THE REPUBLIC OF LIBERIA

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THE GUIDELINES FOR WATER AND SANITATION SERVICES IN LIBERIA

MINISTRY OF PUBLIC WORKS

In Collaboration with The Liberia WASH Consortium and UNICEF

MINISTERS FOREWORD

Liberia is striving to correct its past performance in the water, sanitation and hygiene sector. The past has been characterized with a fragmented yet decentralized structure of water governance. This state of fragmentation has led to a lack of effective implementation in the absence of technical and procedural standards. This is reflected in the high rate of failures and non-functional (35 to 45%) WASH facilities across the Country at any given time. Given the lack of capacity at community-level and the unsuitability of any central structure to deal with the huge backlog of maintenance problems nation-wide, breakdown downtime is often over a year or more for the vast number of facilities, thus increasing the likelihood of communities returning to traditional pollution sources of water supply and open defecation.

A milestone in the era of the Poverty Reduction Strategy is the promulgation of policies and policy instruments to govern various sectors. For the water, sanitation and hygiene sector, the Government of Liberia through the Cabinet has endorsed Integrated Water Resources Management (IWRM) and Water Supply & Sanitation (WSS) Policies as the basic foundations of creating uniformity and centralizing water governance. With the imminent prospect of being approved by the National Legislature, efforts are now concentrated on the mechanisms of operationalizing these documents.

These documents have unanimously sounded the necessity of a uniformed and standardized operational procedure for implementing water, sanitation and hygiene programs and projects in Liberia. This is against the background that past attempts (1999 and 2004) to establish and implement standards have been weak and narrow in scope, not addressing all aspects of the sector.

These improved guidelines have come as a result of the dedicated work of water and sanitation professionals with wide range of knowledge in the planning, execution, monitoring and evaluation of WASH projects worldwide. Our heartfelt gratitude goes to such individuals who tirelessly supported and worked to the completion of these guidelines

The guidelines are therefore intended to add value to the sector by instituting a state-of-the art technology in conducting business in Liberia.

Honorable Attorney Samuel Kofi Woods, II

Minister of Public Works

REPUBLIC OF LIBERIA

THE GUIDELINES FOR WATER AND SANITATION SERVICES IN LIBERIA

INTRODUCTION

Many years before 2007, the implementation of water, sanitation and hygiene activities was un-guided by standards, with the main implementer being the public sector. At the same time technology options were equally limited, whereas hygiene issues were at their lowest ebb. Much has transpired with more technology options, the involvement of private and non-governmental organizations leading the implementation of WASH activities.

This should in its true application place more authority in the hands of the public institutions to leverage resources into monitoring, supervision and evaluation. In order to perform this important role, standards need to be established and agreed upon for effective monitoring and enforcement for the good of the Liberian population. Such standards must exhibit best practices and be state of the art.

In 1999, the first of any attempt to organize standards to govern WASH activities were introduced into the sector. These were later modified in 2004, with mere considerations on alternative designs for sanitation facilities without recommending additional options for facilities. A review of both documents proved limitations and thus a unanimous attempt to broaden the scope the combined guidelines to incorporate other options was agreed.

The Water and Sanitation Technical Guidelines is aiming at covering a large territory of options for implementing water and sanitation activities in Liberia, with the necessary hygiene components being the foundation for achieving success. The Guidelines are meant to be used as tools for technicians, as a guideline for monitors and evaluatorsand for decision-makers.

INDEX

List of Figures

Annexes

Glossary of Terms

Annulus - the space between a well casing and the wall of a dug or drilled hole (shaft) in the ground

Apron - a concrete platform placed around the top casing of a well to provide sanitary protection.

Aquifer – a water bearing geologic formation that yield sufficient water to wells and springs

Artesian aquifer- an aquifer whose water is under pressure greater than atmospheric pressure

Casing – material used to seal off a well shaft from the earth surrounding it, for example concrete rings, PVC, steel, etc

CLTS – Community Led Total Sanitation – a participatory approach of improving sanitaion conditions, where the community takes the lead to find its own solutions to mak the area free of open defecation

Collar- the reinforced concrete beam placed around the latrine pit as a footing for the walls of the latrine to prevent caving in of the pit

Concrete- a mixture of water, cement, sand and crushed rocks or pebble usually expressed in a ratio or three numbers representing cement, sand and crushed rocks, either by volume or weight

Cone of depression- a conical dimple in the water table which develops when there is draw down in a well

Conglomerate- a sedimentary rock made up mostly of rounded gravel

Consolidated – to be made hard or solid

Drawdown- the magnitude of the lowering of the water surface in a well, and of the water adjacent to the well, resulting from withdrawal of water from the well by pumping or other forms of extraction

Drilled well – a well constructed of small diameter using auger or mechanized drilling equipment

Downtake pipe – A vertical pipe fitted to a gutter to carry water from the gutter to the ground or a storage tank

Effluent – the liquid coming out of a waste water treatment process

formation – the formal unit for the classification of lithologic sequences, which for Liberia are Quaternary Sands, Edina sandstone, Farmington River Formation, Jurassic Diabase, Paynesville Sandstone and Precambrian Granite Basement

Ferrocement – A technique of building structures using steel mesh, steel bars and cement-sand mortar

Ferrocement tank – A water tank constructed using ferrocement technology

Gravel- sediments with grain size between 0.2 centimeters (0.08 inch) and 205 centimeters (81 inches)

Gravity water supply scheme – an arrangement for water supply where the source of water is at a higher elevation from the point of delivery. Structures are bilt to tap the source and pipes are laid from the source to the delivery point to transport water. Water supply is usually provided through taps

Gutter – A channel that collects and transports water. Genrally referred in the context of channels fitted on walls to collect flow from roof

Hand dug well- a manually constructed well, with diameter larger than 0.6 meter, which is usually lined with concrete and sealed

In-site- 1) in its original place 2) occurring at the location where it was formed

Institutional latrine – a latrine with multiple accesses for use at an institution usually a school or health center

Laterite a tropical soil rich in aluminium and iron formed under condition of good drainage

Latrine – a toilet with a pit or trench in the ground, and which is covered by a slab or seat with an access hole

Lining – The protection of walls of an excavation or a channel

Lithologic – of or relating to lithology

Lithology – the physical description of the occurrence, distribution and classification of rocks

Log- a time and / or depth specific record of rocks penetrated, conditions met and activities carried out during the construction of well

Manhole- a covered opening on top of the well to allow access to the well

Mortar- a mixture of water, sand and cement expressed as a ratio of two numbers representing cement and sand, either by volume or weight

Operation and Maintenance – the day to day running of services including regular and minor repair works

PVC – poly vinyl chloride

Permeability- the ability for water (or a liquid) to flow through a rock or formation

Radius of influence- the distance from the center of a well to the outer limit of its cone of depression

Rain water harvesting – The method of collecting runoff from rainwaterfor use as water for human consumption. Generally used when runoff from a roof is collected and stored for future use

Safe drinking water – Potable water that meets the quality criteria accepted in the country

Sandstone – a sedimentary rock made up mostly of sand

Sedimentary- particles and fragments that have been transported by water, wind or gravity

Spring – The area or location wherever ground water meets the earth’s surface, and converts to a surface flowing stream

Spring Box – The structure built to protect a spring and collect water from the spring for suplying to a community

Soakaway pit-a pit of porous construction with unlined walls which is backfilled with crushed rocks to allow water from the hand pump or well to seep into the ground

Static water column- the depth of water in a well under static water conditions

Static water level (SWL) – (1) the elevation of the water table or pressure surface when it is not influenced by pumping or other forms of extraction from the ground water body (2) the level of elevation to which the top of a water column may rise, if afforded the opportunity to do so, from an artisan aquifer

Super chlorinate- the addition of chlorine solution to water to establish a 'free chlorine residual' of 5 milligrams per litre after 30 minutes of contact time

Telescoped well- a well constructed with at least two different sizes of casing usually with the smaller diameter casing used to extend the depth of the well

Water seal – An arrangement provided in flushed toilets or latrines where a U bend is provided in the pipe which retauns water. It prevents flies and smell from entering the cubicle

Well- a hole or drilled in the ground , usually fitted with a pump, for the withdrawal of water

1. Hand dug wells

1.1 Hand dug well site selection

a. In siting a well potential sources of groundwater contamination must be clearly established including: pit latrines, septic tanks, sewage lines, garbage dump sites, animal lots, unprotected, open or abandoned wells, old and/or existing cemetery or burial sites, buried fuel - diesel, gasoline, kerosene tanks and any other sources of contamination such as chemical depots, industrial waste.

b. A well must be sited at least 98 feet (30 meters) above potential sources of contamination. In fractured formations special care should be taken and where possible the radius of influence of the well should be calculated.

c. The local community and local authorities should be involved in the process of well site selection.

1.2 Hand dug well design and construction

Detailed technical drawings of a hand dug well are presented in Figures 1.1, 1.2 and 1.3. The following paragraphs give the specifications for the construction of hand dug wells in Liberia.

1.2.1 Manhole

A hand dug well should have an access manhole with the following dimensions: 14 inches by 14 inches (35.6 by 35.6 centimeters). The manhole should be sealed immediately after the well is completed and disinfected – see below. The manhole should only be opened in emergency to allow access when the hand pump is not operating[1]. The manhole cover should be sealed with cement on a 0.5 inch (1.3 centimeters) high footing to prevent water from seeping into the well. The well cover slab must have a 4 inch (10 centimeters) PVC pipe extending 12 inches (30 centimeters) above the slab for hand pump installation.

1.2.2 Well lining

A hand dug well must be fully lined with: concrete rings fabricated with a concrete mixture of 1:2:3 and reinforced with wire mesh; and/or an in-situ lining with a concrete mix of 1:2.5:5 and 8 mm diameter re-rods (Watt and Wood, 1979).

In low yielding stable consolidated formations[2] perforated culverts can be used at the intake section of the well to increase well recharge rates – seepage holes can be inserted by casting lengths of oiled re-rod or wooden pegs in to the rings at an upward (to reduce the risk of fine sand being drawn from the aquifer, through the seepage holes, in to the well) angle toward the inside of the well, and removing them before the concrete is completely set – see Fig 1.3.

[1] Well rehabilitation should be conducted by removing the well cover-slab.
[2] In unconsolidated formations porous concrete (1:1:4) can be used for the intake section, however these rings are weaker and consequently unless the well has been lined in situ, this method is not recommended.

