

Terms of Reference

Project overview

The WASH project refers to Water Sanitation and Hygiene is a project in the Lebanese Red Cross Disaster Management Unit. Both component Water and Sanitation needs the involvement of a contractor to implement the project. The project is to support Syrian Refugees and vulnerable Lebanese living in Informal tented settlements, Collective Shelters and vulnerable villages of Lebanon. Mainly all of the works take place in agricultural field with muddy soil.

The project is implemented in areas all over Lebanon, it consists of the following major activities:

- Installation of Latrines superstructures
- Digging of Pits
- Connection of Sewage networks
- Installation of water Tanks
- Connection of water networks
- Plumbing works
- Steel works (manufacturing, welding...)
- Site Improvements (Excavation Works, Channel digging, land elevation...)

Areas of Implementation

The LRC WASH project will be implemented in 9 branches of LRC as follow:

Lot 1 Hermel/ Baalback

- Hermel
- Baalback

Lot 2 South Lebanon

- Saida
- Hasbaya

Lot 3 Bekaa Valley

- Rachaya
- Quob Elias
- Zahle

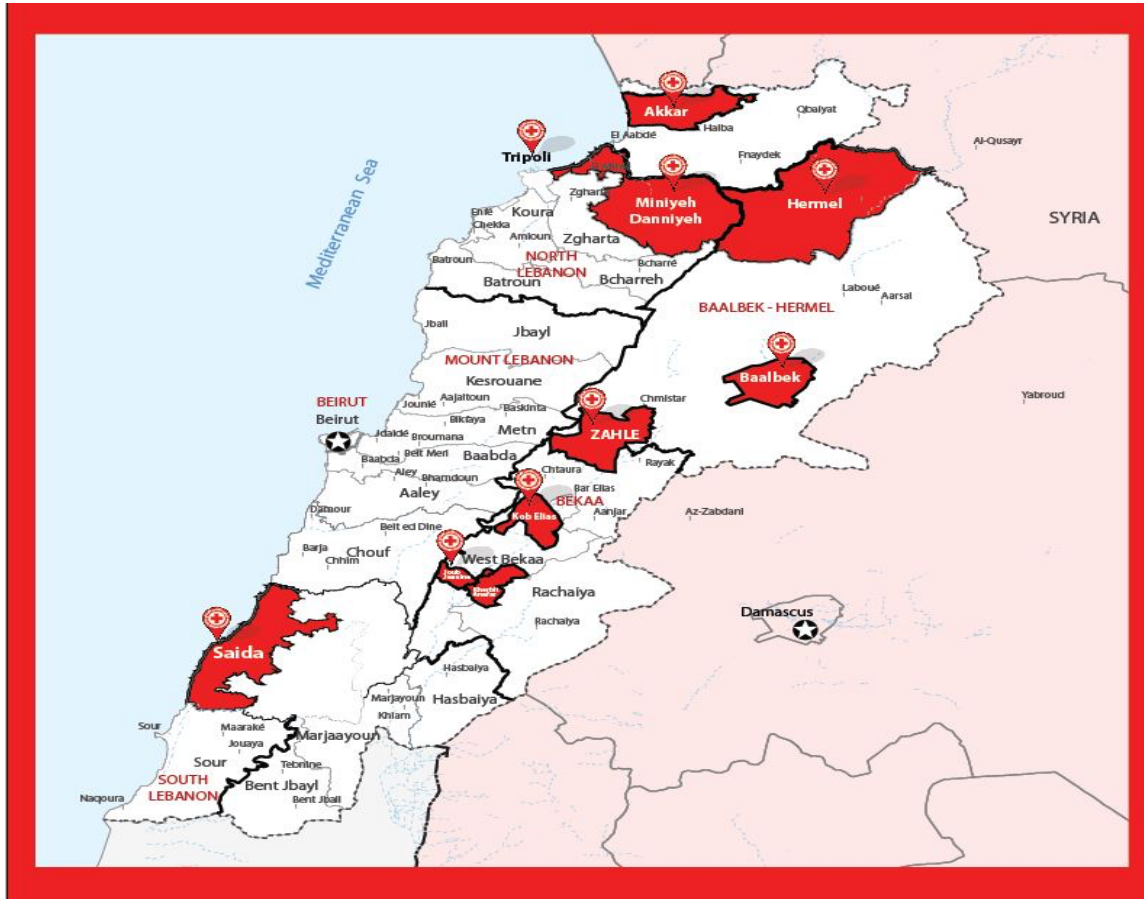
Lot 4 North Lebanon

- Akkar
- Tripoli

A detailed list of the specific sites will be shared with the contractors with specific coordinates and list of works to be done in each site.

An average of 15 – 20 sites per area of implementation, depends on the region and the number of Informal tented settlements in the location served, for an average total of 1000 Latrines per year.

Map of areas of implementation



Contents

Terms of Reference	1
Project overview	1
Areas of Implementation	1
Map of areas of implementation	3
Delivery condition	5
Safety	5
End of work	5
Activities	6
Water facilities	6
Water tower stand	6
Water tank & connection	8
Shelter Protection	12
Site improvement: Ground Leveling	13
Site improvement: Channel Cleaning	13
Soak away pit	14
French drainage	15
Sanitation facilities	18
Latrine cabin	18
Latrine Concrete Base	21
Holding Tank 2,5m3	23
Septic tank	31
Safety	37
Pit excavation	37
Metallic tank construction	37
Metallic tank installation	37
Completion work	37
Design	37
Bill of Quantities	38
Single pit latrine	39
Double pit latrine	43
Triple pit latrine	46

Delivery condition

The supplier undertakes to supply items and materials in the quantities specified on the purchase order form issued by LRC. The quantity and the quality of the delivered items and materials shall be verified by a representative of LRC Branch or the WASH field officer, in the presence of the supplier, by visual inspection and counting.

LRC reserves the right to refuse supplies which are found not to comply with the quantitative and qualitative specifications of the order, or which are incomplete deliveries or in excess quantities.

Acceptance of the equipment shall only be effective once the quantitative and qualitative verification of the supplies confirms that the supply conforms to the order and to the technical specifications.

Acceptance shall be notified by LRC on the delivery slip. This document shall be signed by the representatives of both parties.

Two possibilities for the reception of material:

- Delivery note (done by the transporter / supplier) will be given to the LRC representative and signed by both party
- Good Receive Notes (LRC procedure)

In case of problem on the material (defective/items missing/...) the GRN/ delivery note will be the only authoritative document. A purchase order will confirm the command and need to be received by the supplier 15 days in advance the delivery date.

The contractor should have the capacity to work at least in 5 different sites at the same time. Winter season should not be an excuse for the delay of implementation, more or less all the sites are agricultural lands with muddy soil.

Safety

The contractor is responsible for the safety of his workers and the people living around the site.

The material & goods delivery will be store to avoid hazards, in particular the risk of falling.

The surroundings of the pit have to be marked and protected to avoid hazards, in particular the risk of falling into the hole. In case of unstable soils, a formwork has to be used for the safety of the workers.

End of work

The evacuation of the all disposal material left over from the site to let the place clean and safe is the responsibility of the contractor.

The contractor works will be monitored by LRC Branch and LRC WASH Field officer and an approval of specifications and detailed agreed on in advance should be confirmed.

Activities

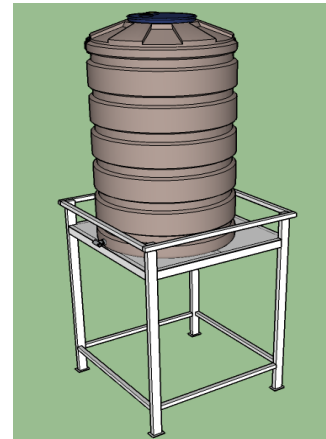
Water facilities

Water tower stand

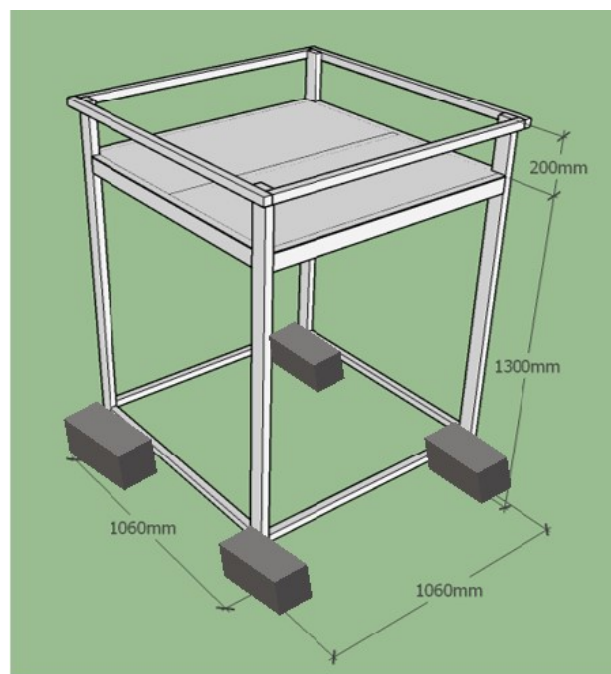
The water tower structure is made of rectangular iron bars 60mm x 30mm, 3mm thickness for the poles and an iron sheet of 1000mm x 1000mm, with 3mm thickness for the base. The structure is reinforced with square iron bars 30mm x 30mm, 3mm thickness.

A barrier made of square iron bars 30mm x 30mm, 3mm thickness and height 200mm fence-in the water tank.

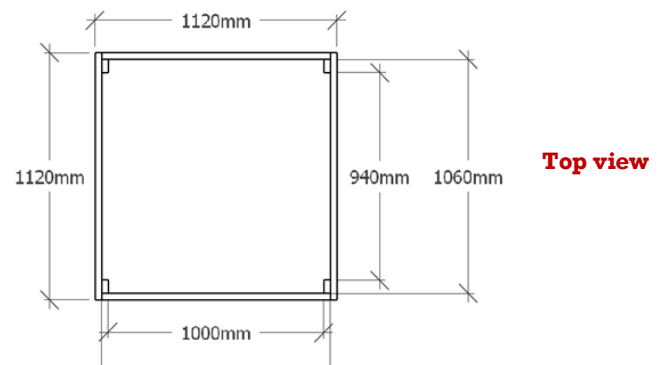
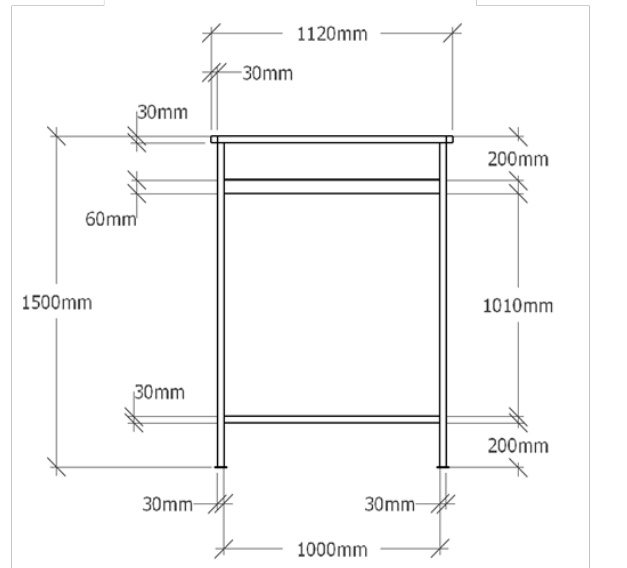
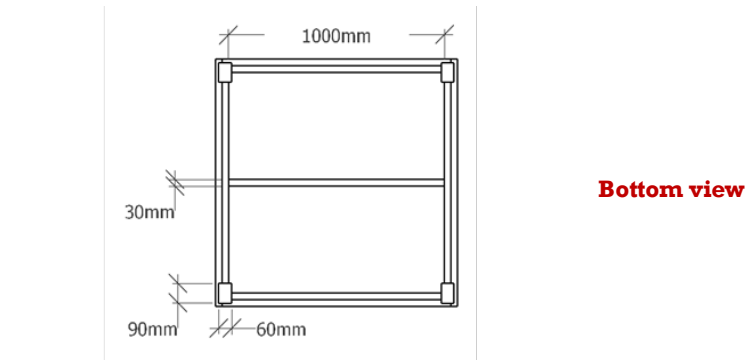
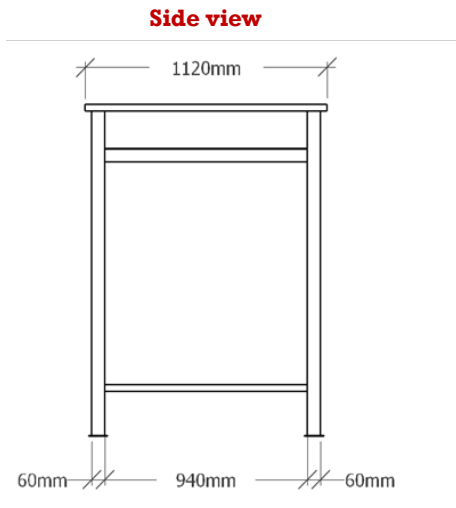
The metallic structure is painted with anti-rust paint and can support a full 1000L water tank (equivalent to approximately 1 ton). The water tank has a valve and Tee junction to provide water to the cabin latrine & to the shelter.



Design



Perspective view



Water tank & connection

The water tank is 1000L and has an exit ¾” female threaded.

- Volume: 1000L
- Material: HDPE, 3 layers plastic
- Shape: Cylindrical form
- Water tank with cover - grey color
- One outlet connection



A plumber kit has to be installed to deliver water from the tank to the cabin and the shelter. The plumber kit is composed of a reducer, a ball valve, two ball taps and different fittings for adaptation. The threaded part will be screwed with Teflon to have water tightness; heat-sealing bonds the PPR.

The assembly of the plumber kit is as follows:

From the tank, a reducer ¾” male to ½” threaded female join a nipple male ½”, then go to an union female 1/2” then a nipple male ½” to the ball valve ½” threaded female. The valve allows isolating the rest of the pipes and the union an easy disconnection in case of maintenance. Refer to figure 1 below.

On the valve, a nipple male ½” is screwed and joined with a Tee PPR smooth/threaded/smooth. On the smooth part 2 PPR pipes ½” are glued. One is going up, and his task is to put at the atmosphere the network and allow a normal flow. The other goes down to another Tee PPR smooth/smooth/smooth.

