Hand Pump and Sanitation Facilities

Design Manual

A SINGLE DROP FOR SAFE WATER

Oxfam

KADTUNTAYA FOUNDATION INC.

MTB

Contents

PART I. HAND PUMP DESIGN MANUAL

PART II. SANITATION FACILITIES DESIGN MANUAL

PART III. Sendong Variations

This Hand Pump and Sanitation Design Manual is a result of the Humanitarian Response to the August 2008 conflict in Central Mindanao. An ongoing response, we have so far faced many issues surrounding the act of responding to long-term displacements. One issue for example, is that it took partners some time to come up with suitable designs and bills of materials, which in turn delayed the implementation of expected infrastructure.

This manual illustrates some basic water and sanitation implementations, and details basic requirements and possible interventions which will provide a starting point for the user.

Engineers from Oxfam-GB Philippines, Kadtuntaya Foundation Inc., Mindanao Tulong Bakwit, and A Single Drop for Safe Water worked together in the implementation of the water and sanitation interventions included here. They then worked together, brainstormed, and went through a review process with the goal of documenting this information for use of their respective agencies. This was also meant for the use of other stakeholders, not only in Central Mindanao but in other areas where effective Humanitarian Response is required.

This First Edition (March 2011) is for trial use only. Note that this is still a working draft being released only for information dissemination purposes. Use this manual at your own risk. Writers and producers of this manual will not be held responsible for any errors or problems that may occur in your use of this manual.

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HAND PUMP
Design Manual

1. PERFORMANCE STANDARDS AND SELECTION PROCESS

1.1 The Hand Pump: A Definition

A hand pump is a simple device that uses human power and mechanical advantage to move groundwater to the surface. Most hand pumps have reciprocating pistons and are positive displacement type pumps.

1.2 Qualities Of A Good Hand Pump

A good hand pump:

- Can access a sufficient quantity of quality safe water in accordance with Sphere guidelines;
- Has a well-constructed platform or apron that permits water to drain safely and rapidly to prevent public health issues;
- Has protection from contamination; and
- Can easily be maintained and locally repaired. Note that this also includes storage tanks and taps.

Note: these **performance standards** were developed by the Technical Working Group (TWG) based on Sphere standards and the local conditions surrounding the Mindanao Displacement 2008-2010.

1.3 Situations and Selection Process

The location of a borehole must be far from potential contamination sites. As much as possible, borehole sites must be uphill from these potential contamination areas.

These contamination points include, but are not limited to:

- Septic tanks or latrines. Boreholes need to be 25 meters away from all operating septic tanks, leach fields or latrines.
- Solid waste pits. Boreholes should be uphill and 25 meters away from the pit.
- Feeding stations for livestock.
- Rice fields or ponds of water formed by the runoff from residential, industrial or intensively farmed areas which are potentially contaminated by pesticides, fertilizers, etc.
- Burial sites for humans or animals.
- Drainage canals, ditches or houses of up to 7 meters.
- Municipal garbage dumps or landfills, as well as gas stations. These areas must be at least 100 meters away.

2 MAIN TYPES OF PUMPS	
SHALLOW WELL PUMPS	DEEP WELL PUMPS
1. Water level is within 25 feet from ground level.	1. Water level is 25 feet or more from the ground level.
2. The pump sucks the water up from aquifer to the surface.	2. The pump is immersed in the aquifer and pushes water to the surface.
3. Commonly called Jetmatic or Pitcher pump.	3. Commonly called Cylinder or Malawi pump.

2. DESIGN: BOREHOLE and CASING

2.1 Borehole Drilling

Once the new site is chosen, a **test borehole** must be drilled. This first borehole may be converted to a production well. The steps to the first borehole drilling are as follows.

- **Borehole logging.** As the well is drilled, soil formations are logged at a maximum of 5-foot intervals or as often as required.
- **Water Table.** At the end of the first soil layer the water level will be measured. This is the unconfined aquifer or water table.
- **Well Yield.** If the water table is less than 25 feet from the pump center line, this should be pumped for at least 2 hours to measure the well yield of the water table.
- **Continuation of Drilling.** To continue drilling the borehole:
    - Enlarge the original hole and install a 3-inch casing. Grout to the bottom of the water table to completely seal from the next aquifer.
    - Once grout is set, continue drilling through the following layers for the 2-inch casing.
    - At the end of each layer, make sure to:
        - Measure the water level.
        - Temporarily install pump and conduct well yield test.
        - Test water for potability and chemical content, i.e., iron, salt, etc.
        - If well yield is low then this is not a water-bearing layer and either continue to drill through to the next layer or decide to use water table water.
        - Repeat process for each soil layer extending 2-inch casing for each layer until a suitable layer is reached.

- **Upon completion of the test borehole drilling** you can design the proposed borehole depth, casing design, and the pump location or suction pipe length. Note that the actual depth will vary from place to place and depends on the soil formation. The test borehole shows what soil formations can be expected but each production well needs to be designed specifically given the soil structure of the particular site.

2.2 Borehole Design and Depth

- **Water Table.** If the water table is your source of water, the borehole should be drilled to the bottom of the layer containing the water table. You must not go any lower. Note that telescoping hole design can be incorporated. A large hole is 2 inches in diameter to proposed casing depth, and a smaller hole is 1 inch in diameter to the bottom of the water table.
- **Lower Aquifer.** The borehole should be drilled no further than the bottom of this water-bearing layer. It should be no less than 4 meters into this water-bearing layer. Note that telescoping hole design can be incorporated. A large hole is 2 inches in diameter to proposed casing depth, and a smaller hole is 1 inch in diameter to the bottom of the water-bearing layer or bottom of borehole. This can be more than 4 meters to increase well yield.
- **Sandy Layers.** If you hit a non-water-bearing layer then the hole should be drilled with the 2-inch casing installed. Drill to prevent the hole from collapsing. If it's a water-bearing layer then the hole should be enlarged and a slotted casing installed. Once the casing is installed 1/4-inch gravel should be packed in between the slotted casing and the wall of the borehole.

2.3 Casing Design

Casings are installed to prevent or reduce contamination of the water supply being pumped. In **shallow well** situations, the water is being taken from the water table (unconfined aquifer) and the casing ensures that surface contamination must go as deep as possible before entering the pump. This casing should extend past the water level, but there should be 2 to 4 meters of uncased borehole for water to enter the well.

For **deep wells**, the casing seals the upper unconfined aquifer from draining into the lower aquifer that's being tapped. In all situations the casing should be grouted into place. Note that the casing also contains the pump and should extend 3 to 4 meters past the static water level. Casing below the pump can be slotted.

Note that for both shallow and deep wells a minimum of 3 to 4 meters should be uncased to allow water to enter the borehole. This can be extended if conditions allow in order to improve the well yield. However it should not extend into the next soil level.

Casings also prevent the hole from collapsing specially in loose soil formations. In cases of extremely loose soil formations the casing is installed as the hole is drilled. If the loose soil is also the water-bearing aquifer then the casing should be slotted and the hole made larger than the casing. This space is then filled with 1/4-inch gravel to reduce sand blocking the slots in the casing.

By using telescoping boreholes at the end of the casing, the casing rests on the shoulder at the point where size changes. This will provide a seal when the casing is grouted in place.

Slotted Casings

These casings are drilled or slotted to allow water to pass into the casing while preventing the hole from collapsing. Note that the open area needs to be maximized to increase well yield. The exterior of the casing can be wrapped with steel netting to protect if from gravel.

Casing Length

- **For Shallow Wells.** Casing must be from the surface to water level or 4 meters from the bottom of hole, whichever is deeper.
- **For Deep Wells.** Casing must be 1 meter inside the water-bearing layer. Depending on the depth drilled in the water-bearing layer and the soil formation, the uncased hole should be a minimum of 4 meters. If slotted casing is used then 1 meter may be unslotted in the water-bearing layer and a minimum of 4 meters must be slotted.

Grouting

Grout is a mix of two (2) parts cement, three (3) parts fine sand, and enough water to allow the grout to move down the hole and fill the gap between the borehole and the casing to create a sanitary seal. In shallow well pumps this prevents contaminated water from flowing down the side of the casing and entering the well. It also ensures that the water passes through as much of the soil as possible prior to entering the borehole. In deep wells it prevents contaminated water in the upper layers from entering the aquifer. It also maintains pressure in the aquifer being tapped.

Grout should be poured between the casing and the hole, from the surface to the end of the solid casing. For telescoping

boreholes this is simple. For slotted casings gravel is packed to the desired level before grout.

For non-telescoping boreholes and no slotted casings, drill the borehole to the end of the proposed casing. Grout in place and then continue digging to desired depth.

2.4 Pump Design

- **For Shallow Wells.** A suction pipe should be connected to the pump and extend to a minimum of 3 meters below the static water level during dry season. The maximum length of the suction pipe should be no more than 10 meters.
    - As previously noted, if static water level is more than 30 feet from pump level, then use a deep well pump.
- **For Deep Wells.** The pump should be installed no less than 3 meters below the static water level during dry season. It may be installed lower than this but it should at least be 4 meters above the bottom of the borehole.
    - Cylinder pumps fit into a 2-inch GI casing. There's no need to install suction piping as the water flows up through the casing.

2.5 Pump Data Sheet

FINAL CONSTRUCTION REPORT			
Project Name:			
HP #	Location	Barangay	Municipality
Construction date started:		Date finished:	
Contractor's name:			
Name of site inspector:			

Well log and profile description "As built"

in meter	water table	suction pipe	casing	borehole	type of soil	in feet
5		indicate diameter	indicate diameter		fine sand	16
10						33
15					clay soil	49
20						66
25						82
30						98
35						115.2
40						131.7
45						148.2
50					gravel	164.7
55						181.2
60						197.7
65						214.2
70						230.7
75						247.2
80						263.7
85						280.2
90						296.7
95						313.2
100						329.7
105						346.2
110						362.7
115						379.2
120						395.7
125					adobe	412.2
130						428.7

Details/Description of the Well

Photo of well, serial number of other identification, disinfection date, test result, demographic and number of users, who is designated as caretaker of the well

Water Quality

Date	NTU	pH	Iron	Color	Odor	E.coli

Supervised by

Name of staff

3. DESIGN DETAILS

3.1 Shallow Well

Figure 1. Shallow Well Pump – Borehole Details

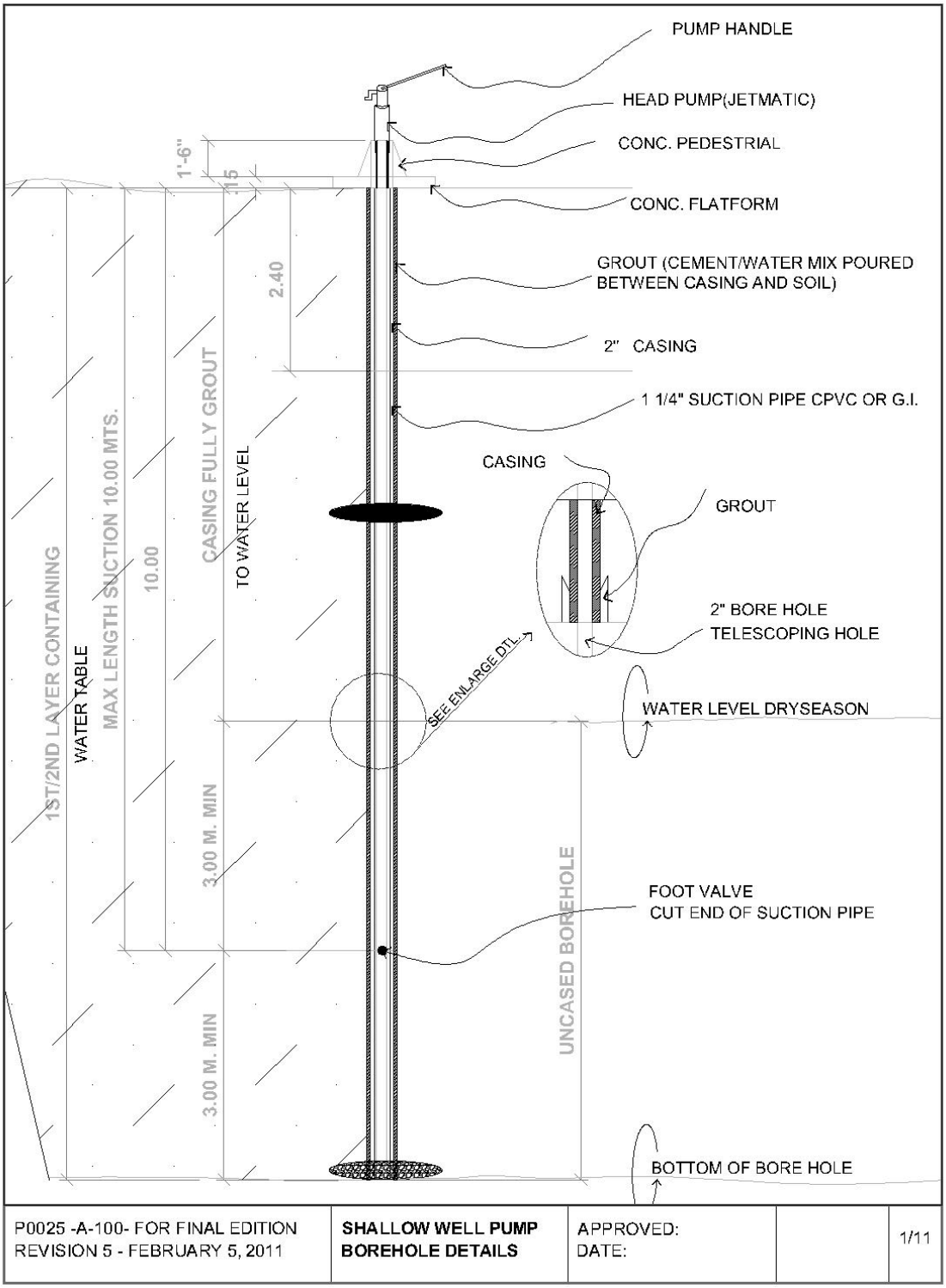


Figure 2. Shallow Well Pump (Discharge, Concrete Stand and Platform Details)

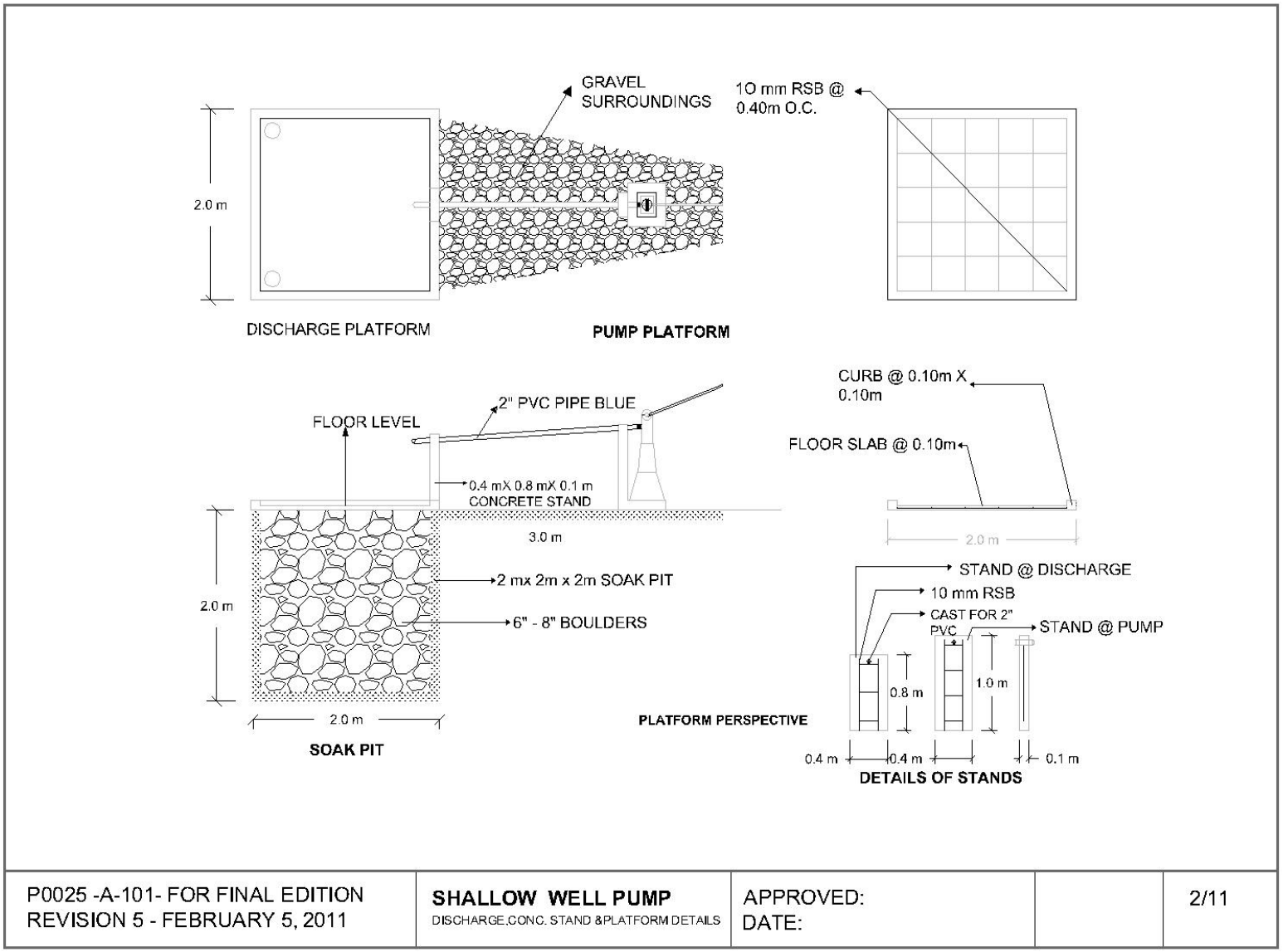
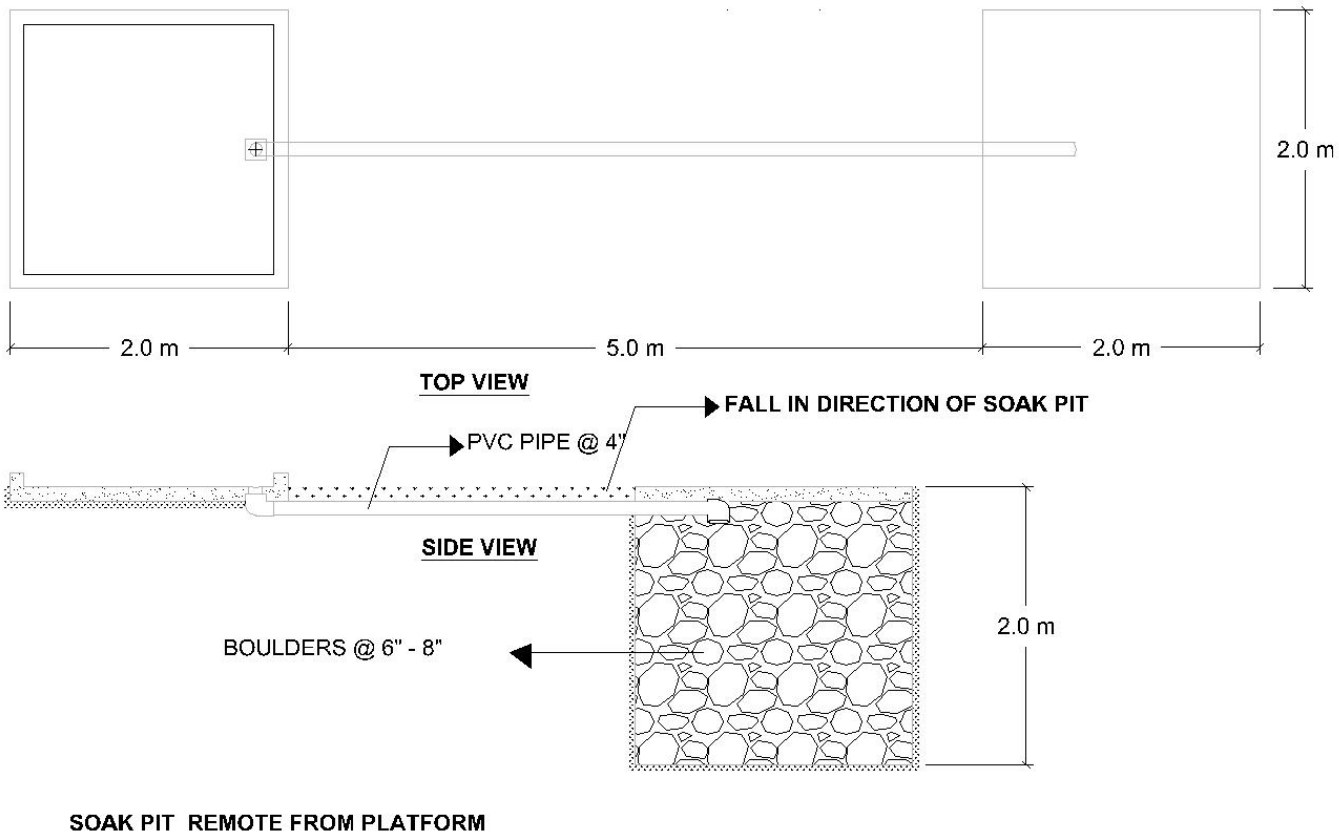


