



NATIONAL COMPENDIUM

WATER, SANITATION AND HYGIENE TECHNOLOGIES FOR DISASTER RESPONSE

A WASH CLUSTER INITIATIVE



Department of Public Health Engineering (DPHE)
Local Government Division
Ministry of Local Government, Rural Development & Co-operatives
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Minister
Ministry of Local Government,
Rural Development and Co-operatives

Message

The Ministry of Local Government, Rural Development & Co-operatives is entrusted with providing emergency services during disaster situations and post-disaster rehabilitation. Prompt and adequate responses to the need for water supply, sanitation, hygiene and solid waste management under such circumstances are crucial. Also important is creating preparedness for WASH services and infrastructures for probable disaster situations. The Local Government Division ensures the services through the active participation of its Departments/Agencies, the development partners and other stakeholders.

The WASH cluster in Bangladesh has made considerable progress in cluster management. The imminent need for a guideline for the sector stakeholders in identified for the smooth operation of WASH technological options (water and sanitation), hygiene promotion including information management and accordingly, ITN-BUET, UNICEF, WASH cluster and DPHE have developed this National Compendium of water, sanitation and hygiene (WASH) in Bangladesh for aiding the response during and after disasters.

The “National Compendium of water, sanitation and hygiene (WASH) technologies for disaster response” will provide adequate guidance to plan and implement water supply, sanitation, hygiene, and solid waste management activities during the emergency and early recovery phases of disaster. This will also help the local administration and policymakers coordinate and supervise the WASH related activities implemented by the sector partners. Furthermore, the well —coordinated approach of the WASH cluster through this guidance document will significantly alleviate the duplication of efforts for timely rehabilitation and disaster response. I wish every success of the WASH cluster in Bangladesh to support delivering WASH- related services to the affected population in emergencies.

The publication will benefit government agencies, local government institutions, I/NGOs, WASH professionals, DRR professionals, researchers, and policymakers. It will be instrumental in guiding policy for the WASH sector and contribute to the ongoing efforts of the Government of Bangladesh to meet the Sustainable Development Goals (SDGs). I thank all who were engaged with this publication.

Joy Bangla, Joy Bangabandhu.

(Md. Tazul Islam, MP)



Secretary
Local Government Division
Ministry of Local Government, Rural Development and
Cooperatives

Message

Bangladesh has made remarkable progress in advancing access to water and sanitation service by increasing access to drinking water to 98% and maintaining open defecation practices to almost zero since 2015. 74.8% of the population of Bangladesh has hand washing stations with wafer and soap on their premises, according to MICS 2019 study. But climate change impacts natural disasters like monsoon floods, flash floods, cyclones, and other disasters affect the sustainability and continuity, and quality of WASH services.

Organizations (GO and NGO) working in disaster response in the country recognize the necessity of a readily available Compendium of WASH technologies focusing on technical details and drawings, materials quantity and specification, and costs. In this regard, DPHE, UNICEF, and WASH Cluster have developed this National Compendium of Water, Sanitation and Hygiene (WASH) in Bangladesh for responses during and after disasters with technical support from ITN-BUET.

We know that achieving Sustainable Development Goals (SDGs) is a high priority of the present Government. Ensuring WASH services in disaster response also focusing the concept of 'leaving no one behind'. From this technical guidance, 32 disaster-affected districts of Bangladesh will be benefited while rehabilitating damaged WASH facilities by government officials and sector partners working during emergencies.

I convey my sincere thanks and gratitude to Honorable Minister, Ministry of Local Government, Rural Development & Co-operatives, Mr. Md. Tazul Islam MP, for his overall guidance for developing this important national WASH Compendium. I am also extending my thanks to the Department of Public Health Engineering, WASH Cluster, ITN-BUET, UNICEF and the members of the 'Working Committee' and 'Technical Review Committee' for their proactive role and continuous support in accomplishing this important task.

This Compendium of WASH technologies will also contribute to achieving SDG 6 by 2030. I expect that this Guideline will be helpful to effective and efficient WASH in Emergency Preparedness and Response to disasters.

Muhammad Ibrahim

Message

Today, more children and families in Bangladesh have the safe water and sanitation facilities required for them to practice good hygiene at home, in school and other public spaces. Over half of the population gets safe drinking water from within their premises. Open defecation is almost at zero. The progress that the Government of Bangladesh has made in delivering these critical water, sanitation and hygiene (WASH) services enables more children to attend school knowing that they can wash their hands and use appropriate sanitation facilities when they need to. Safe water and sanitation facilities also help to protect children from diseases such as diarrhea and pneumonia.

However, these gains are threatened by the increasing frequency and intensity of climate-driven disasters such as cyclones, drought, floods, river erosion and salt-water intrusion. Bangladesh is particularly vulnerable as it is one of the most disaster-prone countries in the world. When disasters hit, they destroy or contaminate entire water supplies, increasing the risk of diseases like cholera and typhoid to which children are particularly vulnerable. In 2022 alone, floods destroyed over 100,000 boreholes in Bangladesh leaving children at risk of deadly waterborne diseases.

Since 2008, in the aftermath of Cyclone Sidr, the Department of Public Health Engineering (DPHE) and UNICEF have brought together government departments, the UN and NGOs in the WASH sector under one cluster for strategic coordination in reducing the risk of disasters and preparing families, communities to respond better to disasters. The WASH cluster is part of a wider country Humanitarian Coordination Task Team and international cluster approach that aims to ensure a more coherent and effective response by mobilizing relevant government ministries, the UN, international NGOs and civil society organizations. Together, we set standards and develop action plans to deliver safe water, sanitation and hygiene facilities in line with relevant policies, guidelines and government commitments.

It is within this mandate that we have developed new guidance to serve children and families better during disasters. In the past, organizations in the WASH sector used different operational modalities for water and sanitation, hygiene promotion and information management for emergency interventions. The new “National Compendium of Water, Sanitation and Hygiene (WASH) Technologies for Disaster Response” will help the WASH sector to take the right preventive and response actions before, during and after a disaster to ensure continuity of safe WASH services during emergencies.

Thank you DPHE, UNICEF colleagues and the International Training Network at the Bangladesh University of Engineering and Technology for the hard work and commitment in putting these guidelines together, and to the UK’s Foreign, Commonwealth & Development Office for supporting this work. I look forward to continued collaboration with partners in the WASH cluster as we translate these guidelines into action for children and families in times of crisis.



Sheldon Yett

Message

Disasters and climate change impacts on WASH technologies in Bangladesh are quite visible, including the physical damage of infrastructures, impairing their functionality and sustainability. During and after a disaster, people often take asylum in cyclone shelters, embankments, or open spaces for different durations and remain vulnerable both physically and mentally. In the absence of good quality water, improved sanitation service/excreta management, and proper hygiene practice (including handwashing), people can easily get affected by different water-borne diseases. So, during a disaster response, among the other services, WASH service becomes very critical and considered a priority service.

The WASH section of UNICEF Bangladesh is providing technical support to the Department of Public Health Engineering to strengthen existing systems, WASH policy related, implementation guidelines, etc. This WASH Compendium presents WASH technologies (water supply, sanitation, and hygiene) selected through a consultative process by the WASH Cluster Organizations working in different disaster contexts in Bangladesh. The Compendium includes WASH technologies that would be used during and after disasters as well as climate resilient options that are to be promoted/implemented as sustainable technologies for disaster preparedness.

Water supply technologies in the Compendium include temporary and resilient tube-well options, pond sand filter (PSF), rainwater harvesting, rainwater storage in protected ponds and desalination systems. It also includes water trucking and emergency water treatment options (for both household and community water supply) during and after disasters. Relevant regeneration/rehabilitation options are also included with different water supply options.

Sanitation technologies in the Compendium include temporary and resilient raised pit toilets. The floating toilet for flood situation, and the temporary communal latrine for flood, cyclone, and earthquake situations as well as mobile toilets are also included. Few emergency excreta disposal options such as deep trench latrine, plastic communal latrine and bucket latrines are included as response options. For shelters of displaced population, multiple chamber pit/tank-based toilet options are also included. Desludging options of toilet containments are presented with each toilet option.

Bathing cubicle with Menstrual Hygiene Management (MHM) corner, tippy tap (for hand washing), readymade and basin type handwashing options, paddle operated handwashing stations form part of the Compendium as hygiene interventions.

The Compendium also includes technical drawings/sketches of the technologies, including plan and sectional views to help the construction of these technologies in the field. Finally, cost estimate including Bill of Quantities have been presented for each of the technologies.

I wish that this Guideline will help to enhance Emergency WASH Preparedness and Response, effectively and efficiently, during disasters. I also believe that this Compendium will also contribute to the achievement of SDG 6 in Bangladesh.



Zaid Jurji



Chief Engineer
Department of Public Health Engineering
Government of the People's Republic of Bangladesh


Preface

The Department of Public Health Engineering is working tirelessly to implement the government's commitment to ensure safe water, sanitation and waste management facilities for all and to achieve the Sustainable Development Goals of the Safe Water and Sanitation (WASH) sector by 2030. The importance of sustainable WASH system in protecting the good health of the people is immense for the social and economic prosperity of the country. Despite many challenges in achieving the Millennium Development Goals, the success achieved by Bangladesh has already been globally appreciated which will act as an inspiration to achieve the SDGs. However, the impacts of disasters and climate change on WASH technologies in Bangladesh are highly visible and result in increased infrastructure damage and reduced efficiency in disaster-prone areas, hampering the sustainability of the technology. People are at risk during and after disasters; Lack of good quality water, sanitation services, waste management and proper hygiene practices (including hand washing) in health protection can easily lead to waterborne diseases. Hence, WASH service among other services is very important and considered as priority service while responding to a disaster.

A "National Compendium of Water, Sanitation and Hygiene (WASH) Technologies for disaster Response" has been prepared through a consultative process with organizations belonging to the WASH cluster to address disaster and post-disaster challenges. This compilation includes disaster and post-disaster technologies that will be promoted/implemented as appropriate technologies for climate resilient disaster preparedness. The compendium also includes technical drawings of various technologies, including plan and section views that will aid in field construction of the technology. Finally, cost estimates with volume are presented for each technology included in this compilation. Bill of Quantity (BOQ) is prepared based on technology design, drawing/specification and current market rate of the item.

I express my sincere gratitude to the Hon'ble Minister of Local Government, Rural Development and Cooperatives Ministry, Mr. Md. Tajul Islam for providing prudent guidance in the preparation of this important compendium. Thanks to Mr. Muhammad Ibrahim, Secretary, Local Government Division, for providing all support in preparing this compendium.

I acclaim the working committee and the technical review committee for their efforts and contribution in preparing this "National Compendium of Water, Sanitation and Hygiene (WASH) Technologies for Disaster Response". Also, thanks to ITN-BUET for technical assistance. I must thank UNICEF for its financial support in preparing the compendium. I look forward to the successful implementation of the "National Compendium of Water, Sanitation and Hygiene (WASH) Technologies for Disaster Response" in Bangladesh. This will guide the WASH sector organizations to achieve the country's SDG-6 and ensure safe water, sanitation and hygiene services during and after disasters.



Md. Sarwar Hossain

Acknowledgement

We express our sincere gratitude to the Hon'ble Minister, Ministry of Local Government, Rural Development and Cooperatives, Mr. Md. Tajul Islam MP for providing overall guidance in the preparation of the WASH Compendium. Sincere thanks for Mr. Muhammad Ibrahim, Secretary, Local Government Division, for providing necessary support in preparing this Compendium.

We extend gratitude to WASH Cluster Bangladesh for their support in developing this Compendium. Special thanks to the Technical Review Committee of Department of Public Health Engineering (DPHE) for extensive review and guidance in harmonizing the contents of the Compendium from the national perspective. We would also like to thank UNICEF Bangladesh WASH Section and WASH Cluster Organizations for their cooperation and support in developing this National Compendium. Their suggestions and comments in every step of its preparation enriched it further. We recognize the support of Mr. Moustapha Niang, WASH Specialist, UNICEF and Mr. Esenbek TURUSBKOV, Emergency Specialist, UNICEF for coordinating the development of this document.

A range of literature, data, photographs from various published and unpublished sources, reports, documents, research notes and internet sources have been utilized in developing the National Compendium. The sources and contributors are duly acknowledged.

Lastly, we recognize the contribution of the ITN-BUET team, including Dr. Muhammad Ashraf Ali (Professor, Civil Engineering, BUET), Mr. Alauddin Ahmed (Project Manager, ITN-BUET), Mr. Md. Azizur Rahman (Assistant Director (Research), ITN-BUET) and other ITN-BUET colleagues. We would like to convey our sincere thanks to CWIS-FSM Support Cell, DPHE for necessary support in preparing this guideline. We hope that the wide dissemination of this Compendium will enhance the emergency response capacity of the WASH Cluster.



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List of Acronyms

ACI	American Concrete Institute	FGL	Finished Ground Level
As	Arsenic	GF	Ground Floor
ASTM	American Society for Testing and Materials	GI	Galvanized Iron
BDS	Bangladesh Standard	GL	Ground Level
BFS	Brick Flat Soiling	GoB	Government of Bangladesh
BM	Benchmark	HFL	Highest Flood Level
BNBC	Bangladesh National Building Code	IDS	The Institute of Development Studies
BoQ	Bill of Quantities	ISO	International Organization for Standardization
BS	British Standard	IT	Income Tax
BUET	Bangladesh University of Engineering and Technology	ITN	International Training Network
BWG	Birmingham Wire Gauge	LICs	Low-Income Communities
C	Carbon	LSE	Local Small Entrepreneurs
CC	Cement Concrete	Mn	Manganese
CI	Corrugated Iron	MPa	Megapascal
Cr	Chromium	MS	Metal Sheet
Cum	Cubic meter	MSL	Mean Sea Level
DPHE	Department of Public Health Engineering	NCF	Net Cement Finishing
EGL	Existing Ground Level	NTU	Nephelometric Turbidity Unit
EIC	Engineer-in-Charge	O&M	Operation and Maintenance
FM	Fineness Modulus	OD	Open Defecation

PL	Plinth Level
PSF	Pond Sand Filter
PVC	Poly Vinyl Chloride
PWD	Public Works Department
RCC	Reinforced Cement Concrete
RL	Reduced Levels
RWH	Rainwater Harvesting
Si	Silicon
Sqm	Square meter
SS	Stainless Steel
UNHCR	United Nations High Commissioner for Refugees
UNICEF	The United Nations Children’s Fund
UV	Ultraviolet
VAT	Value Added Tax
WASH	Water, Sanitation and Hygiene

WASH TECHNOLOGIES DURING DISASTER

WATER SUPPLY TECHNOLOGIES

Temporary Tubewell

Context and Description

Context

Applicable during flood/disasters.

Major Components

- > No. 6 shallow handpump (Barrel, Plunger/Piston rod, plunger assembly, seat valve and handle) with baseplate
- > Blind pipe/rising pipe (PVC and GI pipes)
- > PVC strainer (screen)
- > Sand trap

Technology Description

- > The handpump of the temporary tubewell is placed on top of the base, bolted to the baseplate.
- > The pump base is connected with a 38 mm diameter blind pipe of small length. The top 1.5 m of the blind pipe should be a robust GI pipe, followed by a PVC pipe up to the perforated screen.
- > The perforated strainer is placed at a designated depth, well below the water level. The groundwater enters this strainer through a prescribed mesh (opening).
- > Beneath the strainer is a sand trap, which is an extension to the blank pipe and it is usually 1.5 to 2 meters in length.

Suitability

For areas where sudden floods/storm surge/water logging occur regularly.