Bill of Quantities for one water tower stand 1,50*1,06*1,06m					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Stand	1	Iron bar rectangular	60x30mm, 3 mm thickness	m	10
	2	Iron bar square	30x30mm, 3 mm thickness	m	10
	3	Iron sheet	1000x1000mm, 3 mm thickness	m2	1
	4	Iron sheet foot	90x60mm, 3 mm thickness	m2	0,025
	5	Painted Iron Bar	2 layers: Anti-rust paint and normal paint	Layer	2
	6	Cement	Portland 50kg bag	bag	1
	7	Sand	Washed,0-4mm diameter	M3	0.03
	8	Gravel	Washed,10-20mm diameter	M3	0.06

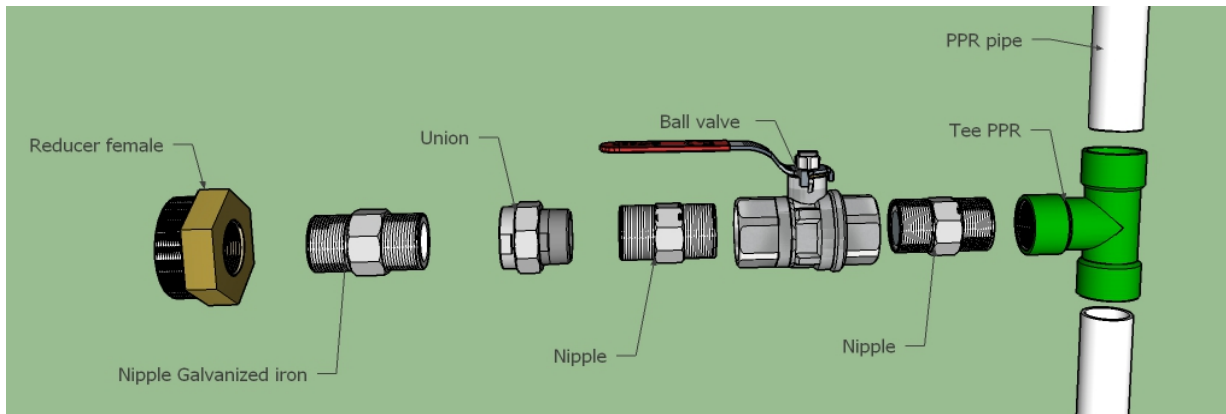


Figure 1 Fittings & connection

2 flexible pipes 1/2" go from the Tee PPR down. The first goes to the cabin, the second to the shelter. A flexible PE pipe white, and with good quality, is used in the connection. A 90° elbow female 1/2" threaded in one side is used to connect the pipe to the ball tap threaded male 1/2". See figure 2 beside.

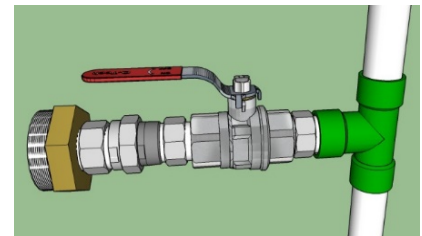


Figure 2 Plumbing kit

The first ball tap is installed inside the cabin, the second inside the shelter. Both of them are metallic, at 50cm above the floor, fixed on the wall and should not be loose. See figure 3 below.

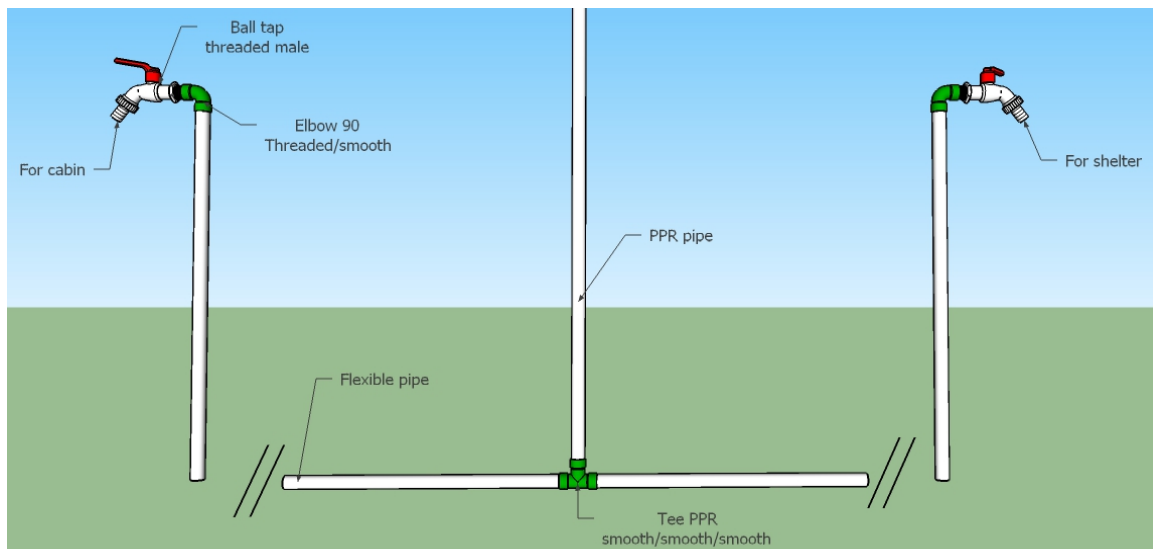


Figure 3 Taps installation

Bill of Quantities for water tank & connection					
No.	Item / Description	Specification	Unit	Quantity	
Material					
Plumbing	1	PVC Tank 1000L with lid	threaded Female 3/4"	pce	1
	2	Reducer 3/4" to 1/2"	threaded male 3/4" - female 1/2"	pce	1
	3	Nipple 1/2"	threaded male 1/2"	pce	3
	4	Union	threaded Female 1/2"	pce	1
	5	Elbow	threaded Female 1/2" - PE	pce	2
	6	Valve 1/2"	Threaded male 1/2"	pce	1
	7	Ball tap 1/2"	Threaded male 1/2"	pce	2
	8	Tee 1/2"	PPR/ threaded / PPR female 1/2"	pce	1
	9	Tee 1/2"	PPR/ PPR / PPR female 1/2"	pce	1
	10	PPR pipe flexible 1/2"		m	10
	11	PPR pipe rigid 1/2"		m	2

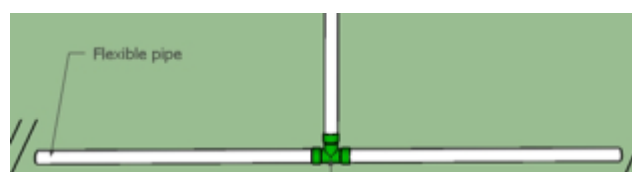
Fixing water tap

Bill of Quantities for fixing water tap					
	No.	Item description	Specification	unit	quantity
plumbing	1	Ball water tap	1/2"	Pcs	1
plumbing	2	Remove old ball water tap		Pcs	1



Fixing PPR pipe

Bill of Quantities for fixing PPR pipe					
	No.	Item description	Specification	unit	quantity
plumbing	1	PPR flexible pipe	1/2"	m	2
plumbing	2	Remove old PPR pipe		m	2



Concrete Foundation for Water Tanks

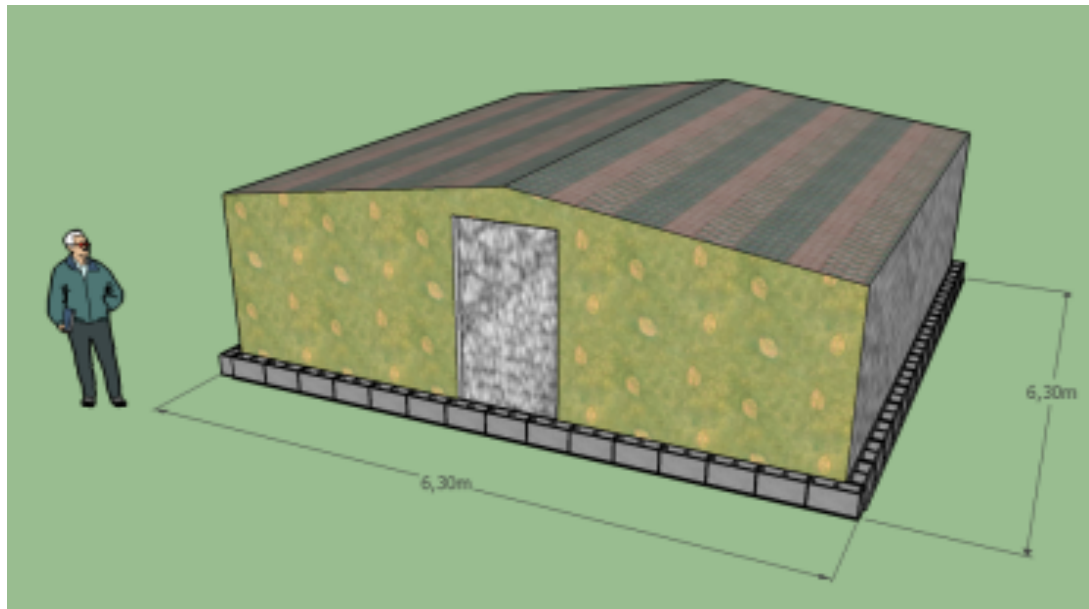
Concrete base for water tank stands to ensure their stability where soil is clayey or unstable. In this case, it is required to use the same specs of concrete used in construction activities. These specs are: Sulphate Resisting Cement should be used in all concrete work adjacent to the soil. The use of vibrations during casting concrete. All shuttering should be made from plywood to ensure acceptable fairfaced concrete faces. Supply, cast, install and vibrate concrete for slabs with compressive strength 25 MPA. use Twisted Steel reinforcement bars of diameter 14mm where needed.

Bill of Quantities for Concrete Foundations for Water Tan					
	No.	Item / Description	Specification	Unit	Quantity
Material					
	1	Concrete	1m3 for every 3 stands	m3	0.33
	2	Labor		manday	1

Site Improvement

Shelter Protection

Assuming an average size square shelter of 6m sides (6x6m), the beneficiaries will receive 60 concrete blocks (0.4m length / 0.15m width / 0.2m height) with 0,5m³ sand and 2 bags of cement to build a belt around their shelter. See figure 4 below.



Blocks belt for shelter improvement

Bill of Quantities for 1 shelter improvement					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Aggregate	1	Hollow block	400x200x150 mm	Piece	60
	2	Cement	Portland 50kg bag	bag	2
	3	Sand	Washed, 0-4mm diameter	m ³	0.5

Site improvement: Ground Leveling

In case the site remains muddy even after drainage works (French drainage or soak away pit) an excavator will level the ground before spreading a first layer of 10cm of small gravels. After compaction of the first layer of gravel, a second layer of 5cm of bigger gravel is spread and levelled.

Bill of Quantities for 200m2 site improvement					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Aggregate	1	Gravel 5 to 20mm	layer of 10cm	m ³	20
	2	Gravel 20 to 50mm	layer of 5cm	m ³	10

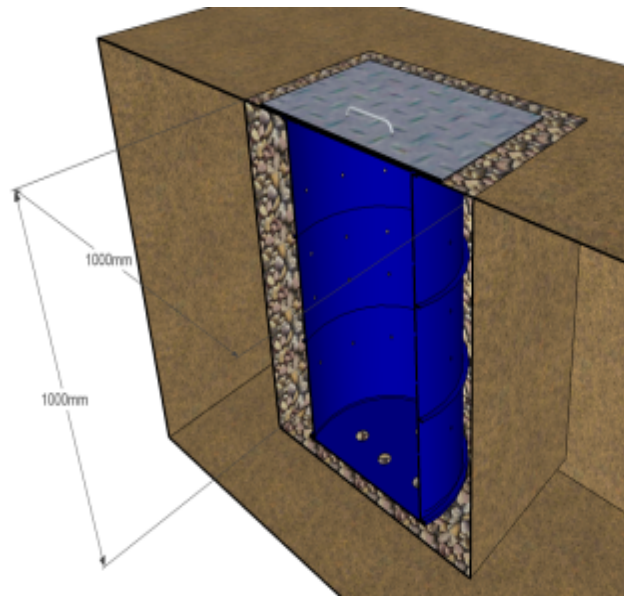
Site improvement: Channel Cleaning

As a method of flood-prevention in ITSs, channels surrounding the ITSs must be cleaned to remove debris and waste.

Bill of Quantities for Site improvement: Channel Cleaning					
	No.	Item / Description	Specification	Unit	Quantity
Material					
	1	Rent of excavator	depending on soil type	manday	1
	2	Labor		manday	2

Soak away pit

In case of stagnant water but no possibility to drain through a French drainage, a soak away pit can be constructed. The pit is between 1.5m and 4m deep, not less than 2m above groundwater. A pit of 1m³ must be dug and a perforated 200L metallic barrel (with holes) is placed inside the hole. Empty space around barrel is lined with porous material and filled with coarse rocks and gravel. Sand and fine gravel spread across bottom to disperse flow. Removable lid to seal the pit. The lid is metallic cover with handle. When the soil is rocky or the water table is high, it is necessary that the barrel and the lid be installed. Quality tested on site with percolation test. See figure 5 below. A wire mesh should be provided on top of the p-trap connected to the soak away pit with a 2-inch, PVC pipe.



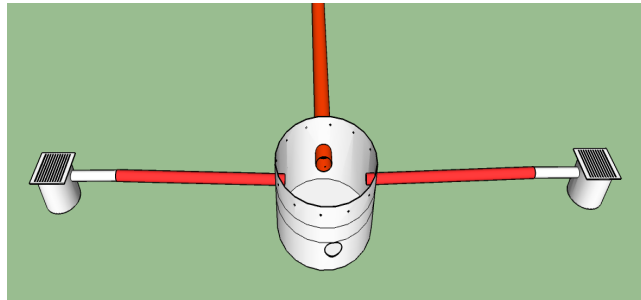
Bill of Quantities for one soakaway pit

No.	Item / Description	Specification	Unit	Quantity
Material				
1	Metallic drum 200L	with holes 1cm diam	piece	1
2	Metallic cover with handle	800x800x3mm	m ²	0.6
3	Gravel 20 to 50mm		m ³	1

French drainage

The size of trench excavation is 6,0m L/ 0,5m W/ 0,5m D (Length/ Width/ Depth). The trench is connected to a pit for the inspection chamber of 0,8m L/ 0,8m W/ 0,5m D for a total excavation of 1,8m³.

A layer of 15cm gravel is poured at the bottom of the trench. A 4" PVC pipe perforated (drilled with holes) is installed. The pipe has a slope of, at least, 1cm/m that allows water evacuation. This pipe is connected to the "metallic drum" regard.



The inspection chamber is made from a half 200L metallic drum (see figure 2) and perforated as follow:

- On the top edges: small holes of 1/2" for rain water;
- On the middle edge holes 2" for grey water connection,
- On the bottom then holes 4" to connect & evacuate the grey and rain water.

This inspection chamber is installed in the pit and covered by iron sheet with handle to protect it and make it safe. See drawing of monitoring form.