Figure 3. Soak Pit Pump (Soak Pit Remote from Platform)



P0025 -A-102- FOR FINAL EDITION REVISION 5 - FEBRUARY 5, 2011	**SHALLOW WELL PUMP** SOAK PIT REMOTE FROM PLATFORM(OPTION)	APPROVED: DATE:	3/11

Figure 4. Shallow Well Pump (Pump Assembly and Remote Pump Installation)

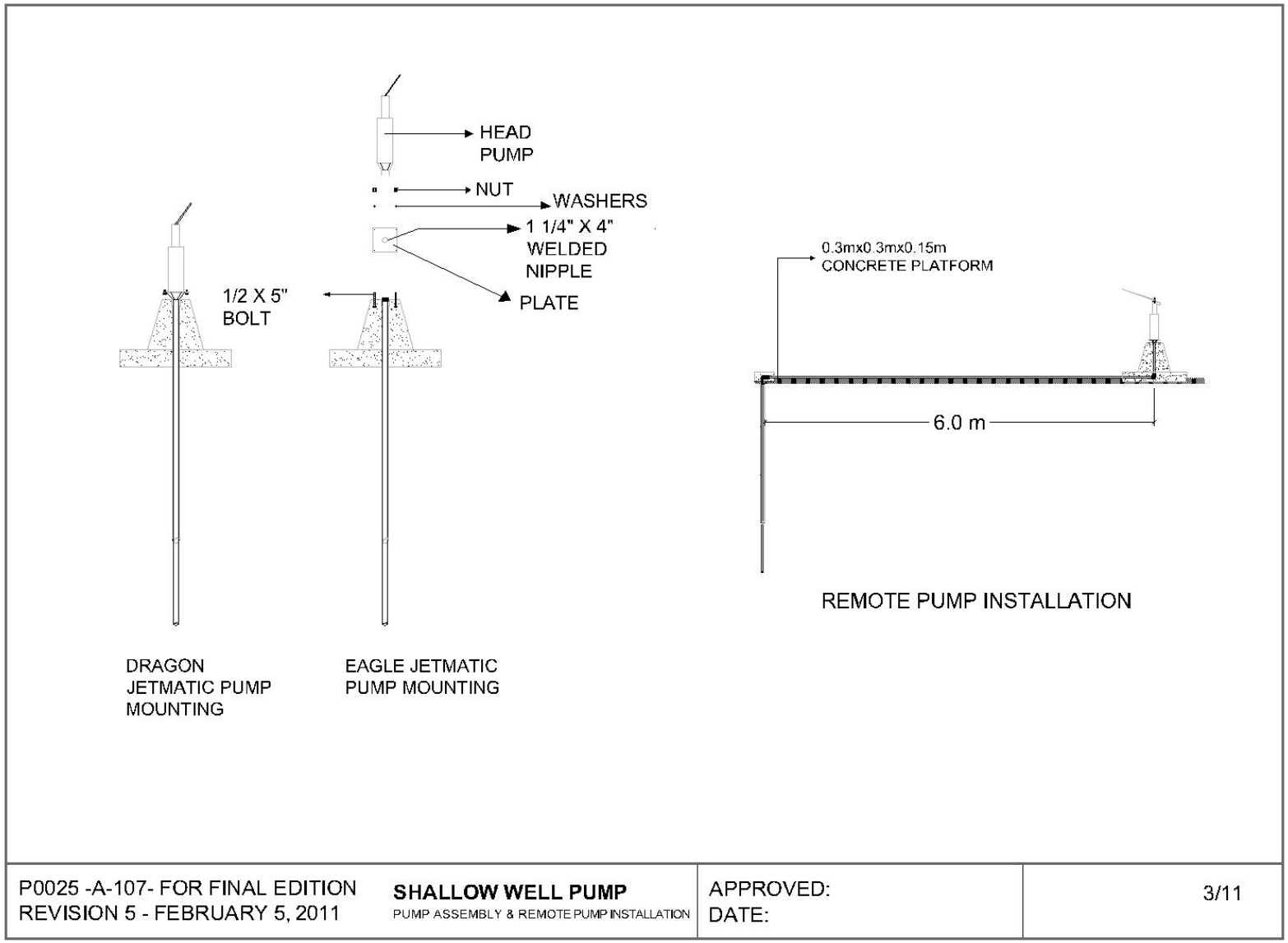


Figure 5. Shallow Well Pump (Platform with Drainage)

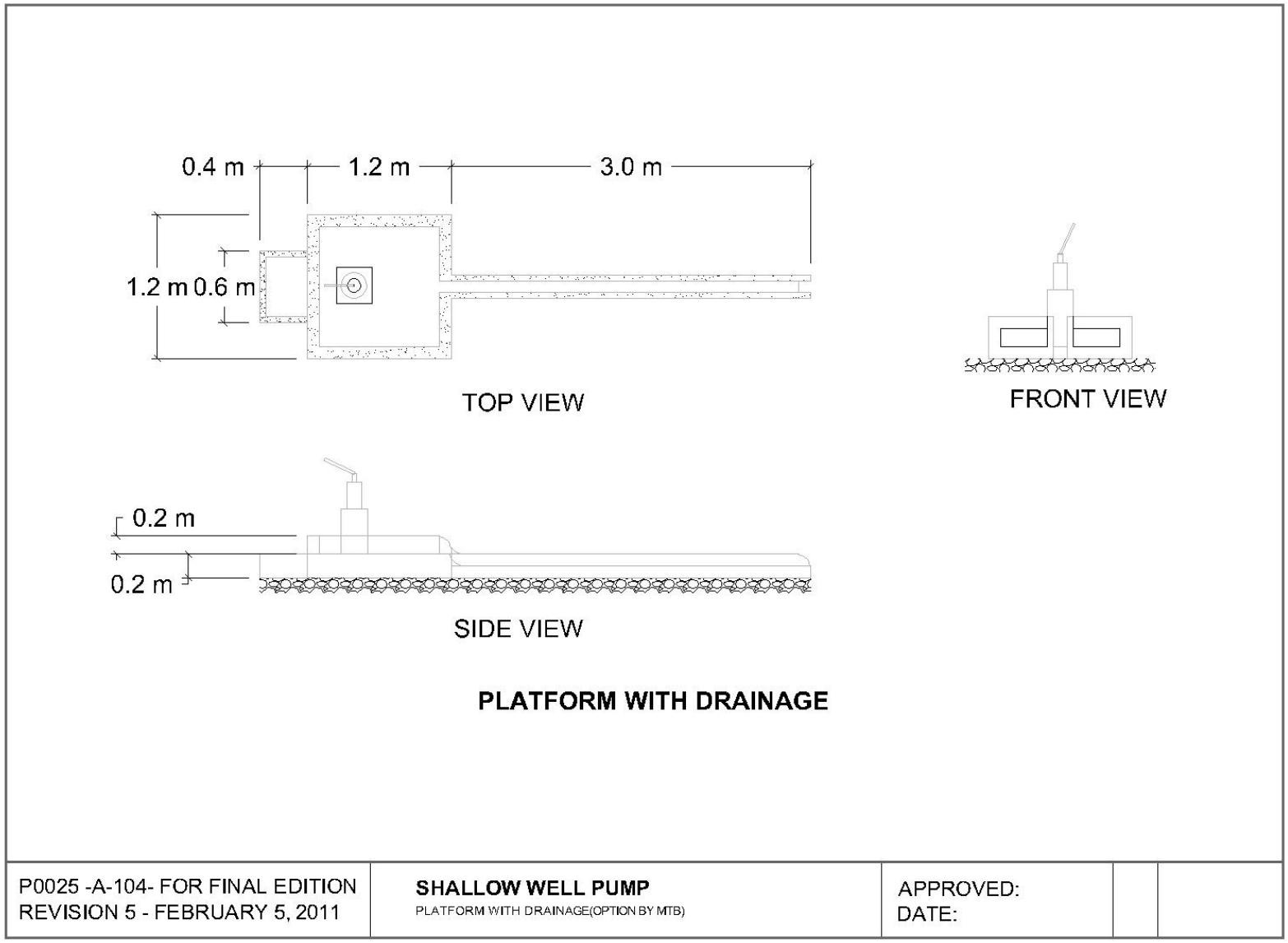
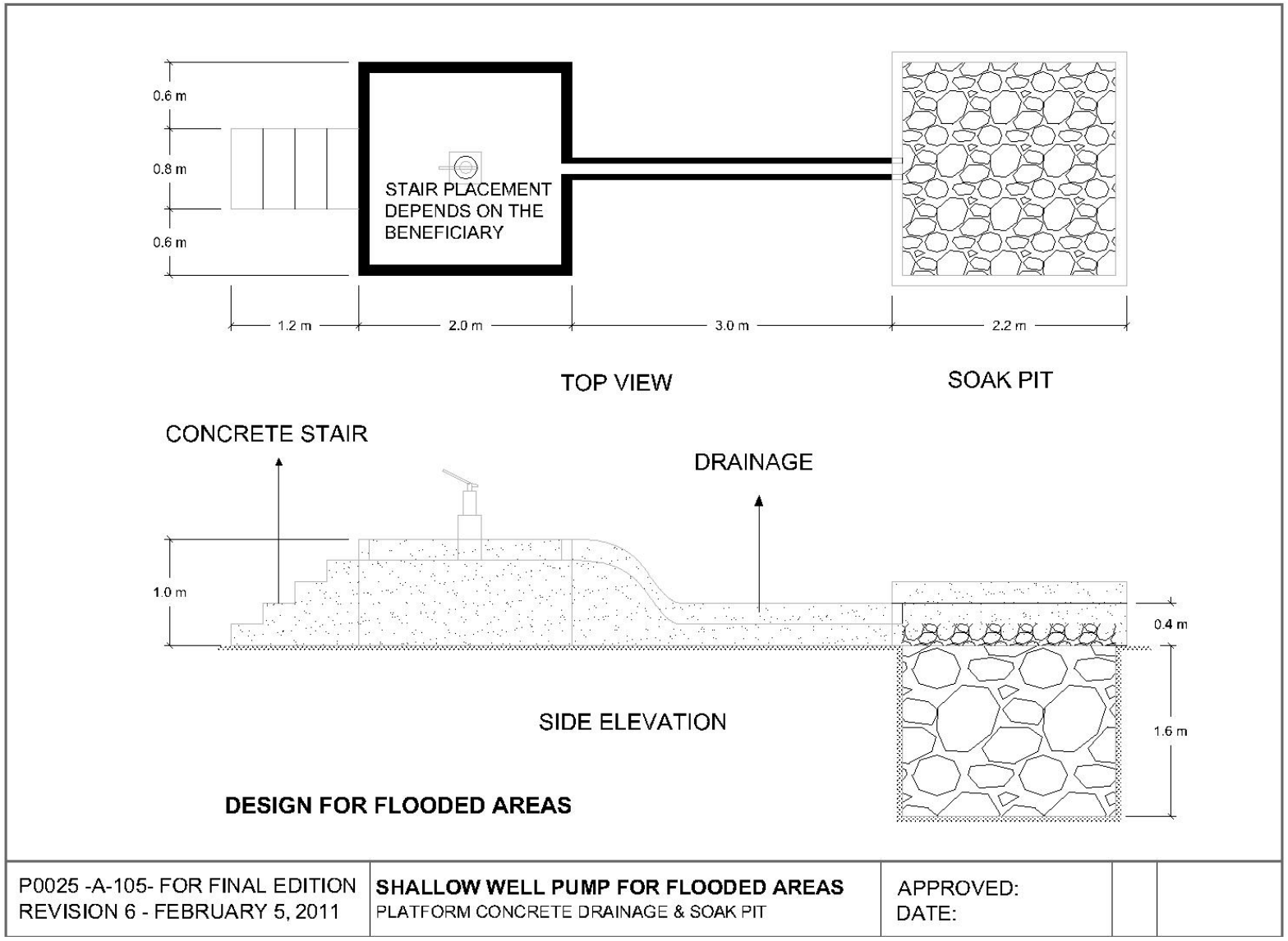


Figure 6. Shallow Well Pump for Flooded Areas (Platform, Concrete Drainage and Soak Pit)