1.2.3 Diameter and annulus

The inner diameter of a hand dug well must be at least 4 feet (1.2 meter). In the case of a telescoped well, the inner diameter of the telescoped concrete ring must not be less than 3 feet (0.9 meter).

The first 10 feet (3 meters) of the annulus – the space between the concrete rings and the wall of the hole in the ground – must be cement grouted to avoid entry of surface runoff. The cement grouting should be of 1:1 ratio.

1.2.4 Filter bed

Crushed rocks or gravel must be used as a filter bed at the bottom of each hand dug well. The filter bed of a well sited in unconsolidated sediments (or sandy formation) must be graded to 0.25 inch (6.4 millimeters) crushed rock. In consolidated formations, the filter must be of 0.5 inch (12.7 millimeters) crushed rock. The thickness of the filter bed must not be less than 1 foot (30 centimeters). The annuals of the intake section - at least the bottom 4 feet (1.2 meters) of the well - should be backfilled with crushed rock.

1.2.5 Apron

The apron of a hand dug well must have a 5 - degree slope in the direction of the drainage channel and the soakaway pit. The apron must be circular in shape with a distance from the edge of well-head to edge of drainage apron of 5 feet (1.5 meters) and a thickness of at least 4 inches (10.2 centimeters). Reinforced concrete must be used in apron construction, using 1:2:3 concrete mixture, reinforced with wire mesh. The well head needs to be attached to the apron to ensure a sanitary seal. Either reinforced concrete or blocks must also be used in apron rim and drainage construction. The void spaces in the block must be filled with mortar. The drainage channel must be plastered with a 1:3 mortar.

1.2.6 Drainage Channel

Hand dug well must be constructed with a drainage channel designed to carry water from the apron to the soakaway. The drainage channel should be 10 inches (25 centimeters) wide by 6 inches (15 centimeters) deep by 16 feet (5 meters) long.

1.2.7 Soak away pit

The dimension of the soak away pit should be determined on the basis of a percolation test but must be 3.2 feet (1 meter) in diameter and 6.5 feet (2 meters) deep, and must be connected to the well apron by the drainage channel and be provided with a cover.

1.2.8 Minimum static water Column

Wells must have a sustainable yield[3] of at least 264 gallons[4] (1,000 litres) per hour. As a proxy guideline for yield, any hand dug well constructed in the raining season- period

[3] The sustainable yield of a well can be established by measuring the well's rate of discharge (in gallons or litres/hour) over at least a 4 hour period at the point where the dynamic water level stabilises at the level where the pump's intake will be installed. Care should be taken to dispose of pumped water away from the well in order to minimise the chance of recharge/infiltration which would reduce the validity of the results – a distance of >100m is recommended. Yield can be measured using a flow meter on the pump's discharge pipe; or volumetrically by timing how long

from 1 May to 31 October – must have a static water column of at least 20 feet (6 meters). Any hand dug well constructed in the dry season – period form 1 November to 30 April- must have a static water column of at least 15 feet (4.5 meters).

1.2.9 Well Disinfection

Every hand dug well must be disinfected after it is constructed or after any repairs are carried out on the well, before it can be used. This can be done by using 1 litre of 0.2% strength chlorine solution for every 100 litres of water in the well, and allowing at least 30 minutes contact time before dewatering the well until chlorine levels are returned to less than 0.5 mg/l of free residual chlorine. A detailed explanation for method of well disinfection is given in Annex 2.

1.2.10 Inscription on well Apron

On completion of the well, the date of completion, the name of implementing and donor agency, total depth of well and static water level must be clearly inscribed on the apron of the well. The inscription should be done in an area which will not be disturbed often by movement of people or water containers.

1.2.11 Water Quality test

Water quality test (chemical and bacteriological) should be done on all wells during and after construction. Water should be tested for iron and other chemicals when the static water level is reached and six months after completion of well. Such test results should be properly documented and data kept with the community and county health authorities.

Where a quality test proves the source unfit for consumption, the water source should be sealed off and clearly marked as non-potable until remedial actions are taken.

1.2.12 Well Completion form

An electronic and printed Well Completion Form (Annex 1) must be submitted to the Ministry of Public Works, District Commissioner, and community for all completed wells.

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it takes to fill a container of known volume. Water levels can be measured using an electronic dip meter, or a chalk covered tape with a weighted end.

[4] Typical discharge rates for handpump vary but can be assumed to be in the range of 1,000 liters/hour (for deep well handpumps) - 2,000 liters/hour (for suction lift handpumps).

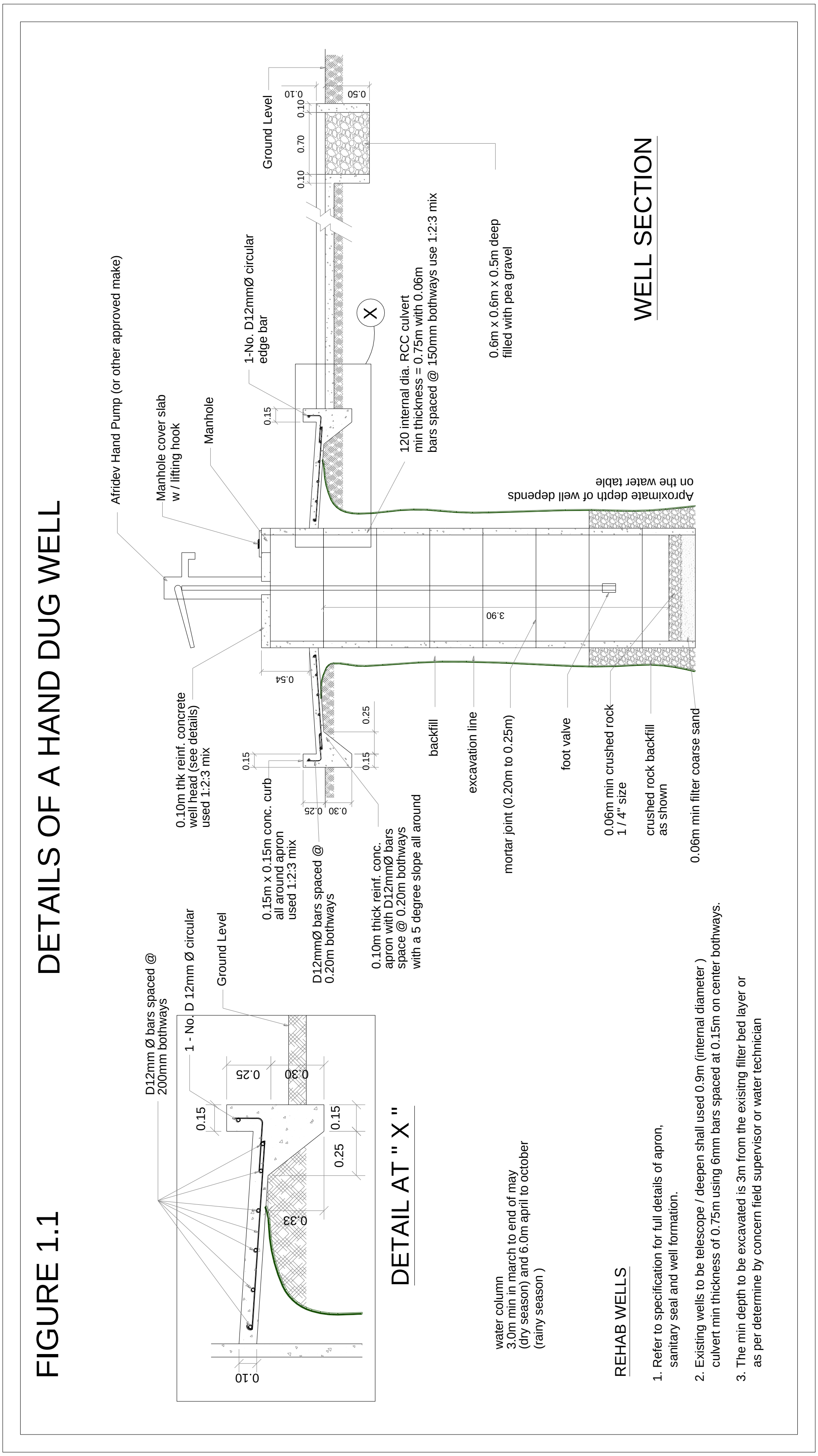

Figure 1.1: Details of hand dug well

FIGURE 1.2

DETAILS OF WELL CONSTRUCTION
Scale 1 / 40
Well Depth = 10 m (9 culv+4culv+1c.edge)