Risks/Challenges

Water Quality may not be suitable for long use, tubewell may be choked up, pump may be stolen



Figure 1: Temporary tubewell installed during flood (Courtesy: DPHE)

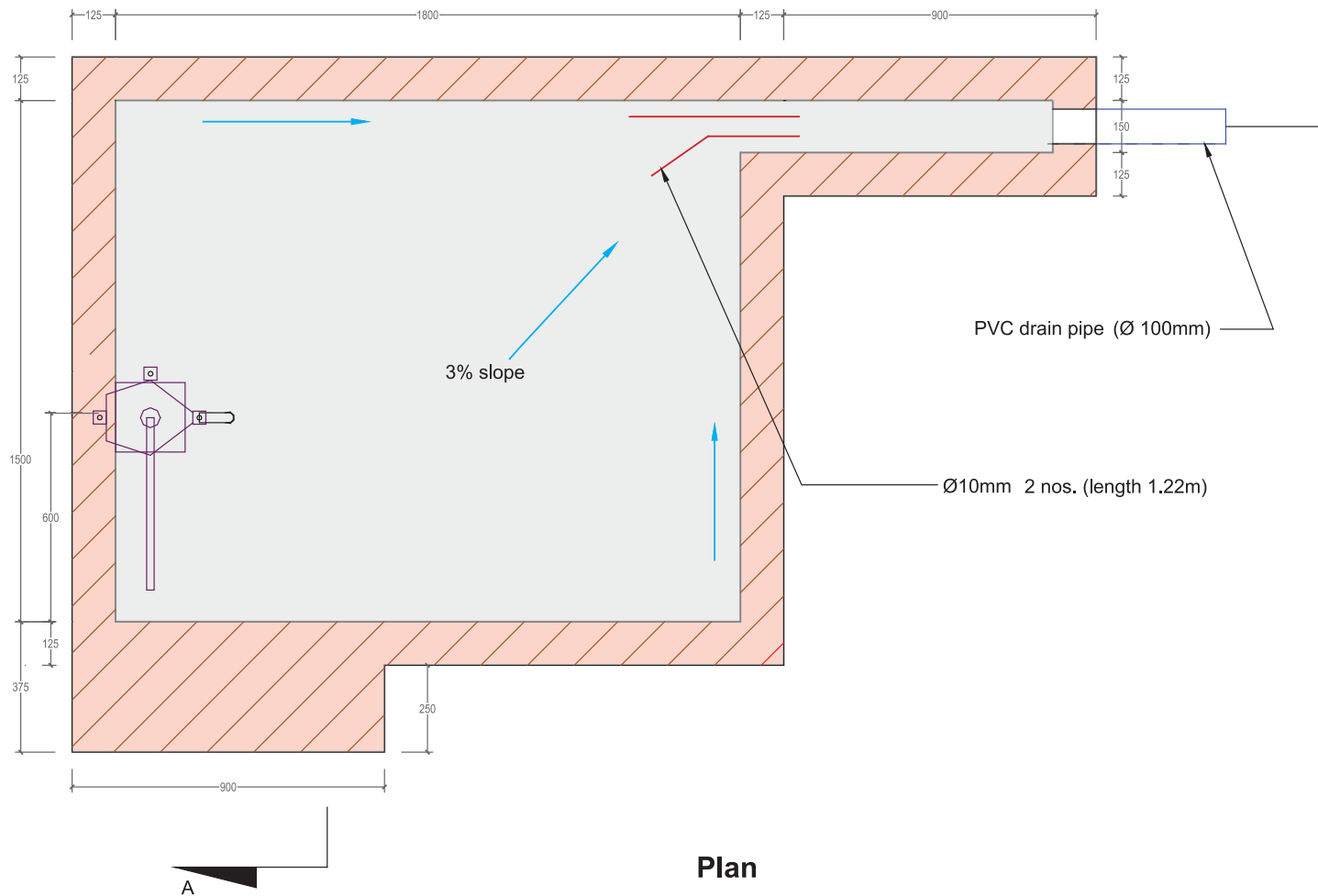
Tubewell Decommissioning

Withdraw temporary tubewells after the disaster event and preposition for next event

Operation and Maintenance

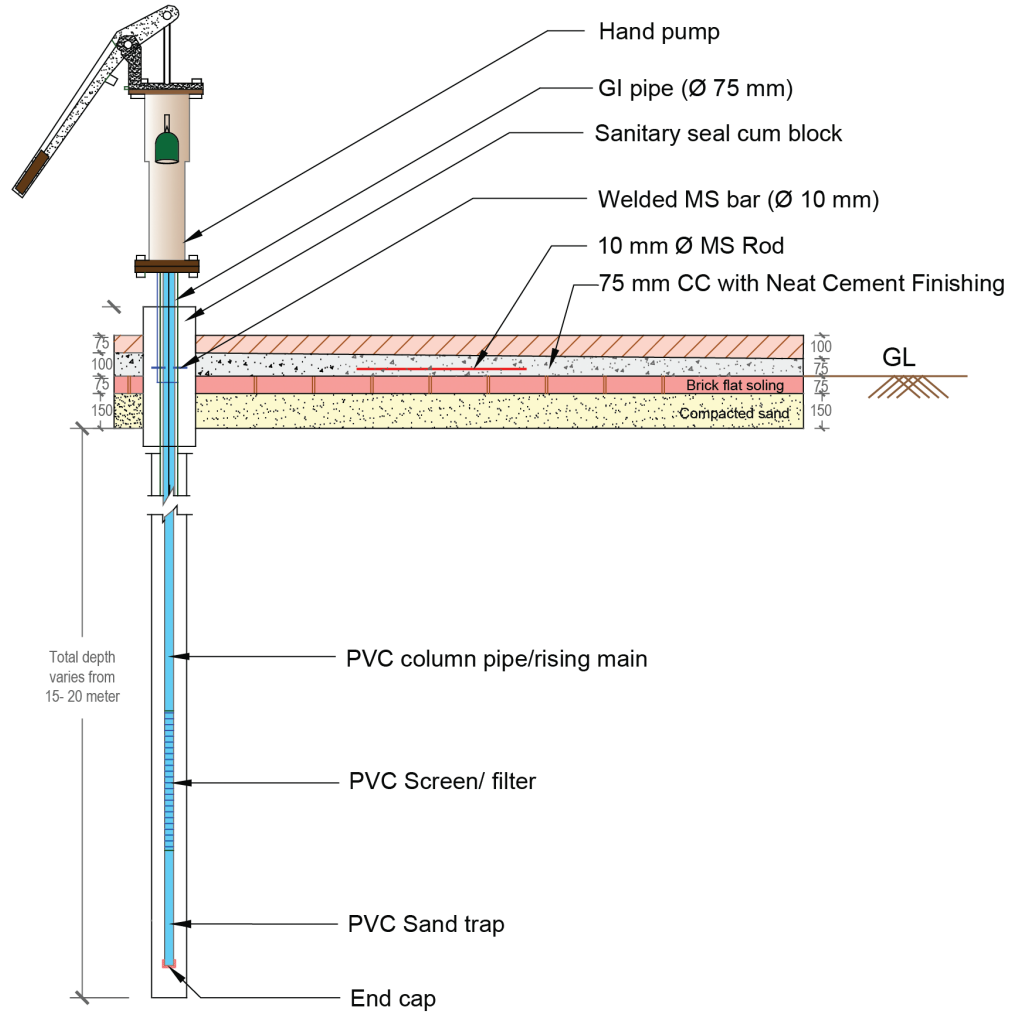
It demands replacement of spare parts of piston assembly, when required.

Design Drawings



Temporary Tubewell

Note: All dimensions are in mm



Section A-A

Temporary Tubewell

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Transportation: Transportation of all kinds of departmental and contractor's materials / equipment to the site for installation of Tube Well with supplying of casing pipe, boring pipe, construction of derrick and dismantling the same, cleaning the site after completion of the work, restore the unused departmental materials to the departmental store etc. All complete as per direction of the Engineer-in-Charge.	1	LS	2,000	2,000
2	Boring by using 100 mm diameter cutter with 38 mm dia GI pipe and other equipment capable of drilling up to required depth to install 38mm dia shallow TW by water jet method or any other suitable method approved by the E/C through all sorts of strata, pea gravel interference, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3 m interval in a white polyethene bag/wooden compartmental box and preserving them for analysis, withdrawal of boring pipes and casing pipes etc. complete and supplying of 38mm dia 1.52m long GI pipe, 38mm dia uPVC pipe, 38mm dia uPVC filter (3m long, slot opening 8-10), 38mm dia uPVC sandtrap (0.76m per piece), 38mm dia uPVC Socket adopter, Solvent cement (100gm 1 tube) etc. to the boring site and done the installation completely as per direction of the E/C (This item includes materials cost, labor charge, carrying charge with VAT, Tax & Profit).				
i)	0.00 m-1.52m (38mm dia 2.65mm thickness GI pipe)	2	m	760	1,155
ii)	1.52m-10.5 m (38mm dia uPVC pipe, 'D'-Class) (Department Supply)	9	m	160	1,437
iii)	38 mm dia uPVC filter, 'D'-Class	2	m	250	500
3	Complete development of the Tube well by mechanical pump to obtain sand & turbidity free water at a satisfactory and direction of the Engineer in Charge.	1	each	1,000	1,000
4	No. 6 Hand Pump: Supplying, Fitting and fixation of no. 6 hand pump (23kg) and complete development of the tube well to get sand, odor and turbidity free drinking water at a satisfactory yield, the tube well have to pump continuously to get the target quality of water etc. All complete as per specifications and direction of the E/C.	1	LS	3,000	3,000
5	Materials Return to the Departmental Store : After flood safely withdraw all pipes, Head & Tube well materials and return to the departmental store etc. All complete as per specifications and direction of the E/C.	1	LS	1,500	1,500
Total Cost					10,592
Total Cost considering disaster context = 10,592 * 1.5 =					15,888

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Raised Dual Platform No. 6 Hand Pump Tubewell

Context and Description

Emergency Context

Applicable in areas affected by flash floods, storm surge, or water logging; primarily in beels, chars, baors and haors and other flood-prone areas.

Major Components

- > Handpump (Barrel, Plunger/Piston rod, plunger assembly, seat valve and handle)
- > Gate valves
- > Blind pipe/rising pipe (PVC pipe and GI pipe)
- > Strainer (screen)
- > Sand trap
- > platform and raised platform; 2 sanitary seals, 2 bases and 1 rising pipe
- > Handrail and/or ramp should be installed for people with disabilities and for the elderly

Technology Description

- > The handpump of the No.6 tubewell is placed on top of the base, bolted to the platform using a sanitary seal.
- > The pump base is connected with a 38 mm diameter blind pipe of variable length. The top 1.5 m of the blind pipe should be a robust GI pipe, followed by a PVC pipe up to the perforated screen.
- > The perforated strainer is placed at a designated depth, well below the water level. The groundwater enters this strainer through a prescribed mesh (opening), the strainer is usually 2 meters long (depending on the aquifer characteristics) with a diameter of 38 mm.



Figure 2: (A) Normal tubewell with raised platform (B) Raised platform with no. 6 handpump in use (Courtesy: Oxfam Bangladesh).

- > Beneath the strainer is a sand trap, which is an extension to the blank pipe and it is usually 1.5 to 2 meters in length.
- > Since an additional platform is constructed for raised tubewells for usage during floods, a T-connection is used to connect the GI pipe at the raised platform. After T-connection, along the direction of flow, two gate valves are fitted. During dry periods, the base of the GI pipe and gate valve along the direction of flow in the raised platform are closed off and the regular handpump is used.
- > Just before monsoon periods, the regular handpump is unbolted and is connected to the raised platform's base. The opening of the ground level GI pipe and the gate valve along this direction are closed off with a cap to prevent flood water from entering. This ensures safe water at the raised platform throughout emergency situations (e.g., floods, storm surge, water logging).

Suitability

For areas where floods/storm surge/ water logging occur regularly.

Risks/Challenges

It is compulsory for the tubewell to be located further than 10 m from a soak pit/latrine pit. After installation, the tubewell requires to be primed, and water quality must be ensured before regular operations. Sometimes, for cost-cutting, the sanitary seal and platforms are not constructed - which should be avoided in all circumstances. Since the platforms are raised, a suction head that can lift water at an added height needs to be available. The normal GI T-connection may be loose if not sealed properly, and consequently may leak water. If any leak is present, flood water may penetrate into the pipes and the tubewell may pump out contaminated water. Lastly, proper drainage arrangement should be provided to ensure wastewater/excess water removal from the tubewell platform.

Operation and Maintenance

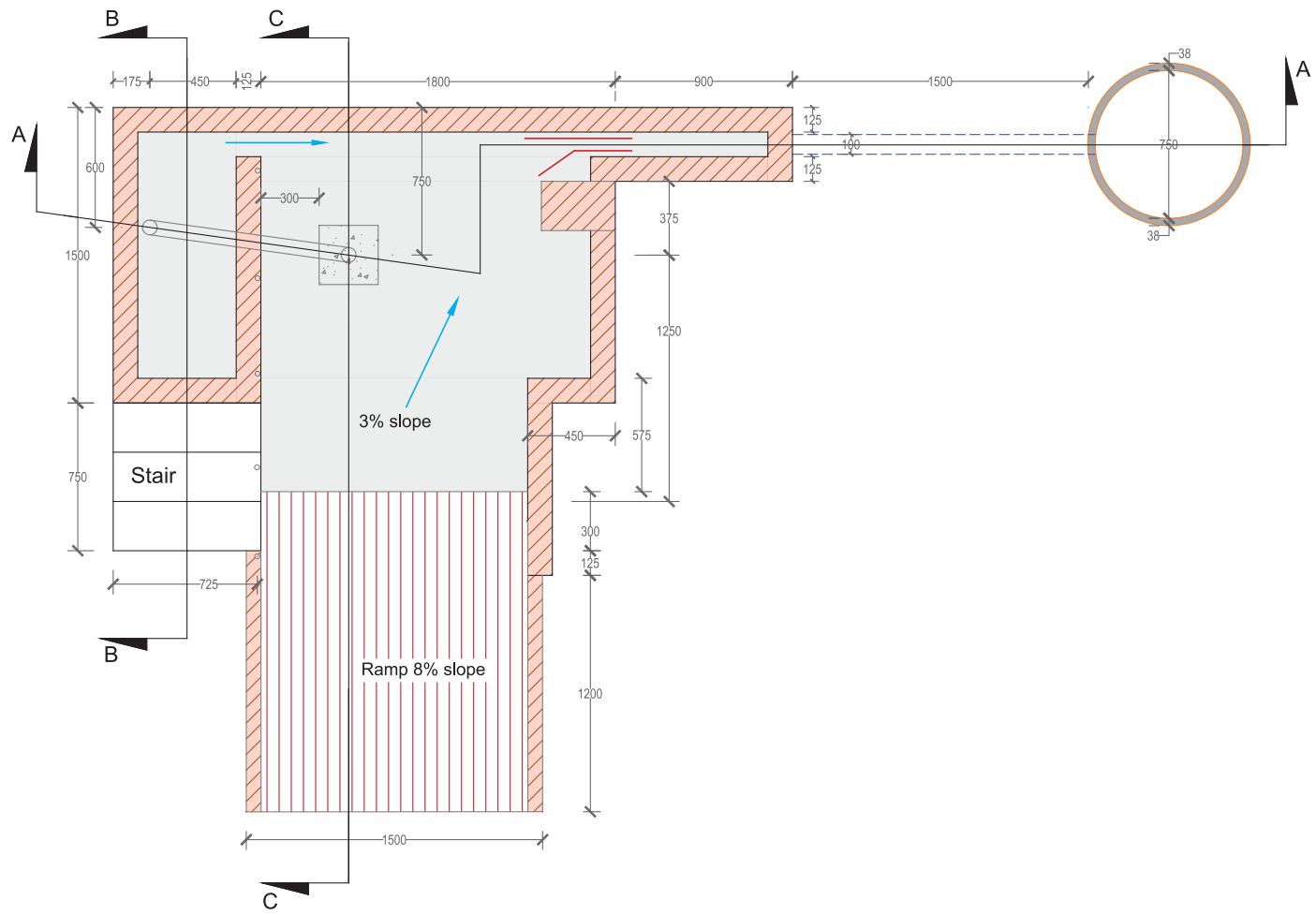
Periodical cleaning of tubewell platform, water drain, and areas at close proximity - at least once per week. If, by chance, leaks are found on the platform, then they should be tended to immediately. The above ground components such as nuts, bolts and other parts should be checked for functionality and damage. Lastly, an annual dismantling and reassembling of the tubewell components should be undertaken to address any structural inadequacy.