3.2 Deep Well

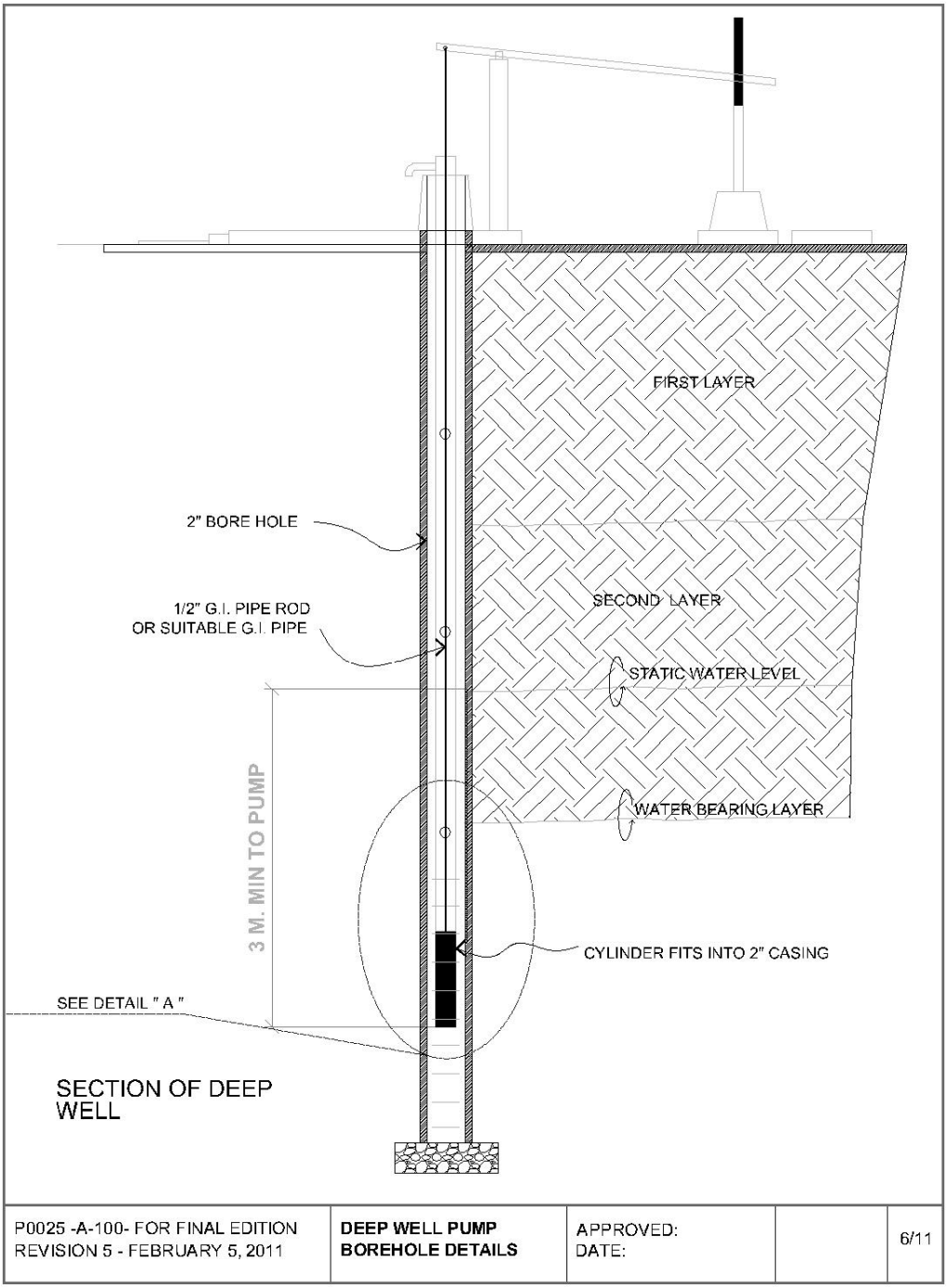


Figure 7. Deep Well Pump

Figure 8. Deep Well Pump

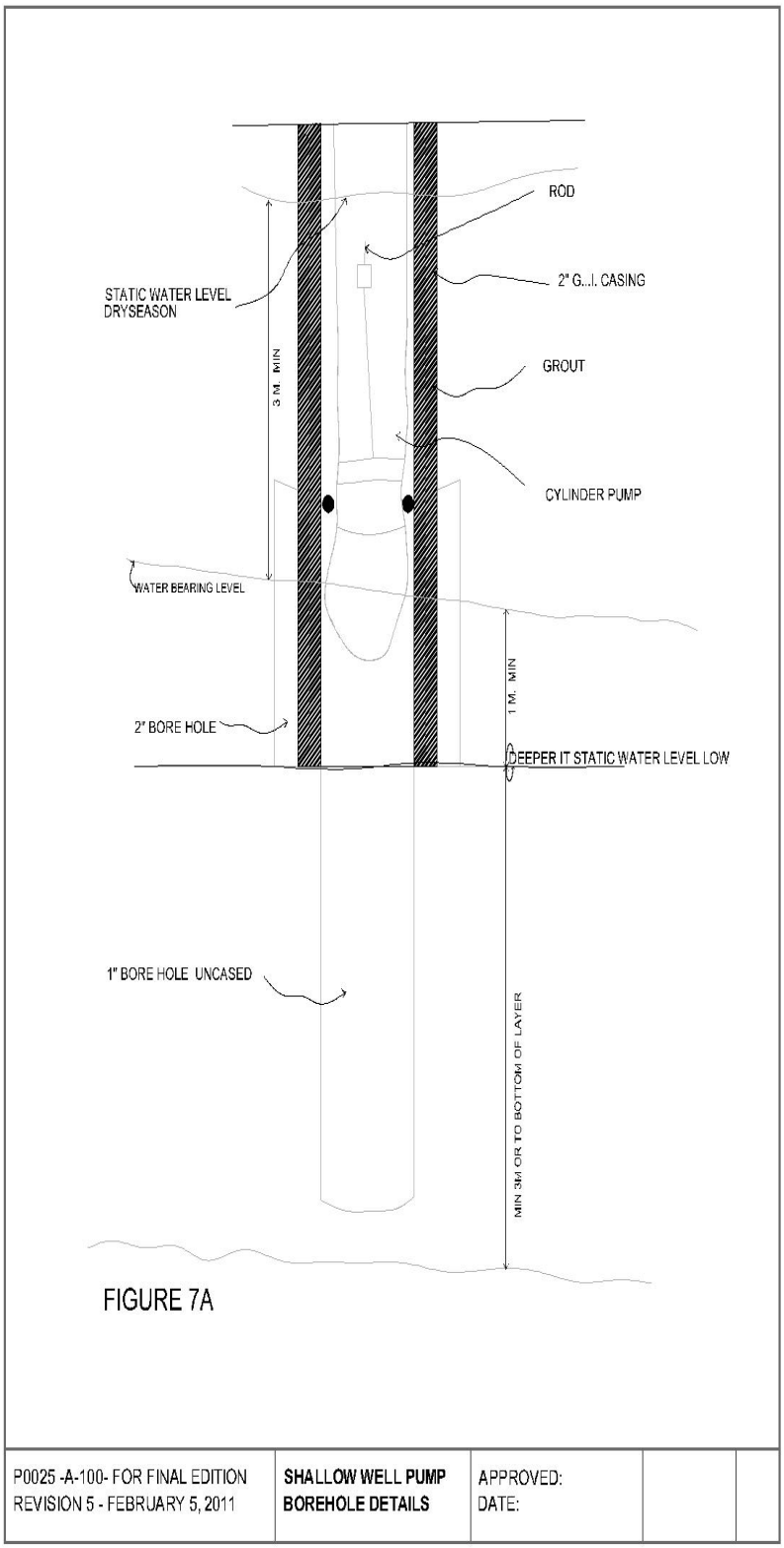
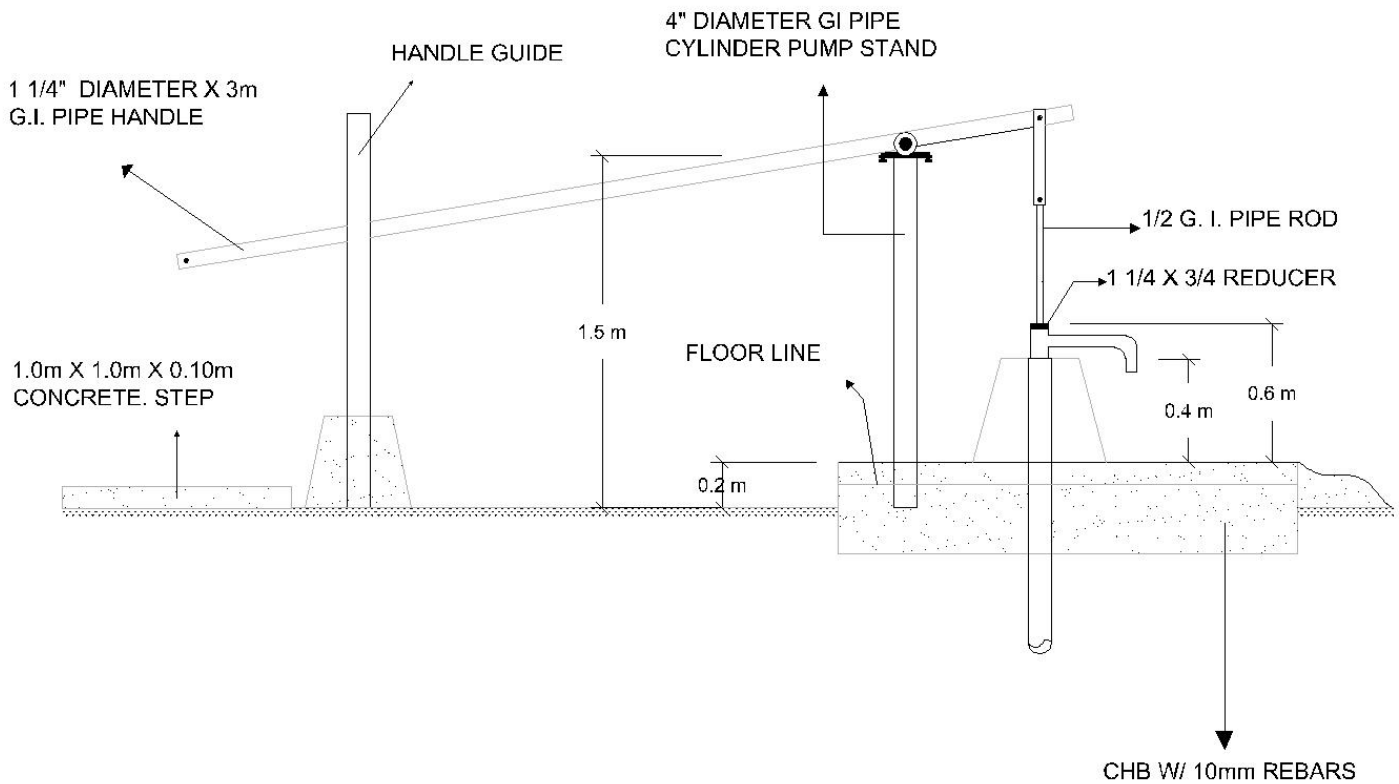


Figure 9. Deep Well Pump (Side Elevation)



P0025 -A-106- FOR FINAL EDITION REVISION 5 - FEBRUARY 5, 2011	**DEEP WELL PUMP** SIDE ELEVATION	APPROVED: DATE:		

Figure 10. Deep Well Pump (Floor Plan)

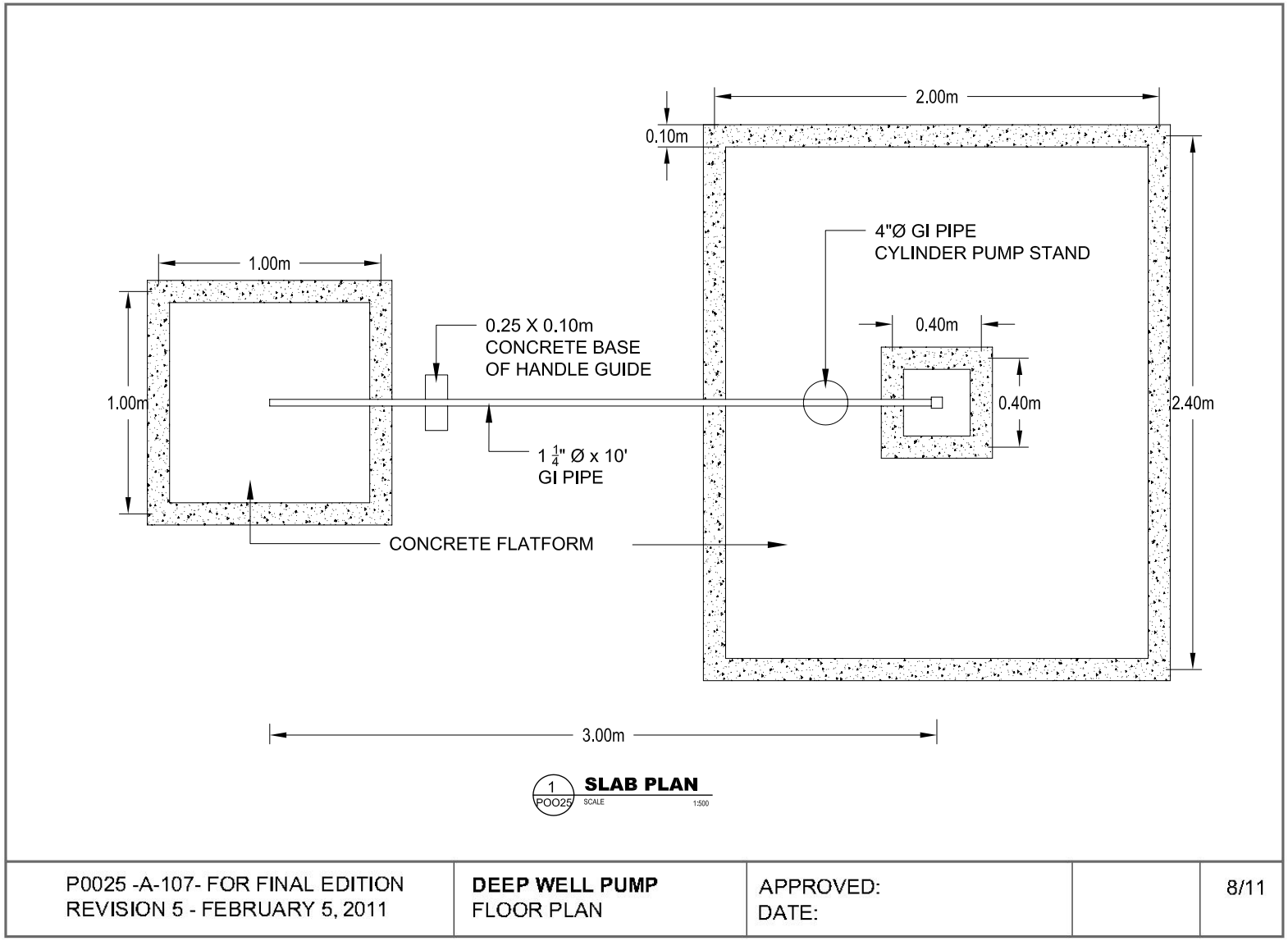


Figure 11. Deep Well Pump (Floor Plan Details)

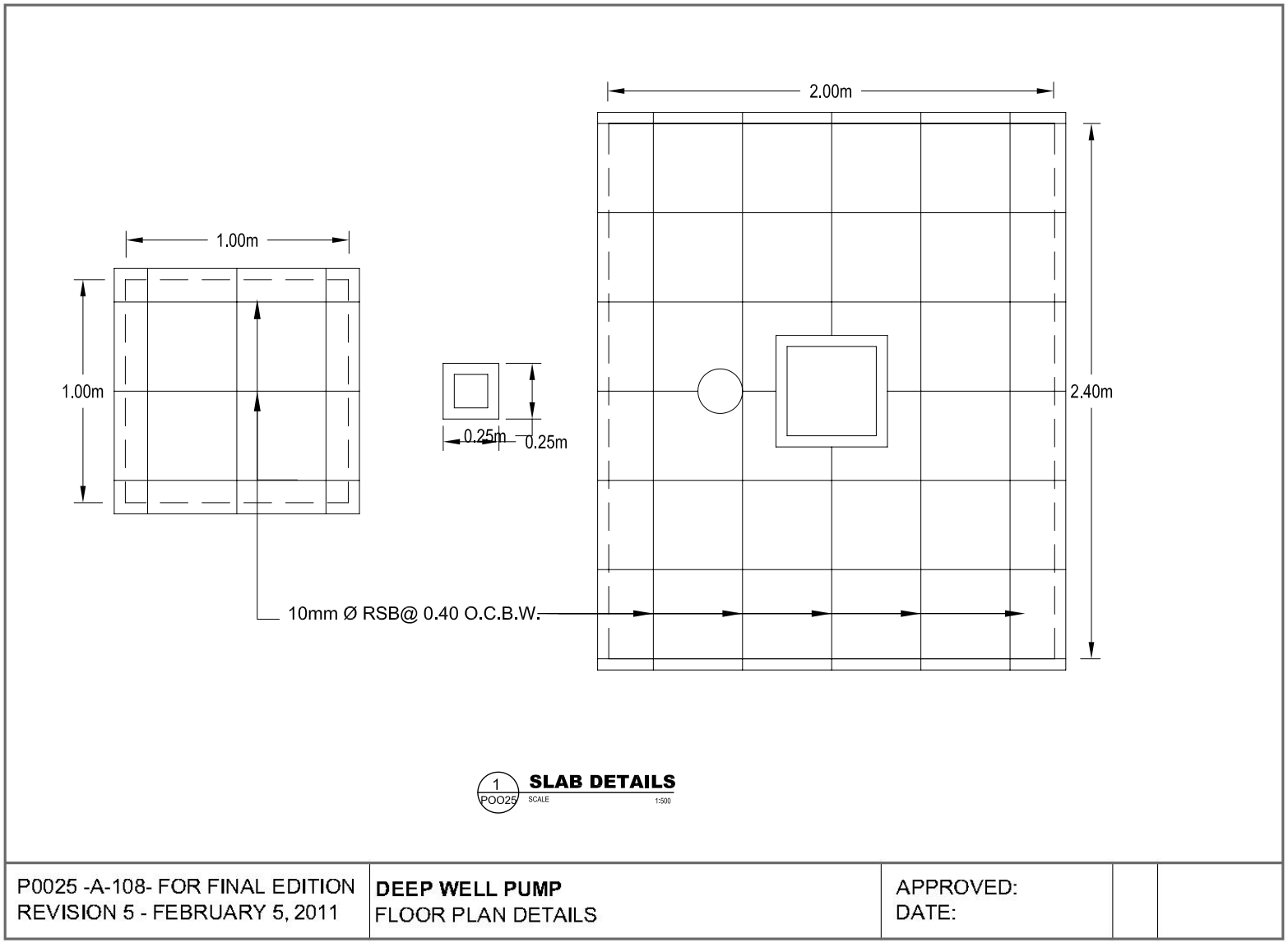
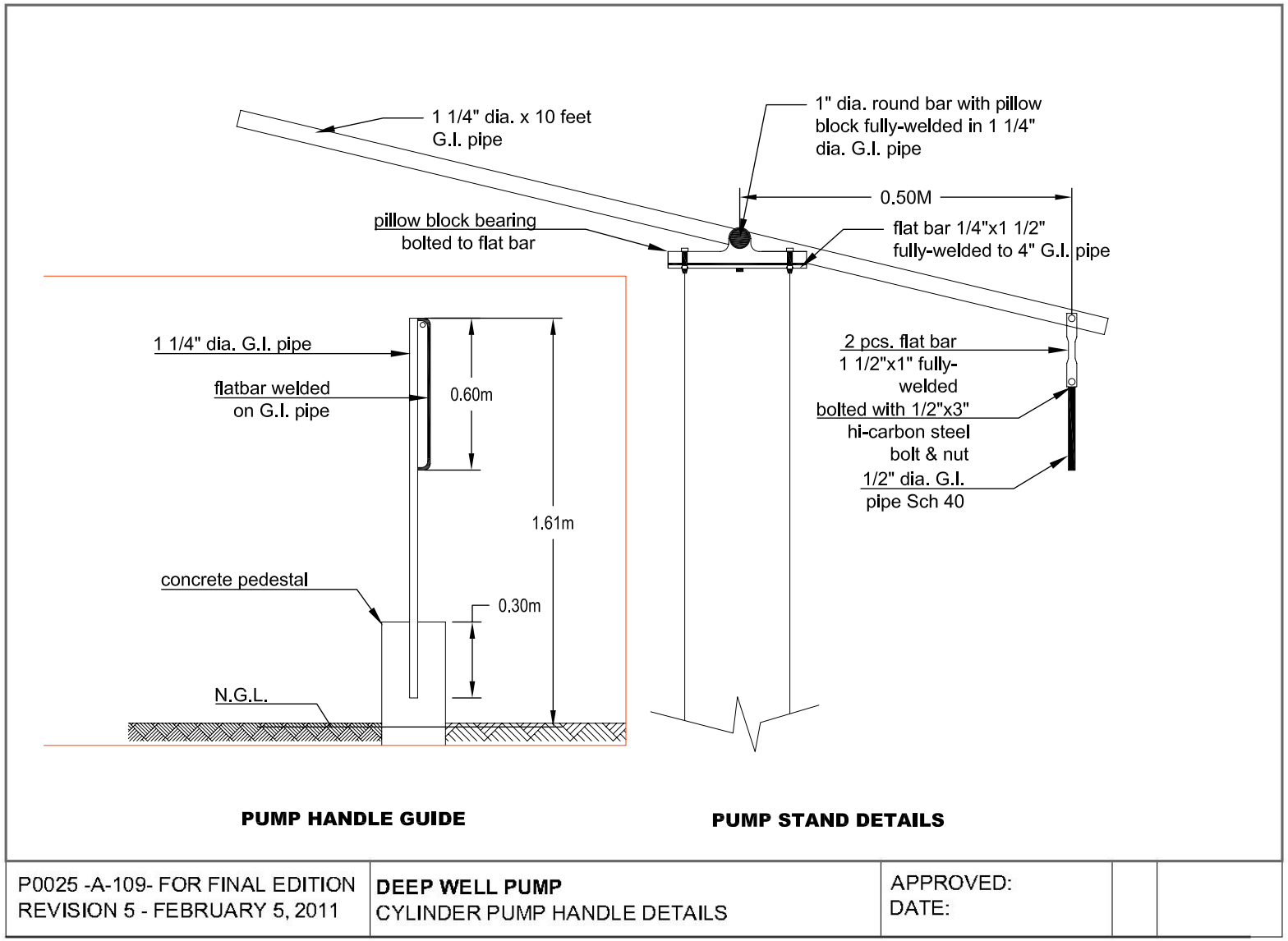
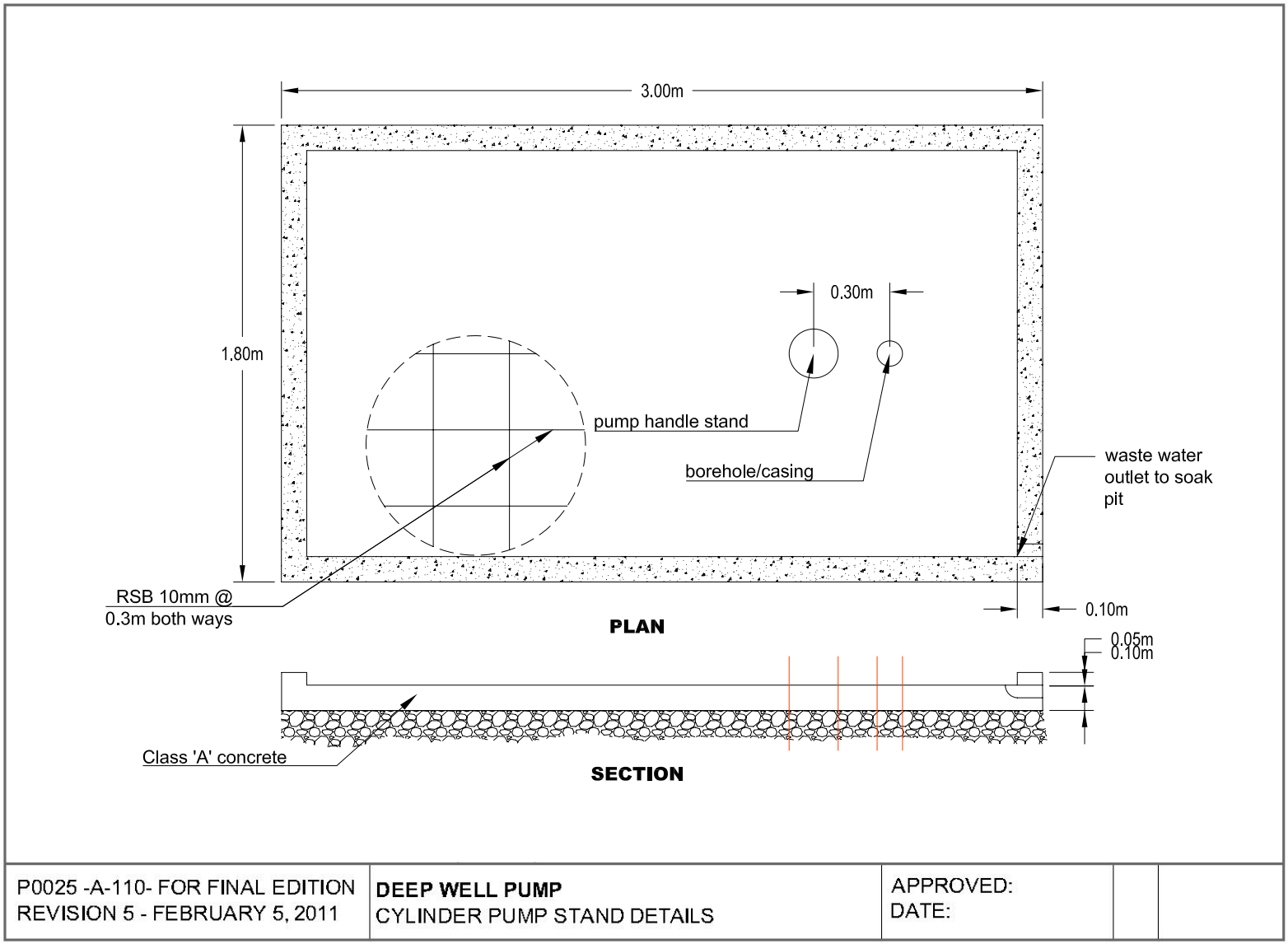


Figure 12. Deep Well Pump (Cylinder Pump Handle Details)



P0025 -A-109- FOR FINAL EDITION REVISION 5 - FEBRUARY 5, 2011	**DEEP WELL PUMP** CYLINDER PUMP HANDLE DETAILS	APPROVED: DATE:	

Figure 13. Deep Well Pump (Cylinder Pump Stand Details)