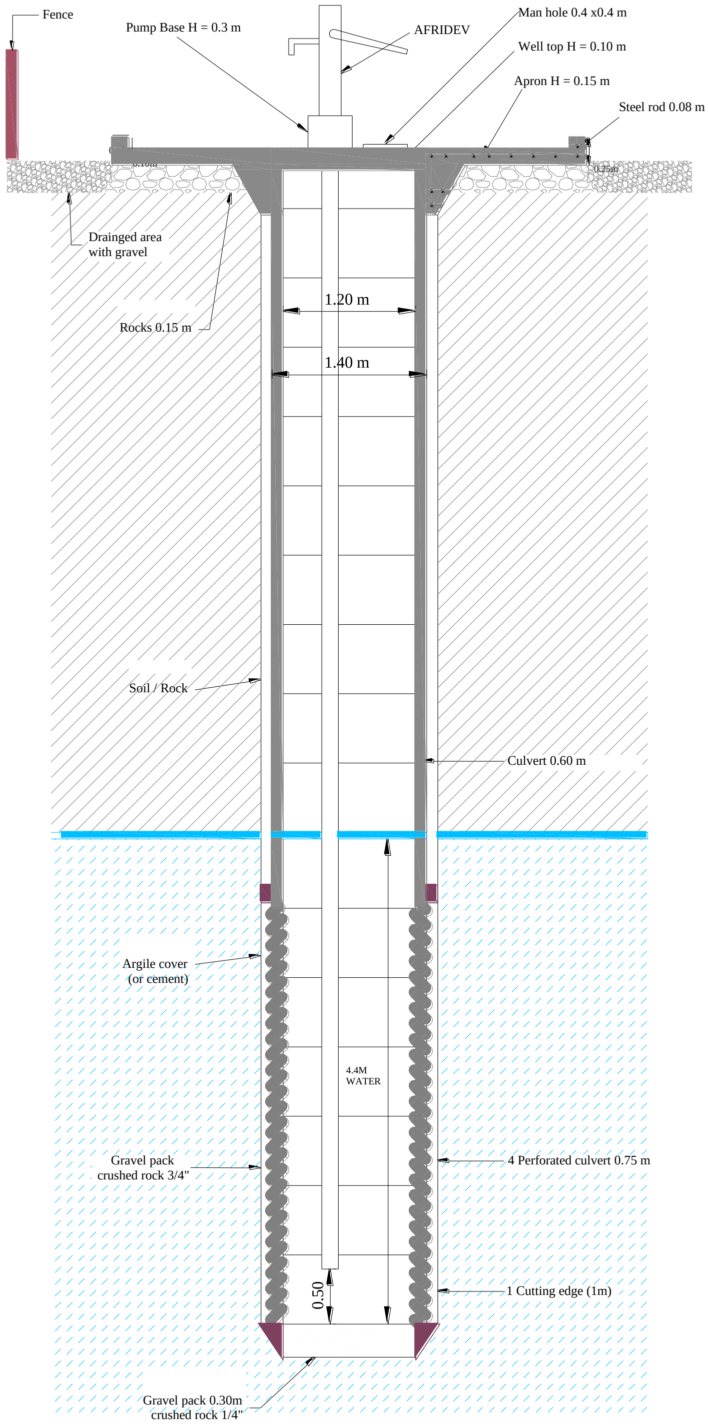

Figure 1.2: Details of well construction

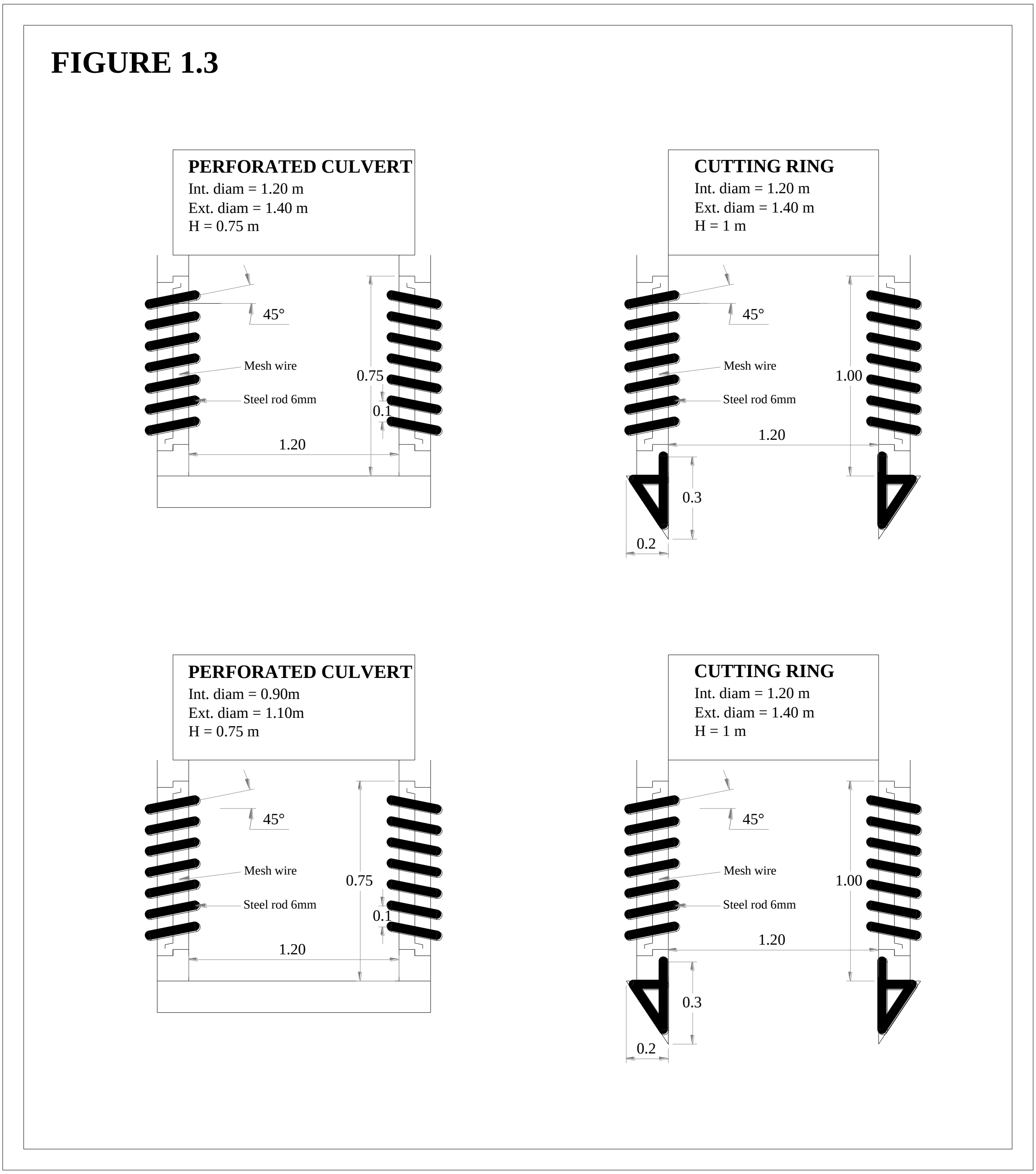

Figure 1.3: Well Technical Scheme

FIGURE 1.4

SCHEMA OF REINFORCEMENT FOR APRON & PUMP BASE

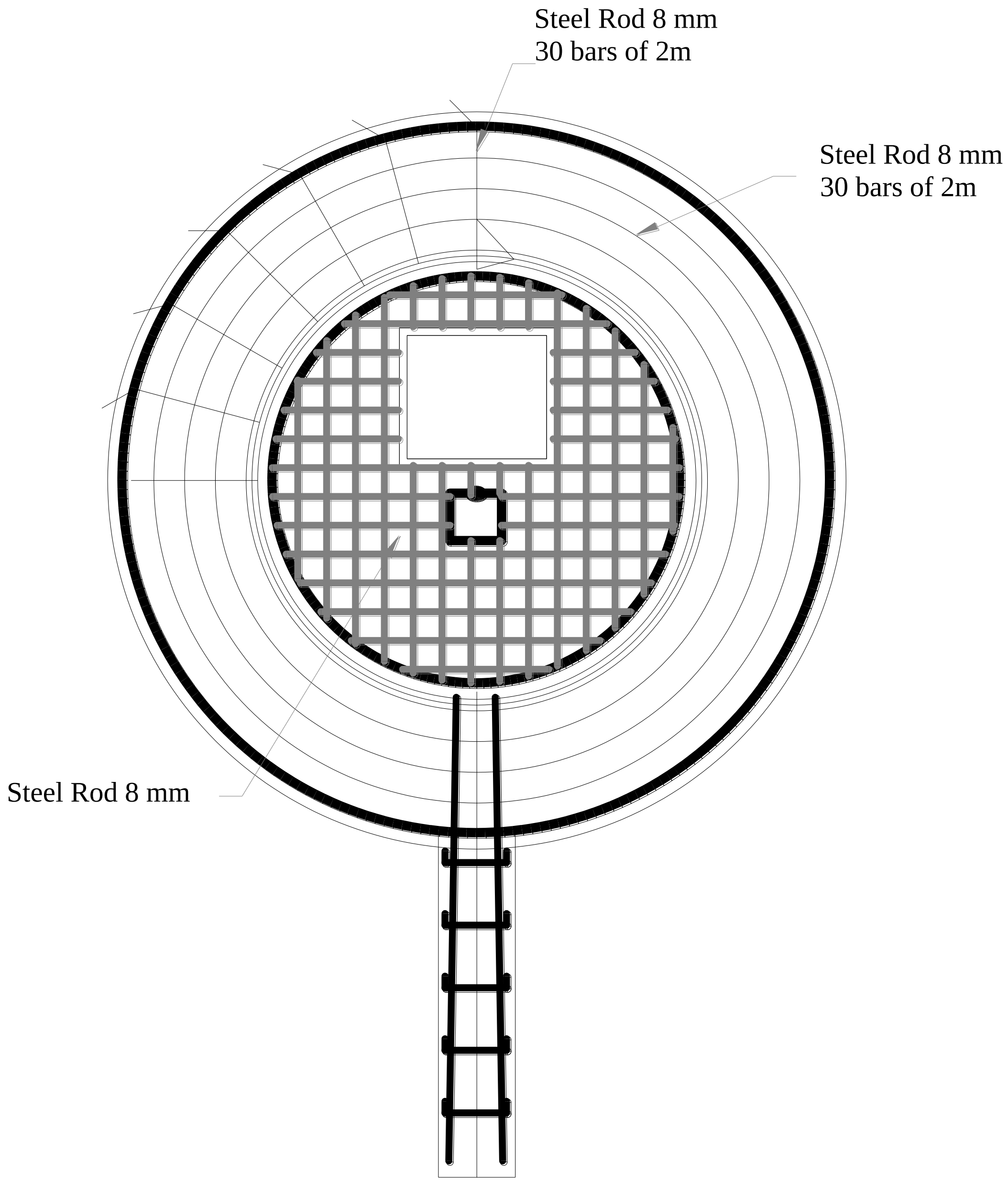

Figure 1.4: Schema of Reinforcement for Apron & Pump Base

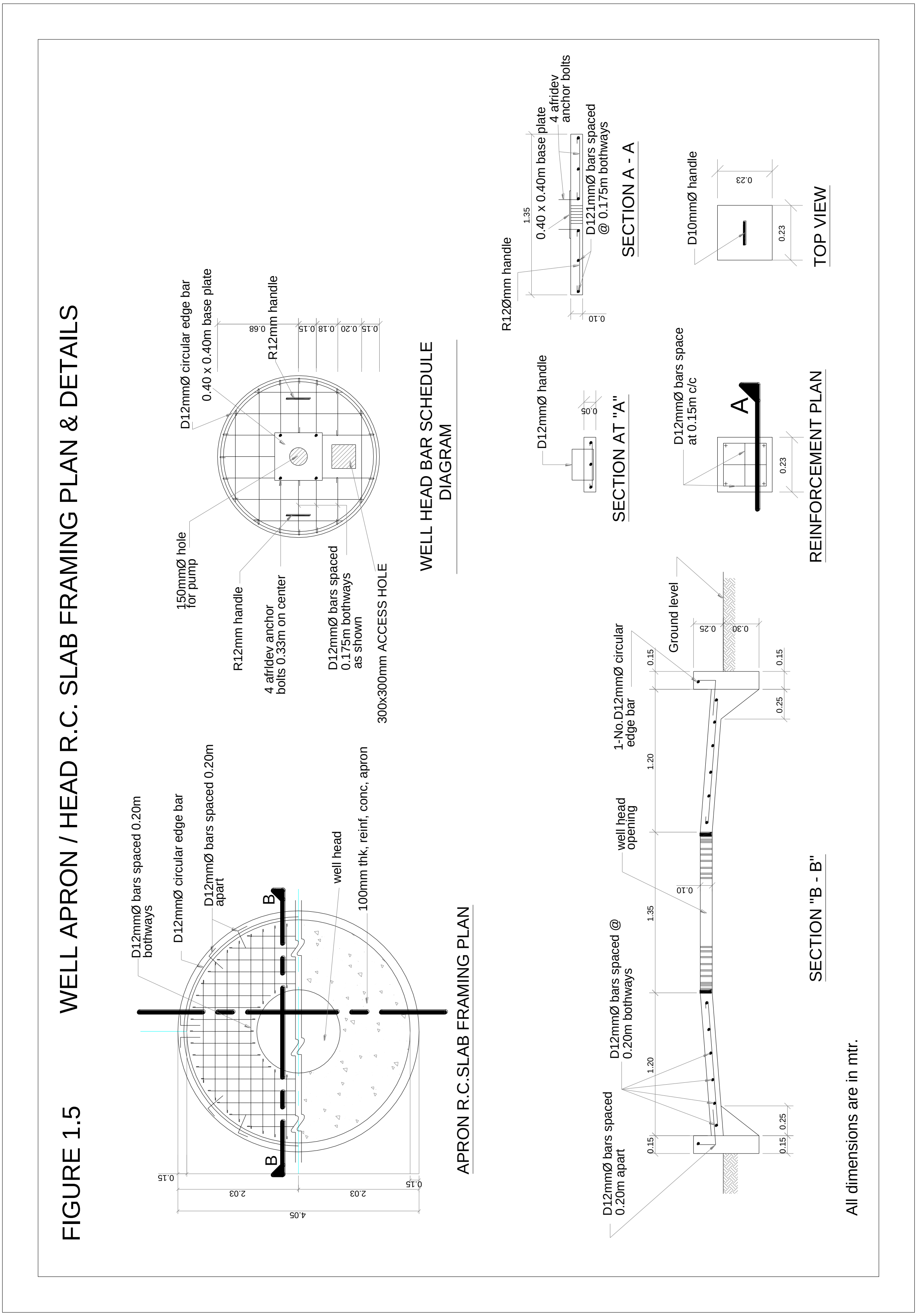

Figure 1.5: Well Apron/Head R.C Slab Framing Plan & Details

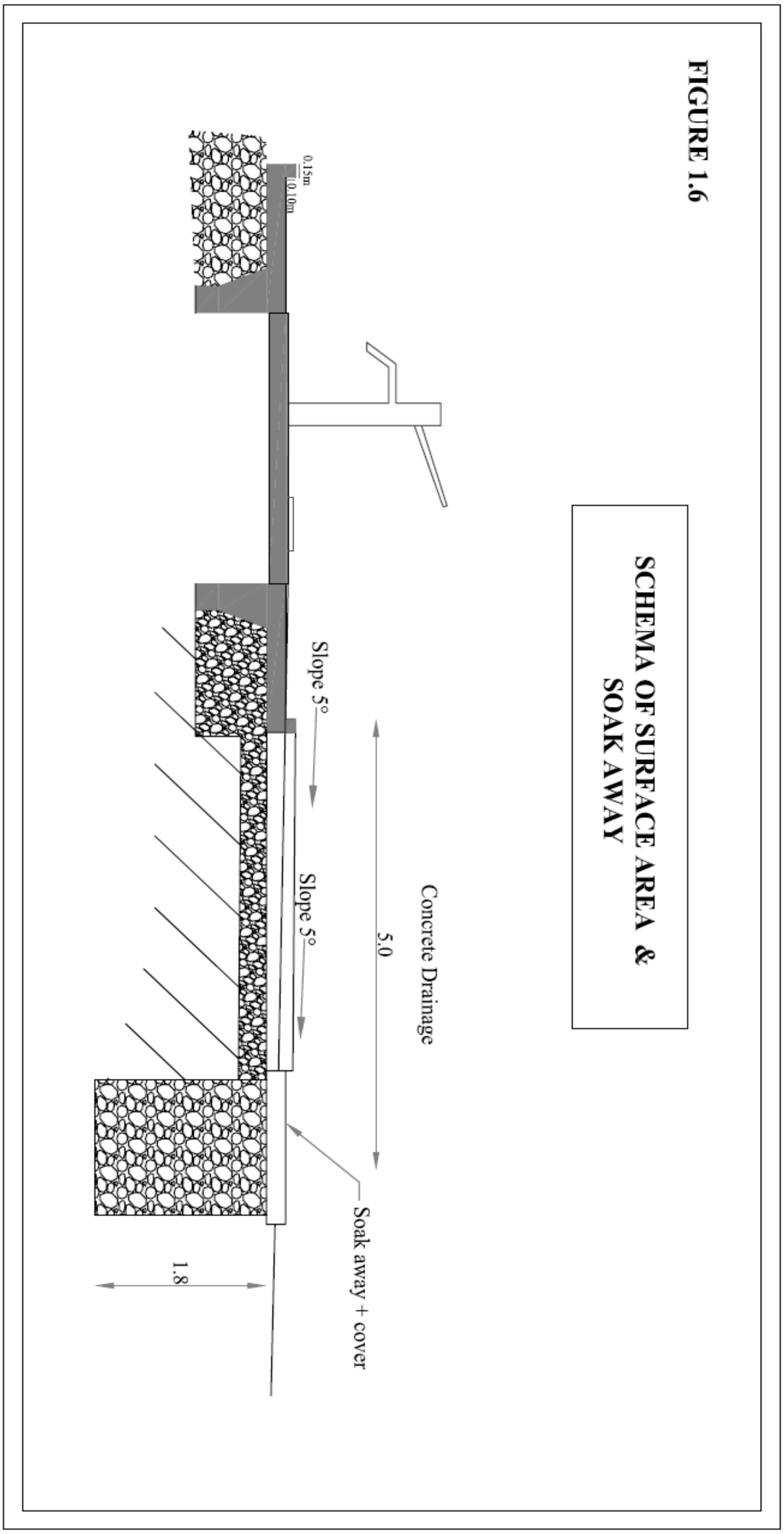

Figure 1.6: Scheme of surface Area & Soak Away

2. Drilled wells

2.1 Drilled wells

2.1.1 Drilled well site selection

The criteria for site selection laid down in the section of construction of hand dug wells (1.1 – Hand dug well site selction) also apply for drilled well site selection.

2.2 Drilled well design and construction

Detailed drawings giving design and construction details are given in Figures 2.1 and 2.2.

2.2.1 The Annulus

The annulus between the casing and drilled hope of a drilled well must not be less than 1 inch (2.5 cm). The first 10 feet (3 meters) of the drilled well annulus must be mortar grouted to avoid entry of surface water. The inner diameter of the drilled well casing must not be less than 4 inches (10.2 centimeters).

2.2.2 Casing for drilled wells

The top casing of a drilled well must extend at least 1 foot (0.3 meter) above the drilled well apron to prevent the inflow of the surface water.

The location of the well screens should be determined by the depth and permeability of the formations penetrated.

At least one screened section should be provided in the bottom one third of the well.

Only pressure PVC pipes and screens must be used in the completion of a drilled well. Metallic casings are not accepted due to corrosion problems.

Two (2) types of borehole completion are recommended in Liberia according to the geology:

For sedimentary and alluvial formations, full borehole lining must be used (Refer Figure 2.1). A sieve analysis should be conducted to determine screen slots size, the need and design of an artificial gravel pack, however as a rough guideline for wells equipped with handpumps a 0.5 to 0.75mm screen slot size, and gravel size 0.7mm – 1.25mm can be used.

For soft granitic weathered rock, crack or fissures storing water, open hole completion is recommended (Refer Figure 2.2).

