are not always used. UNICEF Zambia has heavily relied on two particular companies to undertake borehole drilling. Meanwhile substantial drilling programmes let out large contracts (of > 100 boreholes), which tends to favour larger companies and exclude small, yet competent drilling enterprises. Pre-qualification processes, based on the company profile, equipment and staff resources, experience and reputation/references are generally lacking in Zambia. There are no roll-over packages, with drilling contracts tending to be for work undertaken over several months, and a year at most. There is no categorisation of risk of unsuccessful drilling in Zambia.

4 Construction Method

Principle 4 The construction method chosen for the borehole is the most economical, considering the design and available techniques in-country. Drilling technology needs to match the borehole design.

This breaks down into the following sub-principles:

- Well depths should not be unnecessarily over-specified or under-specified.
- A stepped approach to technology selection should be followed. Very low-cost methods, including protected hand dug wells and manual drilling, are considered first, if they are feasible, before mechanised drilling.
- Subsequently, the use of small rigs, which provide the specified diameter and well depth and reach remote locations, should be considered.
- Finally, the use of larger drilling rigs should be considered.

Table 4 Summary of Status of Adherence to Principle 4 – Construction Method

Sub-principle	Burkina Faso	Ghana	Zambia
Proper specification of well depths			
Stepped approach to technology selection with very low-cost methods considered first.			Not always
Appropriate drilling rig selection	No	No	No

Drilling equipment in **Burkina Faso** is generally old, although there are little incentives to modernise this as the market is small in relation to the number of enterprises and equipment available. Hand drilling has not been a priority.

Most of the drilling rigs used in **Ghana** seem to be overdesigned for the requirements in the country, although it should be noted that the companies also undertake work in neighbouring countries and therefore justify owning versatile equipment.

In **Zambia**, wells are drilled to an average of 60m ad certainly less than 100m. Aquifers lie at a depth of about 24m to 85m. Most water well drilling is undertaken for handpump supplies. It has been noted that the drilling equipment in use in the country is generally heavier than required for the construction of such sources as much of the rigs and compressors can reach depths of several hundred meters. There are only two light rigs (both PAT rigs) known to be in use in Zambia. The study noted that there is a lack of awareness of lighter drilling equipment by stakeholders in the country. There is considerable experience of rehabilitating and further developing hand dug wells in Zambia but this could be exploited even further.

5 *Water Well Design and Construction*

Principle 5 The water well design is cost-effective, designed to last for a lifespan of 20 to 50 years, and based on the minimum specification to provide a borehole which is fit for its intended purpose.

This breaks down into the following sub-principles:

- Minimum specification for "fit for purpose" well in terms of yield, diameter, depth, casing and screen, gravel pack/formation stabiliser, verticality, alignment, drilling additive and sanitary seal. Over-design of boreholes, especially excessive depth or diameter, is wasteful and should be avoided.
- The procedures for well development are agreed and clearly specified in the drilling contract. The drilled well must be developed until the water is free of solids and fine materials (fines) and any turbidity for a continuous period of 30 minutes.
- The procedures for well development and for pumping tests are agreed and clearly specified in the drilling contract. Pumping test requirements for a handpump should be realistic and not over-specified.
- Water quality testing for specified chemicals and microbiological content is undertaken, particularly for areas at risk and water wells serving institutions (e.g. health centres and schools).

Table 5 Summary of Status of Adherence to Principle 5 – Water Well Design and Construction

Sub-principle	Burkina Faso	Ghana	Zambia
Minimum specifications for "fit for purpose" well	Some aspects	Yes	Sometimes
Appropriate well development		Yes	No
Suitable pumping test requirements		Yes	No
Water quality analysis	Yes		