A P-trap is installed inside the shelter. It is connected to the inspection chamber by a flexible 2" pipe (used for irrigation) to evacuate the grey water from HH. See figure 3 & 4.

When all the pipes are connected, a test is done to control water flows, no reverse slope and no leakage. Then the upper gravel layer is made. See figure 5.

The evacuation of the soil from the site is the responsibility of the contractor.

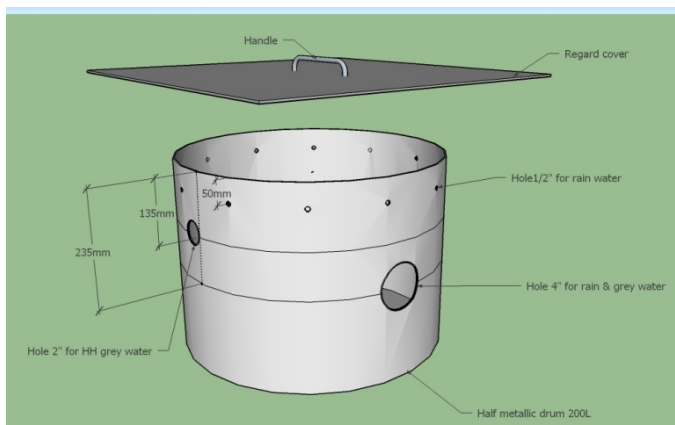


Figure 4: 'Regard'/Inspection chamber

Bill of Quantities for 6m of French Drainage					
No.	Item / Description	Specification	Unit	Quantity	
Material					
1	PVC Pipe	4" diam, 6 m length	m	1	
2	PVC Pipe	2" diam, 6m length	m	1	
3	Gravel	20 to 30 mm	m3	2	
4	P-trap kit with grid	2" diam	Piece	2	
5	Manhole	Half 200L metallic drum	Piece	0.5	
6	Manhole cover with handle	Iron sheet TOT	m2	1	

An additional amount of 1 to 5 pcs of PVC pipe 4" and 2" might be needed for each 6m French drainage, it will depend on the site requirements.

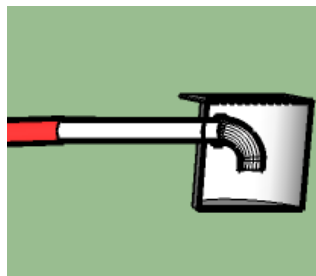
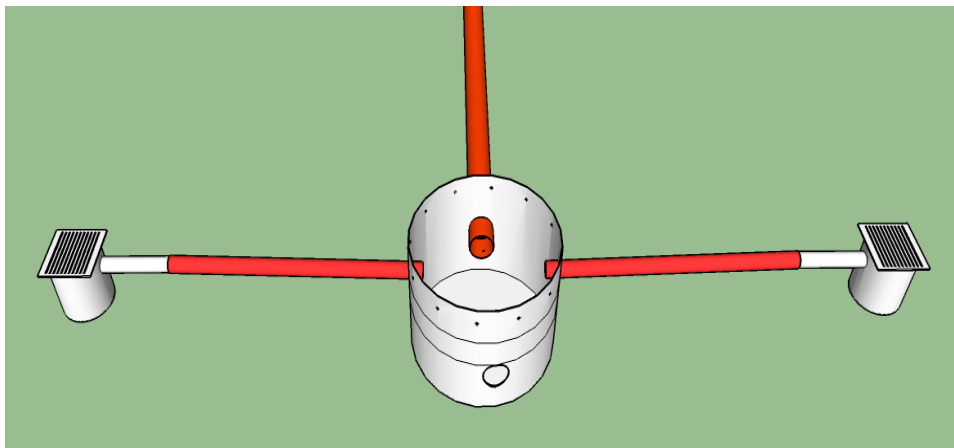


Figure 5: Regard with connection to P trap in HH shelter

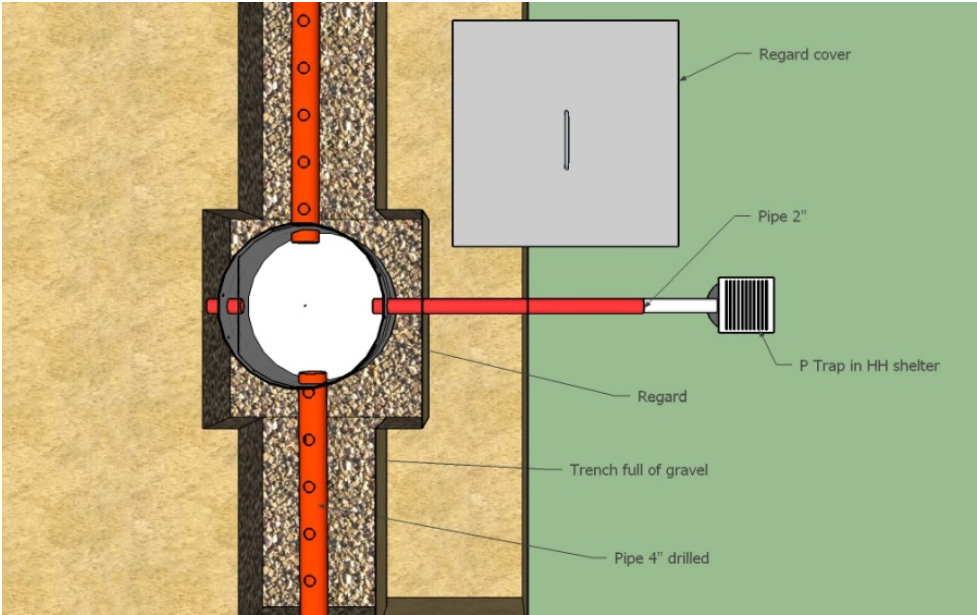


Figure 6: Top view 'Regard' & P Trap

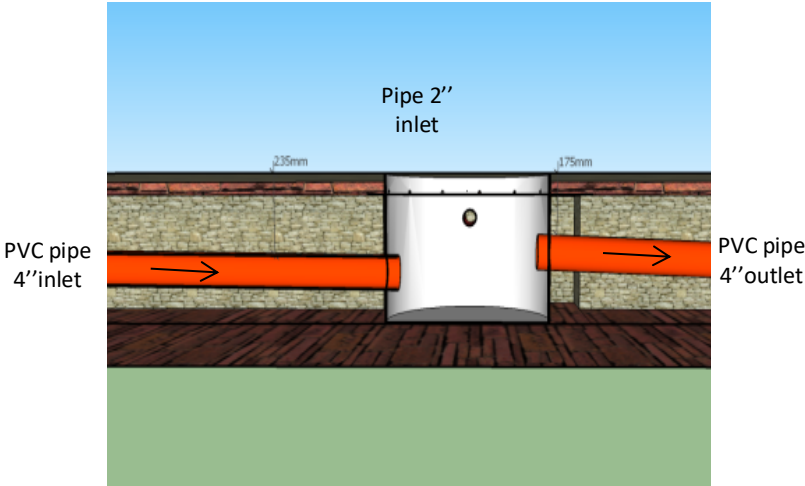


Figure 7: Section view 'Regard'

Sanitation facilities

Latrine cabin


Construction of the metallic cabin

The structure is made of square iron bar 30x30mm with 3mm thickness. The bars are welded together to form a skeleton or body of the superstructure.

An iron bar is added to support the hinges. Two small iron bar pieces are installed at the same level as the hinges to block the door opening till 90°.

To cover the structure, a white galvanized metallic sheet 0.6mm thickness/1050mm width is used (sides, door and roof). The roofing sheet is folded to ensure a better waterproofing quality.

All screws are screwed into the metallic bar to ensure the safety of the beneficiaries.

The  screws are self-thread cutting TH4 25mm.

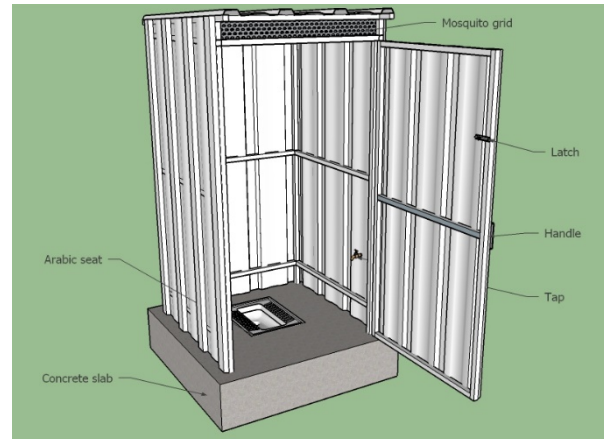


Figure 8: General view cabin latrine & concrete base

The door is equipped with an external handle. A locking system (interior/exterior) is installed at 0,80m height. This locking system allows adults to open from outside in case a child is locked inside. A latch is installed at 1,5m height to allow only adults to use it.

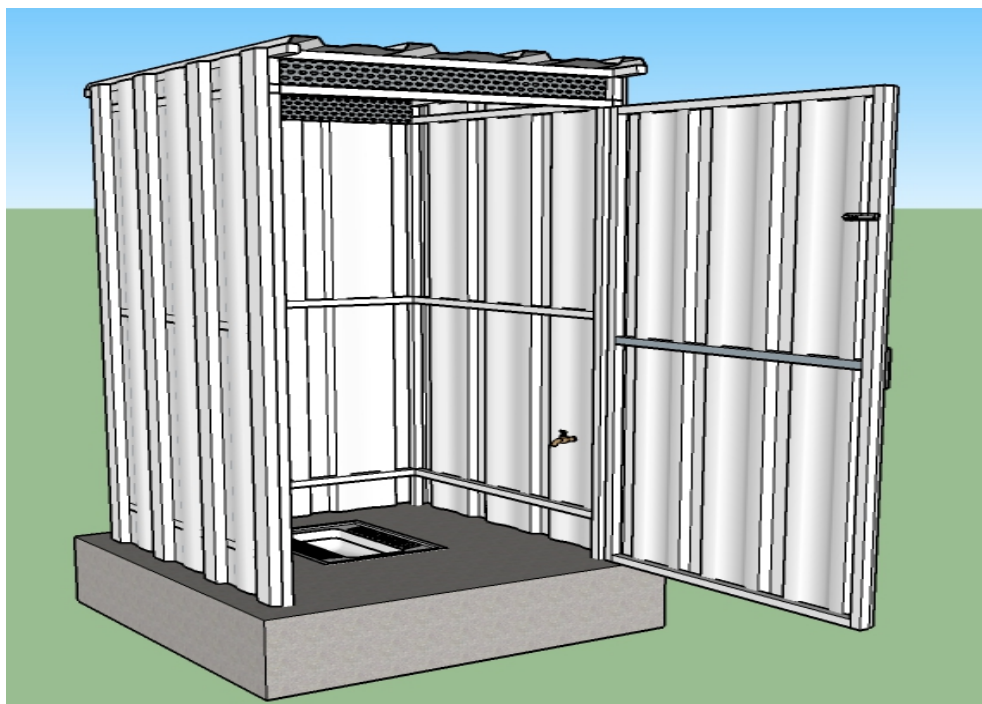
An iron mesh sheet welded from the interior will close the gap underneath the roof both in front and back to avoid the insects enter and ensures ventilation.

The complete superstructure (square bars, iron mesh sheet, feet) is first protected with anti-rust paint, and secondly painted with white acrylic paint.

Installation of the latrines cabin

The metallic cabin is installed at the center of the concrete base. The cabin's feet are buried in the concrete slab to avoid to be removed. The location of the cabin shall be in a place with lights or where it is easy to install a light to be used at night. The cabin must ensure safe and easy access for all beneficiaries.

On the 4" PVC pipe going to excreta collector (e.g. septic tank, pit, holding tank), a PVC Tee is installed. It has a reduction to 2" where is connected a 2" PVC ventilation pipe. This pipe shall be attached to the cabin to be protected. On top of the ventilation pipe a 2" PVC Tee turns toward the main wind. It shall be higher than the roof to limit odors.



Bill of quantities of one latrine cabin 1.2x1.2x2m					
No.	Item / Description	Specification	Unit	Quantity	
Cabin	1	Metal square bar	square 30x30 mm, thickness 3mm	m	35
	2	White metal sheet	thickness 0,6mm / width 1200mm	m	9
	3	Iron mesh sheet	Length 1200mm/ thickness 1mm/ hole diam. 4mm	m	0,2
	4	Hinge	size	pce	2
	5	Bolt (outside/inside)	size	pce	1
	6	Latch	size	pce	1
	7	Paint	acrylic white	liter	1
	8	Paint anti rust	for exterior use	liter	1
	9	Screw for metal	self-thread cutting screw TH4 25mm.	pce	100
Total					