2.2.3 Bottom Cap

A PVC sump of least 3 feet (1 meter) and bottom cap must be used to seal the bottom of drilled wells (see Fig 2.1) to collect silt that may enter in the casing.

2.2.4 Borewell disinfection

Every completed drilled well must be disinfected (see above) and then sealed or capped pending pump installation.

2.2.5 Apron, Drainage Channel and Soak away pit

The dimension of the drainage channel and soakaway pit for a drilled well are the same as those of the hand dug well. (Refer figure 1.5 & 1.6).

The dimension of the drilled well apron are the same as those of hand dug well, except when a submersible pump is installed in which case a drainage channel and soakaway pit will not be necessary.

2.2.6 Well Yield

Wells must have a sustainable yield of at least 264 gallons (1,000 litres) per hour - if the yield is found to be below this mark, the borehole should be considered as unusable. Ideally a step-draw-down yield test should be performed on each drilled well. (Refer annex 5 for details of a pump test)

2.2.7 Inscription on well Apron

On completion of the drilled well, the date of completion, the name of implementing and donor agency, total depth of well and static water level must be clearly inscribed on the apron of the well. The inscription should be done in an area which is not disturbed often by movement of people or water containers.

2.2.8 Geologic log and well completion form

An electronic and printed Well Completion Form (Annex 1 & 2) and geological drilling log (Annex 3) must be submitted to the Ministry of Public Works, District Commissioner, and community for all completed drilled wells.

2.3 Well protection

2.3.1 An animal proof fence should be constructed around every completed well which is intended for community or public use. Hedges or timber can be used in constructing the fence.

2.3.2 Wells are constructed as a point for collecting water. Water collected should be utilized at home. Therefore, washing of clothes and household utensils and bathing are prohibited near a well. Mixing of chemicals, washing of petroleum product containers, and handling of potential pollutants near a well are also prohibited. A 98 feet (30 meter) protection zone from the well must be maintained. Cattle should not be allowed near public wells.