In **Burkina Faso** hand-pump sources are equipped with 125 mm (5") diameter uPVC casing with wells designed for motorised systems are installed at 160 mm. In the country there is a progression from hand-pump supplies to small piped systems, particularly in areas with a high population density. Thus due attention is given to ensure that the diameter is large enough to enable this upgrade at some stage in the future. Given the small diameter of many submersible pumps (which can be installed in 5" diameter cased wells this may not actually be necessary). National standards currently specify that rotary drilling in unconsolidated materials is undertaken at 10" diameter, with temporary casing of 8" diameter installed. Subsequently, drilling is at 6.5" diameter in consolidated materials. The well needs to be able to provide a minimum of 0.7m^3/h to be declared a success. Specifications with respect to the gravel packing, backfill and sanitary seal are in line with the Code of Practice. A study is planned to further examine the technical specifications for borehole construction. The standards set by DRGE are not always adhered to. In particular, the skills to control the **construction** quality are lacking in Burkina Faso (Principle 6). Water quality testing for arsenic, fluoride and nitrates is undertaken, particularly in parts of the country which are at risk. Water is tested prior to pump installation so that appropriate measures can be taken, including the decommissioning of a well if the water quality is not acceptable.

Three borehole designs are used in **Ghana**: (i) 126 mm (5") diameter uPVC lined for handpump supplies; (ii) 150 mm diameter uPVC lined for motorised rural boreholes and (iii) 200 mm diameter uPVC lined borehole for urban water supply. The 126 mm (5") diameter for handpump supplies was adopted the minimum so that if a borehole is productive and the community is large enough the borehole may be fitted with a motorised pump. This design is adhered to by UNICEF but not the NGO RuralAid, who are not able to drill at this diameter (smaller rigs). CWSA prohibits the use of bentonite in drilling but some contractors still use it. Both well development and pumping test requirements in Ghana are adequate for the requirements.

In **Zambia,** the specifications for finished well diameters for handpumps are 4" (as recommended by the Code of Practice). However, in the case of wells to be fitted with submersible pumps, the diameter specified

is 6" (Code of Practice recommends 5"). The specified drilled diameter for 4" cased wells is usually 6.5" (also considered as fit for purpose in the Code of Practice). However, there are some programmes which specify larger diameter drilling (including German-funded, JICA-funded and Danida-funded work). One of the reasons for this is a perception that the drillers are not able to do a good job, and that the supervision is likewise very poor. Therefore, this is compensated by larger diameter drilled wells. It has been noted that in Zambia there is a tendency for well development and pumping test to be over-specified on one hand but in effect not undertaken properly by the drillers.

6 Contract Management, Supervision and Payment

Principle 6 Adequate arrangements are in place to ensure proper contract management, supervision and timely payment of the drilling contractor.

This breaks down into the following sub-principles:

- Normally, contract management should be based on Government systems. These should follow international best practice and use standard contract forms.
- Contract documents need to be straightforward and readily understandable by the drilling contractors.
- Supervision should be undertaken by Government personnel or by the private sector. Additional expertise can be brought in to cover capacity gaps with a view to building expertise over the long term.
- Payment for construction works should be timely.
- A defects liability period should be considered whereby a financial retention (of about 10%) is held in an insurance bond, bank guarantee or cash.
- Ideally a robust legal framework that supports compensation, financial retention mechanisms, and audit and compliance procedures is required.

Table 6 Summary of Status of Adherence to Principle 6 – Contract Management, Supervision and Payment

Sub-principle	Burkina Faso	Ghana	Zambia
Proper contract management	No		
Proper supervision by professionals	No	Not always	No
Straightforward and understandable contract documents			No
Timely payment	No	Not always	
Defects liability period			
Robust legal framework			

In **Burkina Faso**, the implementation of contracts is frequently delayed, supervision of drilling is often sub-standard (i.e. undertaken by young technicians with a very limited knowledge and experience who are also dependant on the contractor for logistics) and payments are very often late. It is also frequently problematic for the supervisor to be paid for extra time spent on the site due to unforeseen circumstances.