Design

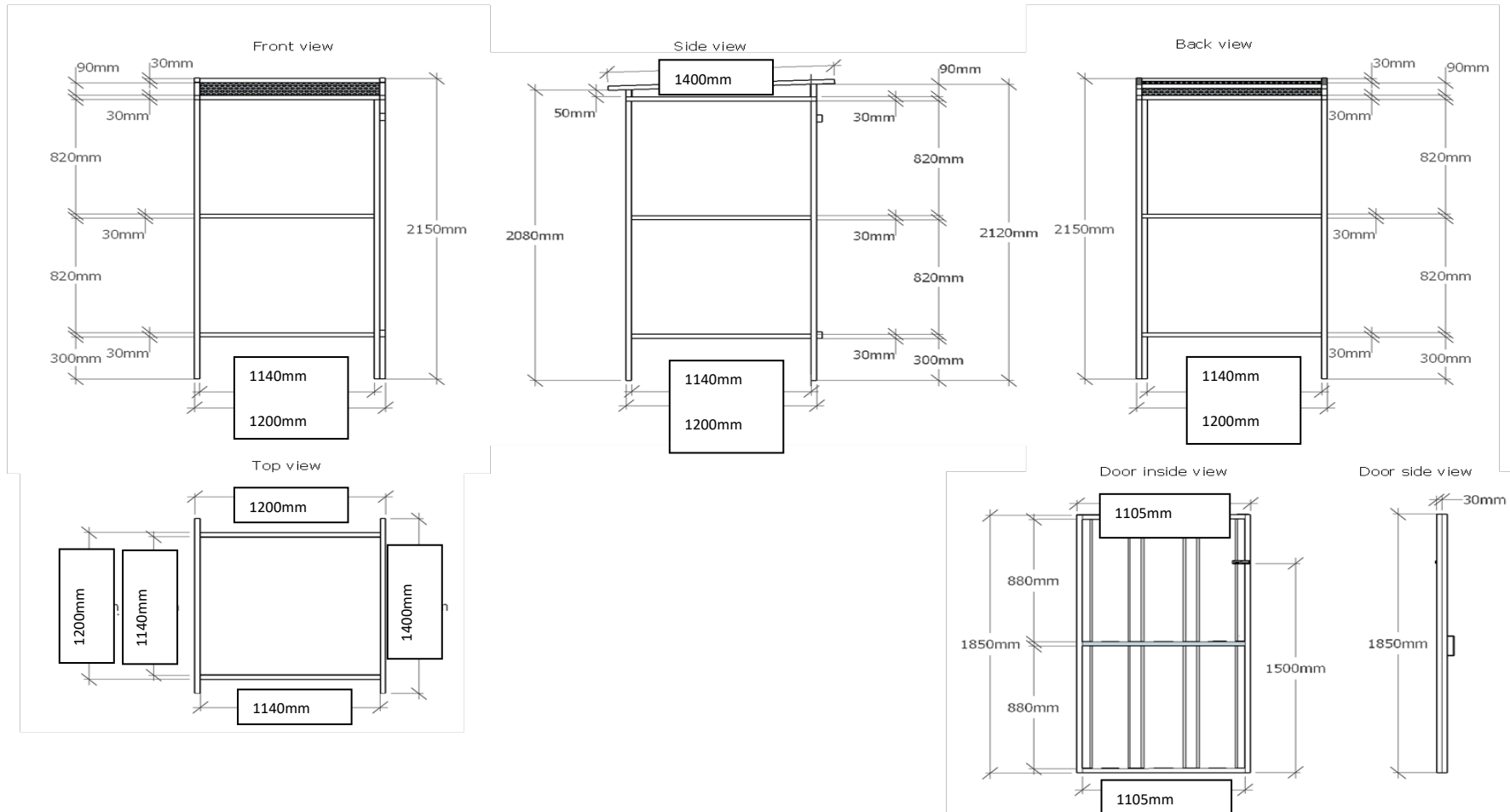


Figure 9: Cabin latrine structure

Latrine Concrete Base

Construction of the concrete base

A formwork is prepared for the base with the following interior dimensions: 1,25m L/1,25m W/0,30m H (Length/ Width / Height). See figures below. A 4" PVC pipe, a P-trap 4" PVC and a ceramic Arabic seat are connected with PVC glue to the sewage system (e.g. septic tank, simple pit, sewage network). The pipe needs a gentle slope to ensure good evacuation of the liquids and feces, minimum 1% or 1cm/m. The concrete mix is at 350kg of cement/ concrete cubic meter or 1:2:4 (Cement/Sand/Gravel). Special focus on concrete is required depending on the weather conditions. For a good curing and a normal shrinkage, it must be sheltered from sun and wind to avoid drying too fast. After pouring the concrete, the completion works includes a smooth floor with a slight slope toward the Arabic toilet, to facilitate water run-off during cleaning. The Arabic WC is set into the concrete and has to be at the same level of the concrete or a bit lower to maintain cleanliness of the cabin. It must not be higher. Attention on the completion works to ensure a smooth slab with slight slope towards the Arabic toilet is of high importance for easy maintenance of hygienic conditions. The location of the cabin shall be in a place with lights or where it is easy to install a light to be used at night.

Installation of the latrines cabin

The metallic cabin is installed at the center of the concrete base. The cabin's feet are buried in the concrete slab to avoid to be removed. See figure 4 below.

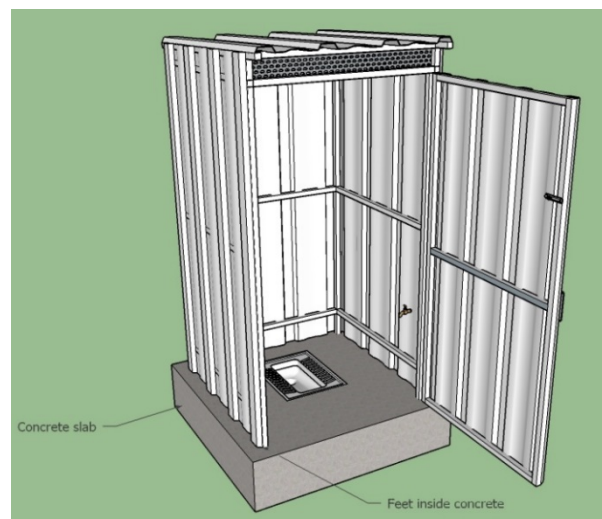


Figure 10: Cabin installed on base

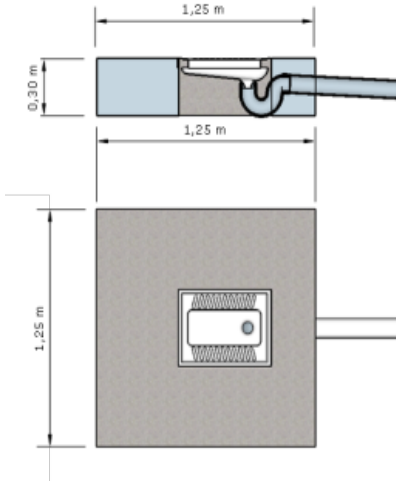


Figure 11: Side view and top view

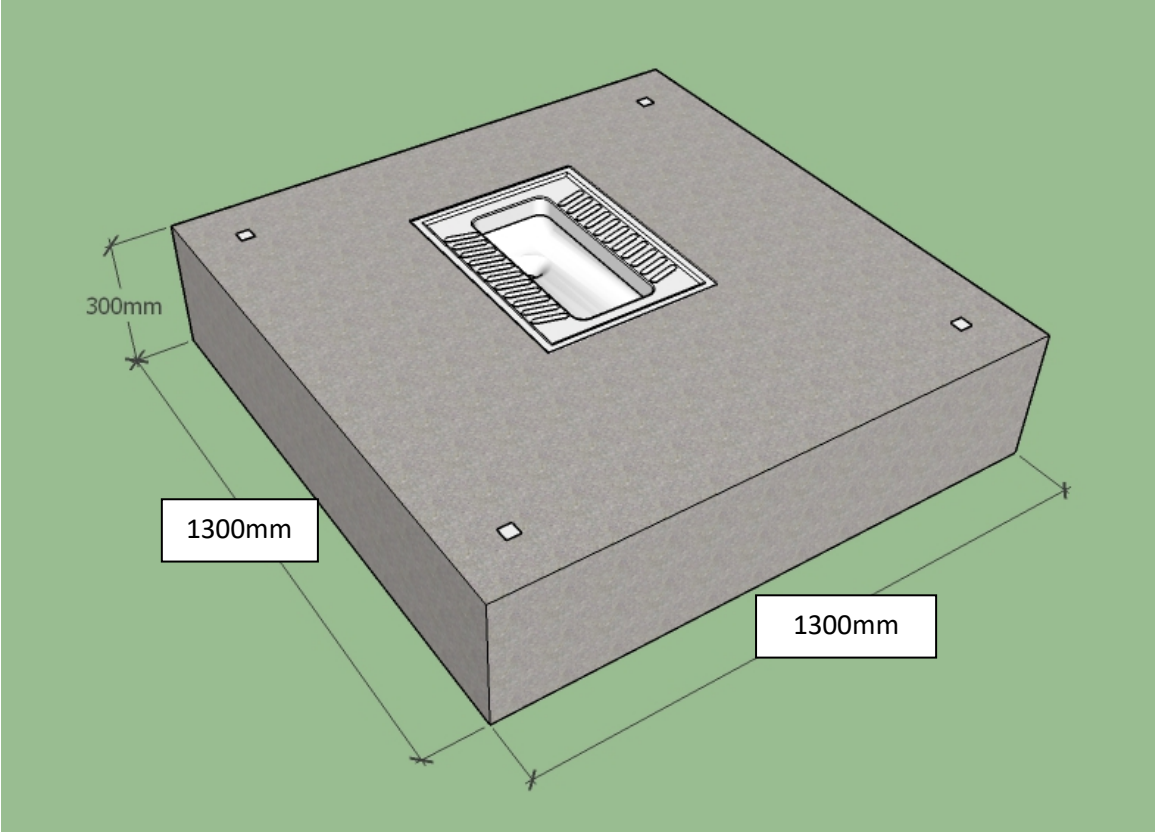


Figure 12: Latrine Cabin Dimensions

Bill of Quantities for a concrete base 1.3x1.3x0.3m					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Base	1	Gravels	10<diаметer<20mm	m3	0.5
	2	Sand	washed, 0<diаметer<4mm	m3	0.3
	3	Cement (50 kg bag)	Portland	bag	3
Plumbing	4	Ceramic arabic toilet	Hole for 4"	pce	1
	5	PVC Pipe	100mm diameter (4")	m	3
	6	PVC P-trap	100mm diameter (4")	pce	1
	7	PVC Elbow 90°	100mm diameter (4")	pce	0.5
	8	PVC glue		bottle 250mL	0.25

French seat

Bill of Quantities for French seat					
	No.	Item description	Specification	unit	quantity
plumbing	1	Ceramic French seat	Hole for 4"	Pcs	1



Holding Tank 2,5m3

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, a formwork has to be used for the safety of the workers.

Pit excavation

The whole pit excavated has a size of 2.0m L/ 1.7m W/ 1.7m D (Length / Width / Depth or Height) or a total excavation volume of 5.8m³. The conditions of the ground may change the dimension of the hole, but the total volume should be kept equal to the extent possible.

If the excavator reaches rocky ground floor or the water table before 1.7m depth and cannot go deeper, the width and length will be reviewed and enlarged to ensure a tank with an inside volume equal to 2.5m³.

If the water table is too high to build a subsurface holding tank, then an elevated latrine may be built and the holding tank may be above ground. For this issue, a plastic holding tank may be a quick response.

LRC intervenes in existing sites, where the path often is narrow and the working area is small and therefore demands the use of a small excavator as “Bobcat”. The depth of 1.7m was chosen as a function on the excavator’s operational limits.

The pit walls should be vertical, to the extent possible. To facilitate the excavation work, draw a square with plaster powder or spray on the ground to mark the location.

The evacuation of the soil from the site is the responsibility of the contractor.

Floor slab construction

Reinforced concrete slab 1.70mL /1.40mW /0.10mH is built on the ground floor with vertical pending iron bars to start the walls.

A wire mesh is done with Ø10 mm twisted iron bars. The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special focus on concrete is required depending on the weather. For a good curing and a normal shrinkage it must be sheltered from sun and wind to avoid drying too fast.

Tank construction

The holding tank has an inside volume of 2.5m³ or 1.4m L/ 1.1m W/ 1.6m H (Length / Width / Height). The walls are made with standard concrete blocks (0.4m length / 0.15m width / 0.2m height).

To build the wall, place the blocks all around the slab and directly on top of the pending iron bars. Use mortar to seal the blocks, layer for layer to create the wall to its specified height. The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand).

None free spaces are left between the concrete blocks as the main objective is to have a waterproofed tank.

When the walls are completed, the whole interior is plastered with a plaster mortar mix 1:4 (1 volume of cement for 4 vol. of sand) to make it waterproofed.

Top slab construction

The holding tank is covered by a slab equipped by a manhole with a size of 0.4mx0.4m. The manhole has a reinforced concrete cover to allow desludging, avoid rainwater infiltration and secure the hole. The size of the reinforced concrete cover is 0.5m L/ 0.5m W/ 0.07m H. All around the manhole there is a protection wall 0.1m W/ 0.1m H is made in reinforced concrete to avoid rainwater infiltration.

A formwork is done with iron sheet and wood for the slab. Wire mesh is done with Ø 10 mm twisted iron bars. The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 1.70mL /1.40mW /0.12mH.

The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Completion Work

The inlet pipe has to be sealed in the wall to avoid water infiltration.

On the inlet 4" PVC pipe, a PVC Tee with reduction is connected to install ventilation 2" PVC pipe. This ventilation pipe is installed attached to the cabin to be protected and higher than the roof.

Depending on the site, the work can be totally covered with soil except the manhole.

After 2 weeks of curing, the time for the concrete to be more resistant by hardening, an integrity test has to be done to ensure the waterproofing of the holding tank.

The test consists of filling up the holding tank with water and check if the water level is the same the next day. After checking, the tank will be emptied. In case of leakage the inside plaster has to be done again

Design

The inner dimensions of the tank are 1.4m / 1.1m / 1.6m, but it is considered that the last 10cm cannot be used. As such, the total storage capacity is 2.3m³. See figure 2 below.

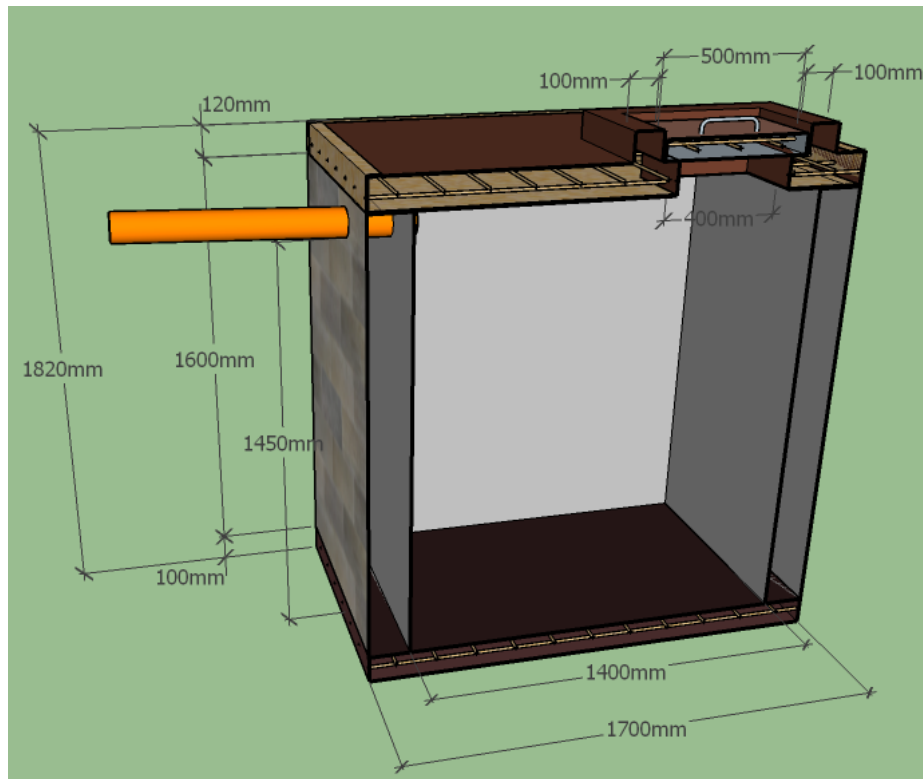


Figure 13: Section view of holding tank

Bill of Quantities for one holding tank 2.5m ³ (1,70*1,40*1,82m exterior)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Masonry	2	Hollow block	400x200x150 mm	Piece	110
	3	Cement	Portland 50kg bag	bag	6
	4	Sand	Washed, 0-4mm diameter	m ³	0,5
	5	Gravel	Washed, 10-20mm diameter	m ³	0,5
	6	Iron U	50/120/50mm & 3mm thickness	mL	6,5
	7	Iron sheet	3mm thickness	m ²	2,5
	8	Twisted iron bars	8 mm diameter - 6m length	pce	6
	9	Twisted iron bars	10 mm diameter - 6m length	pce	5
	9	Bending wire		kg	1
Plumbing	12	PVC pipe 4"		m	2

Holding Tank 7m³

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, formwork has to be used for the safety of the workers.