4. BILL of MATERIALS

4.1 Shallow Well Pump

- Table 1. Bill of materials for Pump and Discharge Platform (both remote and integrated)
- Table 2. Bill of materials for Soak Pit
- Table 3. Bill of materials for Platform Materials for Flood Design including stairs and drainage
- Table 4. Bill of materials for Soak Pit for Elevated Pump
- Table 5. Bill of materials for Shallow Well Pump

4.2 Deep Well Pump

- Table 6. Bill of materials for Deep Well Pump

Table 1. Pump and Discharge Platform (remote & integrated)

Description	Quantity	Unit	Unit Price	Amount
Cement	8.00	Bags		
Sand	0.50	Cu.m		
Gravel	1.00	Cu.m		
10 mm x 6m RSB	8.00	Pcs		
# 16 G.I. Wire	1.00	Kg		
#2 x 10 Blue PVC. pipe s-900 (remote platform only)	1.00	Pc		
2" PVC Elbow 90 deg	1.00	Pc		
Floor drain	1.00	Pc		
PVC Solvent	1.00	Pc		

Table 2. Soak Pit

Description	Quantity	Unit	Unit Price	Amount
Boulders Minimum size 8"	4.00	Cu.m		
4" PVC Pipe (Orange) (Note: remote pit 3 systems 1 piece 1m each, Integrated 2 pcs to reach soak pit))	1.00	Pc		
Item 201 or Gravel for surrounding traffic paths	1.00	Cu.m		
4"PVC Elbow (Orange) (Note only for integrated platform and remote Pit)	1.00	Pc		

Table 3. Platform for Flooded Design (including stairs and drainage)

Description	Quantity	Unit	Unit Price	Amount
4 x 8 x 16 Concrete Hallow Blocks	120.00	pcs		
Cement	17.00	Bags		
Sand	1.50	Cu.m.		
Gravel	2.50	Cu.m		
10 mm dia. RSB	14.00	Length		
# 16 Tie Wire	2.00	Kg		

Table 4. Soak Pit for Elevated Pump

Description	Quantity	Unit	Unit Price	Amount
4 x 8 x 16 Concrete Hallow Blocks	20.00	Pcs		
cement	4.00	Bags		
Sand	1.00	Cu.m		
10mm dia. RSB	2.00	Pcs		
Boulders Minimum size 8"	8.00	Cu.m		
Gravel	1.00	Cu.m		

Table 5. Shallow Well Pump

Description	Quantity	Unit	Unit Price	Amount
Jetmatic Pump	1.00	Pcs		
# 1 ¼ x 20 G.I. Pipe, s – 40 (PVC also applicable + Adopter/Connector + PVC Coupling + Solvent)	2.00	Pcs		
# 2 x 10 PVC Pipe S-900 Casing	1.00	Pc		
# 1 ¼ G.I. Coupling	2.00	Pc		
1 ¼ x 12 G.I Nipple	2 .00	Pc		
1/4 plate 10" x 10" round or square with 4 x ¾ holes fully welded to middle of 12" nipple (welded in shop prior to delivery)	1.00	Pc		
½ x 4" bolts c/w nuts and large flat washers	4.00	Pcs		
Startup and maintenance kit. Disinfection materials for start up, wrenches to dismantle pump, gasket set	1	Pcs		
Teflon Tape	3 .00	Pcs		
1 ¼ foot valve	1.00	Pc		

Table 6. Deep Well Pump

Description	Quantity	Unit	Unit Price	Amount
Cylinder pump	1	pcs		
1 ¼ GI Coupling welded to pump	1	pcs		
1 ¼ GI couplings (depends on depth)	x	pcs		
1 ¼" GI Pipe (depends on depth)	x	pcs		
2" GI Couplings (depends on depth)	x	pcs		
2" GI Pipe Slotted	1	pcs		
2" GI Pipe (depends on depth)	x	pcs		
¾" Steel rod threaded both ends (depends on depth)	x	pcs		
¾" couplings (depends on depth)	x	pcs		
1 ¼" GI threaded Tee	1	pc		
1 1'4" GI Nipple 12" long (discharge)	1	pc		
1 ¼ 90 GI deg Elbow	1	pc		
1 1'4 x 1" reducing bushing	1	Pc		
4" GI Pipe (handle mount)	1	pc		
1 ¼" GI Pipe (handle	1	pc		
1" round bar 12" long	1	pc		
Pillow Block Bearings to fit 1" round bar	2	pcs		
1 ½" x ½" flat bar 5' long	1	pc		
½" dia x 3" long Grade 5 bolt and nut	2	sets		

5. OTHER DESIGN FEATURES

With regards design and location, the following need to be considered.

1. Distance from contamination sources in all directions. Contamination sources include septic tanks and latrines, trash pits, bathing areas, and animal ditches (see section 1.3).

2. Laundry and bathing platform.
   - A soak pit for drain-off needs to be installed (see drawings).
   - Note that if drainage is available direct runoff from platform to drainage is advisable. Free flowing drainage is needed to prevent the collection of stagnant water.

3. Accessibility.
   - Gravel pathways must be constructed for high traffic areas.
   - Safety and security issues must be addressed.

4. Well Development. Well drilling leaves debris at the bottom of the borehole, and the surfaces of the borehole are often clogged by drilling activities. To clean out the hole and unclog the surface, well development is required.
   - Install a pipe smaller in diameter than the hole and casing to about 5 feet from the bottom of the hole.

- Use a pump to force clean water down the small pipe into the hole so that returning water is discharged through the casing. This water will contain the debris. Continue until water is clear.

5. Test the facility (section 6) and maintain its cleanliness.

6. Cloth Filters. When starting up, the pump sand and drilling debris might be pumped as well. The pump should be used until the water is free from sand. The use of cloth filters over the pump discharge should be discouraged as they are a potential breeding ground for bacteria and would contaminate the water being discharged from the pump.

7. Handles. Often handles on supplied shallow well hand pumps are not made for the demands of an intensively-used facility. The light gauge pipe can be replaced with an appropriately sized schedule 40 pipe drilled to fit the locating bolts in the pump body.

8. Riser pipe materials. In shallow wells Blue PVC piping can be used for the riser piping. Note that with the installation of the check valve at the bottom of the riser, the load on the connection is high and should be accounted for. Note as well that PVC piping will reduce apparent iron content in discharged water, in areas of high iron content.

9. Base design of pump. This varies depending on the brand. The adapter for the riser pipe will change, but must ensure that the top of the borehole remains sealed to prevent contamination of the well.

10. Spare parts and tools. For every installation there must be:

    - Basic user training on maintenance.
    - Spare gaskets and other wear parts.
    - Tools for the correct installation of these spare parts.

11. Signage. Signage should be installed at all pumps indicating the purpose of the water, i.e., if it's for drinking or laundry use only. Details of the last testing and the test results should be indicated as well.

6. WATER TESTING PROTOCOL

6.1 Pump Start-Up

During the installation and construction of the pump there is ample opportunity for contamination to occur. Chlorine shock treatment is required to disinfect the borehole, pump, and piping.

Shock treatment using 50 ppm chlorine must be administered before using the pump. The following are the steps to take.

A. Calculate the amount of bleach to be used.

Using household bleach with 5% concentration, the amount required is 1 liter per cubic meter of water in the well.

- Borehole diameter is 50mm = 0.05m
- Borehole depth is 20m (60 feet)
- The amount of water is dependent on the depth of water from the surface.
    - 2-meter water level
    - Volume = 3.14 x $(0.025)^2$ x (20-2)
    - 0.035 cubic meters
    - Use 35ml of bleach

B. Disinfection

- Pour bleach into the borehole between the casing and the suction pipe.
- Assemble the pump.

- Continuously pump water until you can't smell the chlorine anymore.
- Keep pumping water continuously for 1 hour.

C. Testing

- Use Delagua or Portable Microbiology Laboratory tests or other approved testing methods, to test the water for e-coli contamination.
- Make sure that the pump is not being used for food preparation or drinking until test results are released showing that the water is safe.
    - Water is low risk for water borne diseases when e-coli is less than 10 per 100ml.
    - Above 10 per 100ml, the water requires treatment in order to be used for drinking and food preparation.
    - Above 100 per 100ml requires treatment for all uses.
- Present test results to pump users and explain the significance of these results.
- Notify all users through local mechanisms (such as ECMs or WSAs) and explain what treatments are required to make the water safe. Post these in prominent locations next to the pump.

6.2 Operational Monitoring

Once the system is operational water quality should be monitored and warnings updated in each of these instances:

- 14 days after start-up.
- After flooding or heavy rains.
- If a water borne disease outbreak in the area occurs.

If the above conditions do not occur then a water quality test must still be administered every three (3) months.

7. CONTRACTOR LIST

Employee or Independent Contractor Checklist

Location of Construction:

Contractor Details:

Inspector's Name and Organization:

Contractor's Representative Name and Signature:

Date of Inspection:

Listed Below is a description of the work needed before the handover:

Re-Inspection Date:

Identifying Factors	Approved	Not Approved
Evaluation		
Check 1 (Site selection)		
a) Suitable siting of borehole in relation to surroundings		
b) Design of facility & type of pump selected (suitability for region/water level)		
c) Earth conditions (type of soil considered)		
d) Investigation of the water table levels to determine depth		
Check 2 (Earthworks)		
a) Site clearance (plants /trees)		
b) Access for vehicles		
c) Suitability of materials selected for back filling hole		
Check 3 (Drilling)		
a) Drilling depth reached (minimum of 60 feet recommended)		
a1) Water level confirmed		
a2) Borehole logged or soil samples (2-meter spacings)		
b) PVC borehole casing fitted (to minimum 10 feet in depth and grouted)		
c) Spoil removed (and disposed of)		
Check 4 (Concrete Works)		
a) Top slab cast (with anchor bolts and re-bar)		
b) Pump support column cast (including pump base)		
c) Concrete apron cast (finish not porous good smooth finish/floated)		
c1) Floor drain installed and piping		
c2) Rebar spaced correctly and tied		
d) Secondary washing area cast (away from pump, joined by pipe)		
Check 5 (Pump installation)		
a) Pump mounted correctly		
b) All nuts & bolts correctly tightened		
c) Handle firmly installed		
d) Pump commissioned (tested for full yield)		
e) Pump disinfected and tested		
Check 6 (Signage/Final Quality Check)		
Water quality posted with water treatment recommendations		
b) Signage displayed (sponsor of facility)		
c) Pump serial numbered location recorded		
d) Signing off ready for use		

Contract Bullet Points

- Drawings will be the basis of the contract. Any changes to the design and installation must be approved by the contracting organization in writing before the contractor begins implementation.

- Mark the location in such a way that all parties concerned understand where the system will be installed.

- The schedule of work and inspections will be adhered to.

- Inspections should be done during the construction phase.

- Specify concrete class as Class A for all concrete and mortar work.

- Dimensions must be maintained within the following limitations:
  - +/- 10mm over 1 meter
  - Vertical walls must be within 5mm over 1 meter
  - Squares must be within 5mm over 1 meter

- Terms and Conditions should be similar to the following percentages:
  - 30% mobilization
  - 60% completion after final inspection
  - 10% one (1) month after final inspection

  Note: If issues with material or workmanship arise within this one month period then the contractor will be informed and must repair the problem(s) within 5 working days from receipt of written notice. If repairs aren't done then the 10% retention will be used to do the work.

  - All mobilization and medical costs will be borne by the contractor.

- The contracting organization can inspect works at any time during construction. Any non-compliant items found during these inspections must be rectified in detail during the inspection.

- During final inspection the contractor must assign an authorized representative to accompany the inspector and negotiate remedial work required.

- The contractor is responsible for the disposal of all trash in compliance with solid waste management regulations.

- The worksite is to be kept clean and safe during construction. Upon completion, the site must be made safe with appropriate warnings and barriers.

- Upon completion of construction, excess materials must be returned to the contracting organization, the site must be cleaned, and all temporary construction materials and trash removed from the site.

SANITATION FACILITIES

for Humanitarian Emergency Situations

Design Manual

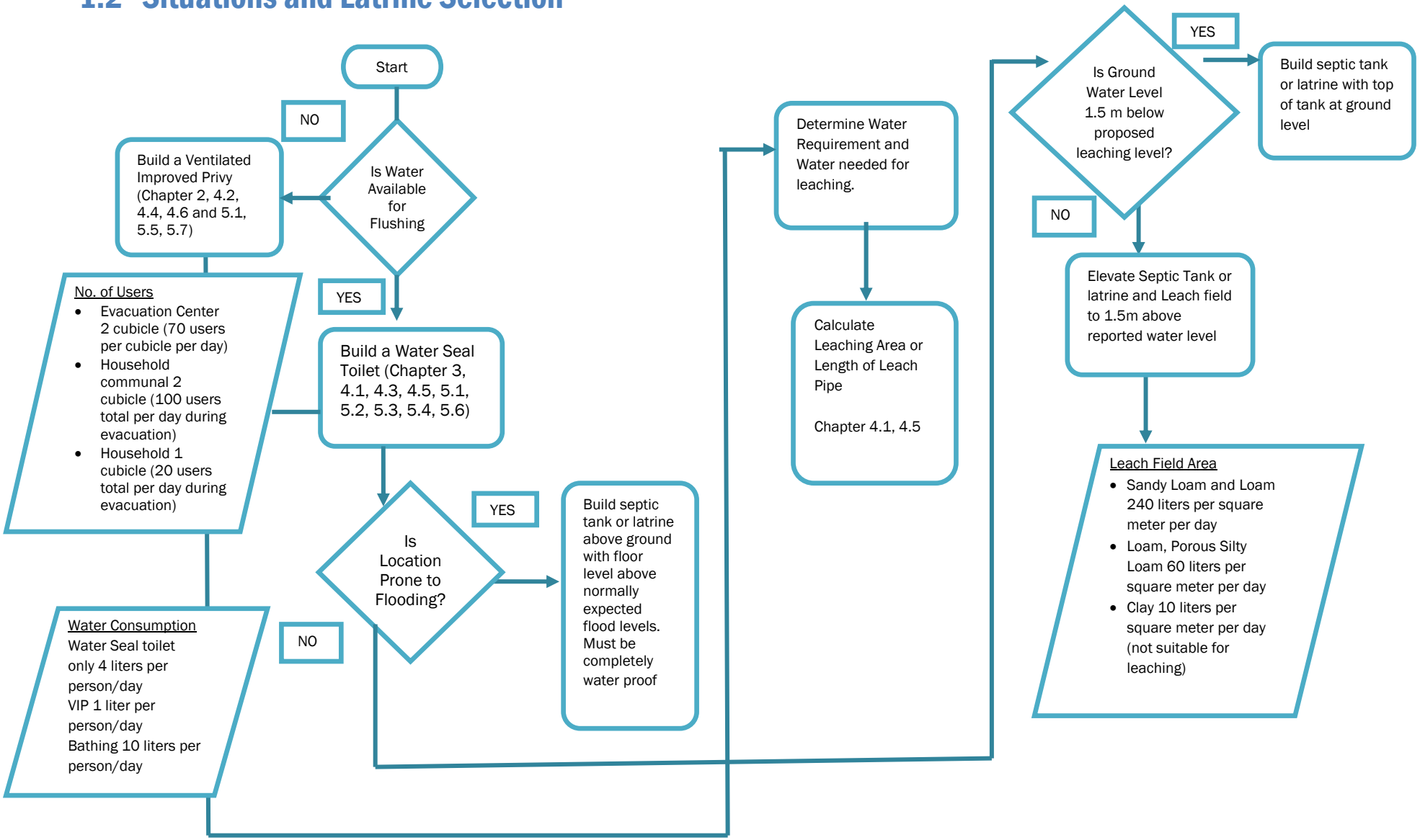
1. PERFORMANCE STANDARDS and SELECTION PROCESS

1.1 Performance Standards

- Safely contains excreta and prevents water supply contamination.
- Easy to clean and maintain, and permits access for de-sludging.
- Provides access to water for cleaning and flushing.
- Has a life span of six to eight (6 to 8) months for evacuation camps.
- Is cost effective and uses locally available resources.
- Is accessible to all people specially vulnerable groups.
- Offers privacy and security for all users specially women, and is culturally acceptable.
- Prevents contact of flies and feces through water seals with screen on vent pipes and a suitable ventilation system.
- Excreta containment is flood resistant.

Note that these were developed by the technical working group (TWG) based on Sphere standards and the local conditions surrounding the Mindanao Displacement 2008-2010.

1.2 Situations and Latrine Selection



2. VENTILATED IMPROVED PRIVY

Ventilated Improved Privy

The ventilated improved privy is used in instances when there is insufficient water for flushing. However, water is still used for anal cleansing. The basic design features of the ventilated improved privy are:

- A pit sized for dry sludge.
- The building is kept dark when not in use so that flies in the pit go up the ventilation pipe and are trapped by the mosquito net at the end of the pipe.
- Ventilation pipes outside the building are dark colored, exposed to sunlight, and are above surrounding buildings to promote air drafting through the system.
- The top of the pit is supported to prevent the pit from collapsing. The bottom of the pit is left clear and the support work is left open to promote the leaching of washing water and urine. Note that if the soil type does not support the leaching rates required, a leach pipe can then be installed to increase the available leaching area to dispose of liquids.

3. WATER SEALED TOILET

Water Sealed Toilet

The water sealed toilet is used when there is sufficient water for flushing.

- Septic tanks are used when there is a large number of users.
- Pits can be used for household systems with a low number of users.
- The P-trap creates a seal between the pit/tank and the user.
- Excreta is contained in the tank or pit. The water then leaches into the ground thru the walls of the pit, the bottom of the tank or into the soil through a leach field.
  - Note that in cases of continual flooding and/or high water tables this leaching process may not be possible. The liquid is contained and must be regularly emptied and disposed of in a suitable manner.
  - Soil types affect leaching. In soils with high clay content leaching may not be possible so either dry pit latrines are required or the liquid must be removed from the containment tank and disposed of properly.
  - The Clean Water Act promotes the use of multiple chambers in septic tanks. The water from the last chamber is clean enough that it can be diverted into grey water drainage.
- Excreta builds up in the tank or pit and eventually fills. This must also be periodically removed and disposed of in an acceptable and safe manner

3.1 Septic Tanks

Septic tanks are designed to capture the sludge and contain it to prevent from contaminating the water table, keep it safe from the environment, and ensure that insects, vermin and other vectors cannot come in contact with it and transfer contamination.

However because it is water sealed, the water used for flushing must be disposed of. The tank is sized so that the water is retained for at least 24 hours so that all of the solids settle at the bottom of the tank. Two compartments are used to promote further sedimentation and ensure that the cleanest water enters the leaching chamber. Usually, the bottom of the leaching chamber is left open so that the liquid can leach into the ground. In cases where there's a high number of users or various types of soil this may be insufficient. Also, over time solids can actually seal this area.

Other important considerations include:

- The ventilation pipe covered with mosquito netting allows air to escape as the toilet is flushed.
- Manholes are installed so that it is possible to remove the sludge after a period of time, which is:
  - One (1) year in evacuation centers, and
  - Five (five) years in household areas.
- If also used for bathing then the floor drain water needs to be disposed of, and the following need to be installed:
  - A separate soakway or leach field, and
  - A bigger septic tank and leach field to handle the increase in liquid.

Clean out port and discharge to Leach Field

3.2 Leach Fields

A leach pipe taking water from the top of the leaching chamber takes the cleanest liquid and transfers this to an area specially prepared to promote the leaching of the water into the soil. This increases the available leaching area.

- Use a perforated 4-inch PVC pipe on top of a bed of boulders and gravel in a trench 1 meter wide and 600mm deeper than the level of the perforated pipe sloping away from the outlet of the septic tank or latrine.
- Cover the top of the pipe with plastic or rice sacks.
- Cover the plastic with soil and/or clay and then re-plant.

The bottom of the leaching field must be at least 1.5 meters above the water table. If it's a flood prone area or area of high ground water then the septic tank and leach field should be built above ground. An artificial leach field consists of boulders, gravel, and local soil. This is then covered by clay and soil that is then planted to prevent erosion.

The pipe length required depends on soil structure. With this design each pipe's infiltration area is equal to the side area of the trench that is underneath the pipe, and is filled with boulders and/or gravel. In this case, every meter is equivalent to 1.2 square meters per meter of pipe. For

limited areas the pipes can be beside each other running parallel with a minimum of 1.5 meters between pipe centers.