In **Ghana**, drilling supervision tends to be undertaken by private consultants. However, concerns have been raised about the lack of experience of some of the newer and younger consultants and the need for a process to develop professional supervisory skills in the country. Although drilling contracts include clauses with respect to late payment for works completed, none of these clauses have been invoked. Although UNICEF and CWSA pay contractors for dry holes, the supervisors (who also site the wells) are not paid if this is the case.

In **Zambia**, poor supervision is sited as one of the main reasons for subsequent failure of the borehole. Although consultants are normally engaged for field supervision of drilling, it is noted that there are few supervisors and that they often lack experience, they are poorly compensated and they are also reliant on drillers for logistical support.

7 Data and Information

Principle 7 High quality hydrogeological and borehole construction data for each well is collected in a standard format and submitted to the relevant Government authority.

This breaks down into the following sub-principles:

- The data to be gathered during borehole drilling is specified in the drilling contract and responsibilities for data collection between the contractor and the supervisor are clear.
- Information, in the form of a national borehole completion report should be submitted to the appropriate government authority after drilling (even in the case of dry boreholes).
- Renewal of drilling licences should be linked to the submission of borehole completion reports.
- Each borehole drilled in the country should have its own unique identification number.
- Government and other water sector stakeholders should collate data on borehole drilling programmes annually, and make the reports available to the public.

Table 7 Summary of Status of Adherence to Principle 7 – Data and Information

Sub-principle	Burkina Faso	Ghana	Zambia
Specify data requirements and responsibilities	Some projects	Inadequate	No
Submit borehole log to authority	No	No	No
Drilling licence renewal linked to submission of completion reports		No	No
Unique borehole identification number		No	No
Annual reports on drilling programmes available to the public and other implementing agencies		No	No

In **Burkina Faso**, borehole completion report formats have been developed by some projects (in particular PN-AEPA) with the supervisor responsible for submitting the report.

Bidding documents issued by CWSA in **Ghana** clearly spell out the data requirements. Although these are also used by UNICEF, closer examination of the logs shows that GPS coordinates a borehole identification number and static water levels are not included. Although borehole log data should be passed on to CWSA for inclusion in the database, in reality considerable data are missing from the database. There is no uniform numbering system for boreholes in Ghana. Both CWSA and UNICEF as well as other agencies prepare annual reports on their drilling activities but these are not published or available to the public.

In **Zambia**, each programme has its own format for borehole completion records. However, standards for the country are in the process of being developed. There is no regulation of water well drilling in the country, hence no licences. Boreholes do not have unique identification numbers and annual reports are not available to the public.

8 Database and Record Keeping

Principle 8 Storage of hydrogeological data is undertaken by a central Government institution with records updated, information made freely available and used in preparing subsequent drilling specifications.

This breaks down into the following sub-principles:

- A national (or regional level) database of all borehole drilling records should be established and kept up-to-date. If no such national database exists, sector stakeholders should keep and archive records of all borehole drilling work undertaken until it is established.
- The data from all drilling programmes and projects in the country should feed into this database.
- Data from the database should be made available free of restriction.

Table 8 Summary of Status of Adherence to Principle 8 – Database and Record Keeping

Sub-principle	Burkina Faso	Ghana	Zambia
National database of all drilling records	Yes	Multiple databases	No
All drilling programmes, projects and works feed into the database	No	No	Pilot project
Information from database is freely available and used			No

In **Burkina Faso** records of boreholes (with CPS references) are stored at the Centre National de documentation de l'Information Eau (CNIEau) within DRGE although in practice some reports are missing.

In **Ghana,** the District Monitoring and Evaluation System (DIMES) records data from drilling works this information is not always passed to the water resources commission who should be responsible for collation, storage and dissemination of this information.

In the Southern Province in **Zambia**, a pilot project is being undertaken to enter data from borehole completion reports into a database.

9 Monitoring

Principle 9 Regular visits to completed water wells are made to monitor their functionality in the medium as well as long term with the findings published.