Pit excavation

The complete excavated pit has a size of 3.0m L/ 2.0m W/ 1.7m D (Length/ Width / Depth or Height) or a total excavation volume of 10.2m³. The nature of the ground may change the dimensions of the hole, but the total volume should keep equal as much as possible.

If the excavator reaches a rocky ground floor or the water table before 1.7m depth and cannot go deeper, the size of the width and length will be reviewed and enlarged to ensure a tank with an inner volume equal to 7.3m³.

If the water table is too high to build a holding tank underground, then an elevated latrine may be built and the holding tank may be above ground. In this case, a plastic holding tank may be a quick response.

LRC intervenes in existing sites, where the path is often narrow and the working area is small and therefore demands the use of a small excavator as “Bobcat”. The depth of 1.7m was chosen as a function on the excavator’s operational limits.

The pit walls should be vertical, to the extent possible. To facilitate the excavation work, draw a square with plaster powder or spray on the ground to mark the location.

The evacuation of the soil from the site is the responsibility of the contractor.

Floor slab construction

Reinforced concrete slab 3.0m L/ 2.0m W/ 0.1m H is built on the ground floor with vertical pending twisted iron bars to start the walls.

A wire mesh is done with 8 mm Ø twisted iron bars. The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special focus on concrete is required depending on the weather. For a good curing and a normal shrinkage, it must be sheltered from sun and wind to avoid drying too fast.

Tank construction

The holding tank has an inside volume of 7.3m³ or 2.7m L / 1.7m W/ 1.6m H. The walls are made with standard concrete blocks (0.4m L/ 0.15m W/ 0.2m H).

To build the wall, place the blocks all around the slab and directly on top of the pending iron bars. Use mortar to seal the blocks, layer for layer to create the wall to its specified height. The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand). No free spaces should be left between the concrete blocks, as the main objective is to have a waterproofed tank.

When the walls are completed, the whole interior is lined with a plaster mortar mix 1:4 (1 volume of cement for 4 volumes of sand) to make it waterproof.

Top slab construction

A slab covers the holding tank. The slab has a manhole of 0,4m x 0,4m for access. The manhole has a reinforced concrete cover in order to allow the desludging, avoid rainwater infiltration and secure the hole. Size of the reinforced concrete cover is 0,5m L/ 0,5m W/ 0,07m H. Around the manhole a protection wall 0.1m W/ 0.1m H is made in reinforced concrete to avoid rain water infiltration.

For the slab, a formwork is made with iron sheet and wood. The wire mesh is made with 10 mm Ø twisted iron bars. The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 3.0m L/ 2.0m W/ 0.12m H.

The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Completion Work

The inlet pipe has to be sealed in the wall to avoid water infiltration.

On the inlet 4" PVC pipe, a PVC Tee with reduction is connected to install a ventilation 2" PVC pipe. This ventilation pipe is installed attached to the cabin to be protected and higher than the roof.

Depending on the sites, the work can be totally covered with soil except the manhole.

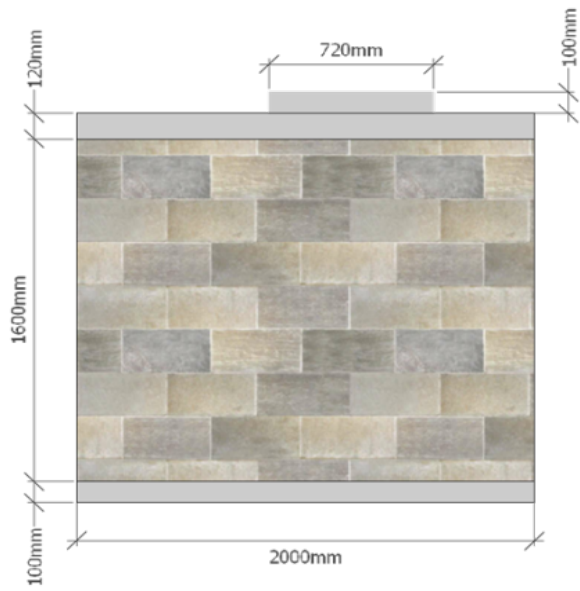
After 2 weeks of curing, time required for the concrete to be more resistant by hardening, an integrity test has to be done to ensure the waterproofing of the holding tank. The test requires filling up the holding tank with water and checking if the water level is the same the next day. After checking, the tank will be emptied. In case of leakage the inside plaster has to be done again.

Design

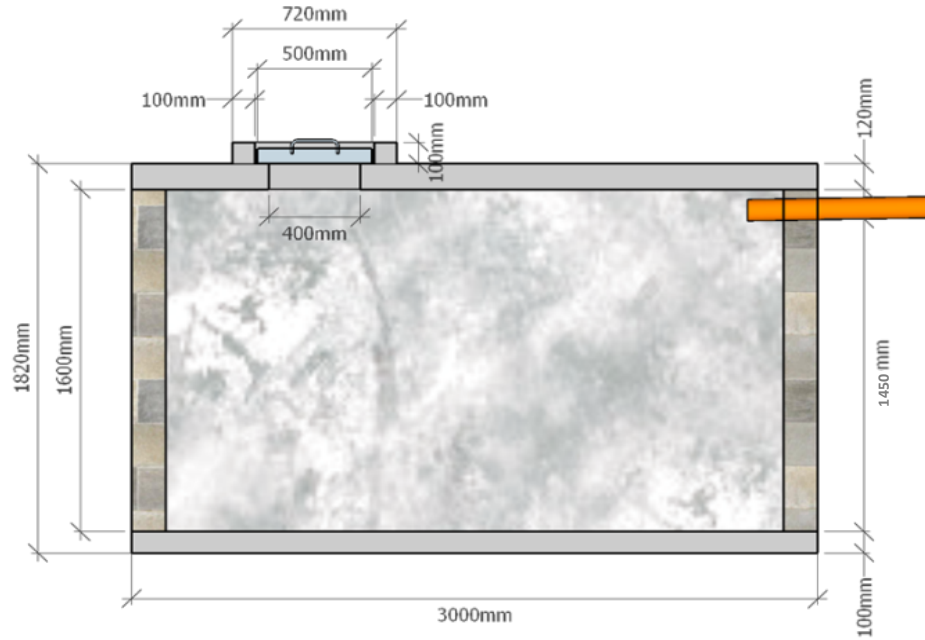
If we have a tank with an inside volume of 2,7m / 1,7m / 1,6m and we consider that the last 10cm cannot be used so it means the storage capacity is 6,9m³. See figure 2 below for calculation.

Bill of Quantities for one holding tank 7m ³ (3,0*2,0*1,82m exterior)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Masonry	1	Hollow block	400x200x150 mm	Piece	220
	2	Cement	Portland 50kg bag	bag	13
	3	Sand	Washed, 0-4mm diameter	m ³	1
	4	Gravel	Washed, 10-20mm diameter	m ³	1,3
	5	Iron U	50/120/50mm & 3mm thickness	Piece	14
	6	Iron sheet	3mm thickness	m ²	6
	7	Twisted iron bars	8mm diameter - 6m length	pce	14
	8	Twisted iron bars	10mm diameter - 6m length	pce	13
	9	Bending wire		kg	1
Plumbing	10	PVC pipe 4"		m	2

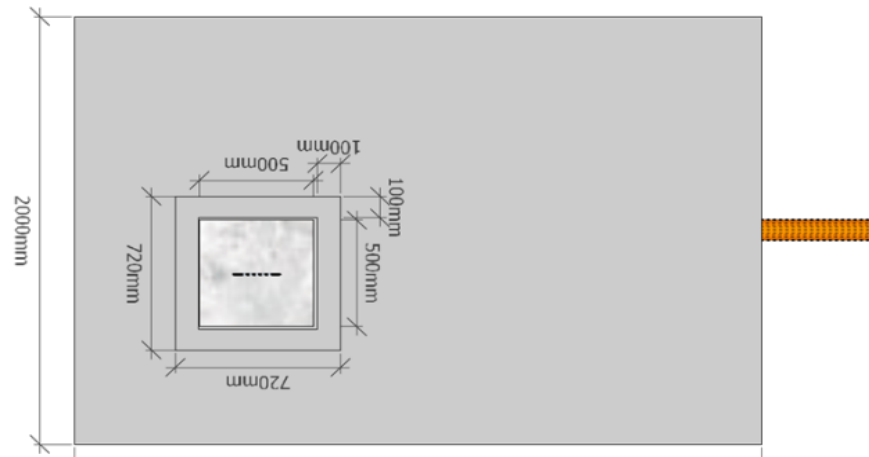
Side view



Sectional view



Top view



Septic tank

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, formwork has to be used for the safety of the workers.

Pit excavation

The completed excavated pit has a size of 3,0m L/ 1,5m W/ 1,7m D (Length / Width / Depth or Height), or a total excavation volume of 7,7m³. The nature of the ground may alter the dimensions of the hole, but the total volume should keep equal as much as possible.

If the excavator reaches a rocky ground before 1,7m depth and cannot go deeper, the size of the width and length will be reviewed and modified to ensure a tank with an inner volume equal to 5,2m³.

LRC intervenes in existing sites, the path is narrow and the working area are small and demand the use of a small excavator as “Bobcat”. The depth of 1.7m was chosen as a function on the excavator operational limits.

The pit walls should be vertical, to the extent possible. To facilitate the excavation work, draw a square with plaster powder or spray on the ground to mark the location.

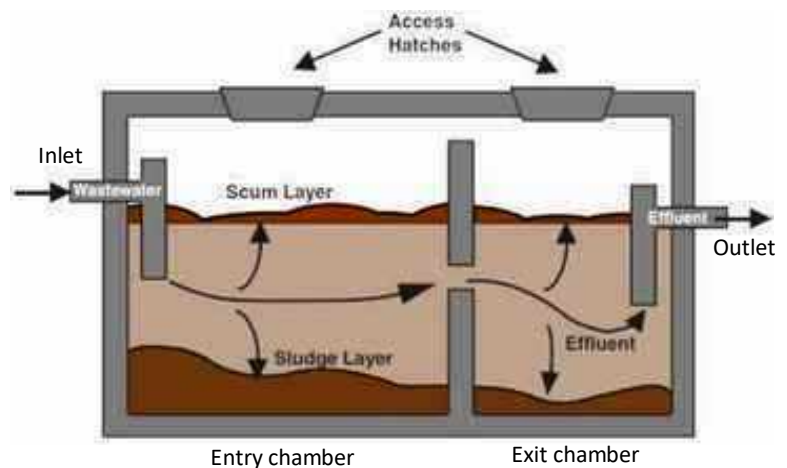
The evacuation of the soil from the site is the responsibility of the contractor.

Floor slab construction

Reinforced concrete slab 3,0m L/ 1,5m W/ 0,1m H is built on the ground floor with vertical pending iron bars to start the walls.

For the slab, a wire mesh is done with 10 mm Ø twisted iron bars. The spacing between each twisted iron bar is 15 cm, tied between them with bending wire. The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special focus on concrete is required depending on the weather. For a good curing and a normal shrinkage, it must be sheltered from sun and wind to avoid drying too fast.



Septic tank pattern

Tank construction

The septic tank has an inner volume of 5,2m³ or 2,7m / 1,2m / 1,6m (Length / Width / Height). The walls are made with standard concrete blocks (0,4m/ 0,15m/ 0,2m).

The volume is divided in 2 chambers with proportion 2/3 for the entry room and 1/3 for the exit room. The 2 chambers communicate through a hole in the middle wall. The separating interior wall does not reach the top slab; about 10 cm of space should be left between the two.

The exterior wall is linked to the floor slab, through pending iron bars, to ensure proofness and strength to the structure. To build the wall, place the blocks all around the slab and directly on top of the pending iron bars. Use mortar to seal the blocks, layer for layer to create the wall to its specified height.

The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand). No free space should be left between the concrete blocks, as the main objective is to have a waterproof tank.

Two 4" PVC pipe with Tee PVC are installed inside the septic tank: one for inlet ("entry") and one for outlet ("exit").

When the walls are completed, the entire interior is plastered with a plaster mortar mix 1:4 (1 volume of cement for 4 volumes of sand) to make it waterproof.

Top slab construction

The septic tank is covered by a slab with two manholes 0,50m/ 0,50m. Manholes have 2 reinforced concrete covers with a size of 0,60m L/ 0,60m W/ 0,07m H in order to allow the desludging, avoid rainwater infiltration and to secure the hole. Around each manhole a protection wall 0.1m W/ 0.1m H is made with reinforced concrete to avoid rainwater infiltration.

A formwork is done with iron sheet and wood for the slab. Wire mesh is made with 10 mm Ø iron bars. The space between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 3,0 m/1,5 m/0,1 m.

The concrete is a mix of 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2 volumes of sand/ 4volumes of gravel.

The 2" ventilation pipe has to be installed on site or beside the cabin connected to a Tee on the 4" pipe inlet for the excreta.

Completion work

The inlet pipe has to be sealed with mortar into the wall to avoid water infiltration.

Depending on the sites, the work can be totally covered with soil except the manhole.

On the inlet 4" PVC pipe, a PVC Tee with reduction is connected to install a ventilation 2" PVC pipe. This ventilation pipe is installed attached to the cabin to be protected and higher than the roof.

At the outlet, the PVC pipe is installed at a lower level than the inlet (down 2cm).

For the outlet, if the space allows it, a 4" PVC pipe with holes on side and bottom is installed at horizontal level with a slight slope in a gravel-filled trench. The trench is 3,0m L/ 0,5m W/ 0,5m D to create a drain field for infiltration.