Tubewell Rehabilitation

- > For flooded tubewells, purging the tubewell to remove unsafe floodwater is mandatory before reuse. The amount of water that needs to be discharged to remove floodwater varies with depth of the tubewell. For instance, a 100-foot deep tubewell requires 33L to 35L of water to be discharged after flood. So, a 600-foot flooded tubewell would require 200L of water to be manually pumped out as purging. Additionally, the pipes and seal should be checked to determine if there are cracks or leaks—if the tubewell is safe, check valves should be working properly.
- > In many cases only purging the well does not remove the pathogens. Disinfection should be done by shock chlorination method—a high dose of chlorine (about 200 mg/L) is added to the well and retained for a specified time period before the well is purged again for pumping out the chemical.
- > A management committee should be formed after installing a tubewell in a neighborhood. At least 3 caretakers (including one female representative) should be versed in operation and maintenance guidelines and should receive proper training. A toolbox and a maintenance manual that allows repair work should be present and be accessible to the caretakers.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 67-68).

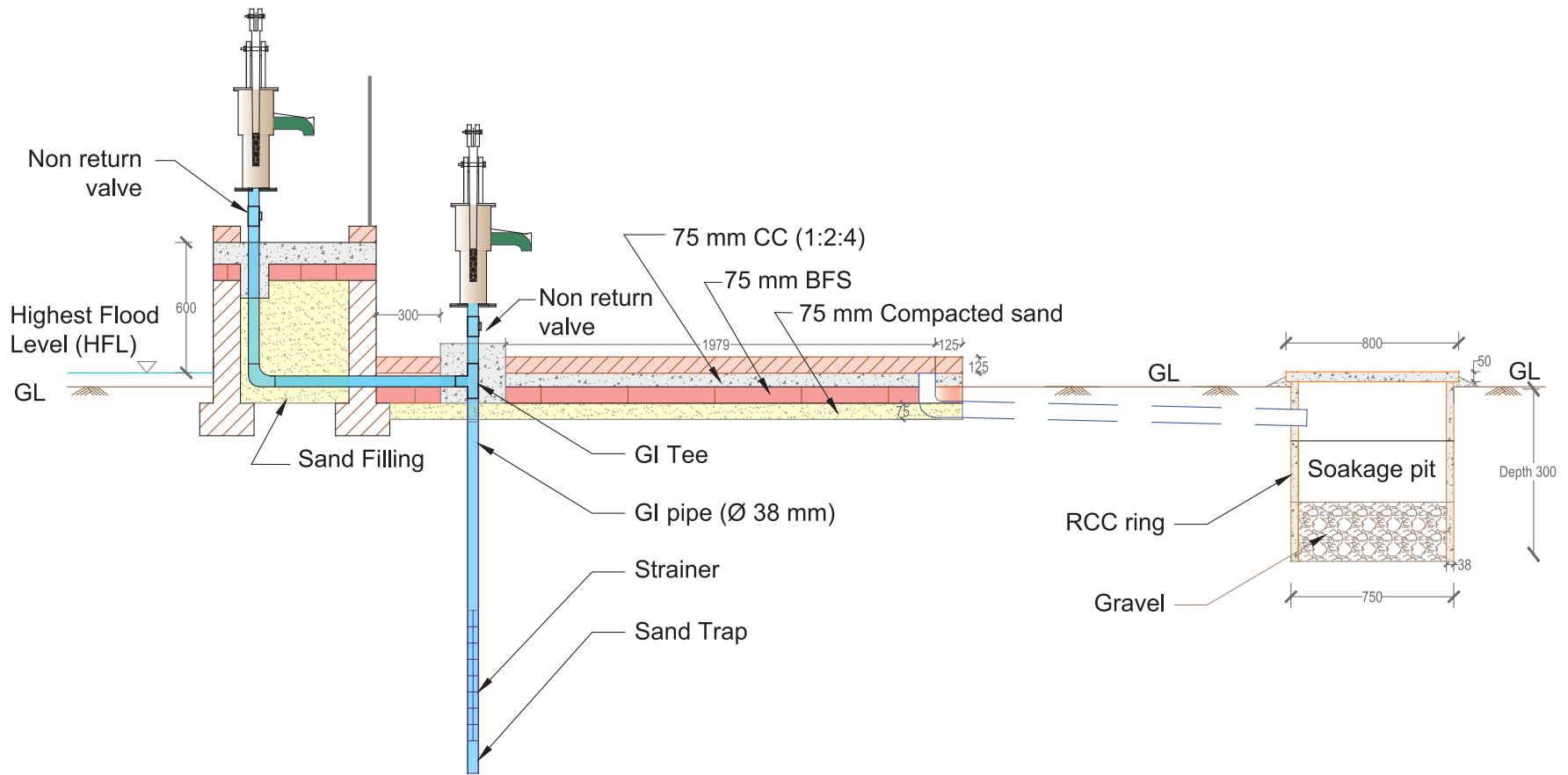
Design Drawings



Plan

Raised Dual Platform No. 6 Hand Pump Tubewell

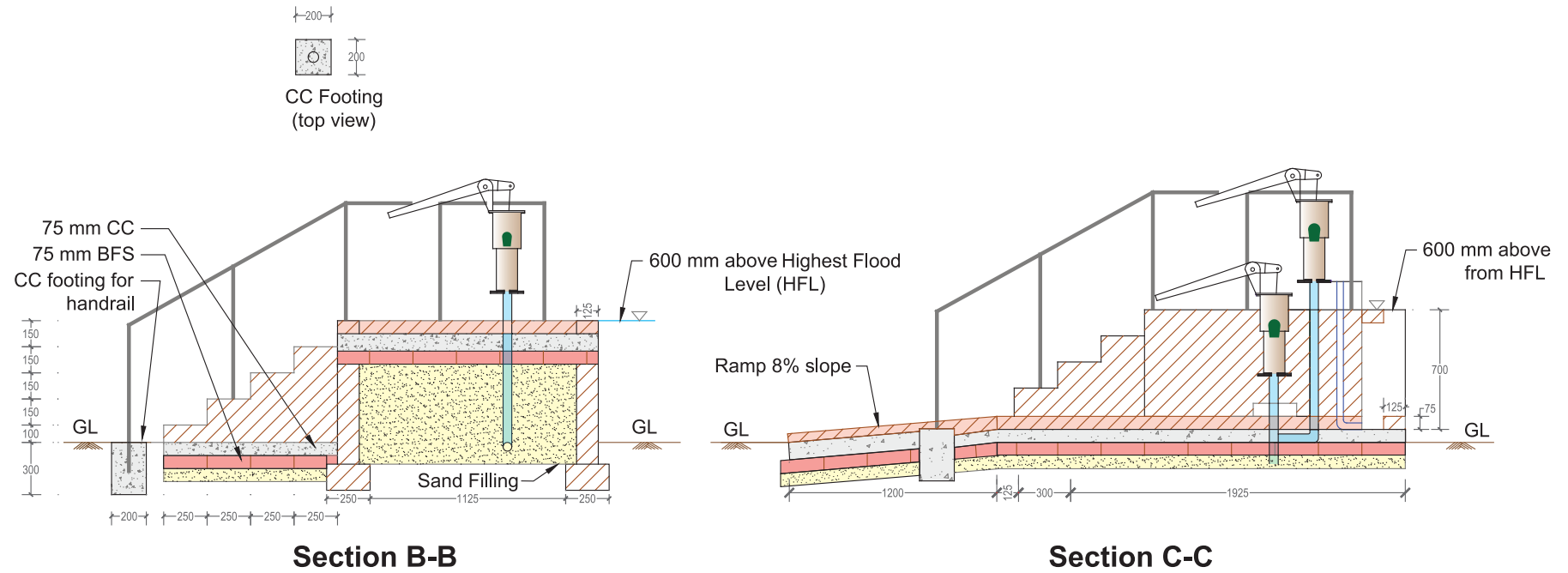
Note: All dimensions are in mm



Section A-A

Raised Dual Platform No. 6 Hand Pump Tubewell

Note: All dimensions are in mm



Raised Dual Platform No. 6 Hand Pump Tubewell

Note: All dimensions are in mm

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Transportation: Transportation of all kind of materials/ equipment to the site for installation of 38mm dia Shallow Tubewell with supplying of casing pipe, boring pipe, construction of derrick and dismantling the same, cleaning the site after completion of work etc. all complete as per direction of the Engineer-in-Charge.	LS	1	2,000	2,000
2	Drilling & Installation: Boring by using 100 mm diameter cutter with 40 mm dia GI pipe (wall thickness 2.9mm, weight 3.517kg/meter, capable to withstand 50kg/cm ² pressure) and other equipment capable of drilling up to required depth by water jet method or any other method approved by the EIC through all sorts of strata, pea gravel interference, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3 m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipes and casing pipes etc. complete, lowering of pipes for installation of all tubewells as per drawing, specification and direction of the EIC. Drilling & Materials including fitting & Fixing:				
i)	0 -1.52 m - 40 mm dia. G.I tube well pipe. conforming to standard BS-1387 & BDS-1031 having wall thickness 3.25 mm, outside diameter 46.5 mm weight 3.83 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	m	1.52	884	1,344
ii)	1.52m - 57.24 mm dia uPVC (Class-D, BS 3535, wall thickness min 2.5mm - max 3.00mm, socket length 125mm) socketed blind Pipe.	m	30	224	7,350
iii)	57.24 m - 60.24 m 38 mm dia uPVC filter (Class-D, BS 3535, wall thickness min 2.5 mm, socket length 125mm, Robo filter length 3.00 meter)	m	3	330	990
iv)	60.24 m - 61.00 m -38 mm dia uPVC sand trap (Class-D, BS 3535, wall thickness min 2.5 mm, socket length 125mm)	m	0.76	245	186
v)	38 mm dia uPVC end cap.	Piece	1	117	117
vi)	solvent cement (100gm Tube)	P/Tube	1	180	180
vii)	38 mm dia uPVC socketed adopter (50mm long)	piece	1	90	90
viii)	Pump Head: Heavy duty # 6 CI pump head marked with EMCRP and painting by one coat anti-corrosive paint and three coats synthetic enamel paint of green colour etc. (without base plate, plunger and rod with minimum weight of 30 ± 0.5kg and use long of handle 900± 10mm)	Set	1	4,540	4,540
ix)	40 mm dia. G.I pipe for connecting in raised platform point conforming to standard BS-1387 & BDS-1031 having wall thickness 3.25 mm, outside diameter 46.5 mm weight 3.83 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	m	1.52	669	1,017
x)	40 mm dia best quality heavy type GI elbow/ bend (90 degree)	Piece	1	175	175
xi)	40 mm dia best quality heavy type GI socket	Piece	3	90	270
xii)	40 mm dia best quality heavy type GI end plug	Piece	1	75	75
xiii)	38 mm dia uPVC Tee	Piece	1	150	150
xiv)	38 mm dia brass non-return valve	Piece	2	1,057	2,114

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	Clay Sealing, Sand Filling and Local/bored Soil Filling				
a)	Supplying and filling coarse sand (F.M-2.2) as shrouding materials. Filling the space between borehole and strainer from bottom of borehole to 03-meter top of strainer etc. all complete drawing and direction of the Engineer in Charge).	m	10	281	2,810
b)	Clay Sealing: Filling up the 6 m annular space from the top of coarse sand with 3-5 mm diameter balls made of bentonite and local clay in a proportion of 1:1 etc. all complete drawing and direction of the Engineer in Charge.	m	10	99	990
c)	Supplying and filling bored soil between the space between borehole and blind pipe from top of shrouding materials to remaining borehole etc. all complete drawing and direction of the Engineer in Charge.	m	41	10	410
4	Wrench: Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 nos nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si = 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge)	Item	1	1,350	1,350
5	Installation and development of the tubewell to get sand, odour and turbidity free drinking water at a satisfactory yield, the tube well have to pump continuously to get the target quality of water etc. all complete as per specifications and direction of the Engineer-in-Charge.	Item	1	1,000	1,000
6	Disinfection: Disinfecting the well by supplying sufficient quantity bleaching powder (33% h), making chlorinated water having 150 ppm available free chlorine and applying to the tubewell, after 24 hours of retention, chlorinated well water to be pumped out until chlorine free clear water is reached etc. all complete as per specifications and direction of the EIC.	Item	1	750	750
7	Collection of water sample and testing: After ensuring proper well development, collection of water samples and sending the samples to the DPHE Zonal Laboratory for testing of Arsenic, Iron, Manganese and Chloride parameters which will be tested at the laboratory. The cost of sampling, carrying to the laboratory and testing by DPHE laboratory has to be done by the contractor etc. all complete as per direction of the Engineer in Charge.	P/Test	4	600	2,400
Platform Construction Work					
8	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	10	24	240
9	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	2.1	193	405

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	2.1	153	321
11	wachieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming Each layer up to finished level as per design supplied by the design office only etc. all complete and accepted by the Engineer-in-charge.	cum	1.25	705	881
12	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	6.85	454	3,110
13	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	7	42	294
14	Cement Concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 27$ MPa, satisfying a specified compressive strength $f'_{c} = 22$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge.	cum	0.7	8,330	5,831
15	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 27$ MPa, satisfying a specified compressive strength $f'_{c} = 22$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality Sylhet sand or coarse sand of equivalent F.M. 2.2 and 20 mm down well graded stone chips conforming to ASTM C-33, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering).				
i)	Individual & combined footing, pile cap, raft/mat, floor slab, ram and foundation beam, lintel up to GF.	cum	0.04	8,346	334
16	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form for:				
i)	Individual & combined footing, floor slab, lintel etc.	sqm	0.6	499	299

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
17	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (ReH)= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.				
i)	Individual & combined footing, floor slab, lintel etc.	kg	4	94	376
18	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	3.15	1,288	4,057
19	Brick works of width one brick or one and a half brick length of first class bricks with cement sand (F.M. 1.2) mortar (1:6) in superstructure including raking out joints, filling the interstices with mortar, cleaning and soaking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	0.32	6,917	2,213
20	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to plinth wall (1:6) with cement up to 150 mm below ground level with neat cement finishing including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity and other charges etc. all complete in all respect as per drawing and accepted by the E/C. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Cement: CEM-II/A-M), Ground floor.	sqm	12.25	311	3,810
21	Manufacturing and supplying 1:2:4 proportion RCC ring and slab of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 40 mm wall thickness, 670 mm inner & 750 mm outer diameter, 300 mm height as per drawing. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	3	600	1,800
22	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 800 mm outer diameter. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production center name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	950	950
23	Supplying and placing of 12 mm and downgraded khoa as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.25	7,000	1,750

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
24	Supplying different inside dia best quality uPVC pressure pipe for drainage line from platform to drain having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating/domed roof grating, bends, sockets etc. including cutting earth laying pipe and filling earth etc. all complete as per direction and approval/ accepted by the Engineer-in-charge. 75 mm dia wall thickness 2.9 mm - 3.5 mm	meter	6	449	2,694
25	Supplying & fitting fixing Geo-Code plate (Marble/ Stone plate size: 300 x150 x12mm). Total depth, installation date, abbreviated project name and ID NO. to be written on the plate engraving. The whole work has to be done as per specification, drawing and direction of the Engineer in Charge	nos	1	1,288	1,288
Total					60,962
Total cost considering disaster context = 60,962 * 1.5 =					91,443

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Water Trucking and Distribution

Context and Description

Emergency Context

Applicable in areas where people are recovering from disasters, affecting prevailing water supply system, where accessible water supplies are cut or contaminated, and in areas where temporary settlements are constructed—such as camps for displaced population.