This breaks down into the following sub-principles:

- The monitoring systems of Government should be utilised (and strengthened if necessary) rather than the development of parallel systems.
- Monitoring of the water well and the pump functionality, including analysis and action-taking should be undertaken at: 6 months, and then at yearly intervals for at least ten years after construction.
- The findings of the monitoring work should be made public.

Table 9 Summary of Status of Adherence to Principle 9 – Monitoring

Sub-principle	Burkina Faso	Ghana	Zambia
Use national monitoring systems	System defined	Yes	
Monitor use and functionality at least: 6 months and then at yearly intervals for at least ten years after construction		Frequency not clear	
Publish monitoring reports			

In **Burkina Faso** procedures for monitoring and evaluation have been established in the PN-AEPA.

In **Ghana**, CWSA has established a District Monitoring and Evaluation System (DIMES) which records data from drilling works as well as subsequent functionality.

4 Recommendations

In order to move the process of the finalisation, adoption and implementation of the national protocols in the three study countries, the following is recommended:

- UNICEF country offices in the three countries should be requested for feedback on the COP work and recent developments by UNICEF New York. In particularly, the ability of UNICEF country offices to take on such a long term development initiative, involving considerable institutional change needs to be reflected.
- Depending on the feedback from the country offices, a decision should be taken as to whether the UNICEF country offices are the best positioned organisations to take forward the national protocols, or if other organisations would be more suitable.
- Funding should be sought by the RWSN flagship coordinator to enable follow-up of the three study countries by the international and/or national consultants. Ideally, funds should be sought to enable regular follow-up over a three to five year period, including workshops or reviews with much wider in-country consultation. The role of the international and national consultants would be to ensure that processes of improvement are embedded into the most suitable institutions.

In the case of new countries, the following procedure with respect to the COP should be undertaken:

- Given the ethos of the COP on alignment of procedures and a professional, coordinated approach, it is essential that there is excellent coordination between all stakeholders from the outset. The local consultant should be identified well before the mission and should start to prepare the agenda, meetings and logistics prior to the arrival of the international consultant. The local consultant should also be involved in ensuring that all of the key stakeholders are fully briefed prior to the commencement of the study.
- The main strengths and weaknesses in relation to the COP should be identified in the first consultancy mission, rather than trying to set this out beforehand.
- The initial assessment and feedback should be carried out over a 30 day period over two stages. The purpose of the second visit would be to enable in-country stakeholders to engage in more in-depth discussion with respect to the new ground uncovered by the studies. Essentially, this would be the “kick-start” of a longer term process. The local consultant should continue to follow up over a period of six months afterwards (say one to two person-days per month).
- The most suitable local champion for the work (institution and individual) should be identified within six months of the study.

5 List of Documents and Tools Produced with Support from the Code of Practice Project

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Annex 1 Recommended Structure of code of Practice Studies

It is recommended that new studies to examine the structure and cost-effectiveness of borehole drilling use the following report structure.

Chapter 1 Introduction

Chapter 2 Political and Physical Terrain

- Political and administrative structure
- Physical Terrain (including relief, drainage, geology, groundwater resources and groundwater quality)

Chapter 3 Rural Water Supply Context

- Population, water supply coverage and water use data
- Institutional framework and sector reforms
- Water supply programmes and projects

Chapter 4 Observations with respect to the Operating Environment

- Planning and Coordination
- Community Selection
- Operation and Maintenance
- Environmental and Groundwater resources

Chapter 5 Adherence to the Principles for Cost-Effective Water Well Construction

- Principle 1 Professional Drilling Enterprises and Consultants
- Principle 2 Water Well Siting
- Principle 3 Procurement
- Principle 4 Construction Method
- Principle 5 Water Well Design and Construction
- Principle 6 Contract Management, Supervision and Payment
- Principle 7 Data and Information
- Principle 8 Database and Record Keeping
- Principle 9 Monitoring

Chapter 6 Borehole Costing and Pricing

Chapter 7 Conclusion and Recommendations

Chapter 8 References and Bibliography

Annex 1 Itinerary and People Met