2.3.3 The community has direct ownership for the community or public well. The community should protect the well and handpump from theft, vandalism and misuse. The community is also responsible for maintenance through trained handpump mechanics and caretakers identified by the community.

2.4 Handpump

2.4.1 Recommended handpump makes

The following hand pumps are recommended for installation on community and public wells in Liberia: Afridev; India Mark II, Kardia type K-65.

Agencies installing hand pumps should ensure that quick moving spare parts are available in communities to facilitate community driven maintenance.

Community or public hand pumps should not be removed from the well on which they were installed without the written approval of the communities. This measure is intended to protect the hand pump against theft.

2.4.2 Hand pumps should be installed with the foot valve set at least 1.6 feet (0.5 meter) above the filter bed and just above the bottom screen for drilled well.

3. Excreta Disposal

3.1 Choosing the right technolgy

While standerdised designs can be used for institutional latrines, implementing agencies should encourage a 'sanitation ladder' approach for family latrines. Through CLTS approach, communities should be sensitised and galvanised into action to make their community "Open Defecation Free" (ODF) and families should be encouraged to find appropriate and affordable solutions for safe excreta disposal. However, in promoting this approach, implementing agencies should effectively communicate key parameters that ensure safe disposal of excreta, and ensure that the options being selected by the community are:

a. Safe to use

b. Dispose excerta in a manner that does not pose a health risk

c. Provide adequate privacy.

The following are the guidelines for ensuring that the above parameters are met. Options for an institutional latrine design to be implemented in Liberia and some basic options for family latrines have been explained in the following section.

3.2 Latrine Site Selection

3.2.1 In selecting a site for a latrine, the location of wells and surface water sources, for example ponds, swamps, creeks, rivers etc. must be clearly established. The location of food markets, kitchen, cook shops and restaurants must be clearly identified.

3.2.2 A latrine must be located at least 96 feet (30 m) below (downslope/downstream) a well.

3.2.3 A latrine must not be located over a surface water body and should be at least 96 feet (30 m) from the edge of the flood plain of a surface water body.

3.3 Alternating pit institutional Latrine Design and Construction

Alternating pit latrines make use of latrine pits on a rotational basis. This means that a permanent superstructure can be used.

Two pits are dug, each sized to store about two year's worth of excreta. Each pit has a removable cover slab, providing access to the pit.

One pit only is put into use and filled over time. Once this pit is full, it is closed off for storage, while the second pit is used. As the second pit fills, the first pit is emptied and put back into use.

Given the right conditions of temperature, moisture content and pH, after 2 years storage the excreta will have decomposed and the disease-causing organisms died off sufficiently that the excreta to be manually handled. (WELL, 2006)

Drawings for latrine units with 1 cubicle, 4 cubicles and 5 cubicles are given in Figures 3.1, 3.2, 3.3 and 3.4.

3.3.1 Latrine Pit

Ideally each pit should be sized to store two year's worth of excreta; however as a guideline the pit should be 7 feet (2.1 meters) deep.

The pit walls are fully lined with 6 inches (15 cm) solid concrete blocks from bottom to 1 foot (30 cm) above the ground. The pit bottom in not lined in order to allow infiltration of liquids.

The pit is divided into underground compartments with partition walls of 6 inches (15 cm) solid concrete blocks.

The width of the pit is 7'6" (2.3 m) and length is as per number of underground compartments. Each compartment is 4'3" (1.3 m) long with the exception of the two end compartments which are 2.1 feet (0.65 meter).

The excavated portion outside the lining walls is to be backfilled.

3.3.2 Latrine Slab

There are two sizes of slab. Slab type A is 2'2" (65 cm) x 4'3" (130 cm) and slab type B is 1'7" (50 cm) x 4'3" (130 cm). Each compartment is covered with 4 slabs- 2 of type A and 2 of type B.

On each compartment out of the two type A slabs – one has two drop-holes and one has a 6 " (15 cm) hole for the vent pipe.

The drop-hole has a key-hole shape of 6" diameter with a stem length of 7" and width of 2".

Both type A and type B slabs are minimum 3" (7.5 cm) thick cast in 1:2:3 concrete reinforced with ½" (13mm) rods placed 4" (10cm) c/c both ways.

In every cubicle 1 drop-hole is operational at a time. The other drop-hole is kept sealed.

On filling of the compartment, the drop-hole is changed and the earlier one sealed.

The pit can be emptied by removing the rear type B slab which gives access to the pit – see below.

The slabs are placed on the 6" concrete block walls and sealed using mortar.

N.b as an alternative to using three separate slabs, a single slab, cast in-situ, can be used, with separate removable slabs used for the man-hole covers.

3.3.3 Super structure

Each cubicle rests over two underground compartments (Figure 3.2)

The recommended material for the superstructure walls are soil stabilised blocks (mud blocks) or concrete blocks. The use of zinc coated sheets as wall material is not recommended.

The inside of the cubicle should provide a minimum clear space of 4’x3’6” (Figure 3.3)

The superstructure height should be at least 7’6” (2.3 m) in the front and 6’6” (2m) at the rear.

PVC Vent pipes of 6” (15 cm) diameter should be provided on each pit compartment.

The doors should be at least 2’4” (0.7 m) wide and 6’ (1.82 m) high.

Privacy walls should be provided in the front of the structure at a distance of 4’6” (1.4 m).

The walls can be built for 4” thick concrete blocks and should be 6 ft high. With an access way on each side at least 3 feet wide.

3.3.4 Roof

Roof should be made of 32 gauge corrugated zinc coated sheets, resting on roofing wood of size 2”x2” (5cmx5cm) purlins @ 3’9” (1.14m) c/c, 2”x4” (5cmx10cm) rafters @ 4’ (1.22m) c/c.

The roofing wood to be fixed to wall plate 2” x 6” (5cmx15cm) placed on top of the wall and tied to the wall using ¼” (10mm) steel rod.

3.3.5 Manual Emptying

The man-hole slabs should be removed to provide access and improve air circulation. Ideally the pit should be emptied by people standing at ground level and using shovels, buckets and ropes to remove the excreta, without having to enter into the pit. If people have to enter the pit they should wear a safety rope. Gloves, boots and other personal protective equipment should be used to reduce the risk of contact with disease-causing organisms that have not died off. (WELL, 2006)

3.3.6 Disposing of faecal sludge

Faecal sludge can be disposed of by composting or by burying in a shallow trench with a large surface area and covered with soil.

To reduce the risk of contact with disease-causing organisms that have not died off, the disposal site should be away from any water source and areas that are liable to flooding. (WELL, 2006)