Technology Description

- > Specialized water containers are put on trucks to store water (improvised trucks for distribution).
- > Stainless steel storage tanks are preferable for a good service life.
- > Distribution of water using jerry cans where water trucks are not available.
- > Distribution of plastic bottles by rickshaw, boats, trucks, etc.
- > About 5000 L of water storage space is available on the purpose-built trucks.
- > For large storage tanks, an access port should be there for manual cleaning, and outlets should be screened for keeping out pests.
- > Accurate requirements must be calculated on the basis of the quantity of water required each day, distance to filling point, and number of trips and trucks required for adequate supply.

Risks/Challenges

- > Temporary tankers may have loose storage tanks which can be easily detached if not tightly fastened.
- > Accessibility in some areas may be an issue, where trucks are replaced by boats or rickshaws/vans which would carry portable water bottles or jerry cans etc.
- > Fuel management and vehicle maintenance needs to be looked into regularly.
- > Costly and inefficient during emergencies.
- > Can generate hefty solid waste from discarded plastic bottles or jerry cans.
- > Narrow or poorly constructed roads may be damaged by the trucks.

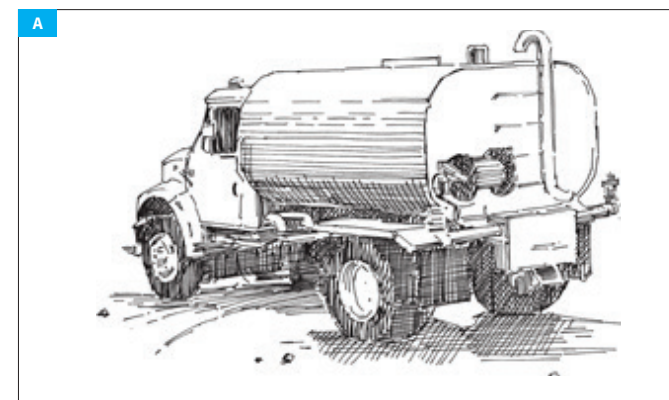


Figure 3: (A) A sketch of a purpose-built water distribution truck (B) A sketch of a purpose-built truck discharging water at a fixed storage tank. (Adapted from WHO-WEDC, 2013)

Operation and Maintenance

- > Vehicle maintenance staff needs to travel with the truck in remote areas.
- > Spare parts need to be carried all the time.

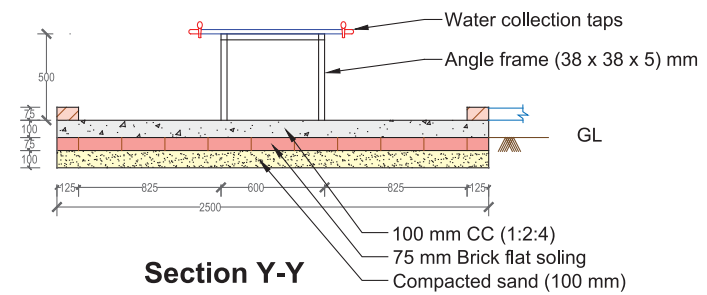
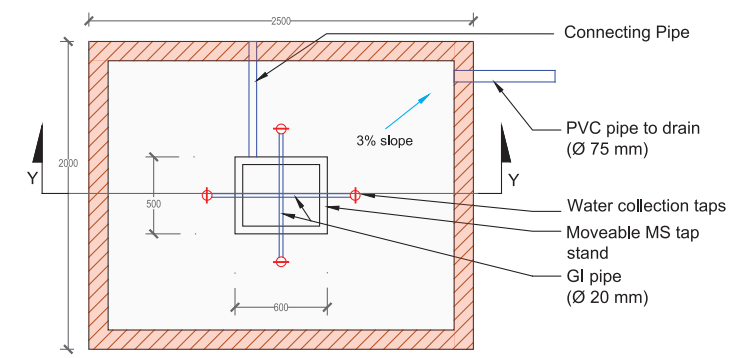
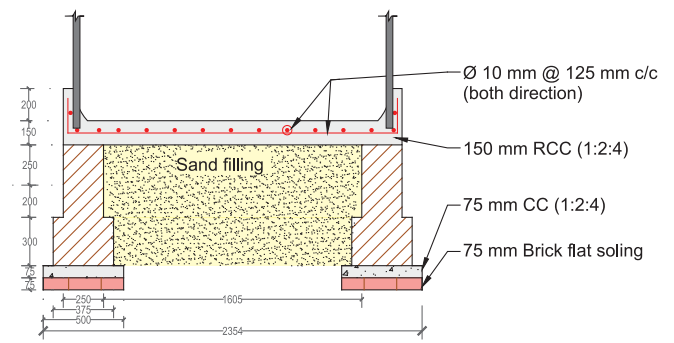
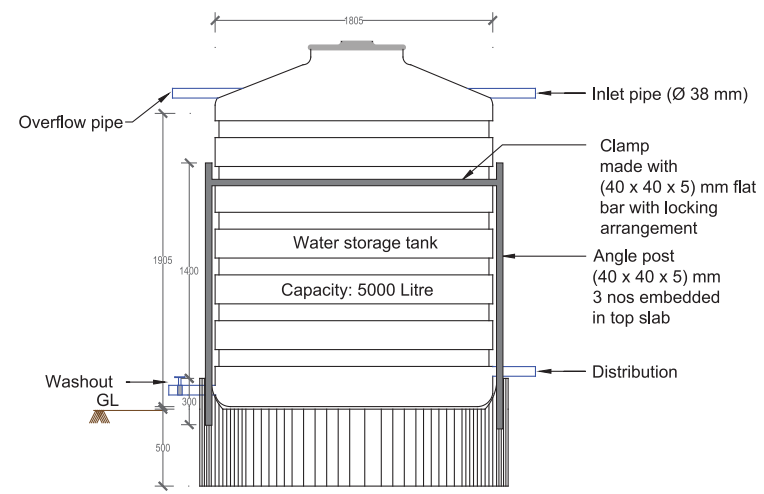
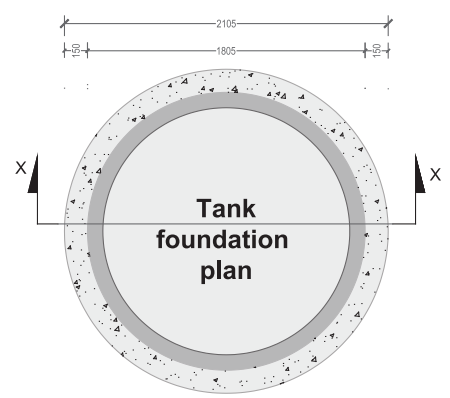
- > Every 3 months the tanker and pump must be cleaned.
- > A tanker record book must be kept which covers basics such as water volume to be delivered, or driver's personal information, and other record-keeping.
- > Chlorine concentrations of 0.2 mg/l to 0.5 mg/l must be kept to ensure pathogen free water.

Suitability

- > In emergencies such as earthquakes, floods or acute water contamination.
- > Areas where water filling and refilling points are nearby to the distribution/delivery zone.
- > Most efficient when a storage tank is present in the delivery point, so after discharge the trucks can swiftly return for refilling.

Note: Adapted from GOB-UNICEF-DPHE Operational Guidelines for WASH (Page: 71); WHO-WEDC Technical Notes on Drinking Water, Sanitation and Hygiene in Emergencies (Section 12).

Design Drawings



Water Trucking and Distribution

Note: All dimensions are in mm

Cost Estimate

Part A: Construction of Platform for Storage Tank

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	15	24	360
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	2.5	193	483
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	2.5	153	383
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	4.95	454	2,247
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	5	42	210
7	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.22	8,330	1,833

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
8	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	1.5	7,292	10,938
9	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 24$ MPa, satisfying a specified compressive strength $f'_{c} = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming to ASTM C-33 including breaking chips and screening, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering), In floor slab.	cum	0.71	8,346	5,976
10	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form, In floor slab.	sqm	3.45	499	1,722
11	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (R_{eH})= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.	kg	165	94	1,5510
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	10	311	3,110
13	Mild steel, Grade 250 with minimum $f_y = 250$ MPa, work in roof frame : supplying and fabrication of mild steel sections as per design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge (measurement to be given for truss member only). Outer frame in two parts over RWR and three parts over three filter should be used 40mm x 4mm x 03mm angles and inner 25mm x 25mm x 03 mm angles as per design, including setting handles made of 25mm x 03mm flat bar for easy handling as per instruction of the Engineer in Charge.	kg	25	153	3,825

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
14	Supply and installation of food-graded plastic internal mini water tank for the use in kitchen, bathroom and toilet for emergency storage and supply of water manufactured from liner low density polyethylene (ILDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables, fittings etc. all complete approved and accepted by the Engineer- in- charge. 5000-liter capacity.	no	1	56,000	56,000
15	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	1	705	705
16	Disinfection of the tank with bleaching powder in water and bailing out water after one day until smell of bleaching powder is gone. All complete as direction of the Engineer-in-charge.	item	1	250	250
17	Water Sample Collection and Test: Collection of water sample and testing for total coliform by DPHE lab as per direction of Engineer-in-charge.	P/test	2	600	1,200
18	Wrench: Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 nos nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si= 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge .	set	1	1,350	1,350
Sub-total of Part A = 104,250					

Part B: Tap Stand platform

1	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.9	193	174
2	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.9	153	138

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	5	454	2,270
4	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	5	42	210
5	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.5	8,330	4,165
6	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	0.75	1,023	767
7	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	7.5	311	2,333
8	Mild steel, Grade 250 with minimum $f_y = 250$ MPa, work in Moveable Tap stand supplying and fabrication of mild steel sections as per drawing and design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge.	kg	12.5	153	1,913
9	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	0.5	705	353
10	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in-charge: 20 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 25.3 mm, weight 1.7 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	meter	1.9	375	713
11	Supplying, fitting and fixing of best quality 12mm dia brass bib cock with sealant etc. complete approved and accepted by the Engineer-in-charge.	each	4	400	1,600

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
12	Supplying, fitting and laying up to depth of invert 75 mm inside dia best quality uPVC pressure soil pipe having specific gravity 1.3 -1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating etc. as drainage pipe. complete approved and accepted by the Engineer (length: 6000 mm each). uPVC soil pipe 75 mm dia wall thickness 2.9 mm,	meter	6	475	3,850
13	Supplying different inside dia best quality CPVC pressure pipe for water supply having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating, bends, sockets etc. approved and accepted by the Engineer-in-charge (length: 6000 mm each). 19 mm dia wall thickness 2.9 mm - 3.4 mm	meter	6	351	3,106
Sub-total of Part B = 7,269					
Total (A+B): 111,519					
Total cost considering disaster context = 111,519 * 1.5 = 167,279					

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Emergency Household Water Treatment

Context and Description

Emergency Context

Applicable as an early recovery strategy during/after an emergency, where visibly clean water (with low turbidity) is available.

Technology Description

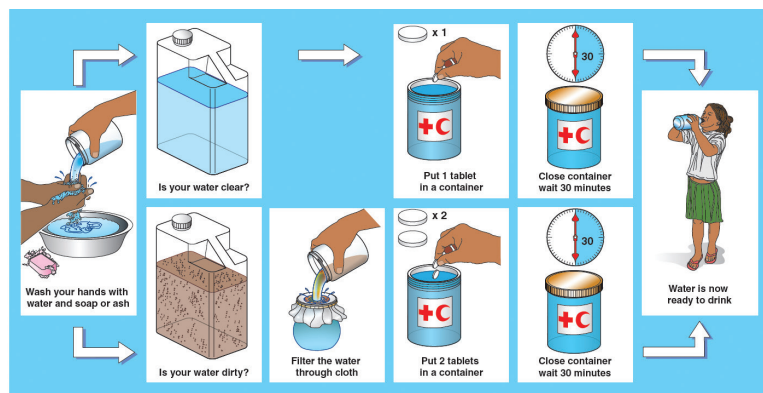


Figure 4: WHO leaflet explaining simple turbidity removal and disinfection (Source: WHO-WEDC, 2013)

1. Simple turbidity removal and disinfection

- > Turbidity removal using alum (or fitkiri). Half teaspoon of fitkiri is mixed with a jar or kolshi of water and shaken for 5 minutes. The particles are left to flocculate and settle in the next 1 hour, after which the top 90% of the water can be considered clean.
- > The water should then be filtered with 100% cotton clothing to remove suspended/flocculated solids.
- > Water disinfection should be performed by boiling. If boiling is not possible then chlorine tablets are used for killing pathogens.

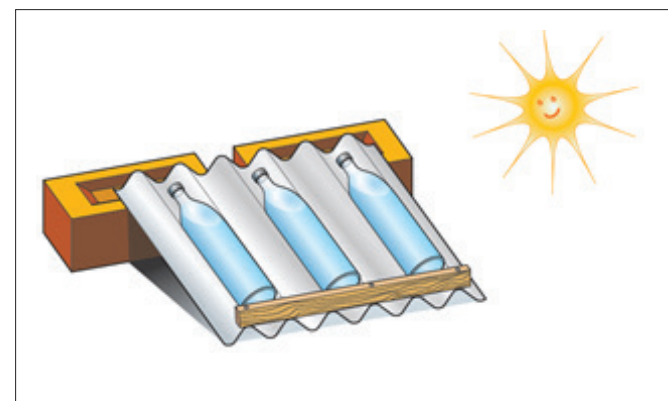


Figure 5: Solar Disinfection (SODIS) by WHO-WEDC (2013)

2. Solar Disinfection (SODIS)

- > Clean plastic bottles can be used to store the water under the sun for long hours.
- > High temperatures and UV rays from the sun debilitates bacteria and germs, thereby disinfecting the water.
- > Since it is not usually practiced in Bangladesh, this method can be taken as a novel system for disinfection. Wherever there is visibly clean water, this method can be applied.

3. Biosand/Roughing Filter

- > Small up-flow/down-flow sand and aggregate filters to remove turbidity and organic matter.
- > The containers can be plastic, fitted with an airtight lid.
- > The filter layers should be thick, and contain fine sand. This can allow some disinfection as some pathogens are killed in the process.
- > Gravel and a thin layer of coarse sand should be ideal choices underneath the sand. Additionally, a PVC or metal perforated plate can be placed to spate the sand and aggregates.

Note: Adapted from GOB-UNICEF-DPHE Operational Guidelines for WASH; and WHO-WEDC Technical Notes on Drinking Water, Sanitation and Hygiene in Emergencies.