3.3 Water Seal Latrines

For low use situations the top of a pit is covered with a slab containing the water seal pan, vent pipe, and clean out pipe. The top of the pit can be lined to prevent the hole from collapsing but must be built to promote the leaching of water. A leach pipe can be installed similar to the photo above.

Note that if this is in a flood prone area or a high water table area then the top of the pit is built above ground with a leach field and with a septic tank.

3.4 Other Water Seal Latrine Options

The described latrines are usually for stable areas or long-term camp situations. However, in the first phase of an emergency or in areas that remain flooded there are several options. All these options need to:

- Contain the solids.
- Have a means of disposing of these solids once containment is full.
- Treat the flushing water so it can be drained or the water removed and disposed of.

Alternatives to the water seal latrines include:

- Elevated latrines using plastic or steel drums as containment systems.
- Floating latrines using plastic or steel drums as containment areas.
- Culverts to build a tall containment area in an elevated building.
- Floating latrines and septic tanks with flexible drain hoses that lead to safe liquid disposal sites.

4. DESIGN CRITERIA

4.1 Evacuation Center Water Sealed

- 70 people per cubicle (12 hours use of 10 minutes each)
  - Total 140 people
- Sludge removal period 1 year
  - Sludge Volume = 2.8 cubic meters
- 560 liters per day flushing water
  - Retention Volume = 0.56 cubic meters
- 0.3m of ventilation space

OVERALL DIMENSION of TANK

- Includes both the digestion and leaching chambers
- Internal dimensions
  - 1.2m wide
  - 2.4m long
  - 2.0m deep
- Internal Dimensions Digestion Chamber
  - 1.6m long
  - 1.2m wide
  - 2.0m deep
- Internal Dimensions of leaching Chamber
  - 0.8m long
  - 1.2m deep
  - 2.0m deep
- Leaching Pipe Length
  - Sandy Loam and Loam - 3 meters
  - Loam, porous silty Loam - 12 meters
  - Clay not suitable for leaching

4.2 Evacuation Center VIP

- 70 people per cubicle (12-hour use of 10 minutes each)
  - Total 200 people

- Sludge removal period of 1 year
  - Sludge Volume = 5.6 cubic meters

- 200 liters per day of anal cleansing water
  - Infiltration Volume = 0.2 cubic meters per day

- Internal Dimensions
  - 2.4m long
  - 1.2m wide
  - 2.3m deep

4.3 Home Based Communal Water Seal

- 50 people per cubicle (12-hour use of 15 minutes each)
  - Total 100 people
    - 25 local Residents
    - 75 IDP's
- Sludge removal period of 5 years
  - IDP's on site for 1 year
  - Sludge Volume -- 4 cubic meters
- 300 liters per day of flushing water (while IDP's are on site)
  - Retention Volume -- 0.3 cubic meters
- 0.3m of ventilation space

OVERALL DIMENSIONS of TANK

- Includes both the digestion and leaching chambers
- Internal dimensions
  - 1.2m wide
  - 2.4m long
  - 2.0m deep

- Internal Dimensions Digestion Chamber
  - 1.6m long
  - 1.2m wide
  - 2.0m deep

- Internal Dimensions of Leaching Chamber
  - 0.8m long
  - 1.2m deep
  - 2.0m deep

- Leaching Pipe Length
  - Sandy Loam and Loam - 3 meters
  - Loam, porous silty Loam - 6 meters
  - Clay not suitable for leaching

4.4 Home Based Communal VIP

- 50 people per cubicle (12 hours use of 15 minutes each)
  - Total 100 people
  - 25 local residents
  - 75 IDP's
- Sludge removal period of 5 years
  - IDP's on site for 1 year
  - Sludge Volume -- 8 cubic meters
- 100 liters per day Anal cleansing water
  - Retention Volume -- 0.1 cubic meters
- Internal Dimensions
  - 2m long
  - 1.5m wide
  - 2.7m deep

4.5 Home Based Single House Water Seal

- Single Cubicle
- 20 people total
  - 10 local Residents
  - 10 IDP's
- Sludge removal period of 5 years
  - IDP's on site for 1 year
  - Sludge Volume -- 1.8 cubic meters

- 80 liters per day flushing water (while IDP's are on site)
  - Retention Volume -- 0.08 cubic meters

- 0.3m of ventilation space

- Internal Dimensions
  - 1m long
  - 1.2m wide
  - 1.5m deep

- Leaching area
  - Sandy loam and loam -- 0.7 square meters
  - Loam, porous silty loam -- 1.25 square meters
  - Clay - 6.7 square meters

4.6 Home Based Single House VIP

- Single cubicle
- 20 people total
  - 10 local residents
  - 10 IDP's
- Sludge removal period of 5 years
  - IDP's on site for 1 year
  - Sludge Volume -- 2.4 cubic meters
- 20 liters per day of anal cleansing water
  - Retention Volume -- 0.02 cubic meters
- Internal Dimensions
  - 1m long
  - 1.5m wide
  - 1.6m deep
- Leaching capacity negligible

5. CONSTRUCTION DRAWINGS and BILL OF MATERIALS

This section shows designs of the following:

- Evacuation centers and home based communal two-cubicle buildings
- Two-cubicle permanent latrine design
- Elevated latrines
- Two-cubicle water sealed latrine and septic tank details
- Leach field details
- Spares and miscellaneous
- VIP pit details
- House based single cubicle water sealed latrine
- House based single cubicle VIP latrine

Figure 14. Two Cubicles Building Lay-out

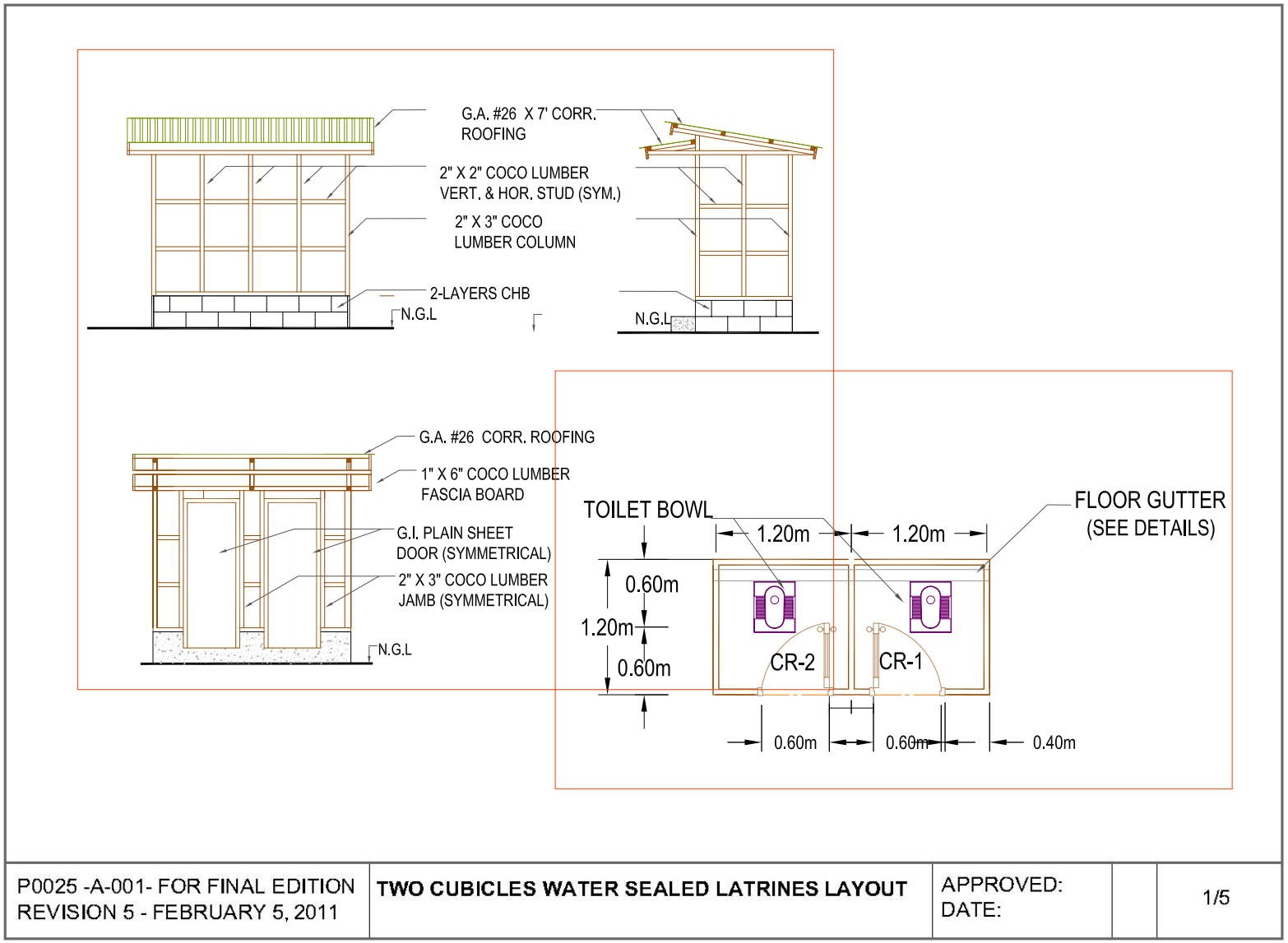
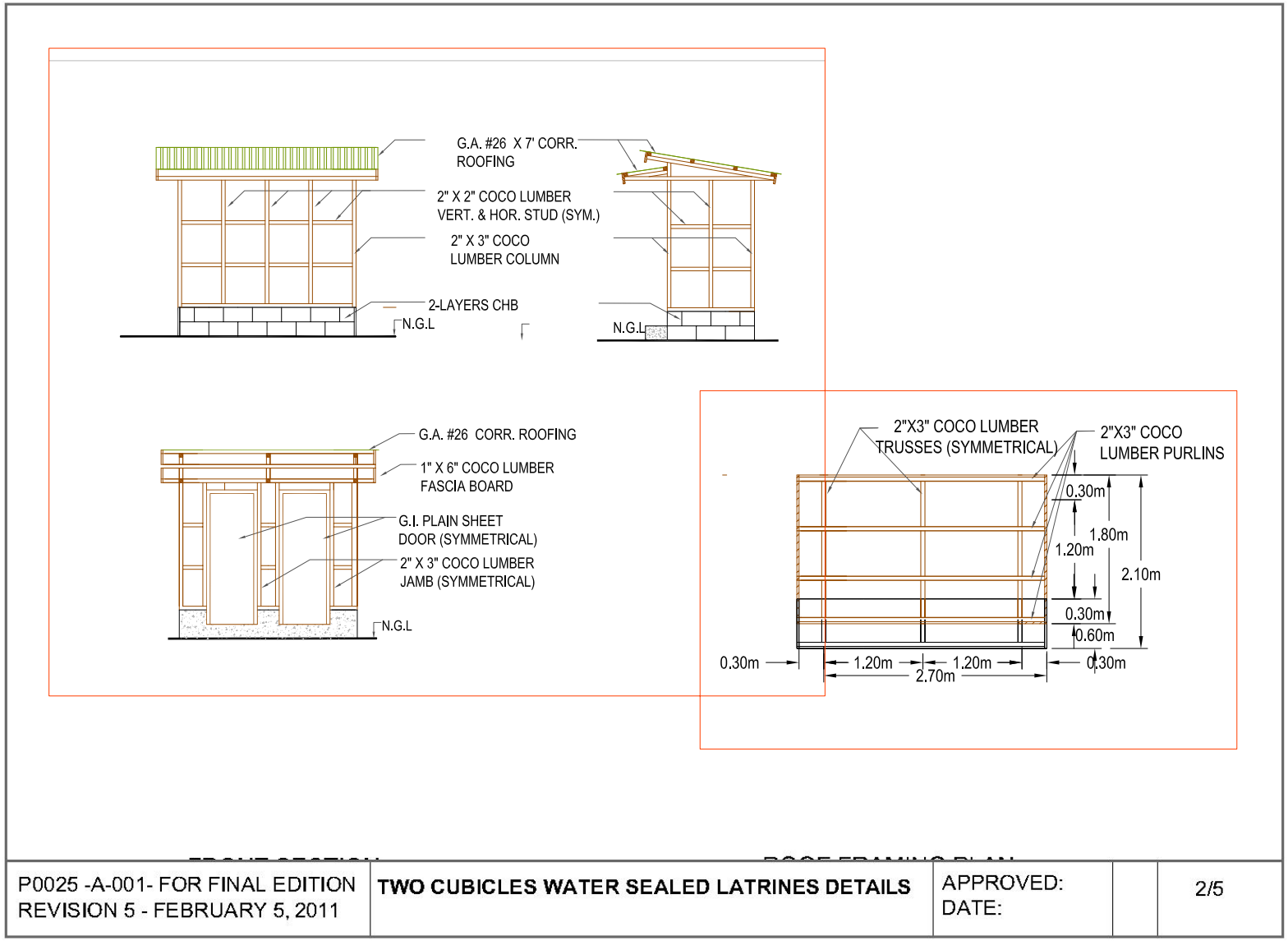


Figure 15. Two Cubicles Water Sealed Latrines Details



P0025 -A-001- FOR FINAL EDITION REVISION 5 - FEBRUARY 5, 2011	**TWO CUBICLES WATER SEALED LATRINES DETAILS**	APPROVED: DATE:		2/5

Table 1. Bill of Materials - Two Cubicles Latrine Building

Description	Quantity	Unit	Unit Price	Amount
2 x 3 x 8 coco lumber @ 17 pcs	68	Bd. Ft		
2 x 3 x 10 coco lumber @ 5 pcs	25	Bd.ft		
2 x 2 x 8 coco lumber @ 19 pcs	51	Bd.Ft		
2 x 3 x 8 good lumber @ 3pcs	12	Bd.ft		
2 x 2 x 8 good lumber @ 8 pcs	22	Bd.ft		
1 x 6 x 10 good lumber @ 5 pcs	25	Bd. Ft		
1 x 2 x 8 clip wood	4	Bundle		
#26 x 8 corr. G.I. Sht	5	Pcs		
#26 x 4 x 8 G.A. Plain Sht.	7	Pcs		
Plastic Transparent Roof Sht	1	Pc		
2 ½" roofing nails	2	Kg		
3 x 3 hinges	4	Pcs		
Door handle	2	Pcs		
Post strap (2x1/4)	4	Pcs		
4" nail	4	Kg		
2.5" nail	3	Kg		
1 ¼ hardi nail	1	Kg		
Roof shield (Baguio Green)	1	Gal		
Roof shield (Apple Green)	1	Gal		

Figure 16. Septic Tank Details for 2 Cubicles

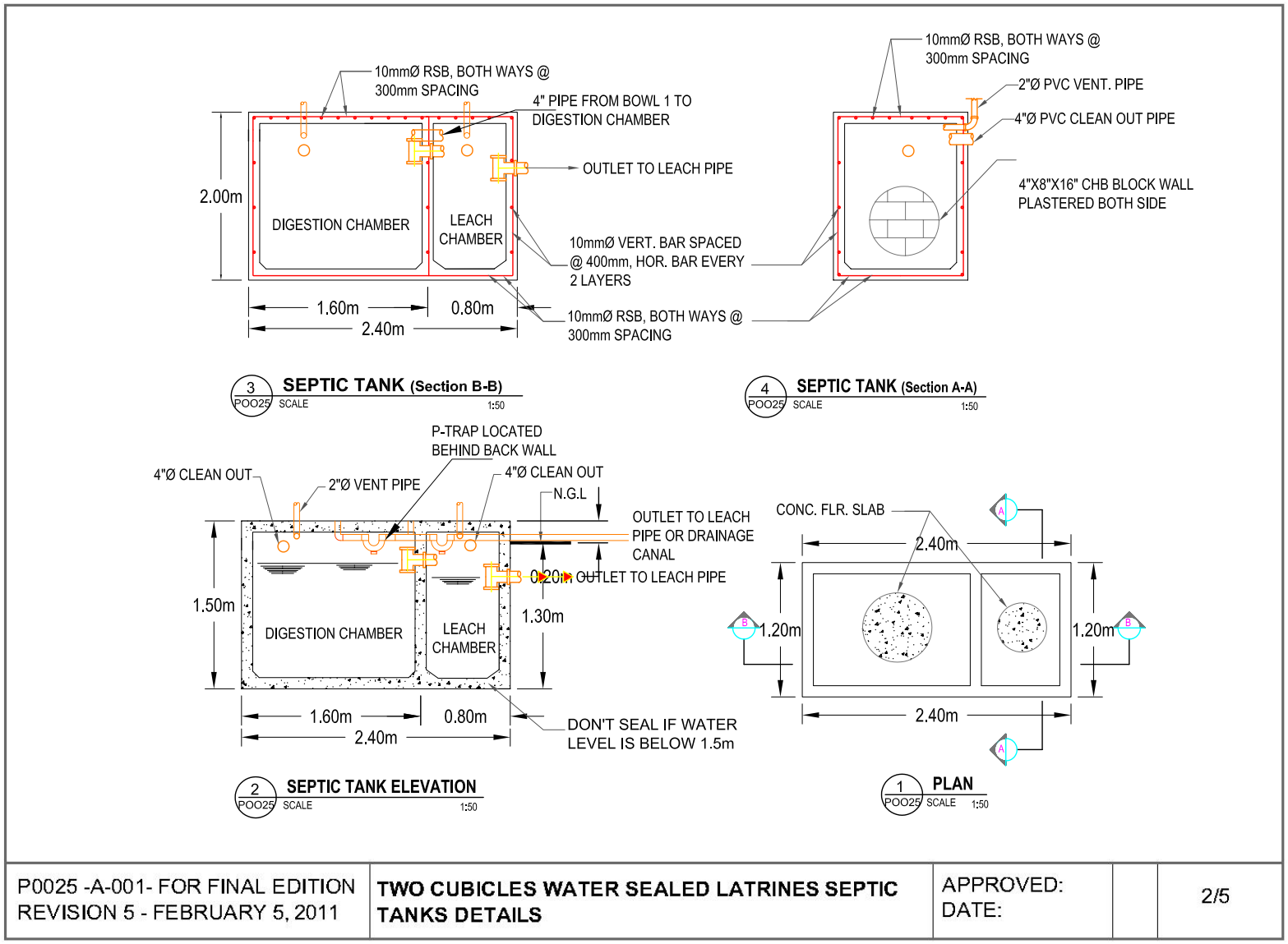


Table 2. Bill of Materials – 2 Cubicle Septic Tank

Description	Quantity	Unit	Unit Price	Amount
5mm x 4 x 8 OPW	1	Pc		
Water sealed squat bowl plastic c/w P-trap	2	Pcs		
Concrete Hollow Blocks	220	Pcs		
Cement	25	Bags		
Sahara cement	2	pck		
Sand	3	Cu.m		
Gravel	2.50	Cu.m		
10 mm x 6m RSB	22	Pcs		
#16 G.I. wire	1.50	Kg		
4” PVC pipe (Orange)	1.	Pcs		
2” PVC Pipe (Orange)	3	Pcs		
2” pvc elbow (Vent and floor drains)	10	Pcs		
4” pvc tee (orange)	2	Pcs		
4” PVC Elbow (orange)	2	Pcs		
4” Clean Out with cover (orange)	2.	Pcs		
2” P. Trap (orange)	1	Pcs		
Solvent cement	1	Can		
Paint brush 3”	2	pcs		
Insect screen (cut into 30 pcs)	1	meter		
6”x6” floor drain (double strainer)	2	pcs		