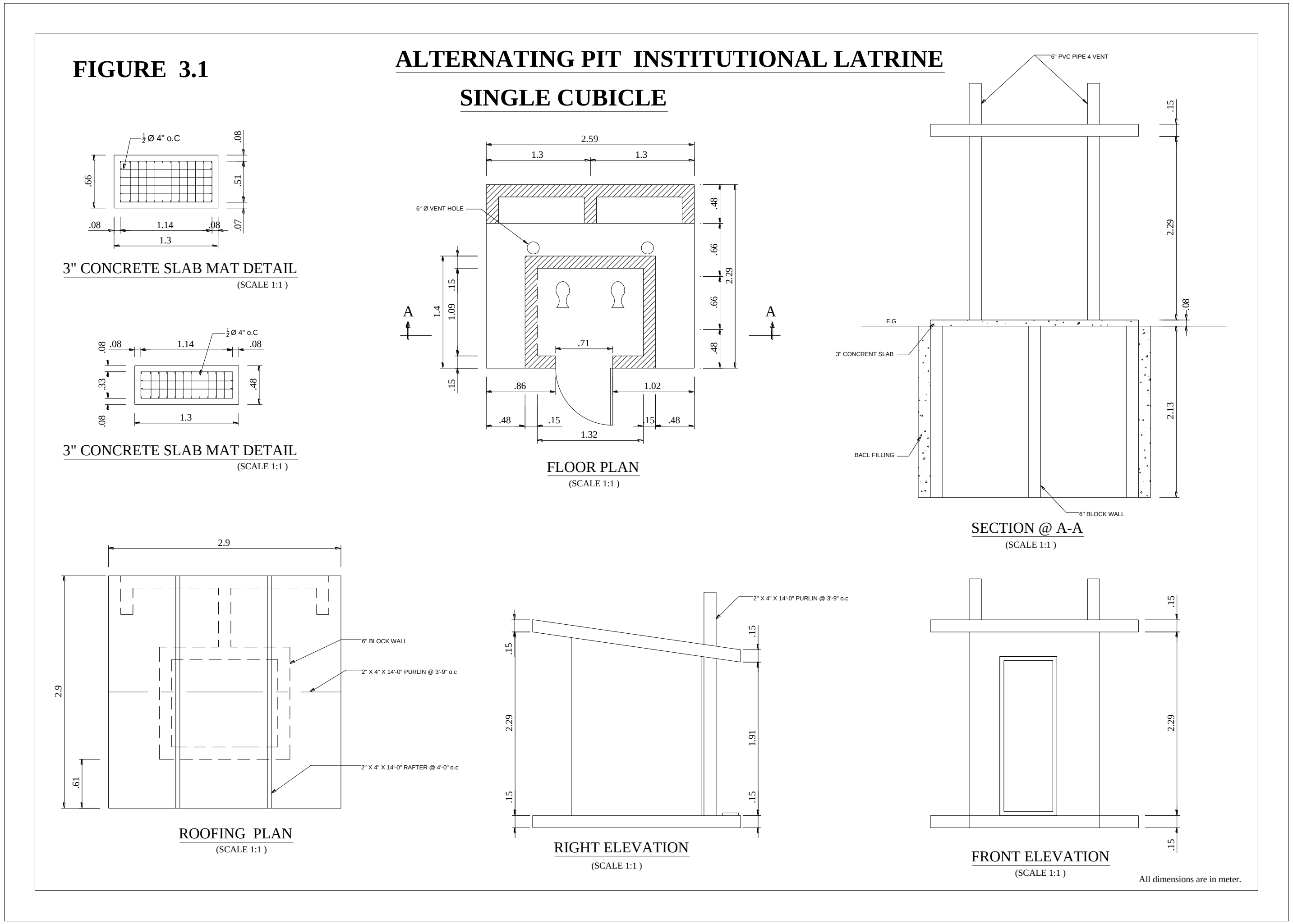

Figure 3.1: Alternative Pit Institutional Latrine

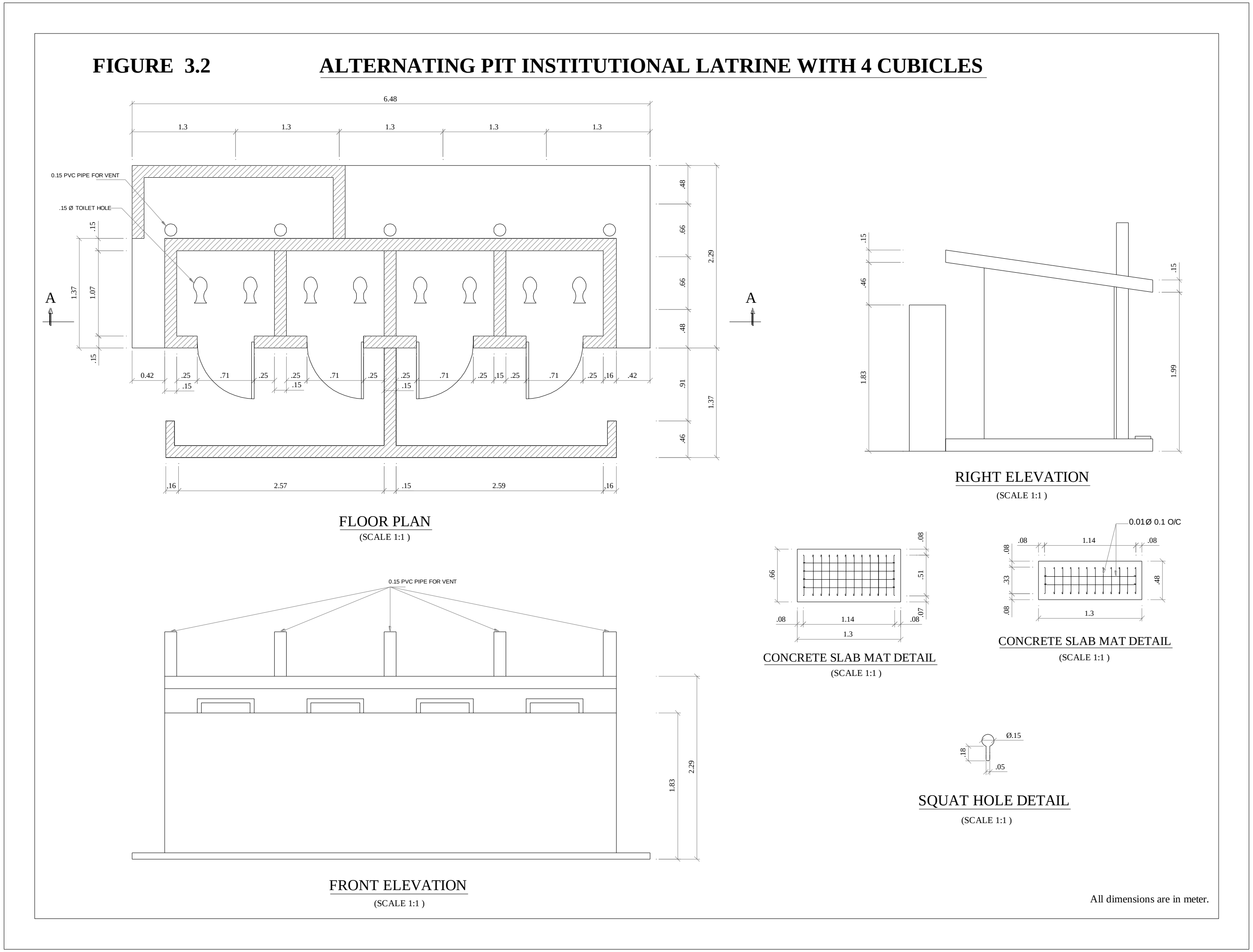

Figure 3.2: Alternative Pit Institutional Latrine with 4 cubicles

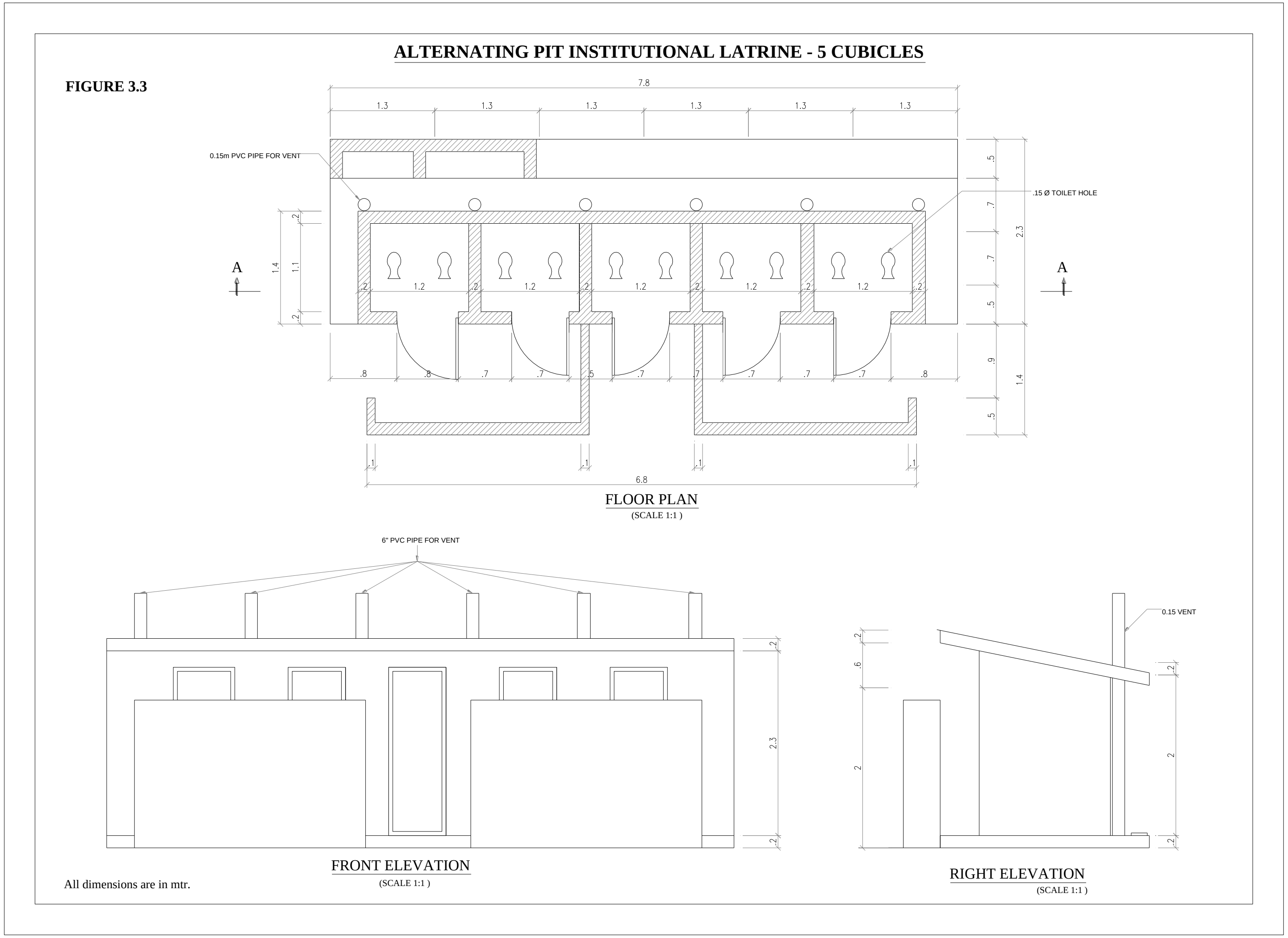

Figure 3.3: Alternative Pit Institutional Latrine with 5 cubicles

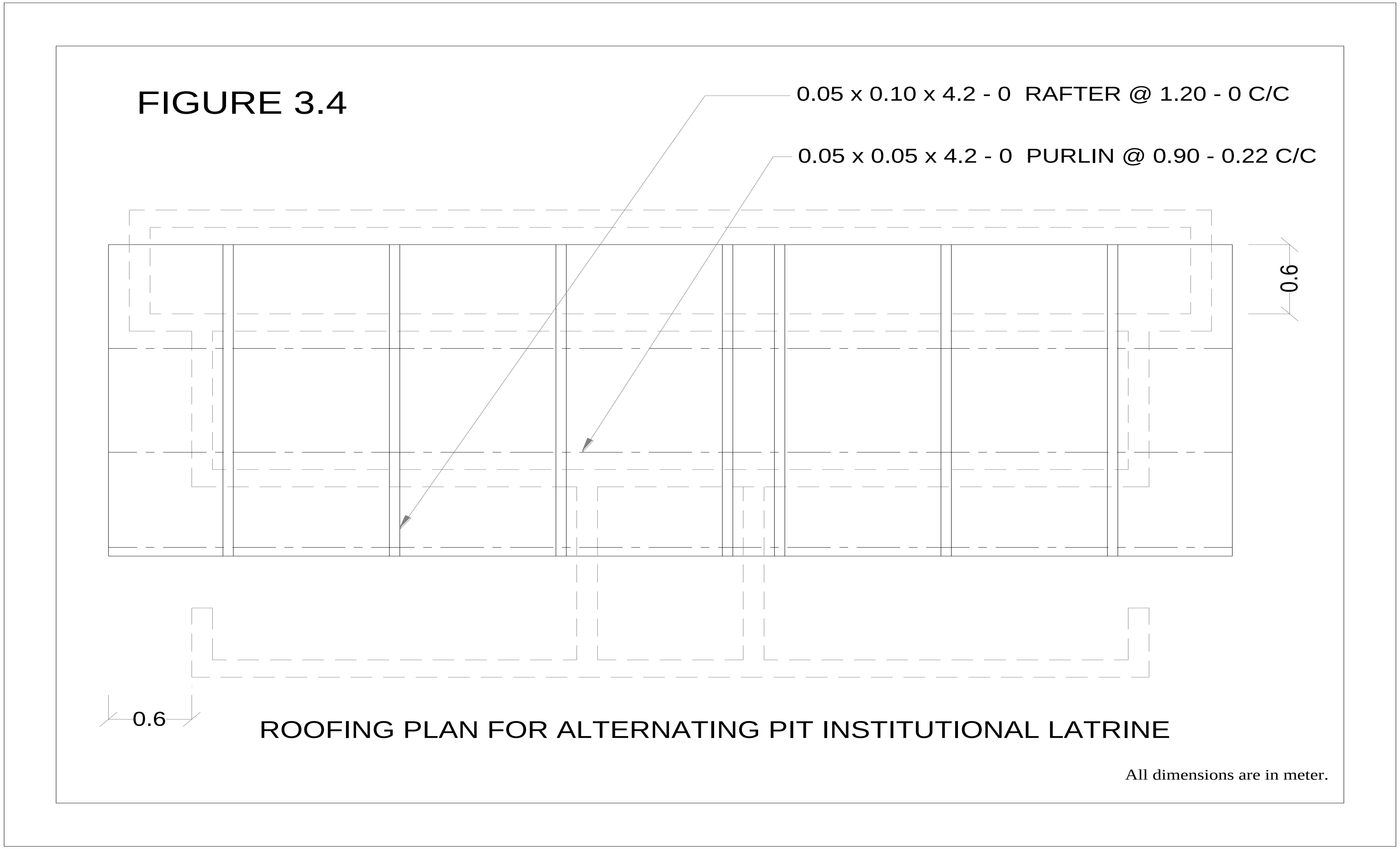

Figure 3.4: Roofing plan for alternating pit institutional latrine

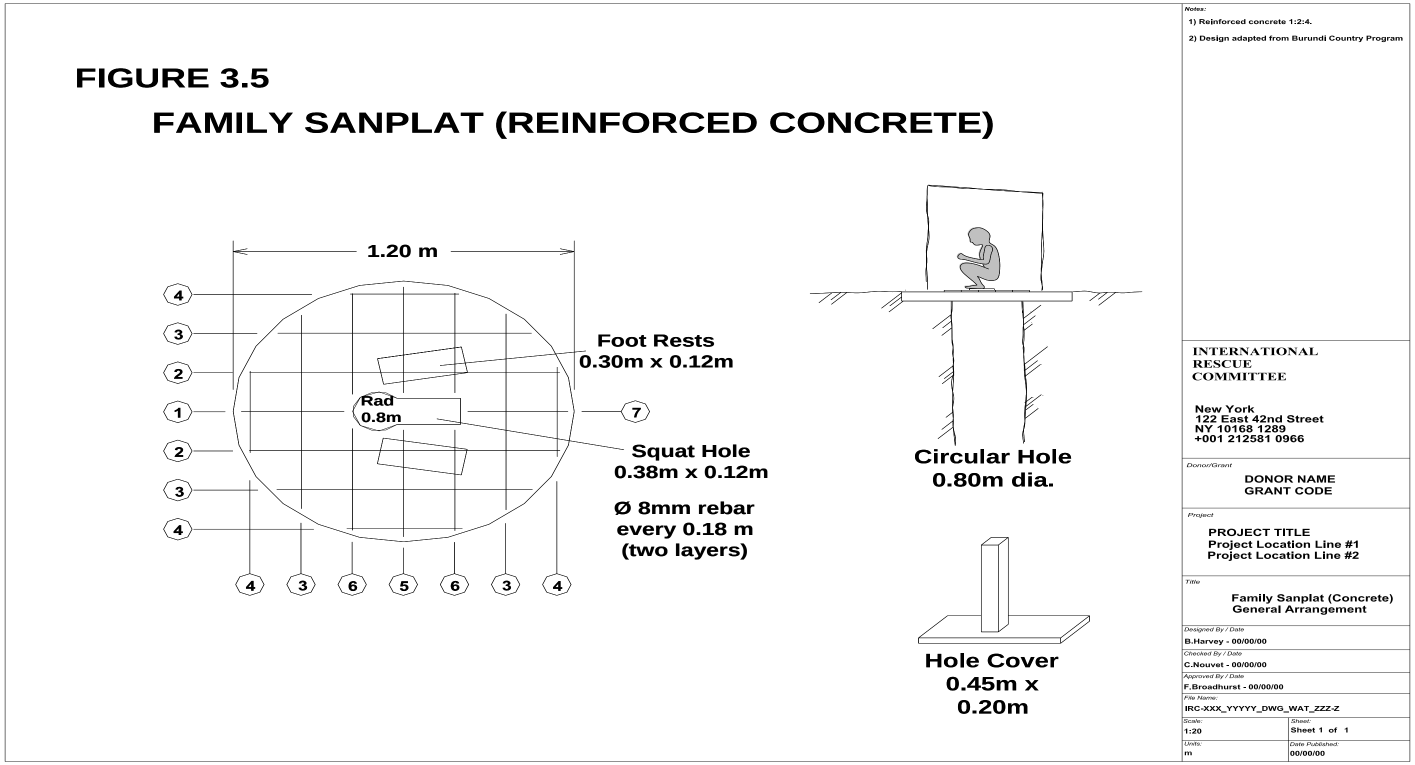

Figure 3.5: Family Sanplat (Reinforced Concrete)

4. Family Latrine

Following a Community Led Total Sanitation (CLTS) approach, families should develop their own latrine designs and construct them using local materials.

The aim of CLTS is for a community to be open defecation free. To enable this, designs developed by community members should allow faeces to be buried and covered and should be easy to keep clean.

As families and communities move up the sanitation ladder, they may wish to use concrete squatting slabs or make other improvements.

A simple concrete 2 feet (0.6 meter) by 2 feet (0.6 meter) by 2 inch (5 centimeter) squatting slab can be made using a 1:2:2 concrete mix, and a mould for the outside of the slab and the drop-hole. A lid can also be cast, and foot-rests added to improve the design. The recommended curing time for the slab is one week. (Brandberg, 1997)

Wood for supporting beams is generally not in short supply in Liberia, but where it is, circular 4.9 foot (1.5 meter) diameter, 1.5 inch (4 centimeter) dome-shaped concrete slabs can be made using a 1:2:2 concrete mix, and a mould for the outside and drop-hole of the slab, cast over a mound of damp sand. The recommended curing time is one week. (Brandberg, 1997)

In areas where soil is unstable, the pit can be made round and lined using rocks, bricks, timber or sand filled bags to reduce the risk of pit collapse.

ANNEXES

Annex 1 Water Points Constructed /Rehabiliated & Assessment Form

Water Point-ID (Official used only): ____________________

BASIC INFORMATION

County: __________________District: __________________________________

Clan:___________________Town/village/community:_______________________

PCode: ___________ Population:______ Number of Households:______________

School Population: # of Boys_____ # of Girls_____ Male-Teachers ____ Female-Teachers_______

GPS Coordinates (WGS84 system): X:_____________ Y:_____________

WORK DONE

Type of work done: ☐ Construction ☐ Rehabilitation ☐ Assessment

Name of Agency (that did the work):____________________________________

Type of Agency: ☐ NGO ☐ Govt ☐ Private ☐ Community

Date the work was completed Start Date [mm/dd/yyyy]: ___/____/___End Date [mm/dd/yyyy] ____/____/____

Number of pump mechanics trained in the community: Male:________ Female:_______

Number of WATSAN committees organized in the community:_________

Ownership of the water point:☐ Community ☐ Private ☐ School ☐ Health Facility

Owner's ID: _______________ Name of the owner: ___________________________

WATER POINT DETAILS