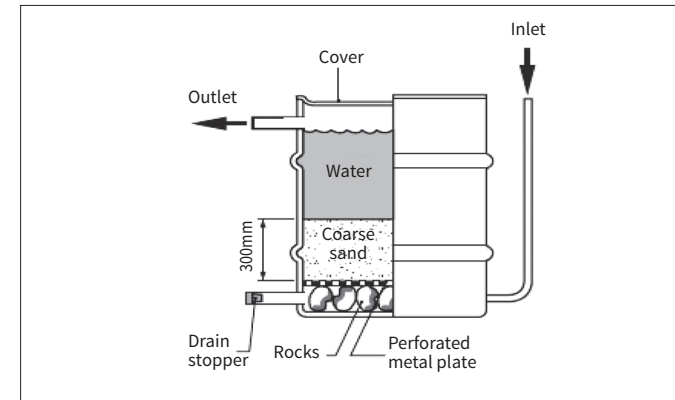


Figure 6: Biosand filter (Source: WHO-WEDC, 2013)

Cost Estimate

1. Disinfection Items

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Fitkiri/Alum (Indian made) Ingredients: Potassium Alum Quantity: 500 g	per packet	1	77	77
2	Aquatabs Ingredients: NaDCC (Sodium Dichloroisocyanurate/Troclosene Sodium) Dosage: 33 mg/tablet Packaging: 10 tablets/strip Raw water quality: Moderately turbid river/pond water. *1 tablet spoon to disinfect 5 liters of water	per strip	1	18	18
3	Pitchers/Kolshi	pcs	2	250	500
4	Piece of clothing (100% cotton)	pcs	2	—	—
Total (Approx.)					600
Total cost considering disaster context = 600 * 1.5 =					900

2. Solar Disinfection (Sodis)

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Clean and transparent plastic bottles Size: 500 ml to 5 L	—	Variable	—	—

3. Biosand Filter with Chulli Disinfection

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	30 Ltr Plastic Bucket	pcs	1	—	—
2	Coarse Sand	kg	15	—	—
3	Brick Chips (aggregate)	kg	5	—	—
4	Aluminum Coil (10" dia, 4 turns)	pcs	1	—	—
5	Popy pipe (Fire-proof)	meter	3	—	—
6	Pitchers/Kolshi	Pcs	1	250	—
Total (Approx.)					1,200
Total cost considering disaster context = 1,200 * 1.5 =					1,800

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on item availability, bulk purchase and site conditions, the quantities and rates of certain items could vary. The quoted rates have been taken primarily from PWD Schedule of rates (2018), Aquatabs distributor, and other sources.

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Ultrafiltration System

Context and Description

Emergency Context

Applicable in areas with groundwater/surface water pollution, arsenic/iron contamination; or in areas with frequent droughts and freshwater scarcity.

Major Components

Manual Pump with handle

- > Mesh Filter (0.05 mm)
- > Inlet Hose
- > Feed Pump
- > Equalizer
- > Ultrafiltration (UF) membrane
- > Valve
- > Disinfectant dispenser
- > Pump Handle
- > Activated Cartridge (optional)
- > Pressure Vessel (back wash buffer)
- > Backwash pressure indicator (manometer)
- > Water Meter
- > Drain Hose
- > Tap

Automated Pump

- > Control panel
- > Malfunction indication LED
- > Main button
- > Manometer indicating Back-Wash pressure
- > Electra Box
- > Back Wash Pressure Barrel
- > Chlorine dispenser
- > Adjustable Pressure Relief Valve
- > Back-Wash Pump
- > Pressure Relief Valve (Back-Wash pressure)
- > Drain Valve Back-Wash Barrel
- > One-way Valve
- > Electrical Socket Mains Current
- > Electrical Socket for Feed Pump
- > Main ON/OFF Switch



Figure 7: Manual ultrafiltration in operation (Source: www.villagepump.org)



Figure 8: Automated ultrafiltration in operation (Source: www.villagepump.org)

Technology Description

- > The ultrafiltration system is a commercial unit that produces 500 L/hr of potable water from low to average polluted source water. The raw intake water turbidity should have a maximum of 100 NTU and the turbidity of treated water is said to be 5 NTU or less.
- > The units can be operated for any type of surface water sources—ponds, lakes, streams, or from storage tanks and rainwater harvesting systems. The outlet tap can be connected to other storage units.
- > The source static water level should be 3 meters (vertical distance between the ultrafiltration unit and water level). A $\frac{3}{4}$ " hose of up to 10 meters is connected from the water body to the inlet of the unit for water collection.
- > Fit the Inlet hose to the mesh filter using a hose clamp and connect it firmly. Check carefully if the mesh filter is really connected well. Attach the floater to the mesh filter with a tie wrap for floating in the water.

- There are two types of systems-one is manually operated and the other is automated. Both versions of the systems use a 0.05 mm mesh filter, followed by the Ultra Filtration (UF) membrane filtration technology. The system removes bacteria, viruses, protozoa and cysts. Additionally, an activated carbon cartridge can be added for further disinfection.
- The automated variant contains a submersible pump (two types available). The power requirement varies from 500 W to 750W, and the unit can be attached to solar cells.

Risks/Challenges

The unit should be in use regularly, and special treatment may be required if it is non-operational for a long period.

Suitability

Suitable for disaster struck areas, smaller communities, refugee camps, areas requiring water kiosks, or anywhere with acute water contamination. It is particularly suitable in remote rural areas, which are off-grid and in need of filtered water.

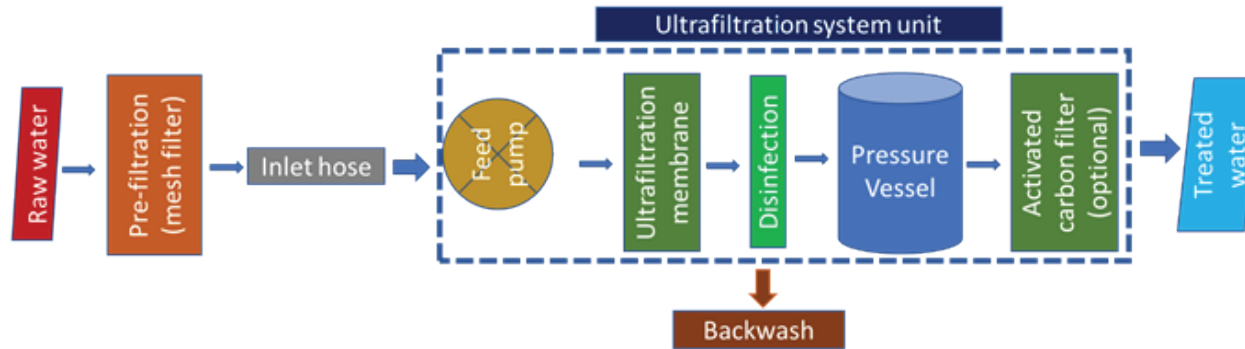
Operation and Maintenance

- A flat platform needs to be created to place the baseplate of the unit. The platform should be made of concrete, wood or metal. Minimum size 2 ft by 4 ft.
- Easy “plug & play” installation, where it only takes 20 minutes to start operation. Required tools for installation (the tools are included in standard delivery): open-end wrenches (10/11, 12/13, 16/17); screwdriver flat 4 - 6 mm; Allen keys 3, 4 and 6 mm.
- The UF membrane has been filled with Glycol. So do not drink the first 100-liter water. Install the AC cartridge only after the UF unit has been used already for at least 2 back wash cycles to be sure the preservative liquid (Glycol) has been removed from the UF membrane. The Activated Carbon cartridge performs well, when it is used on a daily basis, otherwise bacterial growth can happen in the cartridge.
- Automatic high-pressure backwash system for long-term functionality without changing filtration membranes.
- Periodical cleaning –

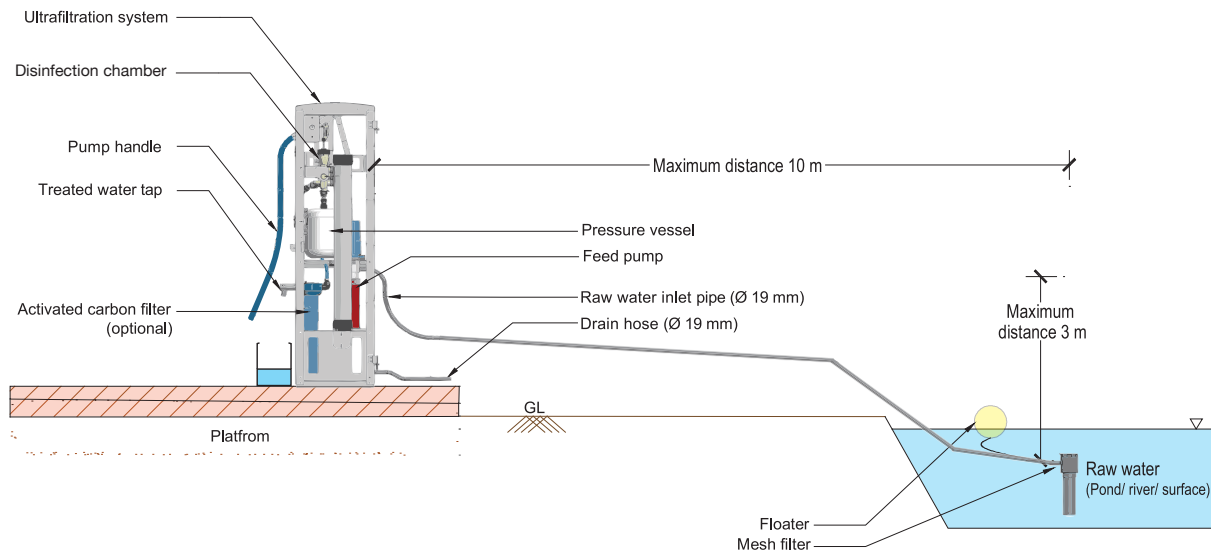
- *Once every 4 weeks:* cleaning mesh filter and flushing UF membrane by chlorine disinfection.
 - *Once every 3 months:* replacing AC filter; disinfection of pressure vessel with chlorine tablets; cleaning flow or gauge.
 - Chlorine disinfection/chemical cleaning of UF membrane, flushing valve, greasing seal and feed pump should be done when required.
 - Water analysis should be undertaken periodically.
 - *Additional cleaning for the electric unit:* cleaning mesh filter of the feed pump every day; conducting water analysis every 6 months.
- The O&M manual should be present at all times for important details and cleaning procedure.

Note: All information and descriptions were taken from Villagepump™ website and technical manuals for the commercial units. Further information regarding the units can be found here: www.villagepump.org.

Design Drawings

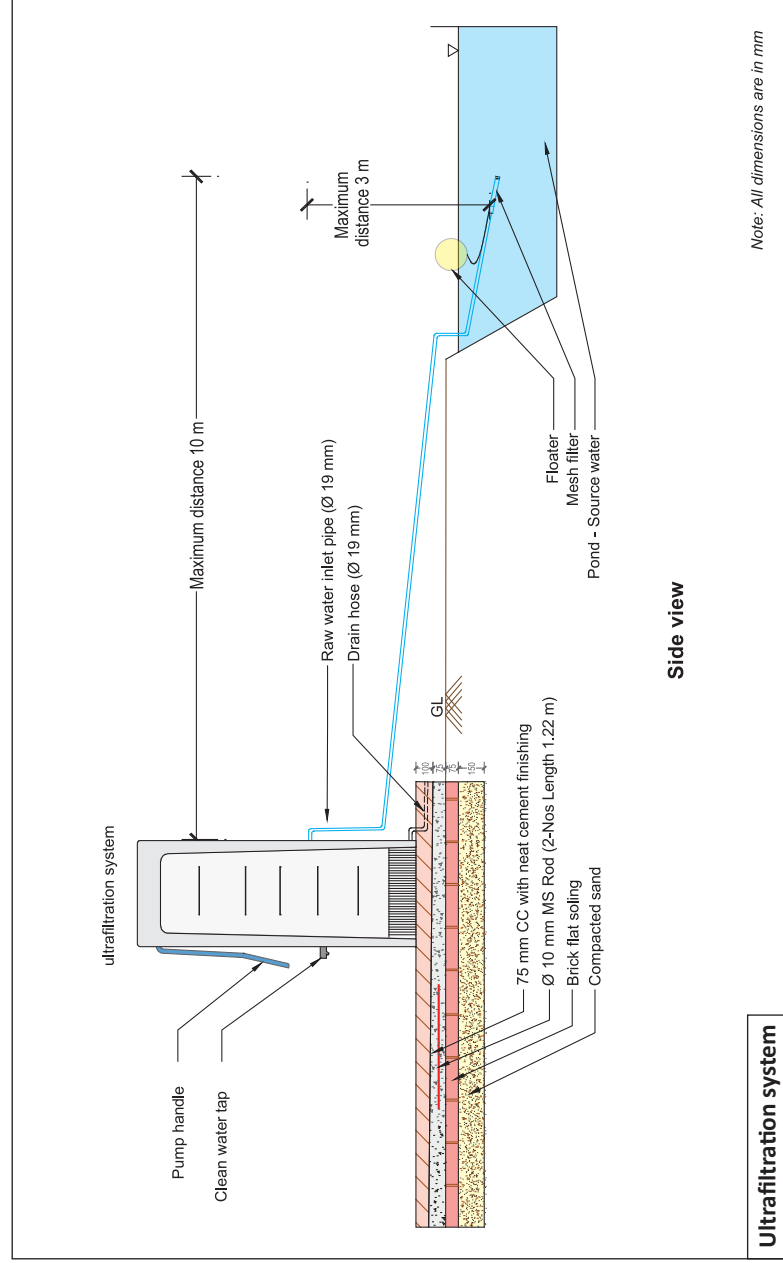
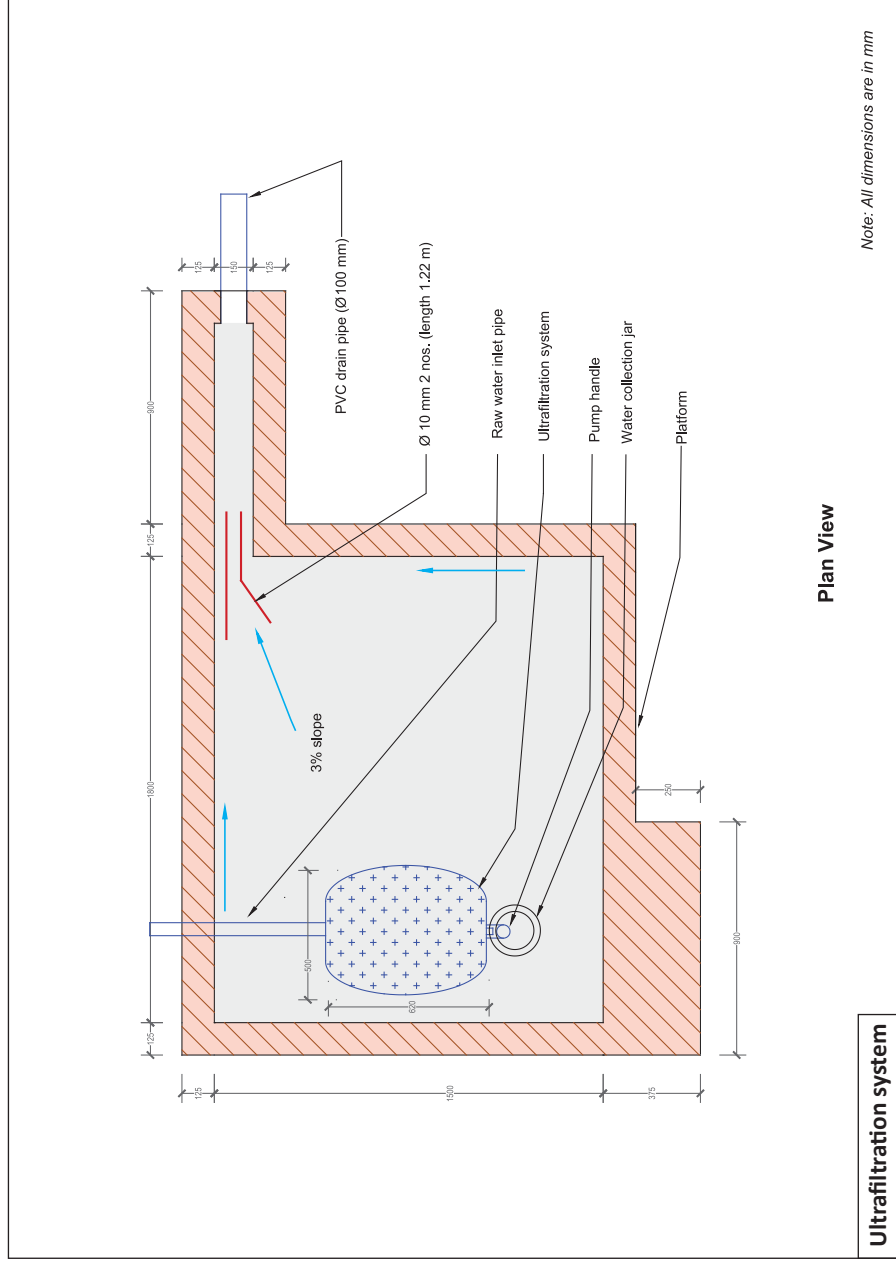