Figure 18. Two Cubicles Water Sealed Latrine Leaching Details

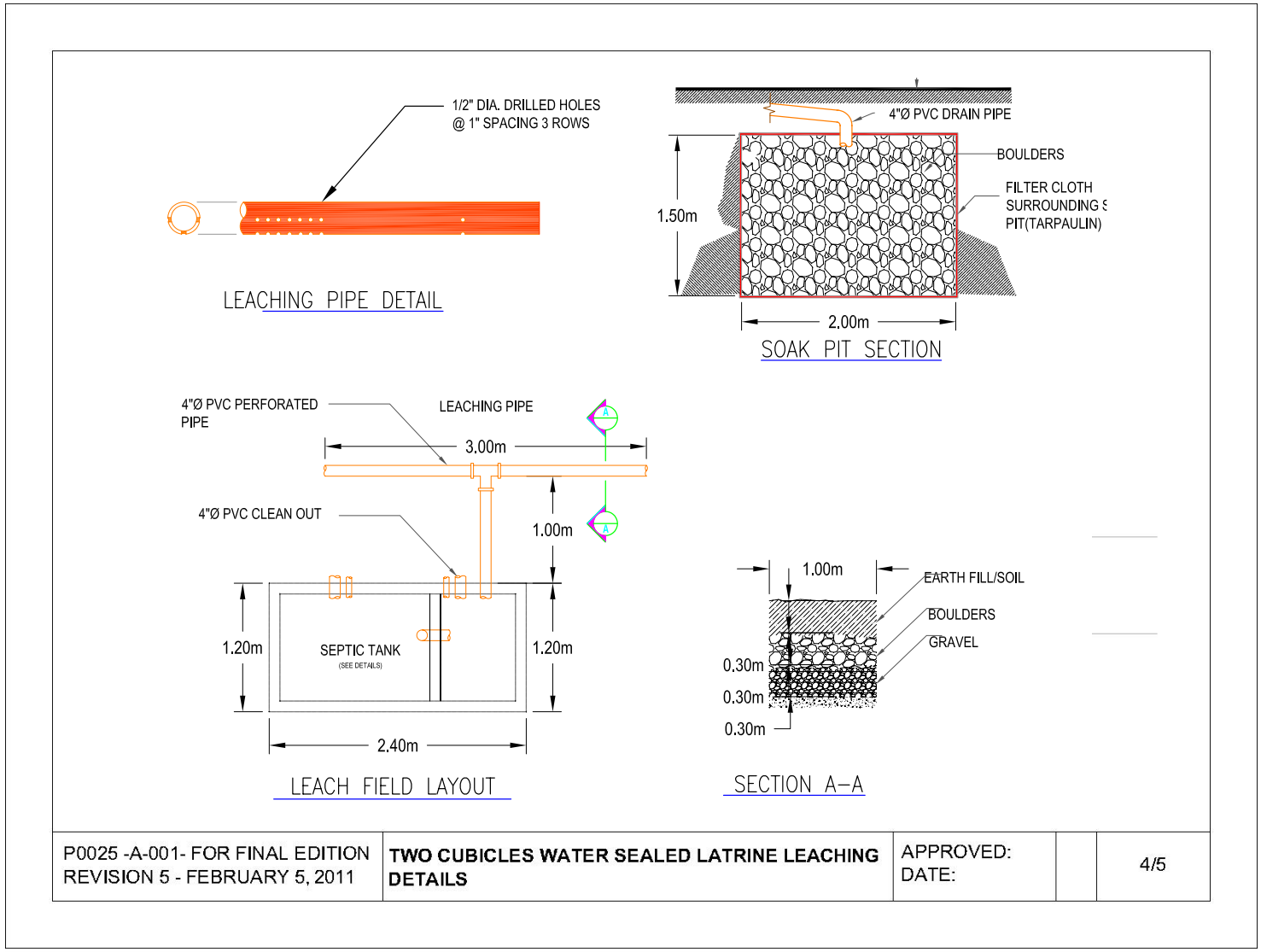


Table 3. Bill of Materials – Leach Field

Description	Quantity	Unit	Unit Price	Amount
Boulders (1 cu.m per 3m length of Perforated pipe)	4	Cu.m		
2” Gravel (1 cu.m per 3m length of perforated pipe)	4	Cu.m		
4” PVC End Cap (Orange)	2	Pcs		
4” PVC Pipe (Orange) no. depends on leach pipe length required. Maximum	5	Pcs		
4” PVC Elbow (Orange) (assumes that leach level is below outlet of tank)	4	Pcs		
4” pvc tee (Orange)	1	Pcs		
Plastic sheeting 1m wide	12	m		
Solvent cement	1	Can		

Note that this depends on the lay-out for the fittings. Listed below is BOM for 12 m of leach pipe with 2 branches for silty loam.

Figure 19. Two Cubicles Water Sealed Latrine For Flooded Conditions

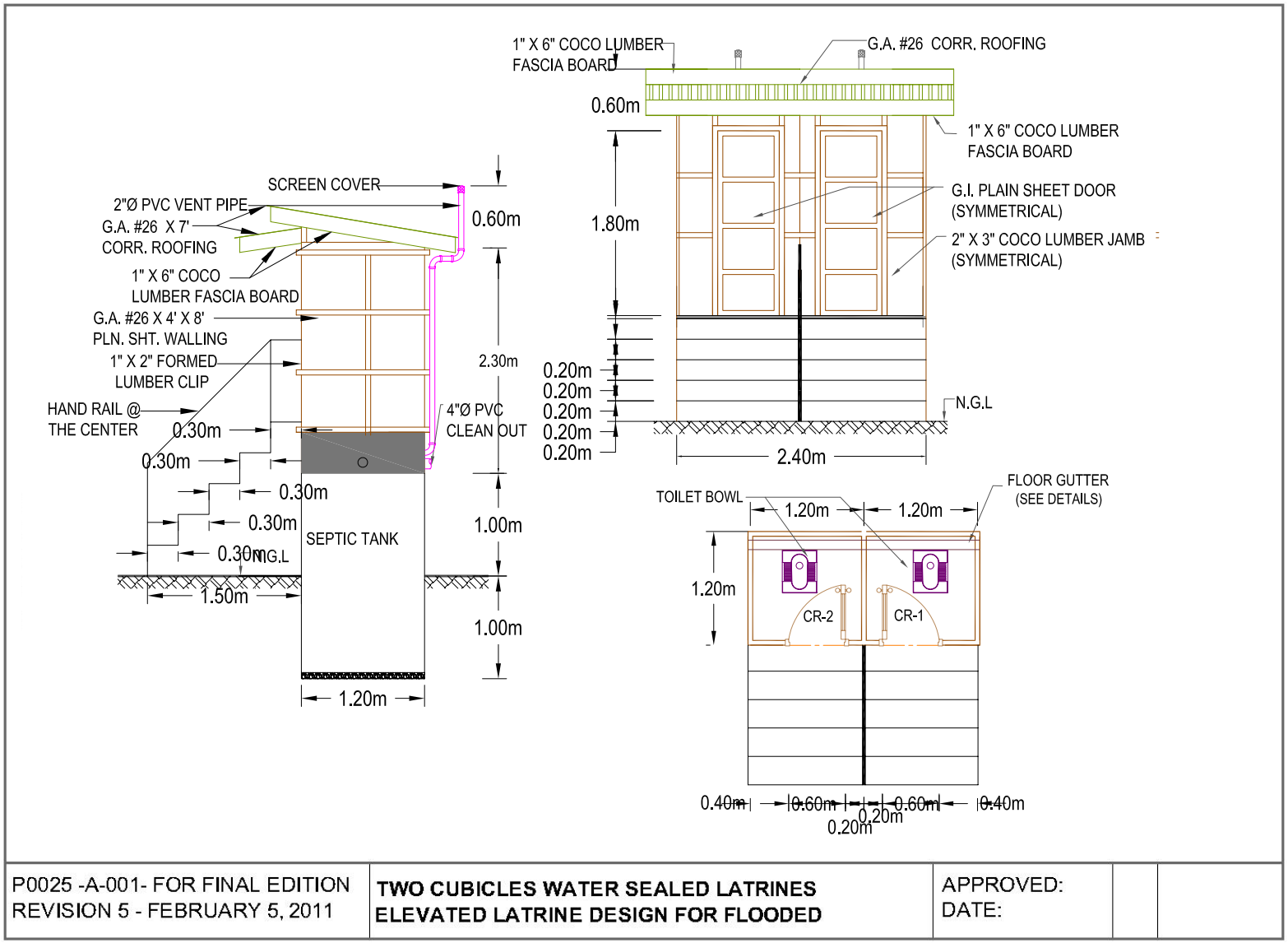


Table 4. Bill of Materials for Stairs for Latrines in Flooded area

Description	Quantity	Unit	Unit Price	Amount
2 x 3 x 10 good lumber @ 1 pc	5.00	Bd.Ft.		
2 x 2 x 10 good lumber @ 1 pc	3.33	Bd. Ft.		
1 ½" x 18"post trap	2.00	Pcs		
4 x 8 x 16 Concrete Hallow Blocks	45.00	Pcs		
Portland Cement	5.00	Bags		
Sand	0.40	Cu. M		
Gravel	0.80	Cu.m		
10 mm dia. RSB	5.00	Length		

5.1 Spares and Miscellaneous

In areas where water is limited, the installation of gutters and water storage drums are a method of gathering rainwater from the roof of the structure or where water can be stored from other sources. The following bill of materials includes typical details as well as the maintenance materials for each structure.

Table 5. Bill of Materials - Rain Water Harvesting

Description	Quantity	Unit	Unit Price	Amount
200 liter plastic Drum	1	Pcs		
4" PVC Pipe (Orange, cut in half, for gutters and directing water into drum)	2	Pcs		
1 ½" Loose pin Hinges (to hinge lid of drum)	1	Pr		
#16 tie wire (to attach gutter)	1	Kg		
Cement	2	Bag		
Gravel (Platform 1mx1mx0.1)	.25	Cu.m		
Sand	.15	Cu.m		

Table 6. Bill of Materials - Maintenance

Description	Quantity	Unit	Unit Price	Amount
Pail (15 liters)	2	pcs		
Water dipper	2	pcs		
Stick broom	2	pcs		
Plunger	2	pcs		
Toilet brush	2	pcs		
Powder soap	2	cartons		
Pail (15 liters)	2	pcs		
Water dipper	2	pcs		
Stick broom	2	pcs		

Figure 20. Ventilated Improvised Pit (VIP Latrine) for HB/EC with No Water for Flushing

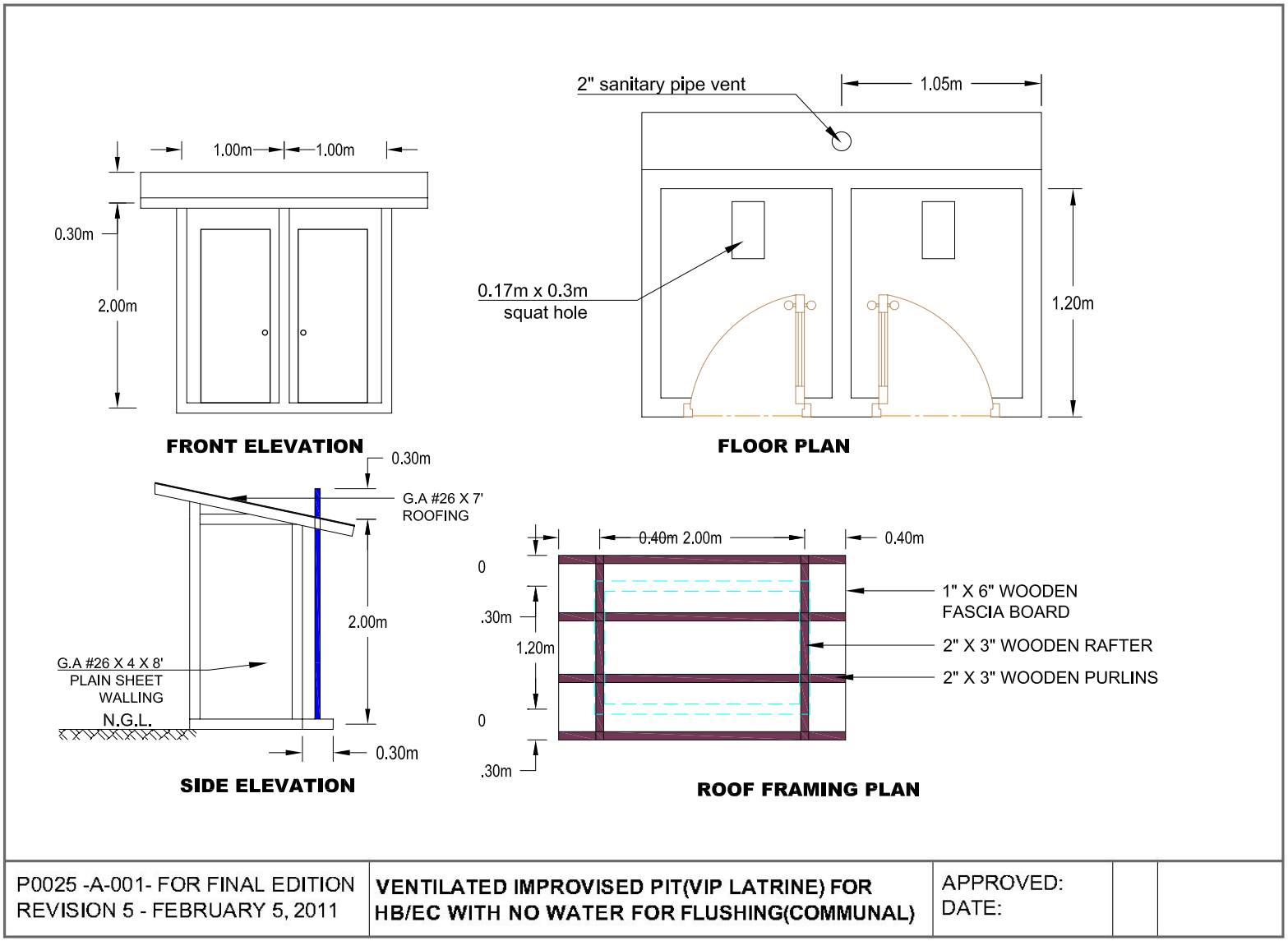


Table 7. Bill of Materials for Pit Construction and Floor

Description	Quantity	Unit	Unit Price	Amount
½ x 6 x 8 form lumber	1	bundle		
2 x 2 x 8 lumber @ 2pcs	5	Bd.ft.		
Concrete Hollow Blocks	90	Pcs		
Cement	14	Bags		
Sand	2	Cu.m		
Gravel	1.5	Cu.m		
10 mm x 6m RSB	18	Pcs		
#16 G.I. wire	2	Kg		
4” PVC pipe	1	Pcs		
Black Triton Paint	1	Liter		
4” Paint Brush	1	Pcs		
4” PVC Coupling to fix screen	1	Pcs		
Mosquito G.I. screen	0.50	M		

6. OTHER DESIGN FEATURES

The following need to be considered in the design and location of sanitation facilities.

Accessibility

- Handrails on steps must be installed for seniors and children.
- Gravel or paved paths must be constructed in high traffic areas.
- Lighting must be installed for use at night if needed.
- Safety and security must be maintained.

Water Supply

- Must be sufficient for flushing.
- Should be useful for cleaning slab.
- Should be available inside or outside cubicle.

To supplement the water supply and reduce drainage issues, guttering and water barrels can be installed to collect rainwater for flushing and cleaning.

Privacy

- Men and women have separate access.
- Entry way should be hidden from public view.
- Make sure that doors are sealed when closed.
- Separate structures should be built for men and women for total gender segregation.

- The number of cubicles should be gender segregated. Note the different needs of women over men (such as menstruation needs, privacy).

Positioning based on cultural sensitivity, i.e., not facing east.

Floor drains and bathing water must go into either septic tanks or separate leach fields. Note that the P-traps for the floor drain should be outside the septic tank for ease of maintenance. Floor drains need to have fine screens and must be easy to clean.

Maintenance Supplies

- Pails must be available for flushing and cleaning.
- A dipper must be available for flushing and anal cleansing.
- Hand washing supplies and instructions must be available.
- A straw broom for cleaning.

General Environmental Conditions

- Translucent roofing can be used to increase natural light during the day.
- Placing the building in a shaded area can reduce heat during the day.
- Ensure that the there is ventilation in the building so that heat can be reduced and odor may be controlled.

De-sludging

- Over time the containment vault in the septic tank will fill with sludge. This has to be removed or sealed and the toilet moved. In the designs that are enclosed, the septic tanks have 4-inch clean out ports for a hose and vacuum pump. The pump can be mechanized or operated by hand.
- The sludge is pumped into barrels or a tanker truck that is tightly sealed and transported to a sewage treatment station. If no treatment station is available the sludge can be disposed of in a correctly designed dumpsite which allows the manure to be broken down and be used as a fertilizer.
- If there is no leaching or possible drainage, this process can be done on a more frequent basis to remove the water and sludge using proper disposal.

7. CONTRACTOR CHECKLIST

Location of Construction:

Contractor Details:

Employee or Independent Contractor Checklist

Inspector's Name and Organization:

Contractor's Representative Name and Signature:

Date of Inspection:

Listed Below is a description of the work needed before the handover:

Re-Inspection Date:

Identifying Factors		
Evaluation	Approved	Not Approved
Check 1 (Siting/positioning)		
Suitable Siting of Intervention (Latrine) in relation to Sphere standards		
Check 2 (Geographical Location of intervention)		
a)Design & Type of Intervention (Suitability for region)		
b)Earth Conditions (type of Soil)		
c)Determination of the Water Table Level and floor level of Latrine		
Check 3 (Earthworks)		
a) Compliance with requested size/capacity (Minimum 1 year)		
Check 4 (Concrete Works Base and Walls septic Tank)		
a) Blinding (Tank Base 10mm thickness)		
b) Concrete Tank Base (100mm thickness)		
b1) Re-Bar Spacing and tied		
b2) Re-Bar uprights in place		
b3) Dimensional and squareness check		
c) Block work (grouting finished Internally and Externally)		
c1) Vertical and horizontal Re-Bar spacing and tied		
c2) Dimensional, squareness and plumness check		
d) Internal & External Rendering completed satisfactorily (Waterproofed)		
Check 5 (Concrete Works Top Septic Tank/Floor facility)		
a) Top slab cast with manhole access/cleanout for De-sludging.		
b) Latrine Bowls cast in to Top slab		
b1) P-Traps and Piping installed correctly		
c) Floor finish not porous (good smooth finish/Floated)		
c1) Floor sloping to drains which are cast in place		
c2) Drains c/w screen and P-traps		
d) Overflow pipe fitted (cast in situ) liquids runoff to Soak away.		

Identifying Factors		
Evaluation	Approved	Not Approved
d1) Leaching materials installed correctly below pipe		
d2) Leach pipe installed and covered and marked		
e) Vent pipe installed with Screen and outlet above roofline		
Check 6 (Roofing and Walls Timber Works)		
a) Check Materials used (materials compliant with request)		
b) Fixing method compliant with specification (nails/screws - non rusting)		
c) Timber frame treated with anti termite treatment (diesel/burnt oil)		
d) GI Sheeting (gauge 24) fitted correctly. (no sharp edges exposed)		
e) Doors fit correctly, offer privacy and lock from inside		
f) Stairs are even and handrail installed		
g) Traffic way graveled		
Check 7 (Signage/Final Quality Check)		
Genders Clearly Marked		
b) Signage Displayed (Sponsor of facility)		
c) Signing off (ready for use)		
Check 8 (Roofing and Walls Timber Works)		
a) Check Materials used (materials compliant with request)		
b) Fixing method compliant with specification (nails/screws - non rusting)		
c) Timber frame treated with anti termite treatment (diesel/burnt oil)		

Contract Bullet Points

- Drawings will be the basis of the contract. Any changes to the design and installation must be approved by the contracting organization in writing before the contractor begins implementation.

- Mark the location in such a way that all parties concerned understand where the system will be installed.

- The schedule of work and inspections will be adhered to.

- Inspections should be done during the construction phase.

- Specify concrete class as Class A for all concrete and mortar work.

- Dimensions must be maintained within the following limitations:
  - +/- 10mm over 1 meter
  - Vertical walls must be within 5mm over 1 meter
  - Squares must be within 5mm over 1 meter

- Terms and Conditions should be similar to the following percentages:
  - 30% mobilization
  - 60% completion after final inspection
  - 10% one (1) month after final inspection

  Note: If issues with material or workmanship arise within this one month period then the contractor will be informed and must repair the problem(s) within 5 working days from receipt of written notice. If repairs aren't done then the 10% retention will be used to do the work.

  - All mobilization and medical costs will be borne by the contractor.

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- During final inspection the contractor must assign an authorized representative to accompany the inspector and negotiate remedial work required.