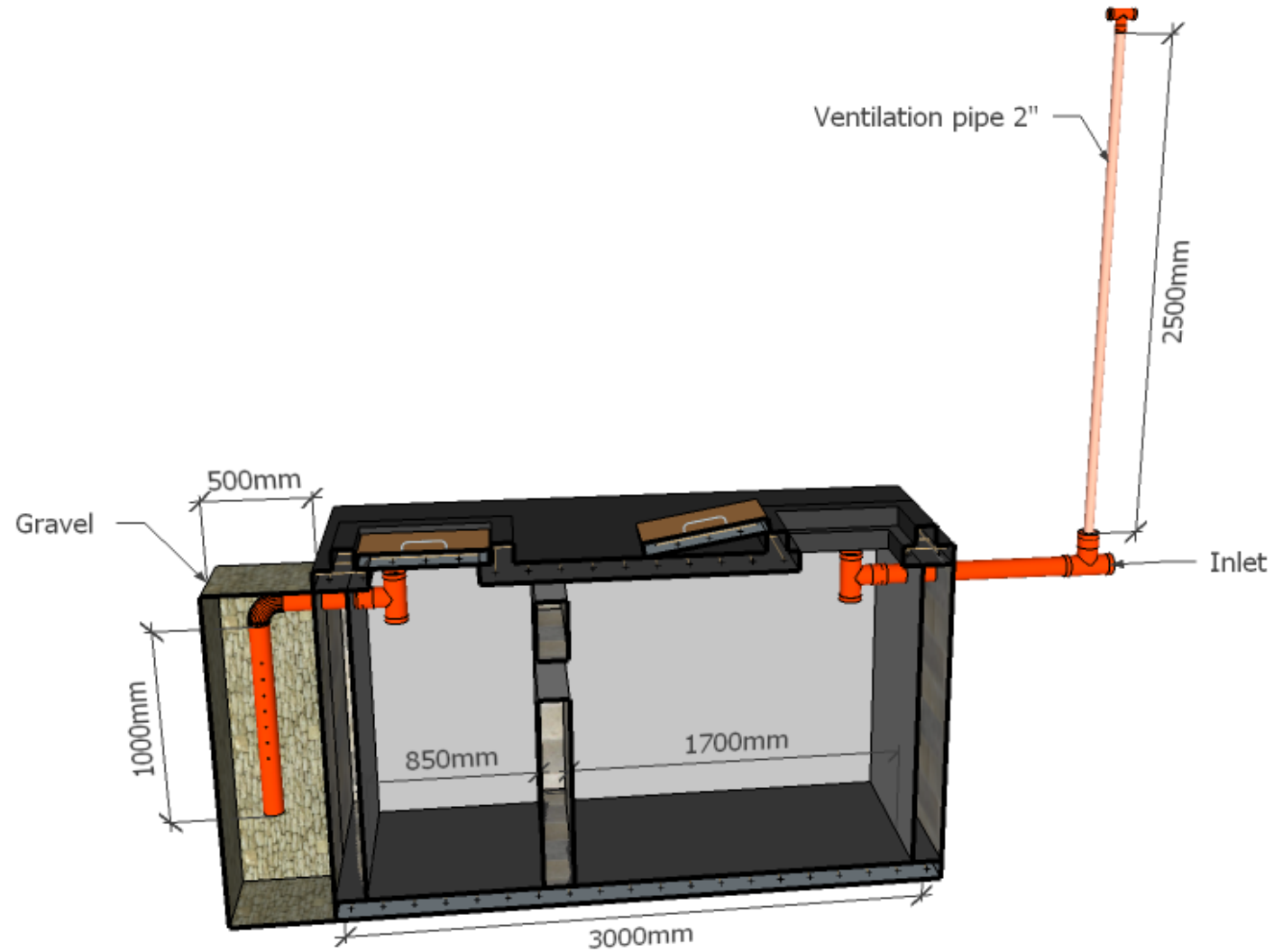
If the conditions are not suitable (i.e insufficient space for a drainage trench), a PVC elbow 90° is installed also at a lower level than the inlet (down 2cm). It extended with a vertical PVC pipe 4" with holes and surrounded by gravel for infiltration. The pit is 1,5m L/ 0,5m W/ 1,7m D to realize a drain field for infiltration.

After 2 weeks of curing, time required for the concrete to be more resistant by hardening, an integrity test has to be done to ensure that the septic tank is waterproof.

The test requires filling up the holding tank with water and checking if the water level is the same the next day. After checking, the tank will be emptied. In case of leakage the inside plaster has to be done again.

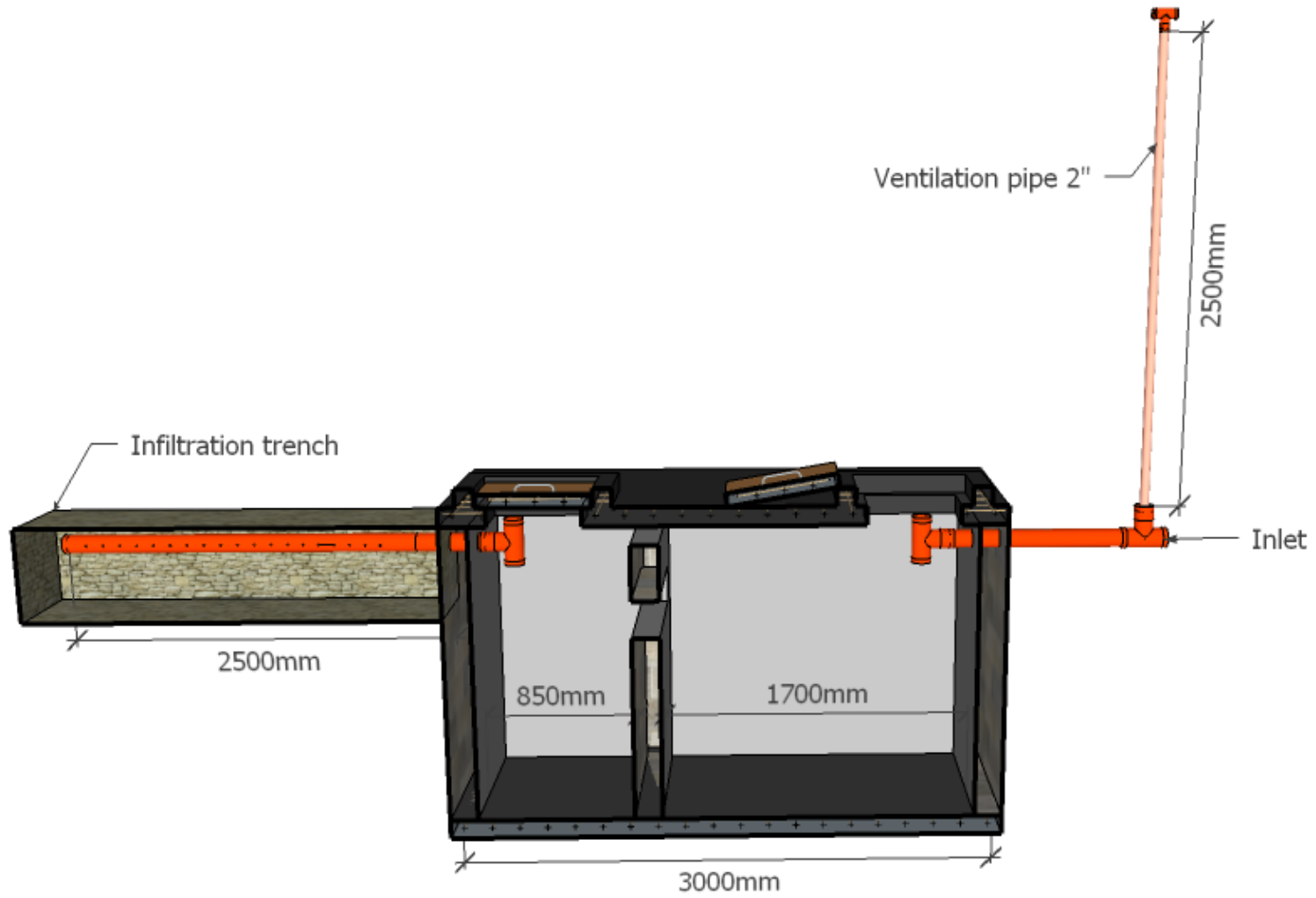
Before commissioning, the septic tank has to be filled up with water for a proper functioning. So if the waterproofing test is validated, the septic tank is kept full.

Bill of Quantities for one septic tank with 2 rooms (3,00*1,50*1,82m exterior)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
	1	Hollow block	400x200x150 mm	Piece	200
Masonry	2	Cement	Portland 50kg bag	bag	10
	3	Sand	Washed, 0-4mm diameter	m3	1
	4	Gravel	Washed, 10-20mm diameter	m3	2
	5	Iron U	50/120/50mm & 3mm thickness	m	9
	6	Iron sheet	& 3mm thickness	m2	5
	7	Twisted iron bars	8mm diameter - 6m length	pce	11
	8	Twisted iron bars	10mm diameter - 6m length	pce	10
	9	Bending wire		kg	1
Plumbing	10	PVC glue	bottle 250mL	Piece	1
	11	PVC T 4"		Piece	3
	12	PVC pipe 4"		m	6
	13	PVC cap for T 4"	with hole 2"	Piece	1
	14	PVC pipe 2"		m	3
	15	PVC T 2"		Piece	1

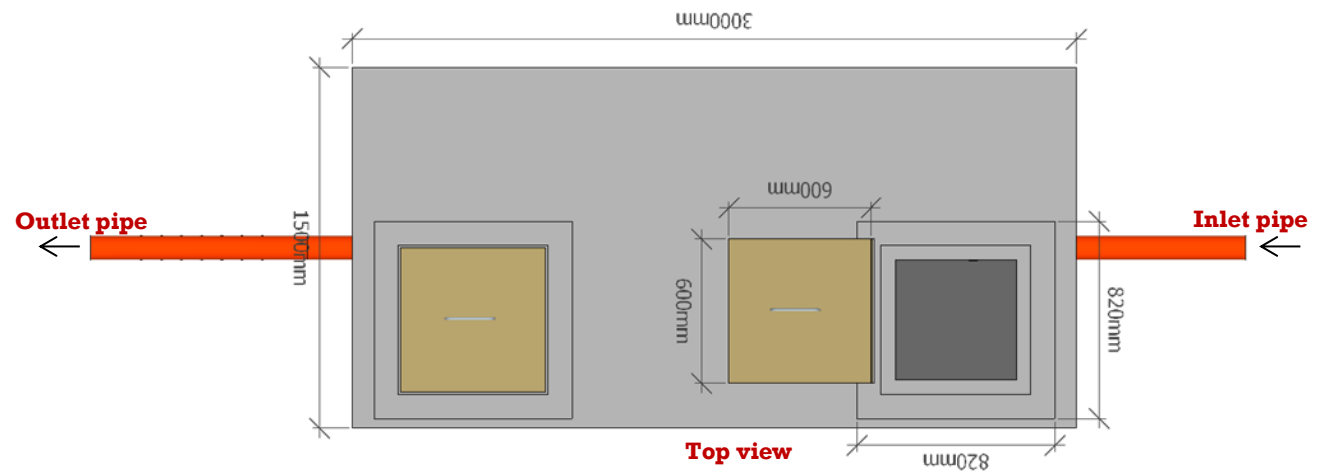
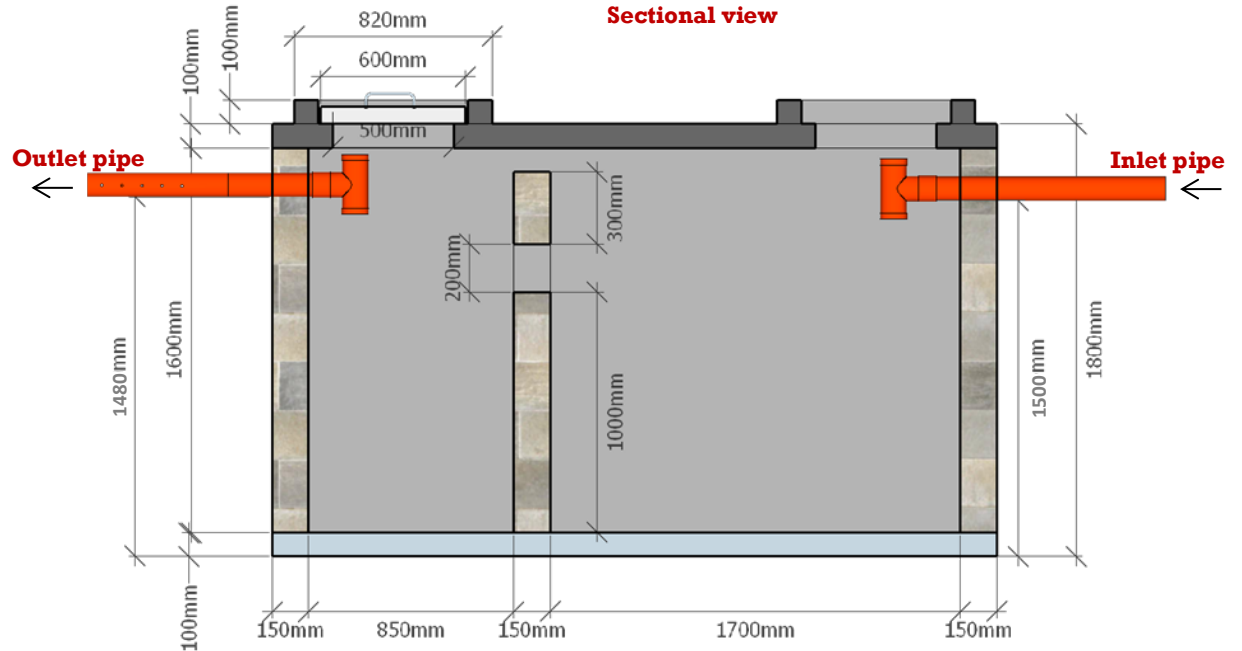
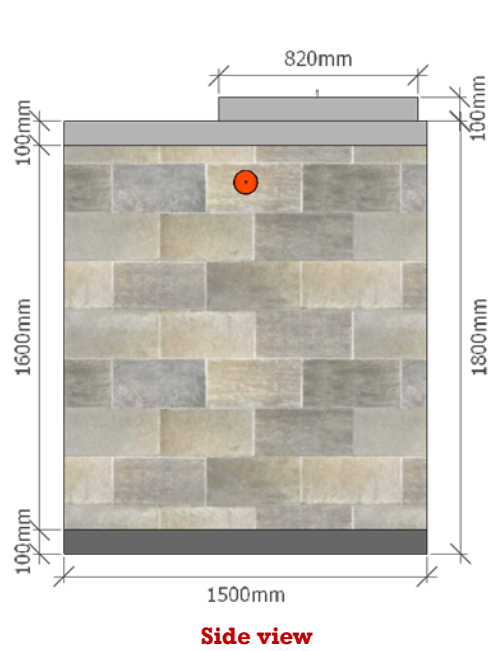


Septic tank with vertical outlet

Design



Septic tank with horizontal outlet



Metallic tank

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, formwork has to be used for the safety of the workers.