Ultrafiltration System



Schematic Diagram

Note: All dimensions are in mm



Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Ultrafiltration standard unit with 20" Activated Carbon Cartridge housing	Pcs	1	470,000	470,000
2	Spare parts (optional, but recommended): Chlorine Dioxide tablets 1g, 120 pieces; Activated Carbon Cartridge 2,5"x 20"; Set of spare parts for Valve (3 plastics covers, 2 one-way valves; Seal Suction Pump; Complete tool set (special tool, Allen keys, wrenches; UF Membrane Filter; Pressure Vessel; Shock absorber (with bearings); Inox Mesh Filter; Complete valve	Pcs	1	130,000	130,000
3	Transportation: Transportation of all kind of materials/ equipment to the site for installation of 75mm x 38mm dia Tubewell with supplying of casing pipe, boring pipe, construction of derrick and dismantling the same, cleaning the site after completion of work etc. all complete as per direction of the Engineer-in-Charge.	LS	1	4,000	4,000
4	Platform Construction: Construction of C.C (1:2:4) platform size 2050mm x 1750 mm x 75 mm with 900 mm long drain over 150 mm thick sand cushioning, brick flat soling and laying polythene under cement concrete before casting concrete as per drawing including well block by making 200mm x 200 mm x 300mm block as per drawing and 12 mm thick plaster (1:4) with neat cement finishing of the concrete surface etc. all complete as per specification, drawing and direction of the Engineer in Charge.	LS	1	8,500	8,500
5	Supplying different inside dia best quality uPVC pressure pipe for drainage line from platform to drain having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating/domed roof grating, bends, sockets etc. including cutting earth laying pipe and filling earth etc. all complete as per direction and approval/ accepted by the Engineer-in-charge. 75 mm dia wall thickness 2.9 mm - 3.5 mm	meter	6	449	2,694
				Total	615,194
				Total cost considering disaster context = 615,194 * 1.5 =	922,791

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from PWD Schedule of rates (2018) and Villagepump pricelist distributor (2021) from www.villagepump.org.

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Solar Desalination cum Rainwater Harvesting System

Context and Description

Emergency Context

Applicable in coastal areas prone to cyclone/storm surge. Also applicable in drought-prone areas.

Major Components

- > Existing suitable raw water source (surface/groundwater)
- > Solar-powered pump
- > Raw water reservoir
- > Solar desalination system
- > Clear water reservoir fitted with
- > UV disinfection system

Technology Description

- > Saline water, either from the existing groundwater or surface water source, is pumped to the raw water storage tank located on the roof of a house/school using a solar-powered pump.
- > From the raw water storage tank, water flows to the solar desalination system, which is commercially available in the market. Each desalination unit has a surface area of about 3 m² (1,110 mm X 2,880 mm) and weighs about 20 kg. Depending on water requirement, multiple units could be installed. On a sunny day, each unit of the desalination system could produce about 1.5 to 1.6 L of water per hour.
- > Treated water from the desalination system flows to the clear water reservoir by gravity; the reservoir is fitted with a UV disinfection system.
- > Each desalination unit has a surface area of about 3 m², which is used as a catchment for harvesting of rainwater.
- > The harvested rainwater is also stored in the storage reservoir (fitted with UV disinfection system) for use.



Figure 9: (A) Solar desalination units of a school in Mongla Upazila; (B) A school student drinking desalinated freshwater (ITN-BUET, 2015).

Suitability

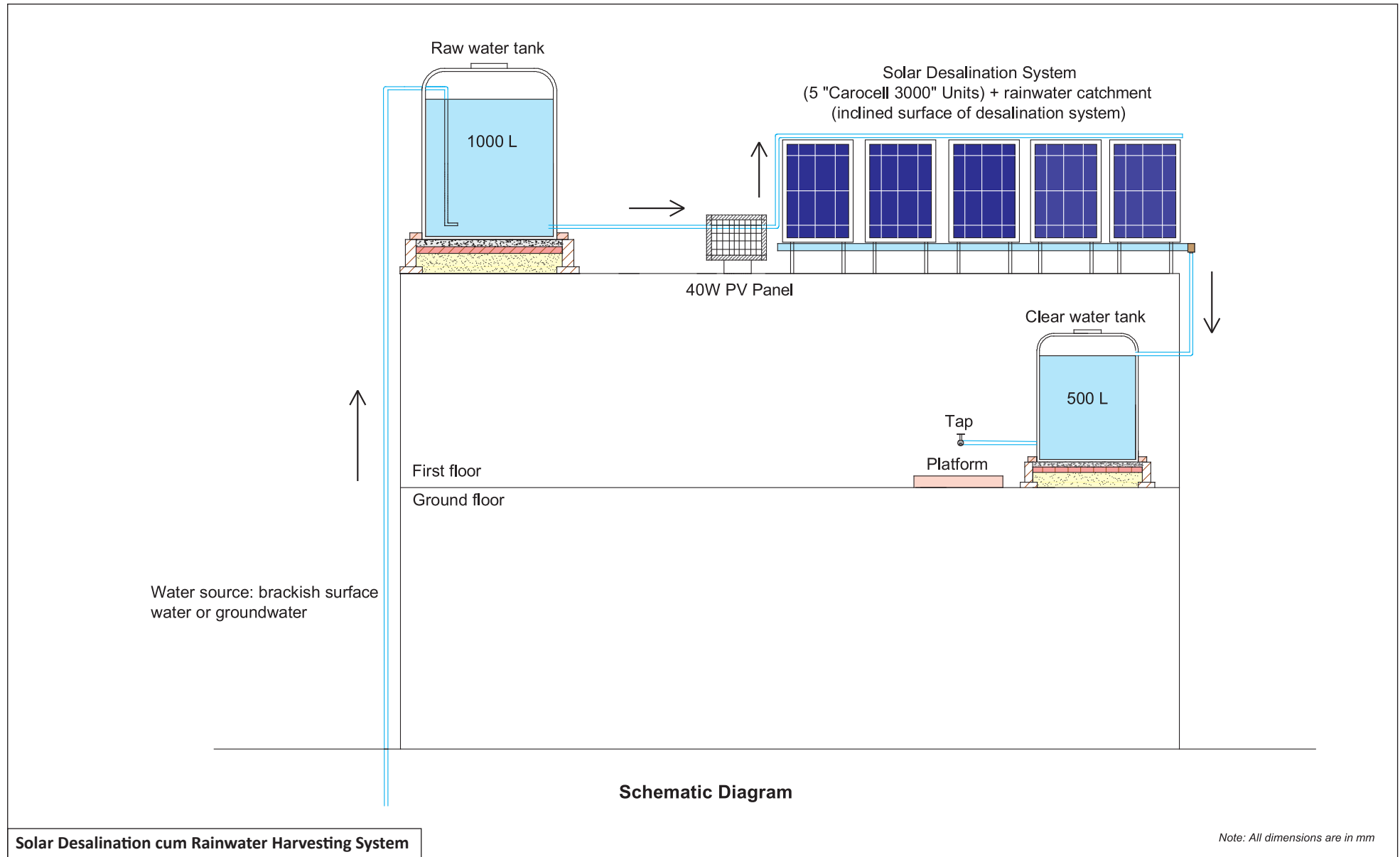
This technology is particularly suitable for salinity-affected coastal areas of Bangladesh. It has also been successfully implemented at household levels in coastal areas. This is also applicable in drought-prone areas.

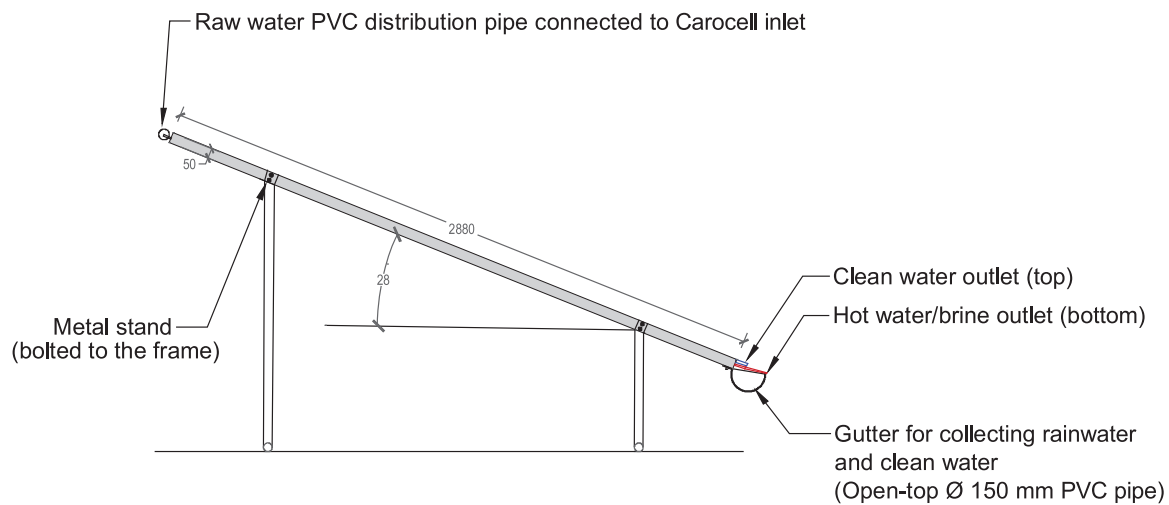
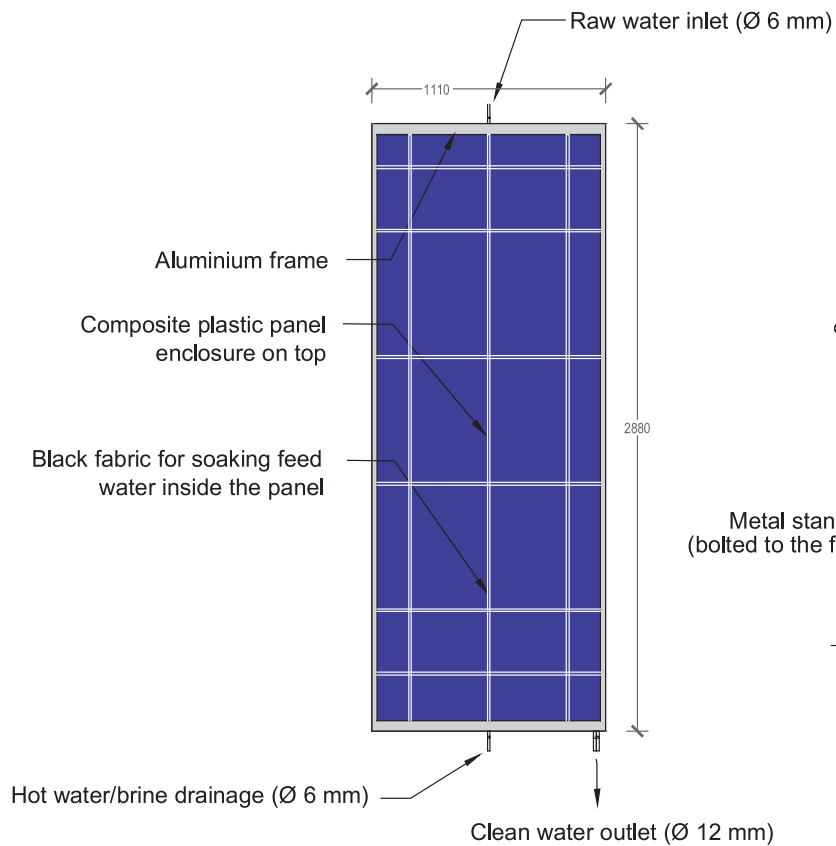
Operation and Maintenance

- > Cleaning of top surface of the solar desalination units at regular interval (the frequency will be site-specific as catchments in some sites would require more frequent cleaning than others due to presence of more particulate matter in air)
- > Regular cleaning of conveyance system (e.g., gutters, downpipes, etc.)
- > Regular cleaning of raw water and storage tanks
- > Regular checking of the UV disinfection system

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 107-108) and GoB-UNICEF-DPHE Operational Guidelines for WASH (Pg.- 7).

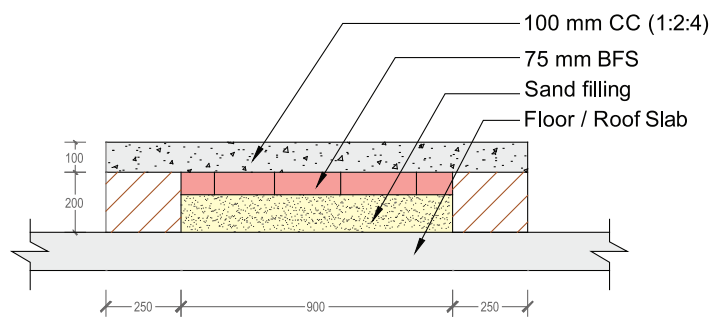
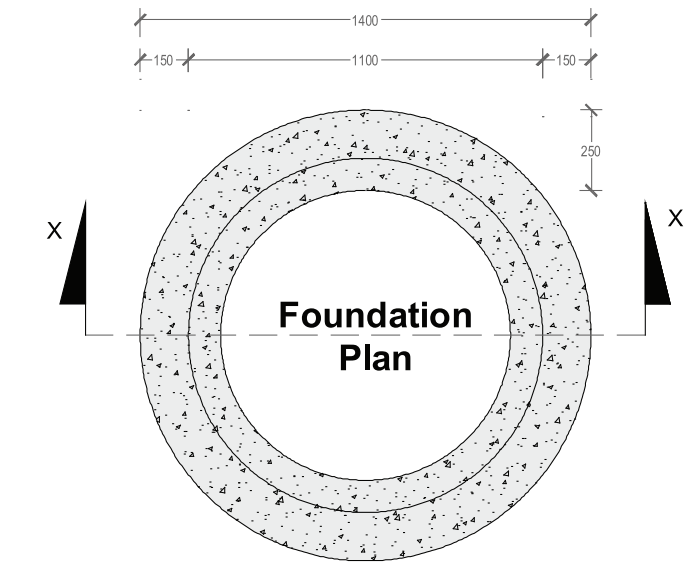
Design Drawings