- The contractor is responsible for the disposal of all trash in compliance with solid waste management regulations.

- The worksite is to be kept clean and safe during construction. Upon completion, the site must be made safe with appropriate warnings and barriers.

- Upon completion of construction, excess materials must be returned to the contracting organization, the site must be cleaned, and all temporary construction materials and trash removed from the site.

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The *Hand Pump and Sanitation Facilities Manual* is a collaboration of engineers from Oxfam-GB Philippines, Kadtuntaya Foundation, Inc. (KFI), Mindanao Tulong Bakwit (MTB), and A Single Drop for Safe Water Inc. (ASDSW).

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PART III SENDONG VARIATIONS

In December 2011 Tropical Storm Sendong destroyed communities residing along the rivers in the Northern Mindanao Cities of Iligan and Cagayan De Oro.

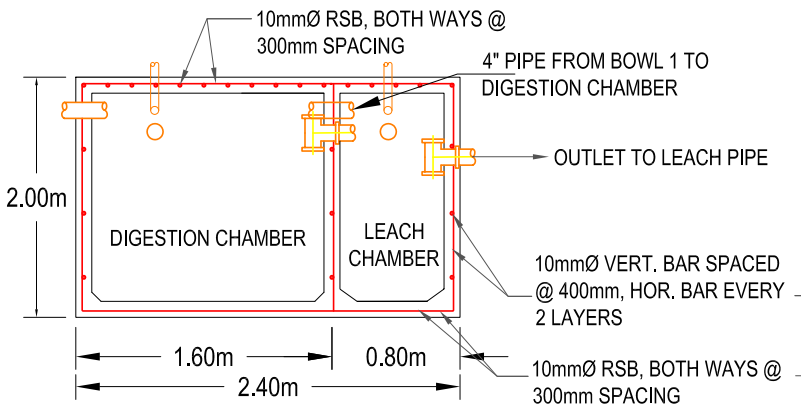
This led to a mass displacement and the Humanitarian Response Consortium (HRC) including ASDSW and KFI as members led a large scale WaSH response in both cities. The designs documented in this manual were used as a basis for this but to deal with large scale camps and shorter displacement periods, ease of desludging and site constraints modifications were made to increase the number of bowls per septic tanks for toilets. In addition was the incorporation of bathing facilities into the design to meet the need of IDP's. By integrating with the toilets this would allow continuation of gender desegregation, reduce the times that toilets are also used for bathing, combining drainage and water points while promoting cleanliness as a hygiene issue.

Note:

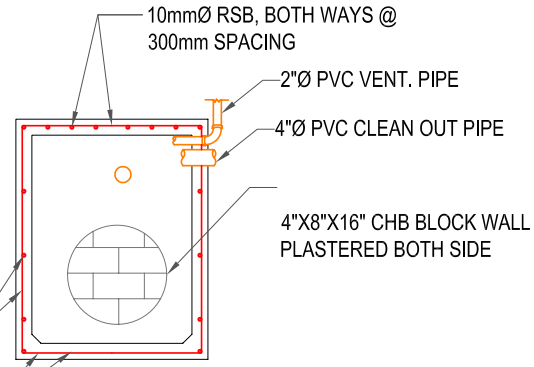
1. Septic Tank design remains constant with height variation depending on no. of users and desludging period. In Sendong overall tank height reduced to 1.5 m for 6 month to 12 month desludging.
2. Good Lumber replaced with Coco Lumber due to maximum of 12 month design life.
3. Built using Cash for Work arrangements with IDP's

The following section shows construction drawings and Bills of Materials for these variations.

1. Septic Tank (Sendong Design)
2. 2 Toilets/2Bathing Cubicles
3. 3 Toilets/2 Bathing Cubicles
4. 4 Toilets/2 Bathing Cubicles
5. 2 Bathing Cubicles no roof



3 POO25 **SEPTIC TANK (Section B-B)**
SCALE 1:50



4 POO25 **SEPTIC TANK (Section A-A)**
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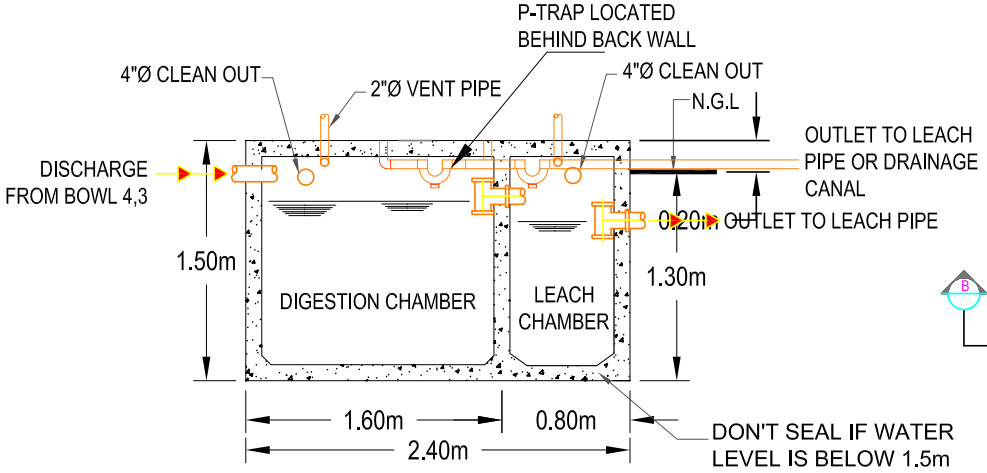

2 POO25 **SEPTIC TANK ELEVATION**
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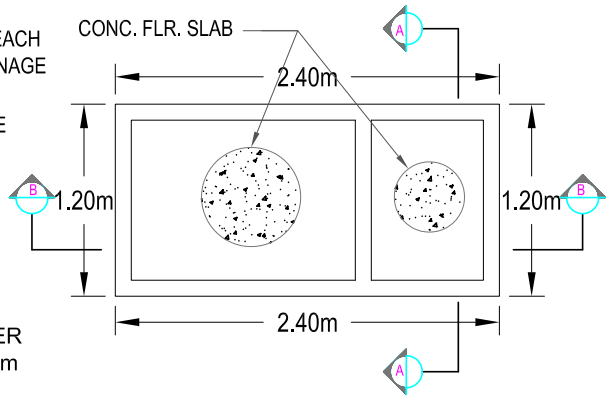
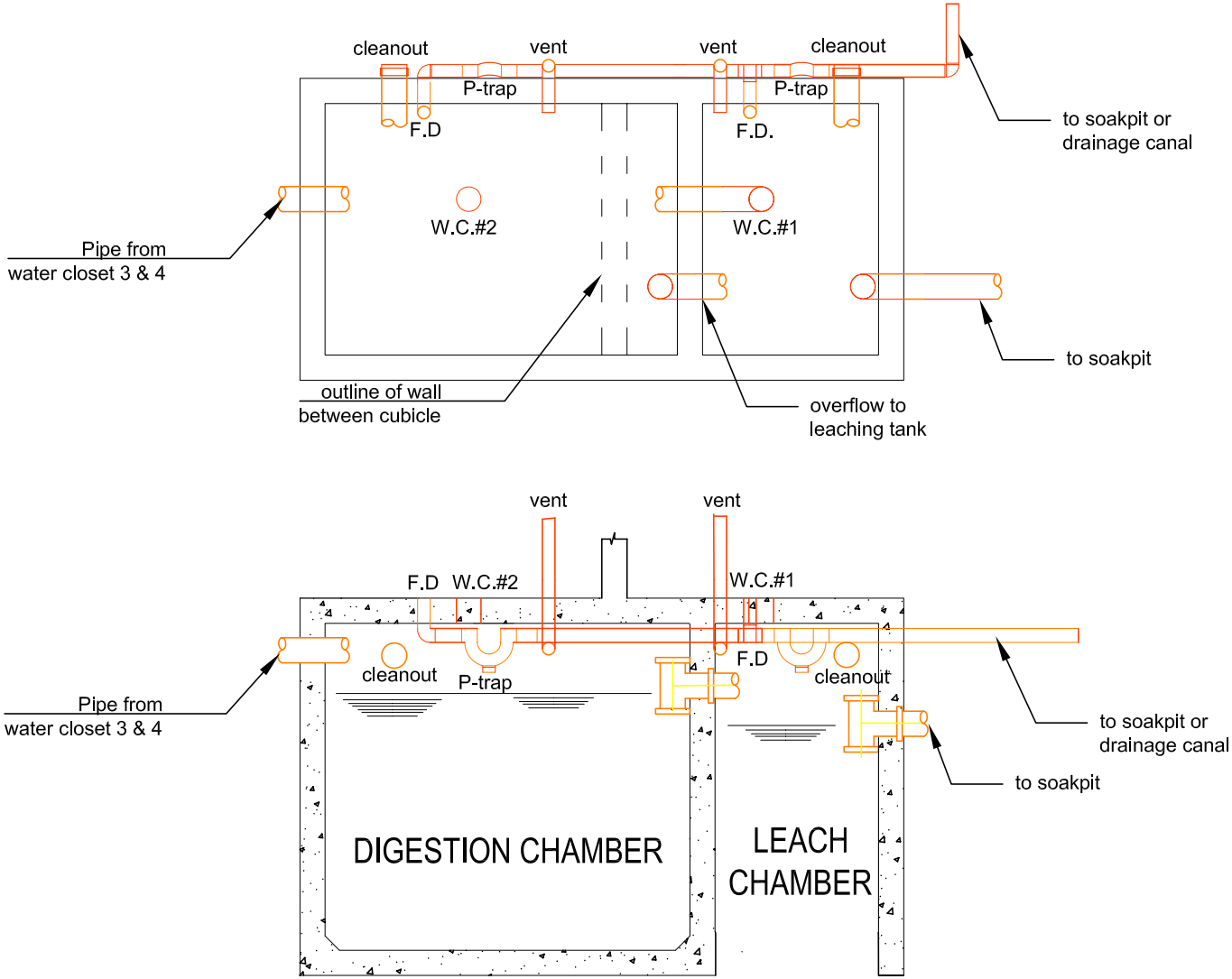
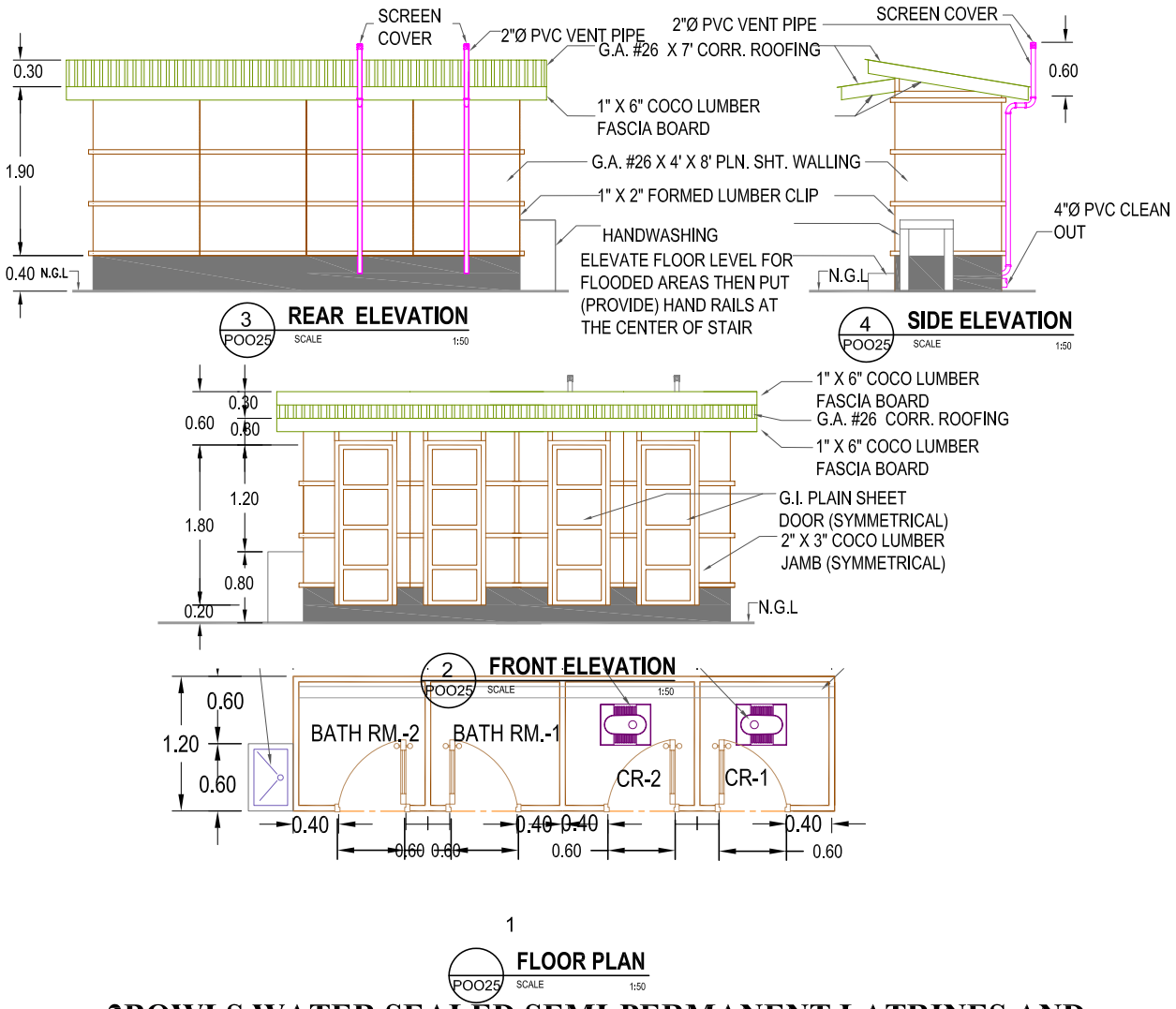


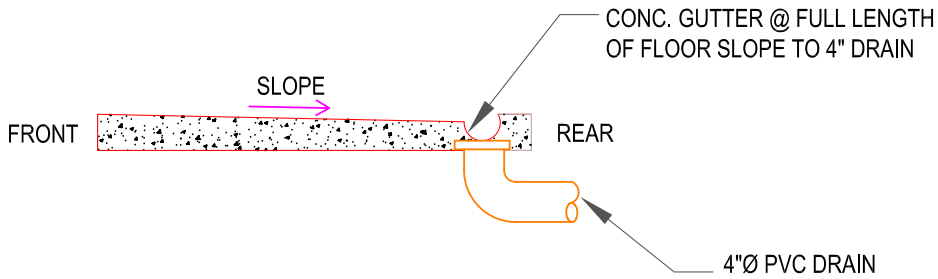
1 POO25 **PLAN**
SCALE 1:50



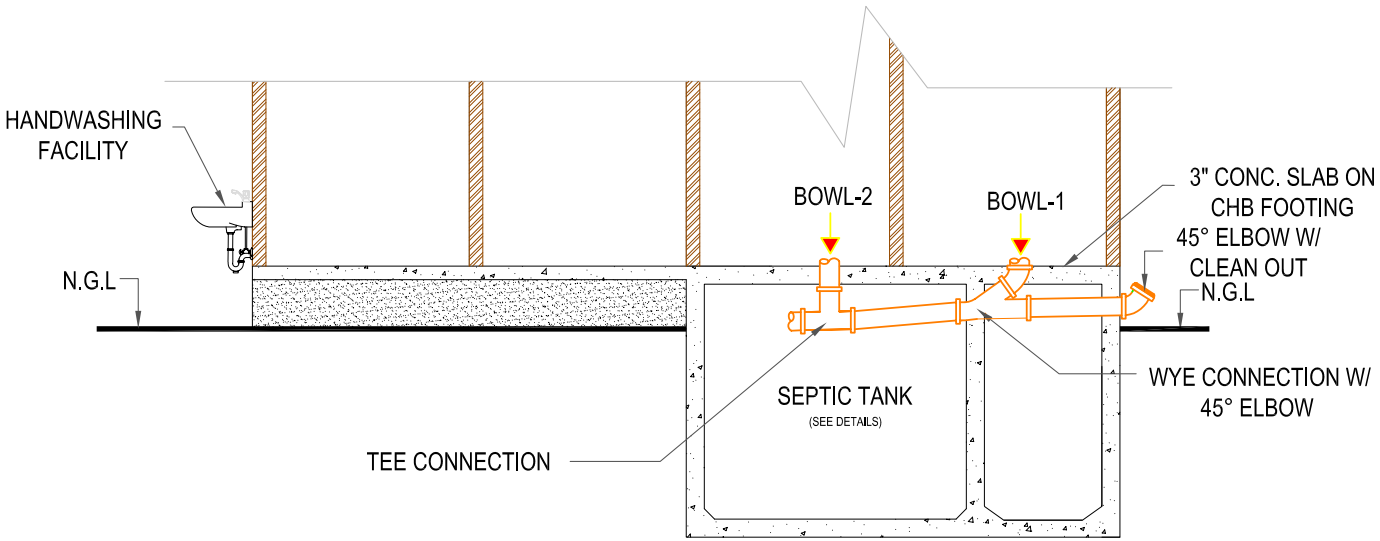
SEPTIC TANK DETAILS & PLUMBING



2BOWLS WATER SEALED SEMI-PERMANENT LATRINES AND 2 DOORS BATHING CUBICLES



2 POO25 **SLAB DETAILS**
SCALE 1:50



1 POO25 **PIPING DETAILS**
SCALE 1:50

WATER SEALED SEPTIC TANK PIPING DETAILS

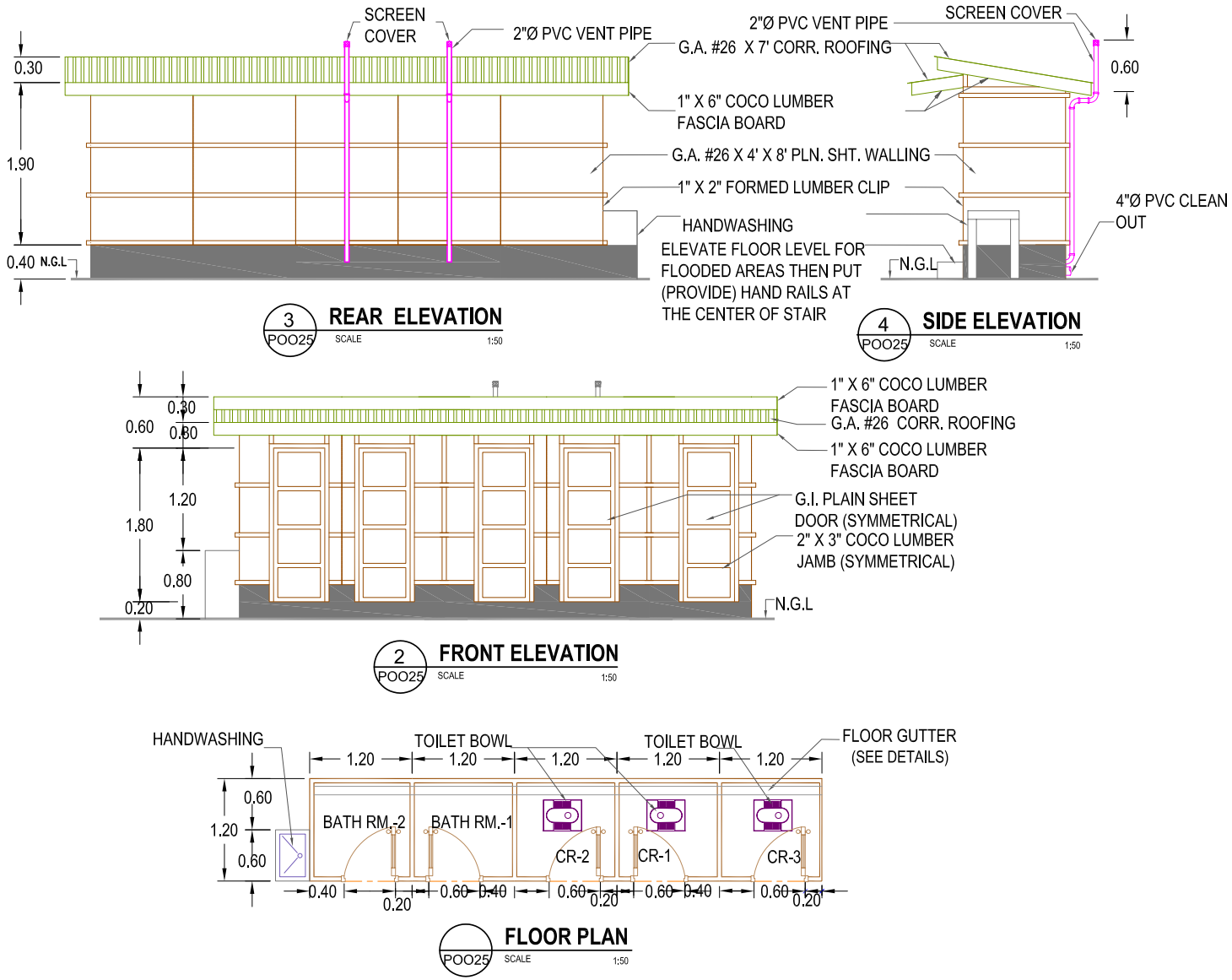
BILL OF MATERIALS:

PHILIPPINE STORM SENDONG (WASHI) EMERGENCY RESPONSE

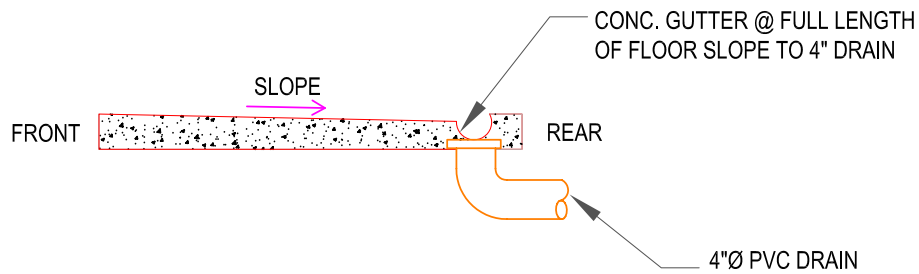
HUMANITARIAN RESPONSE CONSORTIUM ASDSW • BALAT • KFI • RDISK • PDRRN HRC Oxfam unicef

TWO (2) BOWLS SEMI - PERMANENT WATER SEALED LATRINE AND TWO (2) DOORS BATHING CUBICLE

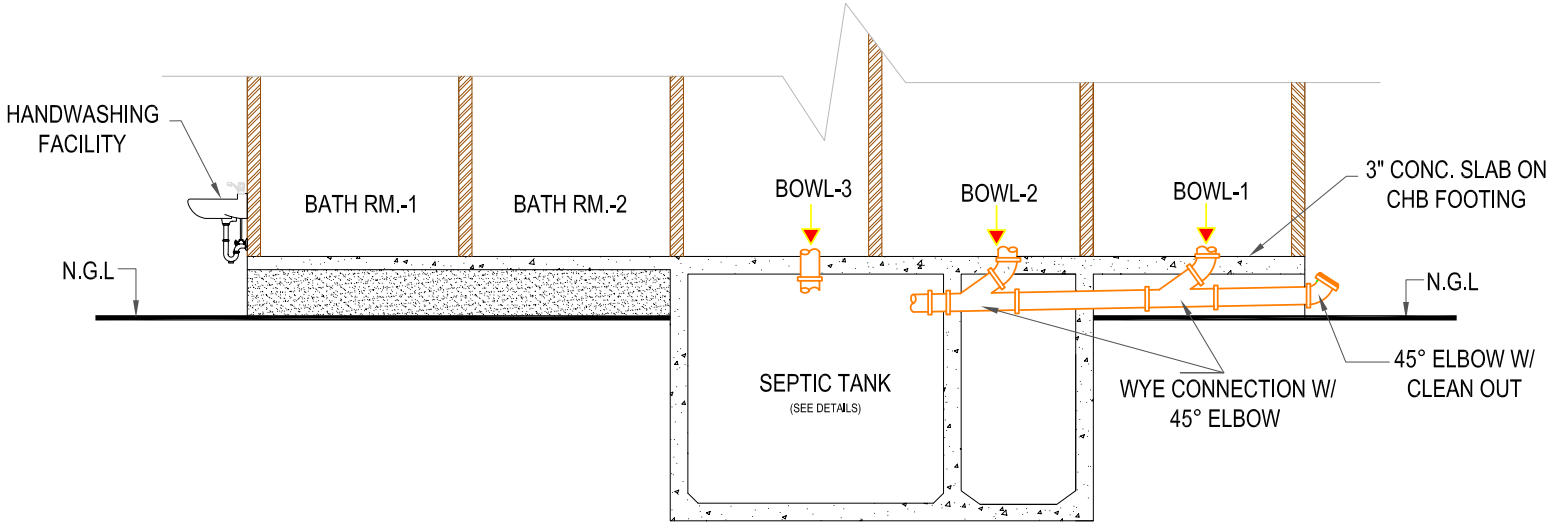
Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	RSB 10 mm dia x 6 m	33	pcs		
2	GI tie wire #16	3	kls		
3	Loose pin hinges (3" x 3")	4	pairs		
4	Coco lumber (2" x 3" x 12')	35	pcs		
5	Coco lumber (2" x 2" x 12')	45	pcs		
6	Coco lumber (2" x 2" x 10')	20	pcs		
7	Good lumber (2" x 2" x 8')	12	pcs		
8	Good lumber (1" x 6" x 10')	6	pcs		
9	Good lumber (1' x 2" x 8')	60	pcs		
10	GI corrugated sheet # 26 x 8'	6	pcs		
11	Plastic transparent roof sheet (8' long)	1	pcs		
12	Plain sheet #26 (4' x 8')	14	pcs		
13	Ordinary plywood 5 mm thick (4' x 8')	1	pcs		
14	Flat head nails (1")	1.5	kls		
15	Umbrella nails (2 1/2")	1.5	kls		
16	Vulca seal	1	quart		
17	CWN 4"	5	kls		
18	CWN 2 1/2"	3.5	kls		
19	CWN 3"	3	kls		
20	Roof paint (baguio green)	1	gal		
21	Enamel paint (apple green)	1	gal		
22	Roof paint (orient gold)	1	gal		
23	Paint brush 4"	1	pcs		
24	Paint brush 2"	1	pcs		
25	Door handle 5"	4	pcs		
26	Barrel bolt 4"	4	pcs		
27	Paint thinner	1	bottles		
28	Hook and eye 4"	4	pcs		
29	Sahara cement	3	packs		
30	Cement (40 kg)	32	bags		
31	CHB 4"	300	pcs		
32	Wash sand	6	cu.m		
33	Gravel (mix)	6	cu.m		
34	PVC tee orange 4" dia.	3	pcs		
35	PVC wye orange 4" dia.	2	pcs		
36	PVC pipe orange (S-900) 4" dia. X 3 m	2	pcs		
37	PVC elbow orange 90 deg. 4" dia	3	pcs		
38	PVC coupling orange 4" dia.	3	pcs		
39	PVC orange clean out with cover 4" dia.	3	pcs		
40	PVC pipe orange (S-900) 2" dia. X 3m	2	pcs		
41	PVC elbow orange 90 deg. 2" dia	4	pcs		
42	Toilet Bowl porcelain / Squat bowl	2	pcs		
TOTAL					



3 BOWLS WATER SEALED SEMI-PERMANENT LATRINES AND 2 DOORS BATHING CUBICLES



2 POO25 **SLAB DETAILS**
SCALE 1:50



1 POO25 **PIPING DETAILS**
SCALE 1:50

WATER SEALED SEPTIC TANK PIPING DETAILS

PHILIPPINE STORM SENDONG (WASHI)
EMERGENCY RESPONSE

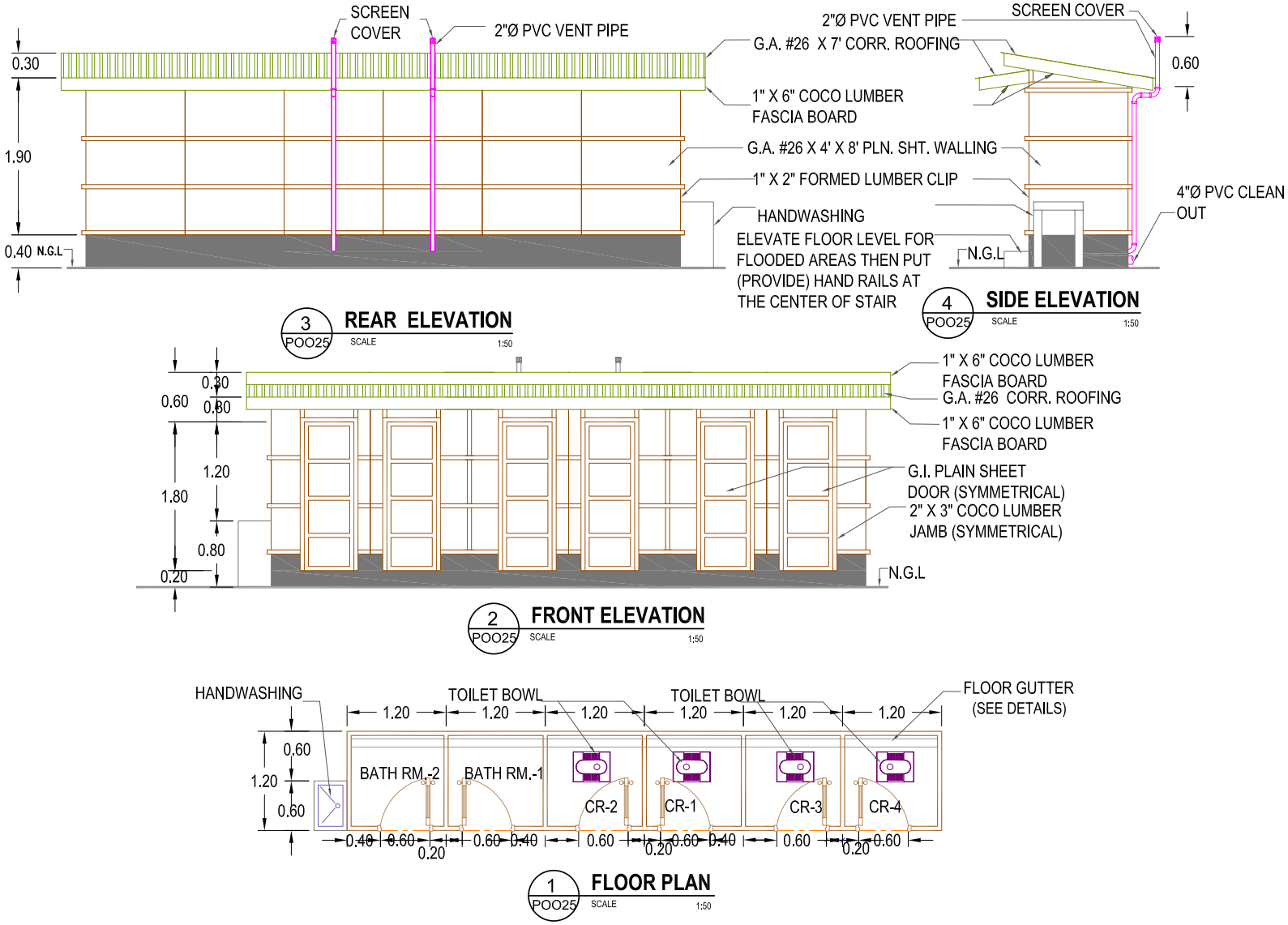
BILL OF MATERIALS:

HUMANITARIAN RESPONSE CONSORTIUM HRC Oxfam unicef

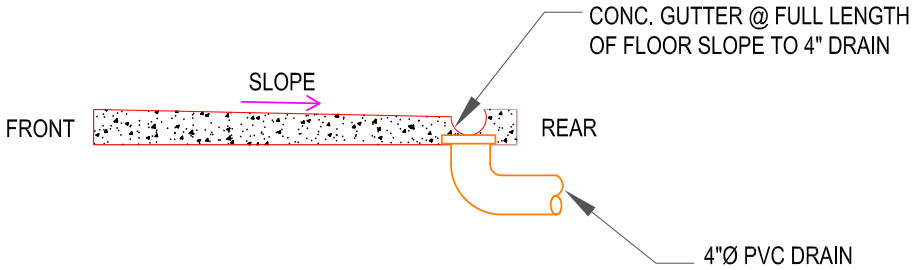
ASDEW • BALAY • KFI • RDISK • PDRRN

THREE (3) BOWLS SEMI - PERMANENT WATER SEALED LATRINE AND TWO (2) DOORS BATHING CUBICLE

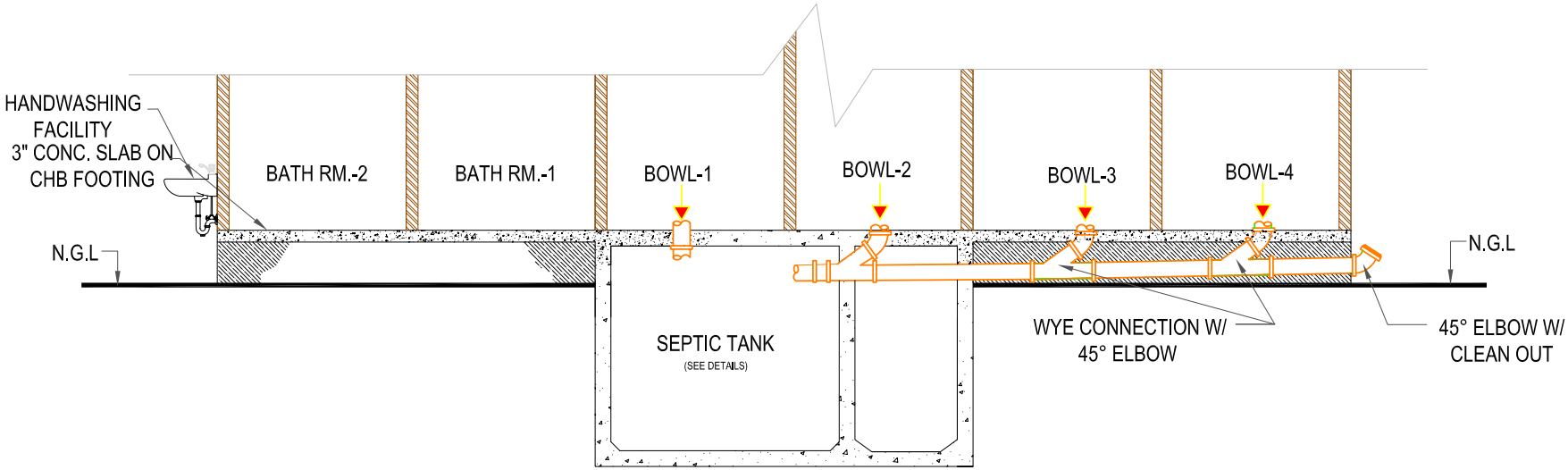
Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	RSB 10 mm dia x 6 m	44	pcs		
2	GI tie wire #16	4	kls		
3	Loose pin hinges (3" x 3")	5	pairs		
4	Coco lumber (2" x 3" x 12')	15	pcs		
5	Coco lumber (2" x 2" x 12')	55	pcs		
6	Coco lumber (2" x 2" x 10')	15	pcs		
7	Good lumber (2" x 2" x 8')	15	pcs		
8	Good lumber (1" x 6" x 10')	12	pcs		
9	Good lumber (1' x 2" x 8')	60	pcs		
10	GI corrugated sheet # 26 x 8'	10	pcs		
11	Plastic transparent roof sheet (8' long)	1	pcs		
12	Plain sheet #26 (4' x 8')	20	pcs		
13	Ordinary plywood 5 mm thick (4' x 8')	1	pcs		
14	Flat head nails (1")	1.5	kls		
15	Umbrella nails (2 1/2")	2	kls		
16	Vulca seal	1	quart		
17	CWN 4"	7	kls		
18	CWN 2 1/2"	7	kls		
19	CWN 3"	4	kls		
20	Roof paint (baguio green)	2	gal		
21	Enamel paint (apple green)	3	gal		
22	Roof paint (orient gold)	2	gal		
23	Paint brush 4"	1	pcs		
24	Paint brush 2"	1	pcs		
25	Door handle 5"	10	pcs		
26	Barrel bolt 4"	5	pcs		
27	Paint thinner	2	bottles		
28	Hook and eye 4"	5	pcs		
29	Sahara cement	3	packs		
30	Cement (40 kg)	50	bags		
31	CHB 4"	450	pcs		
32	Wash sand	8	cu.m		
33	Gravel (mix)	8	cu.m		
34	PVC tee orange 4" dia.	6	pcs		
35	PVC wye orange 4" dia.	2	pcs		
36	PVC pipe orange (S-900) 4" dia. X 3m	4	pcs		
37	PVC elbow orange 90 deg. 4" dia	6	pcs		
38	PVC coupling orange 4" dia.	6	pcs		
39	PVC orange clean out with cover 4" dia.	10	pcs		
40	PVC pipe orange (S-900) 2" dia. X 3 m	4	pcs		
41	PVC elbow orange 90 deg. 2" dia	8	pcs		
42	Toilet Bowl porcelain / Squat bowl	3	pcs		
TOTAL					



4 BOWLS WATER SEALED SEMI-PERMANENT LATRINES AND 2 DOORS BATHING CUBICLES



2 PO025 **SLAB DETAILS**
SCALE 1:50



1 PO025 **PIPING DETAILS**
SCALE 1:50

WATER SEALED SEPTIC TANK PIPING DETAILS

BILL OF MATERIALS:

PHILIPPINE STORM SENDONG (WASHI) EMERGENCY RESPONSE

HUMANITARIAN RESPONSE CONSORTIUM HRC Oxfam unicef

FOUR (4) BOWLS SEMI - PERMANENT WATER SEALED LATRINE AND TWO (2) DOORS BATHING CUBICLE

Item No.	Description	Quantity	Unit	Unit Cost	Total Cost
1	RSB 10 mm dia x 6 m	58	pcs		
2	GI tie wire #16	5	kls		
3	Loose pin hinges (3" x 3")	6	pairs		
4	Coco lumber (2" x 3" x 12')	20	pcs		
5	Coco lumber (2" x 2" x 12')	65	pcs		
6	Coco lumber (2" x 2" x 10')	20	pcs		
7	Good lumber (2" x 2" x 8')	20	pcs		
8	Good lumber (1" x 6" x 10')	15	pcs		
9	Good lumber (1' x 2" x 8')	60	pcs		
10	GI corrugated sheet # 26 x 8'	12	pcs		
11	Plastic transparent roof sheet (8' long)	2	pcs		
12	Plain sheet #26 (4' x 8')	21	pcs		
13	Ordinary plywood 5 mm thick (4' x 8')	1	pcs		
14	Flat head nails (1")	2	kls		
15	Umbrella nails (2 1/2")	3	kls		
16	Vulca seal	1	quart		
17	CWN 4"	8	kls		
18	CWN 2 1/2"	8	kls		
19	CWN 3"	4	kls		
20	Roof paint (baguio green)	2	gal		
21	Enamel paint (apple green)	3	gal		
22	Roof paint (orient gold)	2	gal		
23	Paint brush 4"	1	pcs		
24	Paint brush 2"	1	pcs		
25	Door handle 5"	12	pcs		
26	Barrel bolt 4"	6	pcs		
27	Paint thinner	2	bottles		
28	Hook and eye 4"	6	pcs		
29	Sahara cement	3	packs		
30	Cement (40 kg)	60	bags		
31	CHB 4"	500	pcs		
32	Wash sand	10	cu.m		
33	Gravel (mix)	10	cu.m		
34	PVC tee orange 4" dia.	6	pcs		
35	PVC wye orange 4" dia.	2	pcs		
36	PVC pipe orange (S-900) 4" dia. X 3m	4	pcs		
37	PVC elbow orange 90 deg. 4" dia	6	pcs		
38	PVC coupling orange 4" dia.	6	pcs		
39	PVC orange clean out with cover 4" dia.	10	pcs		
40	PVC pipe orange (S-900) 2" dia. X 3 m	4	pcs		
41	PVC elbow orange 90 deg. 2" dia	8	pcs		
42	Toilet Bowl porcelain / Squat bowl	4	pcs		
TOTAL					