Pit excavation

The whole pit excavated has a size of 1.80m L/ 1.4m W/ 1.7m D (Length/ Width / Depth or Height) or a total excavation volume of 4.3m³. As the metallic tank is built in factory, it doesn't allow flexibility on the dimension of the excavation.

LRC intervenes in existing sites, where the path often is narrow and the working area is small. Therefore the work demands the use of a small excavator as "Bobcat". The depth of 1.7m reflects the maximum depth of the excavator's operating range.

The pit walls must be vertical, to the extent possible. Draw a square with plaster powder or spray on the ground to mark the location to facilitate the excavation work.

The evacuation of the soil from the site is the responsibility of the contractor.

Metallic tank construction

The metallic tank is made of square iron bars 30mm x 30mm, 3mm thickness for the skeleton structure and covered with plain metal sheets 3mm thickness and with grid metal sheets 3mm thickness. All the structure is assembled by welding. See the design Figure 2 & 3.

After the control of the welding, the whole metallic structure is painted with anti-rust paint for the first layer and with acrylic paint for the second layer.

Metallic tank installation

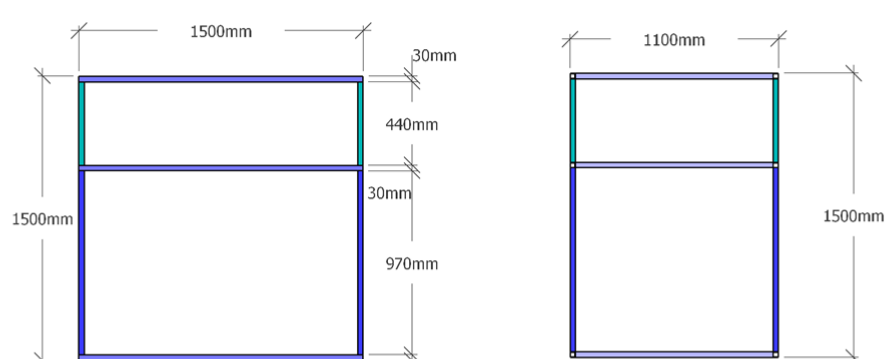
The metallic tank has an inside volume of 2.5m³ or 1.5m L / 1.1m W/ 1.5m H. Allow 0.15m of free space between the structure and the ground walls (all around). This space is to be packed with gravel at the end of the construction process to ensure better infiltration into the soil. The ground floor is left bare.

On top of the metallic tank, there is an open hole with a PVC pipe 4". Then a PVC tee 4" allows two different functions: 1/on the side, the tee is connected to the pipe coming from the cabin latrine, 2/on top the tee is extended with a pipe and covered with a PVC cap to allow desludging.

Completion work

The free space of 0.15m around the metallic tank is filled it up with gravels to ensure a better infiltration. Then plastic sheeting covers the whole excavation place to avoid a quick clogging. Then the soil excavated is reused to cover the plastic sheeting and protect the pipes.

Design



Bill of Quantities

Bill of Quantities for one metallic tank for pit latrine (1,50*1,10*1,5m ext.)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Metallic structure	1	Iron bar square	30x30mm, 3 mm thickness	m	24
	2	Iron plain sheet	3 mm thickness	m ²	7
	3	Iron grid sheet	3 mm thickness	m ²	3
	4	Paint	acrylic white	liter	1
	5	Paint anti rust	for exterior use	liter	1
Plumbery	6	PVC glue	bottle 250mL	Piece	1
	7	PVC lid threaded	100mm diameter	Piece	1
	8	PVC Tee	100mm diameter	Piece	1
	9	PVC pipe threaded	100mm diameter	m	0,5
Filtration	10	Gravel	Washed, 10-20mm diameter	m ³	2
	11	Plastic sheeting	2x2m	m ²	4

Single pit latrine

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, formwork has to be used for the safety of the workers.

Pit excavation

The whole pit excavated has a size of 2.0m L/ 1.7m W/ 1.7m D (Length/ Width / Depth or Height) or a total excavation volume of 5.8m³. The nature of the ground may change the dimension of the hole, but the total volume should be kept equal as much as possible.

If the excavator reaches a rocky ground floor before 1.7m depth and cannot go deeper, the size of the width and length will be reviewed and enlarged to ensure a tank with an inside volume equal to 2.6m³.

LRC intervenes in existing sites, where the path often is narrow and the working area is small. Therefore, the work demands the use of a small excavator as “Bobcat”. The depth of 1.7m reflects the maximum depth of the excavator’s operating range.

The pit walls must be vertical, to the extent possible. Draw a square with plaster powder or spray on the ground to mark the location to facilitate the excavation work.

The evacuation of the soil from the site is the responsibility of the contractor.

Tank construction

The tank has an inside volume of 2.6m³ or 1.4m L / 1.1m W/ 1.7m H. Allow 0.15m of free space between the concrete blocks and the ground walls (all around). This space is to be packed with gravel at the end of the construction process to ensure better infiltration into the soil.

The walls are made with standard concrete blocks (0.4m L / 0.15m W / 0.2m H).

The ground floor is left bare. Two options can be made to build the foundation:

1) a reinforced concrete belt of 0.2m width and 0,1m height and 8mm diameter (or Ø) twisted iron bars

2) with a first line of blocks put on its wider side (0.2m width and 0.15m height).

The blocks are stacked to build the entire pit wall from the top of the foundation of the pit to the ground level. Use mortar to seal the blocks, layer for layer to create the wall to its specified height. The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand). Some spaces are left between the concrete block, each has to be between 0.5 and 1 cm.

Slab construction

The slab covering the pit has an open hole made with PVC pipe 4" (cover with a PVC cap) to allow for desludging. The pipe is 0,10m above ground, see illustration below.

The slab is made with an iron formwork where concrete is poured. The frame is reinforced with Ø 8 mm twisted iron bars (or wire mesh if available). The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 1.7 m x 1.4 m and 12cm thickness.

The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special attention to the drying of concrete is required depending on the weather. For good curing and normal shrinkage, the concrete must be sheltered from sun and wind to avoid drying too fast.

Completion work

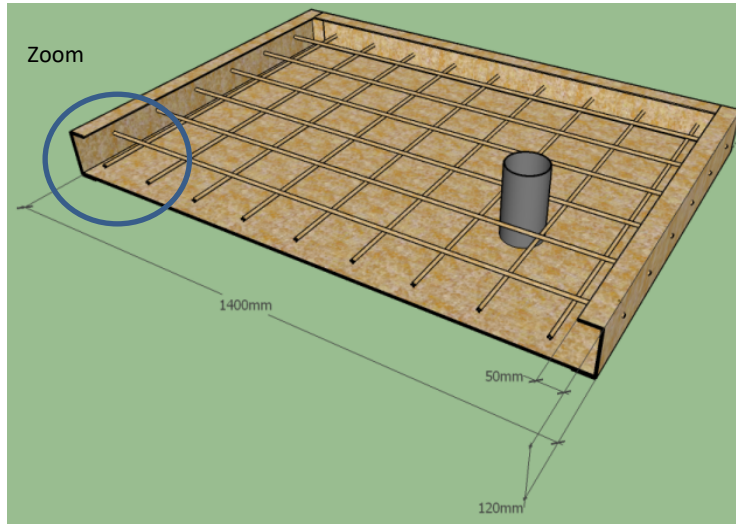
The inlet pipe has to be sealed in the wall to avoid water infiltration.

The free space of 0.15m around all walls is filled it up with gravels to ensure a better infiltration. Then a concrete layer 0.03m height and 0.20m width is poured on the top of the gravel to avoid a quick clogging.

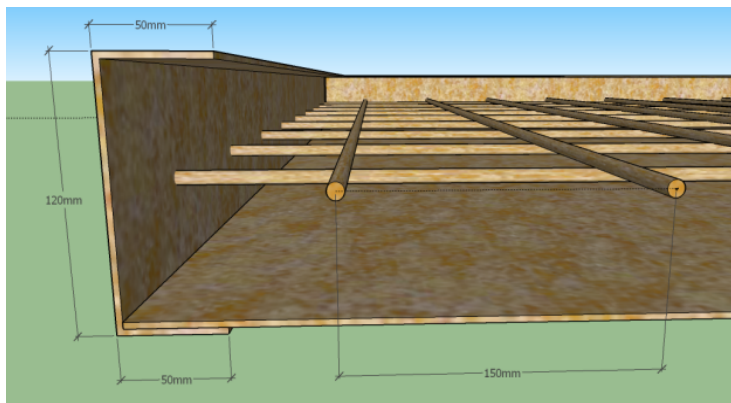
Four (4) concrete block sealed with mortar (mix 1:6) protect the desludging pipe. The work can be totally covered with soil if the site allows for it, but the 4 blocks protecting the desludging pipe must remain uncovered; see the illustration in monitoring sheet below.

Bill of Quantities for one pit latrine (1,70*1,40*1,82m ext.)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Pit & slab + filtration gravel	1	Hollow block	400x200x150 mm	Piece	125
	2	Cement	Portland 50kg bag	bag	5
	3	Sand	Washed, 0-4mm diameter	m ³	0.4
	4	Gravel	Washed, 10-20mm diameter	m ³	2.5
	5	Iron U	50/120/50mm & 3mm thickness	m	6
	6	Iron sheet	3mm thickness	m ²	2.4
	7	Twisted iron bars	8mm diameter - 6m length	Piece	3
	8	Twisted iron bars	10mm diameter - 6m length	Piece	6
	9	Bending wire		kg	1
Plumbing	10	PVC glue	bottle 250mL	Piece	1
	11	PVC lid		Piece	1
	12	PVC pipe threaded		m	1

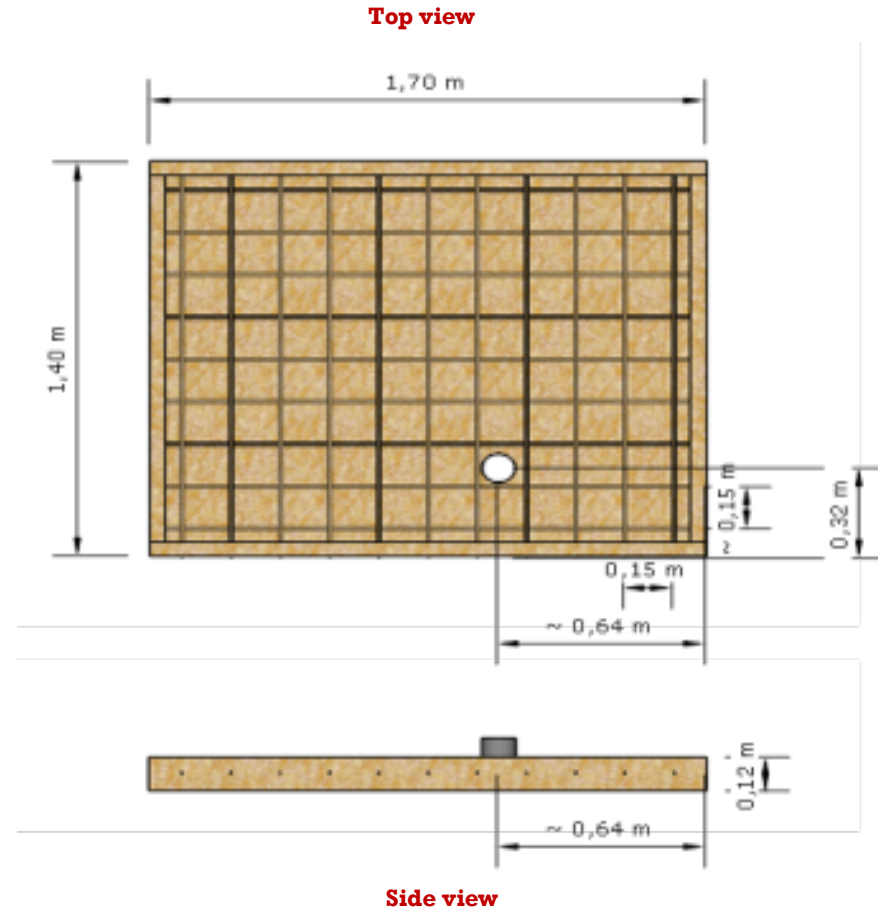
Design

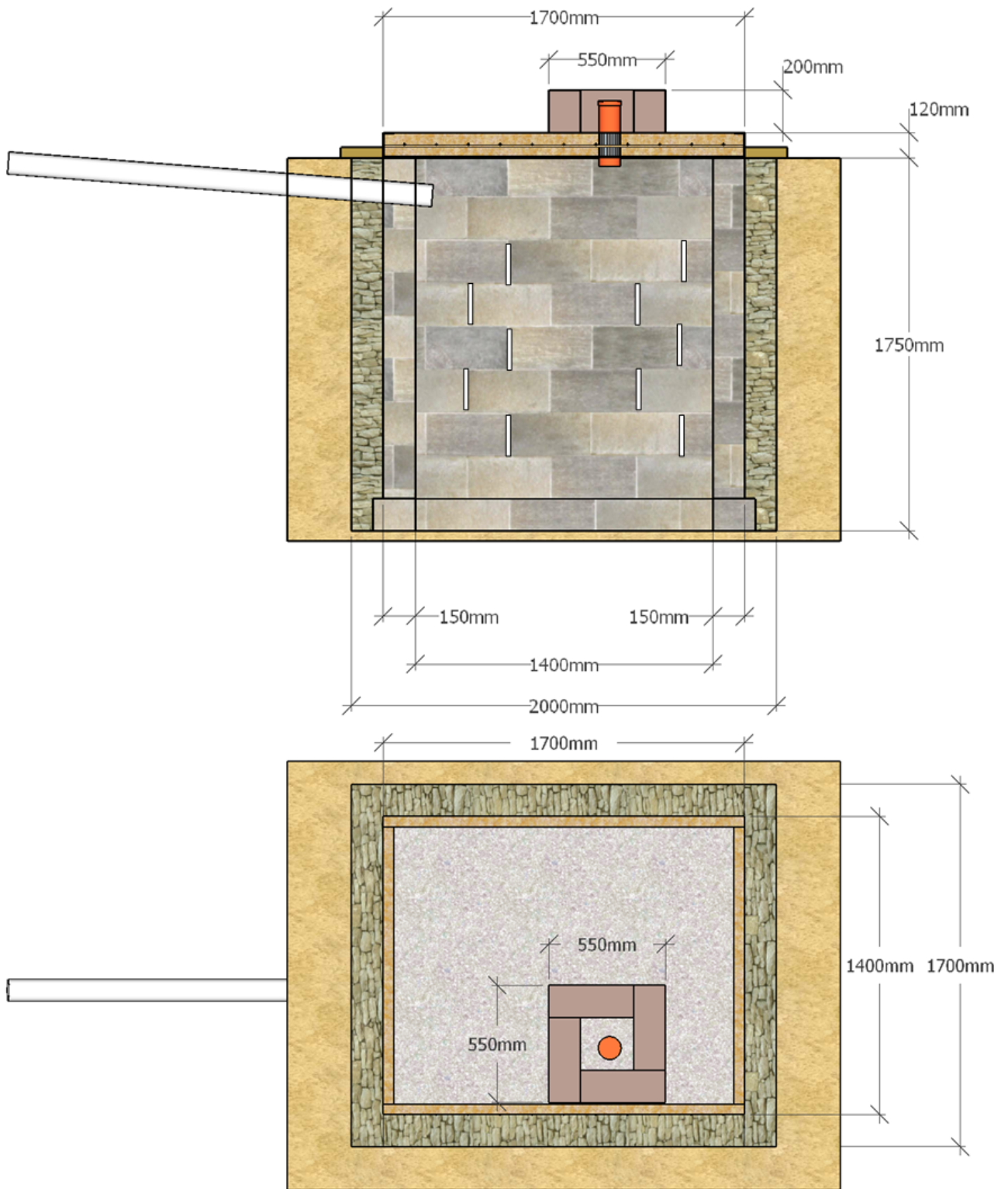


Section view on formwork



Zoom on section view





Double pit latrine

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, a formwork has to be used for the safety of the workers.