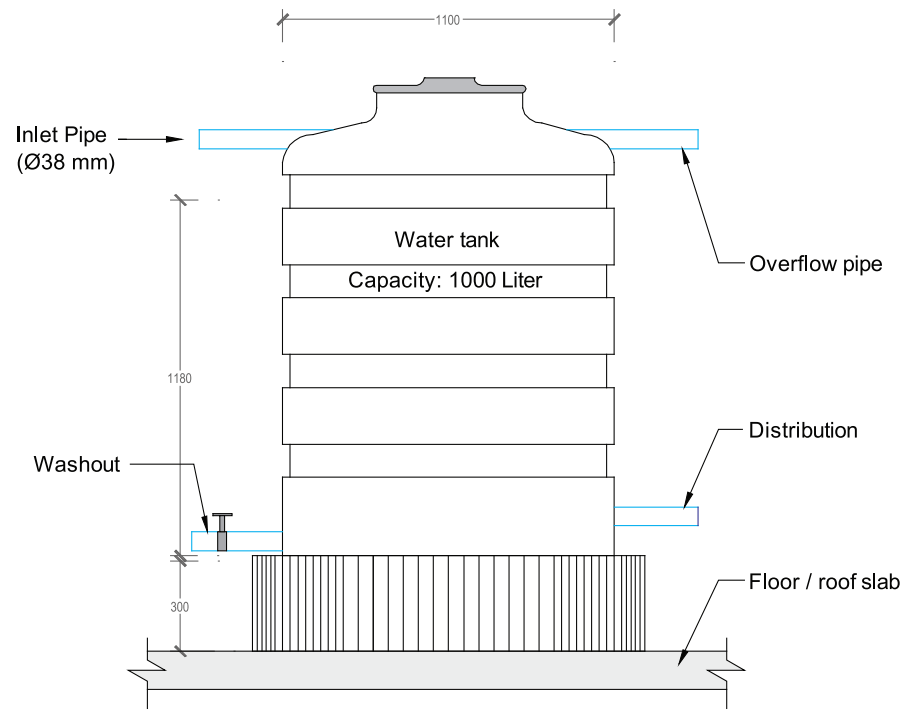


Side view

Solar Desalination System Unit

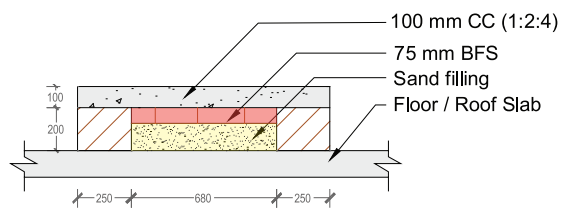
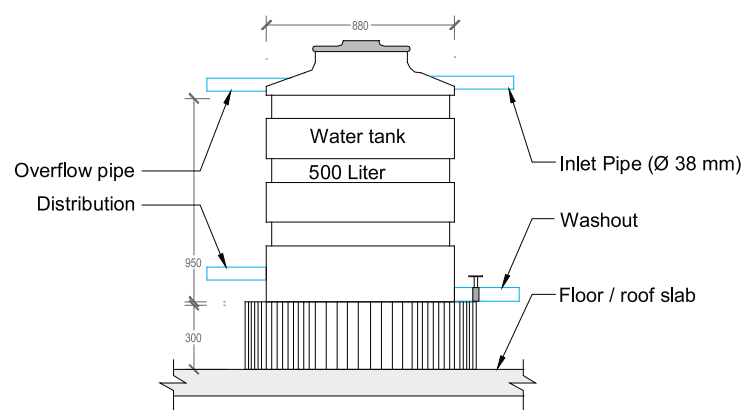
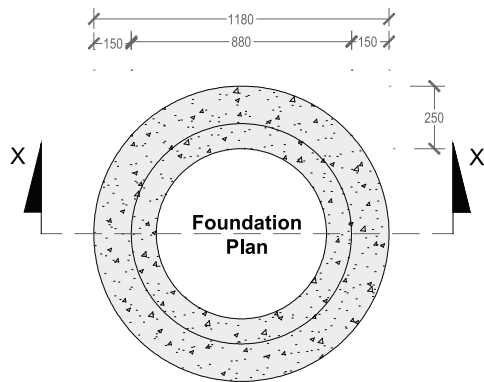


Foundation: Section X-X

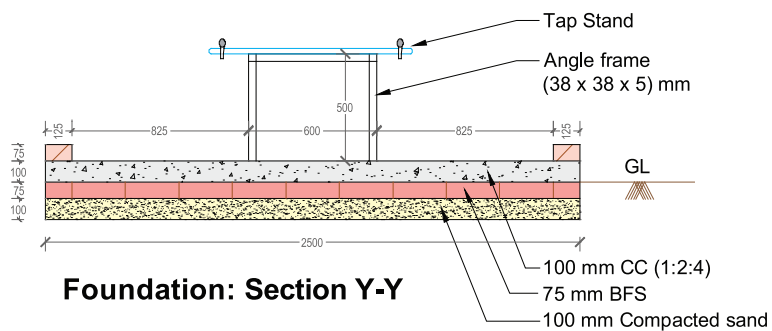


Elevation

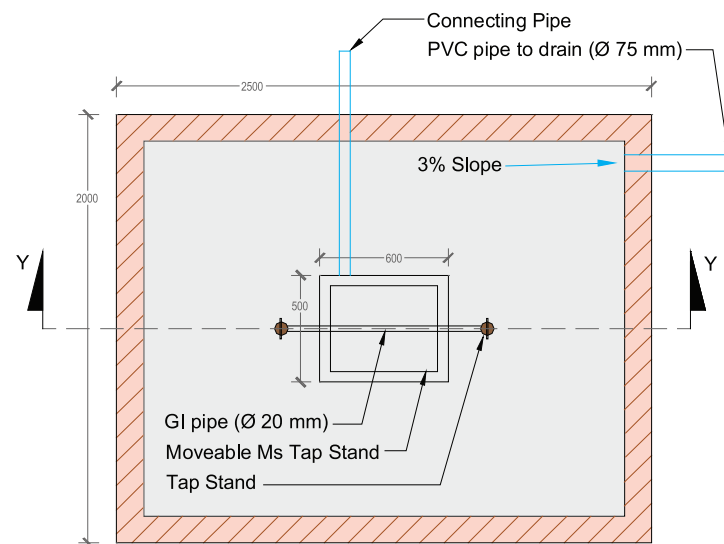
Raw Water Reservoir



Foundation: Section X-X



Foundation: Section Y-Y



Plan of Platform

Clean Water Reservoir and Platform for Distribution

Cost Estimate

Part A: Solar structure & Raw water tank

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Supply and install module mounting structure according to the detailed drawing provided and approved by the Engineer. Fixed Panel Structure mounting on pole with 23 degree south facing. Rate should include Aluminum anodized /HD galvanized angle structure of 38mm x 38mm x 3mm and the pole is 75mm dia GI two supports, plates & screw, bracing and angles for dividers etc to complete the structure. Rate shall include excavation, concentrating and fixing of structure. all complete as per direction of the engineer in charge.	set	1	40,000	40,000
2	Supply, installation of 100Wp of solar module/panel for LED light and UV system with necessary electrical cables to the DB's as well as controller to have a complete operational circuit, conduits, cable trays, earthing system and complete main junction box according to the drawing and engineer instruction and approval. all complete as per direction of the engineer in charge. solar panel would be from the same brand as pump, motor and controller. Warranty: 5 Years warranty for complete system	Item	1	7,000	7,000
3	Supply and installation of food-graded plastic internal mini water tank for raw water storage and supply of water manufactured from liner low density polyethylene (ILDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables, fittings etc. all complete approved and accepted by the Engineer- in- charge. 1000 Liter capacity	no	1	12,000	12,000
4	Brick works with first class bricks with cement sand (F.M. 1:2) mortar (1:4) in exterior walls for tank platform including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	0.18	7,293	1,313
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	0.64	454	288
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	1	42	42
7	Mass concrete (1:2:4) in foundation or in floor of platform with cement, sand (F.M. 1:2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.16	8,330	1,333
8	Minimum 12 mm thick cement sand (F.M. 1:2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	7.5	311	2,333

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	0.15	705	106
10	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in-charge. 20 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 25.3 mm, weight 1.7 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	m	6	375	2,250
11	Supplying different inside dia best quality CPVC pressure pipe for water supply having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating, bends, sockets etc. approved and accepted by the Engineer-in-charge (length: 6000 mm each). 19 mm dia wall thickness 2.9 mm - 3.4 mm	m	6	449	2,694
Sub-total of Part A					69,359

Part B: Solar desalination unit

1	Supply, assemble and installation of Solar Distillation Panel "Average Distillation Processing Capacity: 73 L/day (seasonal variation 57 to 145 L/day), Average Rain Water Harvesting Capacity: 52 L/day (seasonal variation 2.5 to 125 L/day), Combined Average Distillation & Rain Harvest: 125 L/day Base Requirements (see schematics below), Feed Water Requirement 480 L/day or 148 L/day with continuous waste recycling.	Nos	5	34,560	172,800
2	Supply, assemble and installation of Panel Racking System (Purlin's, Legs & Mounting Brackets) End Clamp 42mm (Length 40mm), Qty-20 Nos HOBSON Square M20x50x6 Galvanized Steel, Qty- 05 Nos BOLT & NUT HEX HD CL4.6 Galvanized Steel 8X25MM, Qty-20 Nos WASHER RND COMM Galvanized Steel 5/16 (8MM), Qty- 20 Nos Purlin Special Galvanized Steel 28 Degree @3040mm long (No Holes), Qty-02 Nos Purlin Special 28 Galvanized Steel Degree Gutter Configuration @3040mm long (No Holes), Qty- 02 Nos 12g CL3 Hex SDS, Qty- 12 Nos 40mm ID XLITE HOT DIP Galvanized Steel Round Tube (Length 6.5 meter), Qty- 03 Nos 10g CL3 Hex SDS, Qty- 08 Nos Purlin Trough Galvanized Steel End Cap - Gutter Configuration, Qty- 01 Nos.	set	1	48,691	48,691
3	Supply, assemble and installation of Distilled & Waste Water Outlet Ancillary Plumping Low Density Poly Tube 13mm x Meters, Qty- 13m Enki Micro Tee -13mmx13mmx13mm, Qty- 10 Nos Enki Micro Ratchet Clip Suits Ldpe 13mm, Qty- 26 Nos Enki Micro End Plug -13mm, Qty- 02 Nos Enki Micro Elbow -13mm, Qty- 02 Nos 13mm L.D Poly Pipe x Meters, Qty- 08m Enki Micro Ratchet Clip Suits Ldpe 13mm, Qty- 20 Nos.	set	1	18,917	18,917
4	Supply, assemble and installation of Feed Water & Pump Ancillary Plumping 4MM TUBE, Qty-08m VARIFLOW VALVE 4mm, Qty- 01 Nos 10MM NYLON TUBE BLACK, Qty- 08m 10MM PUSH FIT TEES 10,8,10; Qty-05 Nos 5/16 - 3/16 TUBE TO STEM, Qty- 06 Nos 10MM-8MM REDUCER, Qty- 01 Nos 10MM PUSH FIT ELBOW, Qty- 02 Nos 10MM PUSH FIT PLUG, Qty- 01 Nos.	set	1	19,017	19,017

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
5	Supply, assemble and installation of Pump Filter Fittings (Not actual Pump) 3/4 to 1/2 Reducing bush, Qty- 02 Nos Pressure Reducing Valve White Spring 20mm, Qty- 01 Nos 10mm push fit to 1/2 bspm, Qty- 02 Nos 10MM PUSH FIT ELBOW - 3/8, Qty- 01 Nos POLY THREADED NIPPLE 15MMX10MM, Qty-01 Nos ENKI MICRO ELBOW - 13MMX15MM Female, Qty- 01 Nos COBRA CLIP C 15/8 SUITS LDPE/HDL640, Qty-04 Nos PLASTIC SCREEN FILTER 120 MESH 20MM, Qty- 01 Nos 3/4 M GREEN BACK VALVE 20MM -13MM, Qty- 02 Nos.	set	1	33,167	33,167
6	Supply, assemble and installation of Pump & Solar Panel TEFLON TAPE WHITE, Qty-01 Roll DP-130B, 12VDC. 1.7 L/MIN 3A, Qty- 01 Nos 4-meter WIRE AND CONNECTOR, Qty-04 Nos and 04 m MC4 Solar Cable Connectors, Qty- 03 Nos 40 Watt Solar Panel, Qty- 01 Nos M5 Captive Nut -Fixing PV Panel to Rail, Qty- 04 Nos M5 x25 Gal Bolt Fixing PV Panel to Rail, Qty- 04 Nos Galvanized Angle 40-40-2.5-C350-6000, Qty- 02 Nos.	set	1	33,167	33,167
7	Supply, assemble and installation of Rain Harvesting Collection System Posh P&W-40mm C/P (C/P Plug + C/P Post), Qty- 01 Nos Poly Threaded Elbow F&F 4655 90d X 40mm, Qty- 01 Nos Poly Threaded Nipple 40mm X 20mm, Qty-01 Nos PLASTIC SCREEN FILTER 120 MESH 20MM, Qty- 01 Nos Enki Micro Director -19mm X 20mm, Qty-01 Nos Micro 13mm Q/Act Shut Off Valve (Vqa12), Qty- 01 Nos 20mm Female /13mm Barb, Qty- 01 Nos Low Density Poly Tube 13mm x Meters, Qty- 01 m Purlin Through Galvanized Steel End Cap - Gutter Configuration, Qty- 01 Nos.	set	1	28,442	28,442
8	Supply and installation of food-graded plastic internal mini water tank for the use in kitchen, bathroom and toilet for emergency storage and supply of water manufactured from liner low density polyethylene (LDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables, fittings etc. all complete approved and accepted by the Engineer- in- charge. DPHE Storage Tanks 500 liters UV Stabilised Tank with Outlet Tap Fittings (Food Grade Inner Layer, Double layer -resistant to 70 degree)	each	1	11,187	11,187
9	Drinking Water Quality Test water samples in a recognized public laboratory for Arsenic, Iron, TDS, fecal coliform and Chloride including collection, transportation and submission of water sample as per direction of the Engineer-in-charge. (Including VAT & IT)	LS	1	5,000	5,000
10	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.9	193	174
11	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.9	153	138

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
12	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	5.5	454	2,437
13	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	5	42	210
14	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.61	8,330	5,081
15	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	0.75	1,023	767
16	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	10	311	3,110
17	Mild steel, Grade 250 with minimum fy = 250 MPa, work in Moveable Tap stand supplying and fabrication of mild steel sections as per drawing and design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge.	kg	12.5	138	1,725
18	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	0.5	705	353
19	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in-charge. 20 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 25.3 mm, weight 1.7 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	meter	2	375	750
20	Supplying, fitting and fixing of best quality 12mm dia brass bib cock with sealant etc. complete approved and accepted by the Engineer-in-charge.	each	2	400	800

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
21	Supplying, fitting and laying up to depth of invert 75 mm inside dia best quality uPVC pressure soil/ waste pipe having specific gravity 1.3 -1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/ IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating etc. as drainage pipe. complete approved and accepted by the Engineer (length: 6000 mm each). uPVC soil pipe 75 mm dia wall thickness 2.9 mm.	meter	6	449	2,694
22	Completion Report containing all site-specific information containing graphical geographical and other interpretation.	set	1	999	999
Sub-total of Part B					389,684
Total (A+B)					459,043
Total cost considering disaster context = 459,043 * 1.5 =					688,565

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

SANITATION TECHNOLOGIES

Temporary Latrine

Context and Description

Context

This technology is applicable in the areas affected by floods and water logging or in areas with high water table.