Nature of the water point: ☐ Borehole ☐ Hand dug ☐ Open Well ☐ River/Stream,

☐ Unprotected spring catchments ☐ Protected spring catchments ☐ Others Specify

Water Static level:______ ft Total depth:________ ft Diameter of the well:_____________ ft

Installation depth of the pump:____________ ft

Lining or casing: ☐ None ☐ Concrete rings ☐ PVC pipes ☐ Metal pipes

Yield of water point: ________ l/h

Is bed rock been reached? ☐ Yes ☐ No,

If yes, at which depth? _________ ft

Is the well telescoped? ☐ Yes ☐ No,

If yes, from: ___________ft to:____________ ft Diameter of the telescoping:_________ ft

Technique of telescoping: ☐ by drilling ☐ by installing smaller culverts

Does the water point goes dry? ☐ Yes ☐ No
If yes, from (month):_______________ to (month): _____________

PUMP INSTALLATION DETAILS

Type of pump: ☐ No pump ☐ Manual / foot ☐ Electrical (surface)

☐ Electrical (submersible)

Pump trade mark: ☐ Kardia ☐ Afridev ☐ Consallen ☐ Vergnet ☐ Other: ___

Model:____________________________ Pump ID: ______________________________

Status of pump**:** ☐ Works perfectly ☐ Works but defective

☐ Does not work at all ☐ Looted

If not working or not working perfectly:

Description of the problem:____

Spare parts needed (estimation):____

Work planned (estimation):____

REMARKS CONCERNING WATER

Is the water: ☐ Dirty water ☐ Milky colour ☐ Reddish colour ☐ Fine sand

☐ Bad odour ☐ Rusty ☐ Salty ☐ Other:__________________________

Detail recorded on apron? ☐ Yes ☐ No

Apron condition: ☐ Good ☐ Fair ☐ Bad

Materials needed:____

Drainage condition: ☐ Good ☐ Fair ☐ Bad

Materials needed:____

Fence Condition: ☐ Good ☐ Destroyed ☐ No fence

Bill Board: ☐ Good ☐ Destroyed ☐ No board

Facility is funded by:____

Report prepared by (name):________________________ Date prepared:_________

Completion report verified by: School, Health, Camp or Community (name):______________Date verified________

Name of verifier must be the following: School Principal/Vice Principal, Clinic OIC, Camp Manager/Leader, Community Leader/Chairman

Annex 2 Handing Over form for Drilled Well

Name of Implementing Agency: ____

County: _________________________

District: _________________________

Community: _________________________

WORK DONE:

<u>DESCRIPTION</u>

Bore well: ______mm Total depth: _______ m

Pump type: ______________ hand pump

Water Test carried out: ______Yes / No

Water test results: Potable / Non Potable

Pum Test Carried out: Yes/ No Well Yeild: ___________ lit/hr

Starting date of the work: ________________

Ending date of the work: ____________

1. The work for construction of bore well has been carried out as per the bore well completion sheet, and to the satisfaction of the community of _____________ ____________________

2. The well is the property of the community. The maintenance of the hand pump and the cleaning of the apron and the area of the bore well as well as fencing of the bore well are under the responsibility of the Community Water Committee (CWC). Tools and training have been given by _____________ for the sustainability of the construction.