Pit excavation

The whole pit excavated has a size of 3.5m L/ 1.7m W/ 1.7m D (Length/ Width / Depth or Height) or a total excavation of 10,1m³. The ground nature may change the dimension of the hole, but the total volume should keep equal as much as possible.

If the excavator reaches a rocky ground floor before 1.7m depth and cannot go deeper, the width and length will be enlarged to ensure a tank with an inside volume equal to 5.1m³.

LRC intervenes in existing sites, where the path often is narrow and the working area is small. The work therefore demands the use of a small excavator as “Bobcat”. The depth of 1.7m of the pit reflects the maximum depth of the excavator’s operating range.

The pit walls must be vertical, as much as possible. To facilitate the excavation work, draw a square with plaster powder or spray on the ground to mark the location.

The evacuation of the soil from the site is the responsibility of the contractor.

Tank construction

The tank has an inside volume of 5.1m³ or 2.9m L/ 1.1m W/ 1.6m H. The walls are made with standard concrete blocks (0.4m L / 0.15m W / 0.2m H). Allow 0.15m of free space between the concrete blocks and the ground walls (all around). This space is to be packed with gravel at the end of the construction process to ensure a better infiltration into the soil.

The tank is divided in 2 equal chambers. The ground floor is left bare. Two options can be made to build the foundation:

1) with a reinforced concrete belt of 0.2m width and 0.1m height and 8mm diameter (or Ø) twisted iron bars or

2) with a first line of blocks put on the wider side (0.2m width and 0.15m height).

The blocks are stacked to build the entire pit wall from the top of the foundation of the pit to the ground level. Use mortar to seal the blocks in order to have a strong structure. The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand). Some space should be left between the concrete blocks; each between 0.5 and 1 cm.

Slab construction

The pit is covered by a slab having 2 open holes made with PVC pipe 4” (covered with a PVC cap), one for each pit, in order to allow the desludging. The pipes are 0.10m higher than the floor.

The slab is made with an iron formwork where concrete is poured. The frame is reinforced with Ø 10 mm twisted iron bars (or wire mesh if available). The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 3.2 m x 1.4 m and 12cm thickness.

The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special focus on concrete is required depending on the weather. For a good curing and a normal shrinkage it must be sheltered from sun and wind to avoid drying too fast.

Completion work

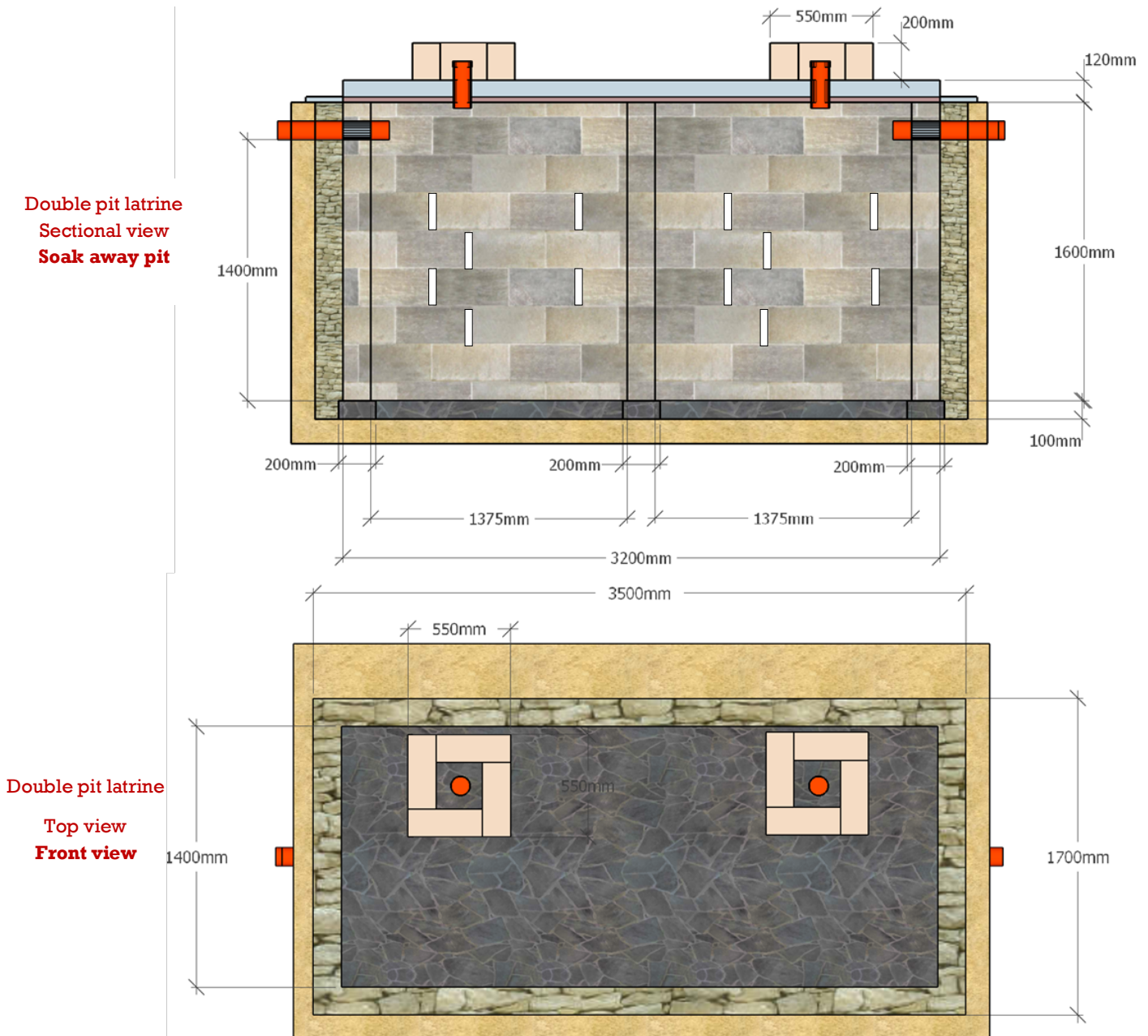
The inlet pipes have to be sealed in the wall to avoid water infiltration.

All around the walls, the free space of 0.15m is packed with gravel to ensure a better infiltration. Then a concrete layer 0.03m height and 0.20m width is poured on the top of the gravel to avoid a quick clogging.

Four (4) concrete block sealed with mortar (mix 1:6) protect the desludging pipe. The work can be totally covered with soil if the site allows for it, but the 4 blocks protecting the desludging pipe must remain uncovered; see the illustration below

Bill of Quantities for a double pit latrine (3,20*1,40*1,82m ext.)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Pit & slab + filtration gravel	1	Hollow block	400x200x150 mm	Piece	210
	2	Cement	Portland 50kg bag	bag	8
	3	Sand	Washed, 0-4mm diameter	m ³	0.7
	4	Gravel	Washed, 10-20mm diameter	m ³	3.5
	5	Iron U	50/120/50mm & 3mm thickness	m	10.5
	6	Iron sheet	3mm thickness	m ²	4.5
	7	Twisted iron bars	8mm diameter - 6m length	Piece	4
	8	Twisted iron bars	10mm diameter - 6m length	Piece	10
	9	Bending wire		kg	1
Plumbing	10	PVC glue	bottle 250mL	Piece	1
	11	PVC lid		Piece	2
	12	PVC pipe threaded		m	1

Design



Triple pit latrine

Safety

The contractor is responsible for the safety of his workers and the people living around the site. The surroundings of the pit have to be marked and protected to avoid avoid hazards, in particular the risk of falling into the hole.

In case of unstable soils, a formwork has to be used for the safety of the workers.

Pit excavation

The whole pit excavated has a size of 5.0m L/ 1.7m W/ 1.7m D (Length/ Width / Depth or Height) or a total excavation of 14.4m³. The ground nature may change the dimension of the hole, but the total volume should keep equal as much as possible.

If the excavator reaches a rocky ground floor before 1.7m depth and cannot go deeper, the size of the width and length will be enlarged to conserve a tank with an inside volume equal to 8.3m³.

The pit wall has to be as much as possible vertical. To facilitate the excavation work, a square drawn with plaster powder on the floor may mark the place.

The evacuation of the soil from the site is the responsibility of the contractor.

Tank construction

The tank has an inside volume of 8.3m³ or 4.4m L/ 1.1m W/ 1.7m H. The walls are made with standard concrete blocks (0.4m L / 0.15m W / 0.2m H). Allow 0.15m of free space between the concrete blocks and the ground walls (all around). This space is to be packed with gravel at the end of the construction process to ensure a better infiltration into the soil.

The tank is divided in 3 equal chambers. The ground floor is left bare. Two options can be made to build the foundation:

- 1) with a reinforced concrete belt of 0.2m width and 0.1m height and 8mm diameter (or Ø) twisted iron bars or
- 2) with a first line of blocks put on the wider side (0.2m width and 0.15m height).

The blocks are stacked to build the entire pit wall from the top of the foundation of the pit to the ground level. Use mortar to seal the blocks in order to have a strong structure. The masonry mortar is a mix 1:6 (1 volume of cement for 6 volumes of sand). Some space should be left between the concrete blocks; each between 0.5 and 1 cm.

Slab construction

The pit is covered by a slab having 3 open holes made with PVC pipe 4” (covered with a PVC cap), one for each pit, in order to allow the desludging. The pipes are 0.10m higher than the floor.

The slab is made with an iron formwork where concrete is poured. The frame is reinforced with Ø 10 mm twisted iron bars (or wire mesh if available). The spacing between each iron bar is 15 cm, tied between them with bending wire. The concrete slab dimensions are 4.7 m x 1.4 m and 12cm thickness.

The concrete is a mix at 350 kg cement/concrete m³ with a proportion in volume of 1/2/4 i.e. 1 volume of cement/ 2volumes of sand/ 4volumes of gravel.

Special focus on concrete is required depending on the weather. For a good curing and a normal shrinkage, it must be sheltered from sun and wind to avoid drying too fast.

Completion work

The inlet pipes have to be sealed in the wall to avoid water infiltration.

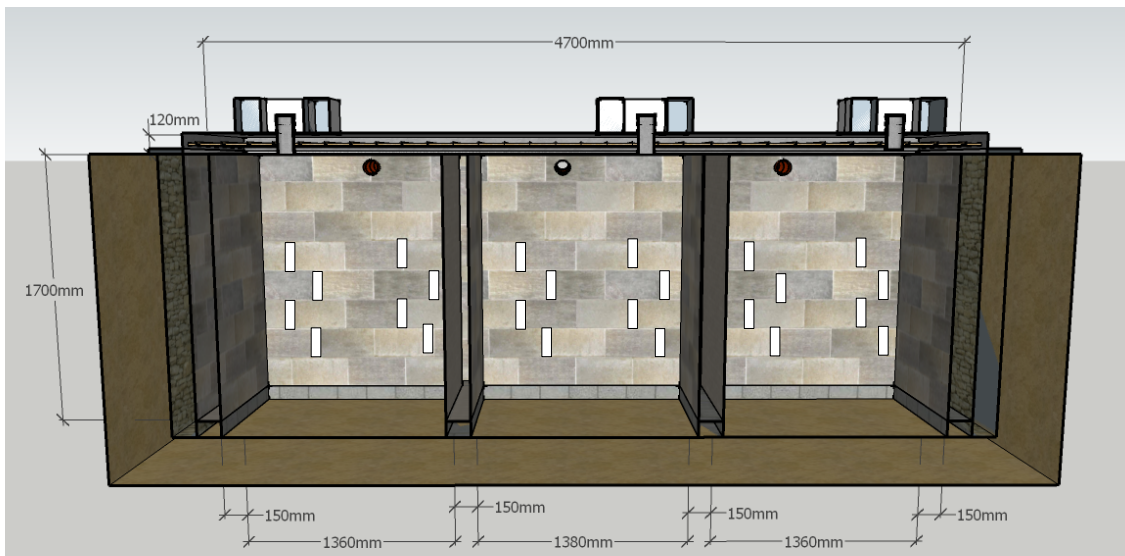
All around the walls, the free space of 0.15m is packed with gravel to ensure a better infiltration. Then a concrete layer 0.03m height and 0.20m width is poured on the top of the gravel to avoid a quick clogging.

Four (4) concrete block sealed with mortar (mix 1:6) protect each desludging pipe. The work can be totally covered with soil if the site allows for it, but the 4 blocks protecting the desludging pipe must remain uncovered; see the illustration below

Bill of Quantities for a triple pit latrine (4,70*1,40*1,82m ext.)					
	No.	Item / Description	Specification	Unit	Quantity
Material					
Pit & slab + filtration gravel	1	Hollow block	400x200x150 mm	Piece	320
	2	Cement	Portland 50kg bag	bag	11
	3	Sand	Washed, 0-4mm diameter	m3	1
	4	Gravel	Washed, 10-20mm diameter	m3	4,5
	5	Iron U	50/120/50mm & 3mm thickness	m	15
	6	Iron sheet	3mm thickness	m2	6,6
	7	Twisted iron bars	8mm diameter - 6m length	Piece	6
	8	Twisted iron bars	10mm diameter - 6m length	Piece	17
	9	Bending wire		kg	2
Plumbing	10	PVC glue	bottle 250mL	Piece	1
	11	PVC lid		Piece	3
	12	PVC pipe threaded		m	1,5

Design

Triple pit latrine
Sectional view



Triple pit latrine
Top view