Done on the ___/___/_______

For the Community of _______________

For implementing agency_________________

A copy of this handing over will be given to the DDC in charge of the area.

Water test results are available in ____________________ office, at (address)

__________ _______________ ____

Annex 3 Borehole Report

Borehole N°

depth	Bit typ / dia	Drilling time	Equipment	Geological log	Description	Water inflow
0 m			0 m	0 m		
5			5	5		
10			10	10		
15			15	15		
20			20	20		

County

District

Community / camp / village

Drilling date

from

to

Drill team

supervisor

assistant

Drill technic

Drilling machine

Total depth drilled

meters

Casing

diam inches

lentgh meters

Screen

25	25	25
30	30	30
35	35	35
40	40	40

diam		inches
lentgh		meters
slot		millimeters
Gravel pack		
from		meters
to		meters
Top cementation		
from		meters
to		meters
Yield		
during drilling		liters/hour
after devt		liters/hour
after yield test		liters/hour
Water Static level		
		meters

Equipment legend					**Equipment legend**		
casing				Jigged sand			
screen				gravel pack			
						° °	
bottom cap						°	
Geological legend				cementation			
Clay							
Granit		+ + + + + + + +					
		+ + + + + + + +					
fractured granit		+ +/ / + + / /+ +					
		+ / / + + / /+ +					
Sand							
		. . . .					
Laterite		°.°.°.°.°.°.°.°.°.°.					
		°.°.°.°.°.°.°.°.°.°.					
Gravel		° ° ° ° ° ° ° ° ° ° °					
		° ° ° ° ° ° ° ° ° ° °					

Annex 4 Disinfecting a well by superchlorination

The water inside a well can gets polluted during well construction or when repairs are carried out inside the well. It is advisable to disinfect the well before it is put to use.

The Most common method to do this is with Chlorine. Chlorine has the advantage that it leaves a residue in the water which can prevent further contamination. Chlorine is also easily available and is easy to measure.

Following are the steps to carry out well disinfection

1. **Measure the Turbidity and PH of water in the well**
   a. Allow the well to recharge fully up to its static water level after the construction / rehabilitation is complete.
   b. Measure the pH and turbidity of water.
   c. The Turbidity of water in the well should be 5 NTU or less. If the Turbidity is more than 5 NTU the chlorination will not be effective.
   d. If the Turbidity is high, pump all the water out and clean the lining of the well of any impurities, and allow the well to recharge before measuring the turbidity.
2. **Prepare a 1% chlorine Solution**

Chlorine compound most commonly used is Calcium Hypochlorite as High Test Hypochlorite (HTH). It is also widely available as Sodium Hypochlorite in liquid bleach or bleaching powder form. Every type of compound has different chlorine content and the chlorine concentration needs to be considered while preparing the solution. The best compound to use is HTH which has 50 to 70% chlorine.

Based on the compound available, prepare 10 litres of 1% chlorine solution. The following table and guidelines give the quantity of various compounds required for 1 litre of 1% chlorine solution.

Preparing the chlorine solutions

Preparation of 1 litre of 1% chlorine solution (1% chlorine solution has 10g / litre, or 10,000 mg/l, or 10 mg/ ml), Ref: Davies & Lambert, 2002, 2nd Edition

Chlorine source	Available chlorine %	Quantity required	Approx measure
High Test Hypochlorite (HTH) granules	70	14g	1 heaped teaspoon
Bleaching powder	34	30g	2 heaped teaspoons
Stabilized tropical bleach	25	40g	3 heaped teaspoons
Liquid household disinfectant	10	100ml	7 tablespoons
Liquid laundry bleach	5	200ml	14 tablespoons
Antiseptic solution	1	1 litre	No need to adjust as it is a 1% solution

Important tips for using chlorine

1. The strength of chlorine reduces quite rapidly over time and hence some allowances should be made for the age of the chlorine.
2. Do not mix chlorine in a metal container as chlorine reacts with metal.
3. Chlorine is a hazardous chemical and should be handled with care. It can irritate skin and eyes and HTH powder or strong solutions produce gases which are dangerous to breathing.
4. Chlorine must be stored in a cool, dry, well ventilated and dark location and should not be stored in the same room as one in which people sleep.

3. Determine the quantity of 1% Chlorine solution required

For disinfecting a well, the water should be treated with a chlorine solution which will leave a free residual of 50mg/l in the well. The chlorine should be allowed to stand in the water for at least 30 minutes, but preferably several hours, before it is pumped out from the well.

A 1% stock solution made up as in the table above, has approximately 10g/l = 10 mg/ml of active chlorine.

In order to chlorinate 1000 lit (or 1 cum) of water with 50 mg /l dosage – the amount of 1% solution required is

$$1{,}000 \text{ lit} \times \frac{50 \text{ mg/l}}{10 \text{ mg/ml}} = 5{,}000 \text{ ml} = 5 \text{ litres of 1\% soln}$$

Calculate the total volume of water in the well, and add 5 lit of 1% solution per 1 cum of water in the well.

> Example:
>
> For a well with 1.2 m internal diameter and depth water as 5 m
>
> Total water quantity in the well = $3.14 \times \frac{1.2^2}{4} \times 3$ m = 3.39 cum OR 3390 lit
>
> Quantity of 1% solution required = 5x (3390/1000) = 16.9 lit

4. Mix the chlorine solution in the well water.

To mix the chlorine solution in the well, use a clean rock on the end of a long rope and move the rock around in the water, lifting it up and down while moving it around the well. An alternative method to mix the solution is to use a bucket and keep on drawing water and then pouring it back into the well.

5. Leave the chlorine in the well for at least 30 min and dewater the well completely.

6. Testing the chlorine residual

After disinfecting the well, dewatering and allowing the well to recharge, check the residual free chlorine level. If the residual is equal to or less than 0.5mg/l then the well can then be put back into use. If it is much higher than the 0.5mg/l then the well should be dewatered again and the process repeated.

Annex 5 Testing the yield of well

Testing the yield of well is important to determine its capacity and to obtain information to help aid in selecting a permanent pump. The yield of a well is generally tested using a pump test. The recommended methodology for carrying out a pump test in Liberia is given below:

1. Install a pump set on the well that can operate continuously for more than 4 hours at varying pumping rates.

2. Ensure that the suction pipe of the pump is long enough so that it can pump from the depth at which the permanenet pumps intake will be installed.

3. Provide the delivery pipe with a flowmeter. In case flowmeter is not available provide a 200 litre barrel to measure flow rate.

4. Pump the water from the well with pump running at maximum capacity.

5. If the water level is depleting keep a close observation of the following water level and reduce a pumping rate near to the depth at which the pumps intake is to be installed.

6. Adjust the pumping rate such that the water level remains constant.

7. Continue pumping at this rate for a period of at least four hours. Note that water level is constant. If not, the flow rate has to be reduced.

8. Measure the flow rate using flow meter or by measuring the time taken to fill a 200 litre drum.

9. The flow rate at which the water level remains constant for nearly four hours can be called as the sustainable yield of the well.

10. Care should be taken to dispose of pumped water away from the well in order to minimise the chance of recharge/infiltration which would reduce the validity of the results – a distance of >100m is recommended.

Annex 6 Pit Latrine Construction/ Rehabilitation/ Assessment Form

Pit-Latrine-ID (Official used only): ________________

BASIC INFORMATION ON THE LATRINE

County: ______________________________ **District:** ______________________________

Clan: ________________________ Town/village/community: __________________________

PCode: _____________Population: ____________ Number of Households:_______________

School Population: # of Boys______ # of Girls________ Male-Teachers ______

Female-Teachers_______

GPS Coordinates (WGS84 system): X:______________ Y:______________

WORK DONE

Type of work done: ☐ Construction ☐ Rehabilitation ☐ Assessment

Name of Agency (that did the work):____

Type of Agency: ☐ NGO ☐ Govt ☐ Private ☐ Community

Date the work was completed Start Date [mm/dd/yyyy]: ___/____/___

End Date [mm/dd/yyyy] ____/____/____

Number of Hygiene Animators trained in the community: Male:__________ Female:________

Number of Hygiene Clubs organized: In Schools:_________ In Communities:_____________

Ownership of the Latrine: ☐ Community ☐ Private ☐ School ☐ Health Facility

Owner's ID: ________________Name of the owner: ____________________________________

LATRINE DETAILS

Type of Latrine ☐ Institutional (VIP) ☐ Family ☐ Emergency

Is there a latrine? ☐ Yes ☐ No

Is the Latrine functional? ☐ Yes ☐ No

Is there an apron around the latrine? ☐ Yes ☐ No

Are there pit details recorded on the apron? ☐ Yes ☐ No

Type of pit latrine (superstructure) ☐ Tarpaulin ☐ Mud brick ☐ Concrete ☐ None

Dimension of superstructure: Length _______ ft Width _______ft Height________ft

Dimension of pit: Depth:________ft Length _______ft

Number of drop holes: ___________________

Is the latrine pit lined? ☐ Fully lined ☐ Partial lined ☐ Not Lined

Dept of lining ______________ft

If mud brick or concrete, is it plastered? ☐ Yes ☐ No

Type of latrine slab used: ☐ Plastic ☐ Wood ☐ Concrete ☐ Steel sheet Metal

Is there a collar beam? ☐ Yes ☐ No

Type of roof ☐ Zinc ☐ Tarpaulin ☐ Thatch ☐ Not Roofed

Type of hand washing bin ☐ Half-metal-drum ☐ Bucket ☐ Concrete

☐ Other Specify__________________________

Is the vent pipe (6') screened? ☐ Yes ☐ No ☐ N/A

Type of doors used: ☐ Timber ☐ Zinc ☐ Tarpaulin ☐ None

Facility is funded by:____

Report prepared by (name):_____________________________ Date prepared:______________

Completion report verified by: School, Health, Camp or Community (name):__________

Date verified____

Name of verifier must be the following: School Principal/Vice Principal, Clinic OIC, Camp Manager/Leader, Community Leader/Chairman