Major Components

- > Latrine pan with water seal (U-trap) or Sato pan
- > A pit constructed with 3-5 rings
- > Vent pipe (preferred)
- > A suitable superstructure

Technology Description

- > After each use, the latrine is manually flushed with 2-5 L of water. In the pit, the liquid infiltrates into the soil, while the solids accumulate in the pit and undergo decomposition.
- > When the pit becomes full (up to the design level), it needs to be desludged.
- > The water seal of the pan (or trap door of Sato pan) maintains a barrier between user and pit contents and help eliminate insect and odor problem.
- > The vent pipe removes obnoxious gas from the pit.
- > Mechanical desludging would greatly facilitate continued operation of the latrine; the fecal sludge emptied from the pit should be carried to a treatment plant (where available) or safely buried in a shallow pit.
- > The elevated pit/toilet facilitates continued use of the toilet even during a flood event.
- > The pit is usually lined with concrete rings, especially in unstable soil or water-logged areas. Plastic rings or sheets, bricks, soil blocks, bamboo sticks or mats, or old drums could also be used in the absence of concrete rings, which strengthens it against collapse.

Suitability

This technology is suitable in all areas where sudden flooding/ waterlogging due to cyclone or during wet season interferes with toilet use, and there is a risk of groundwater pollution due to liquid infiltration. The distance from the pit to water wells and surface water should be at least 10 m to decrease the risk of water pollution and the bottom of the pit should be at least 2 m above the groundwater table. The design is suitable for one or two families.

Desludging

Desludging should be avoided during flood or water logging condition and should be carried out during normal condition. Pit could be desludged mechanically. If sludge pumps are not available, manual desludging could be carried out ensuring adequate safety measures.

Risks/Challenges

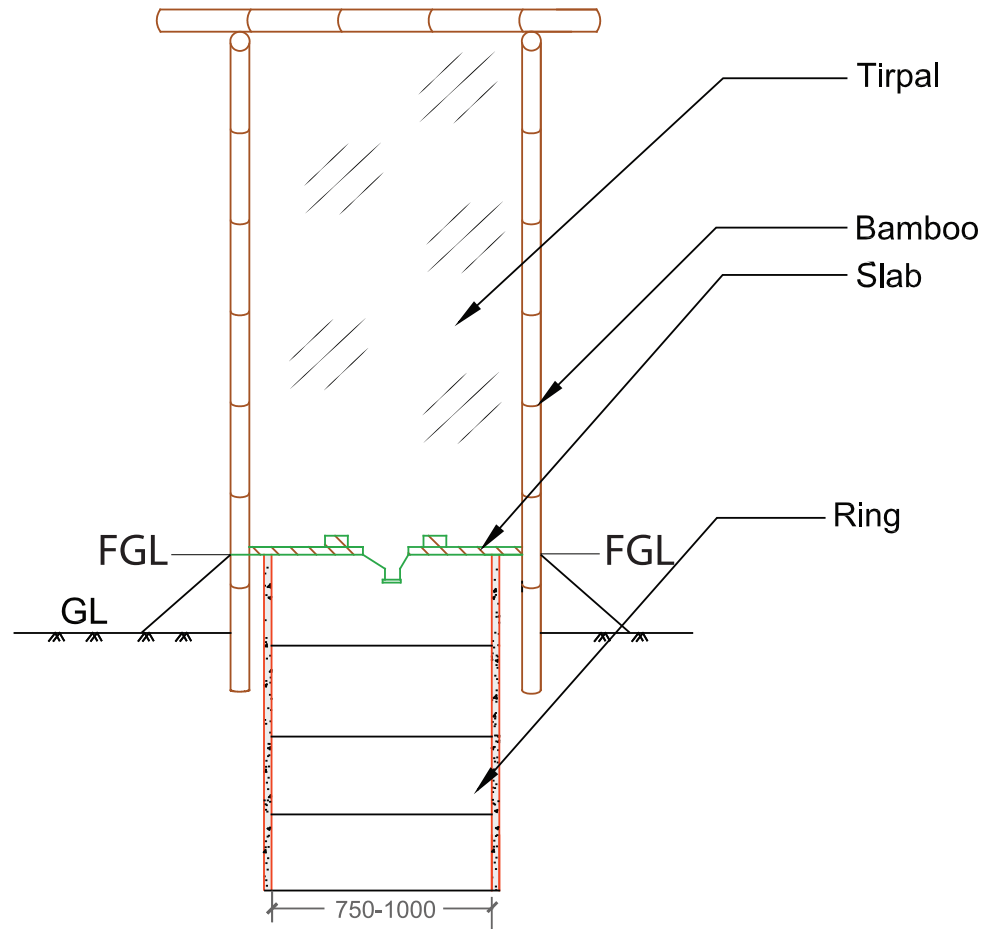
Environmental pollution may occur; health hazard risk from unsafe handling of excreta.

Operation and Maintenance

All temporary latrines should be filled with soil and ash. After filling, the surrounding areas should be sprayed with bleaching powder. The place should be demarcated so that people do not dig within 6 months.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 15-18).

Design Drawings



Cross sectional view

Temporary Latrine During Flood Emergency

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	500	500
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	5.00	24	120
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	2.00	193	386
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with excavated earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	2.00	153	306
5	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneur (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production center name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	5	800	4,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
6	Manufacturing and supplying 1:2:4 proportion RCC precast slab fitted with best quality uPVC long pan with sato pan, over well fitted with fresh portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 1126 mm outer diameter. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	2,250	2,250
7	Supplying fitting and fixing approved quality matured bamboo of 85 mm average dia for post in trench lining, toilet post, perlin, rafter, fencing post and half size horizontal tie as per design and drawing including placing in position and binding with Nail and 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	meter	20.00	75	1,500
8	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet with two layers of sheet for roof including placing double layer thick polythene sheet (weighing one kilogram per 6.5 square meter) between layers of sanwitch sheet including binding the edges of roof with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	3.90	425	1,658
9	Supplying and laying of single layer dark polythene sheet weighing one kilogram per 6.5 square meter as privacy screen etc. complete in all respect and accepted by Engineer-in-charge.	sqm	8.00	50	400
10	Supplying, fitting and fixing of best quality 25 liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equalant with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700
11	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. or fixing in walls with supply of all accessories as per instruction of EIC etc. all complete as approved and accepted by the Engineer- in- charge.	each	1	460	460
12	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. or fixing in walls with supply of all accessories as per instruction of EIC etc. all complete as approved and accepted by the Engineer- in- charge. White (porcelain).	each	1	577	577
13	Supplying of best quality 10 liter capacity plastic padel waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equalant etc. all complete approved and accepted by the Engineer- in- charge.	set	1	500	500
14	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
Total					13,817
Total cost considering disaster context = 13,817 * 1.5 =					20,726

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Floating Latrine

Context and Description

Emergency Context

This technology is applicable in haor areas and areas affected by floods or water logging, especially for temporary use during an emergency situation.

Major Components

- > Six plastic drums (three used for keeping the latrine floating, while the remaining three used as toilet components)
- > Toilet pan with provision for separation of urine and cleansing water
- > Provision of collection of urine as well as filtration of cleansing water
- > Vent pipe
- > A suitable superstructure, built over the platform on the floating drums

Technology Description

- > Among the 6 drums used in this design, 3 are used for keeping the toilet afloat. The remaining 3 are used as toilet components. Of these 3 drums, one is used for installation of the toilet pan and the other two are used for installing filtration system for preliminary treatment of cleansing water.
- > The toilet pan has three holes; the central hole fitted with a lid is for fecal matter, the hole in front is for urine, and the hole at the back is for cleansing water. Fecal matter drops directly into this drum through the central hole and accumulates. This central hole should be covered with a lid, which needs to be removed only during using the toilet. Urine enters into the drum through a separate hole and is diverted through a pipe to a urine collection jar.
- > Cleansing water collected through another hole is diverted through a pipe to a drum filled with filter materials. After flowing (in up-flow mode) through the filter material, the cleansing water flows to a second drum also filled with filter material. After passing through the filter material (in up-flow mode) in this drum, the partially treated cleansing water is discharged into water.
- > The lid of the central pan maintains a barrier between user and fecal matter and helps eliminate insect and odor problem; the vent pipe removes obnoxious



Figure 10: A floating latrine in haor area during flood (Courtesy: Oxfam)

gas from the collection drum. When the drum becomes full, the fecal matter is disposed of safely (e.g., buried in soil).

Suitability

This technology is suitable for use on a temporary basis during flood, when households and toilets remain under water and become inaccessible. This technology may also be considered for use in *haor* areas under special circumstances.

Desludging

The drum containing fecal matters needs to be frequently emptied and disposed properly.

Risks/Challenges

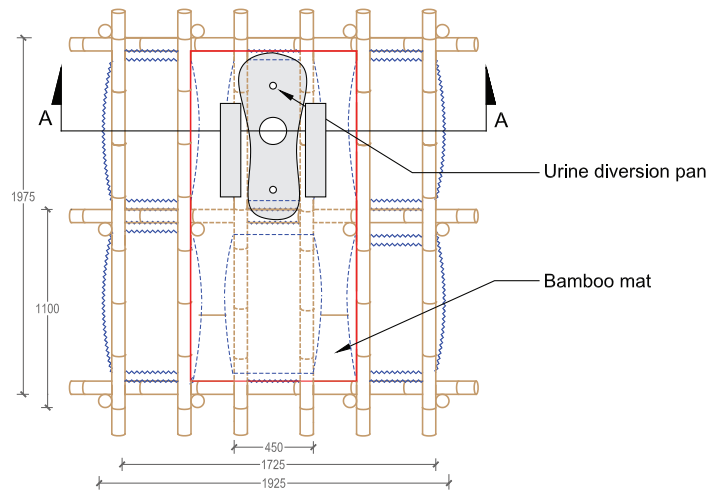
Proper use of the toilet (e.g., moving of users for anal cleansing) is a challenge. Reluctance to properly use/dispose collected urine and dispose of accumulated excreta would lead to water/environmental pollution.

Operation and Maintenance

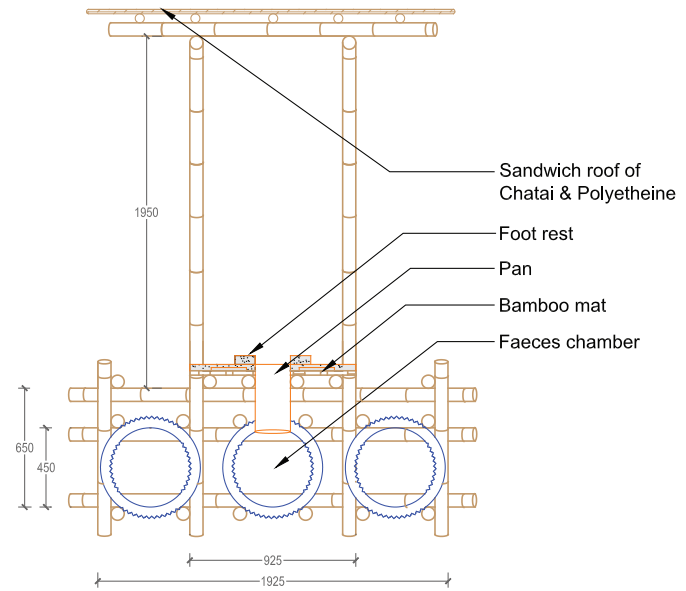
Require proper use of the toilet (including proper anal cleansing), and proper disposal of collected urine and fecal matter.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 21-22).

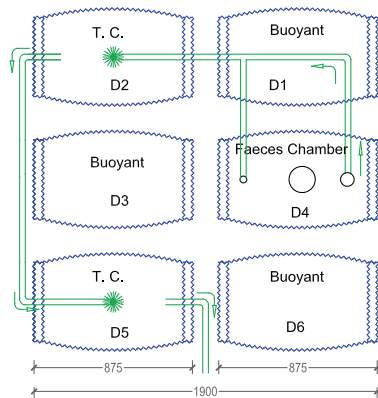
Cost Estimate



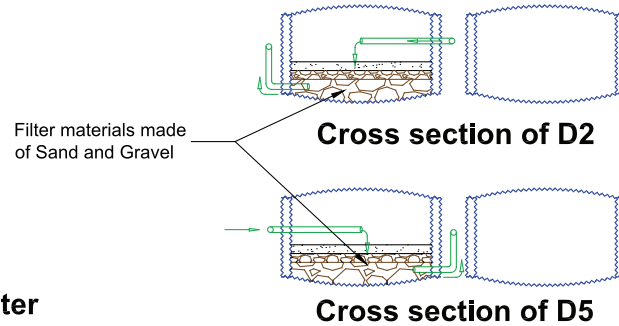
Plan



Section A-A



Flow diagram of treatment of anal cleaning water



Cross section of D2

Cross section of D5

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Supplying fitting and fixing approved quality 200-liter capacity used plastic drum as per design and drawing etc. all complete and accepted by Engineer-in-charge.	each	6	1,000	6,000
2	Supplying fitting and fixing approved quality three holes plastic pan as per design and drawing etc. all complete and accepted by Engineer-in-charge.	each	1	900	900
3	Supplying fitting and fixing approved quality matured bamboo of 90 mm average dia for toilet post including placing in position and binding with Nail and 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	meter	18	85	1530
4	Supplying fitting and fixing approved quality matured bamboo of 85 mm average dia for post in trench lining, toilet post, purlin, rafter, fencing post and half size horizontal tie as per design and drawing including placing in position and binding with Nail and 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	meter	90	75	6750
5	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet with two layers of sheet for roof including placing double layer thick polythene sheet (weighing one kilogram per 6.5 square meter) between layers of sandwich sheet including binding the edges of roof with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	1.8	425	765
6	Supplying and placing of 20 mm to 12mm downgraded khoa as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.15	6,000	900
7	Supplying and placing of sand FM 1.2 as filter materials 150 mm thick as shown in drawing and direction of the Engineer in Charge.	cum	0.1	800	80
8	Supplying different inside dia best quality 32 mm dia uPVC pressure pipe for water supply having wall thickness 2.7 mm - 3.6 mm, specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating/domed roof grating, bends, sockets etc. approved and accepted by the Engineer-in-charge.	meter	6	208	1248
9	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
10	Supplying of best quality plastic waste box of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	120	120
11	Supplying and laying of single layer dark polythene sheet weighing one kilogram per 6.5 square meter as privacy screen etc. complete in all respect and accepted by Engineer-in-charge.	sqm	8	50	400
				Total	19,153
				Total cost considering disaster context = 19,153 * 1.5 =	28,730

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources (Oxfam).

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Communal Latrine with Plastic Ring

Context and Description

Emergency Context

Communal latrine can be established in the initial phase of emergency for displaced population.

Major Components

- > Plastic slabs and plastic pans
- > Pits made of plastic rings
- > A suitable superstructure

Technology Description

- > This technology involves setting of several cubicles by placing pit rings in a single trench to collect excreta.
- > In the pit, the liquid infiltrates into the soil while the solids accumulate in the pit and undergo decomposition.
- > When the pits become full (up to the design level), they need to be desludged; alternatively, the filled-up pits could be covered with soil.
- > Mechanical desludging would greatly facilitate continued operation of the latrine; the fecal sludge emptied from the pits should be carried to a treatment plant (where available) or safely buried in pits.
- > The cubicles have plastic sheeting attached to bamboo poles/ light timber frames as privacy screen and a roof can be provided if necessary.

Suitability

This sanitation facility is particularly suitable for a community where people do not have individual sanitary latrines, and sufficient space is not available for installation of individual latrines.



Figure 11: A. Positioning of plastic rings; B. Placing of Plastic slabs of a plastic communal latrine (Courtesy: Oxfam)

Desludging

When the pit fills to within about 0.5 m from the top, it should be emptied. This can be achieved by using various types of sludge pumps to extract the excreta from the latrine pit, then disposing it of in a new pit and cover it with soil. If sludge pumps are not available, manual desludging could be carried out ensuring adequate safety measures.

Risks/Challenges

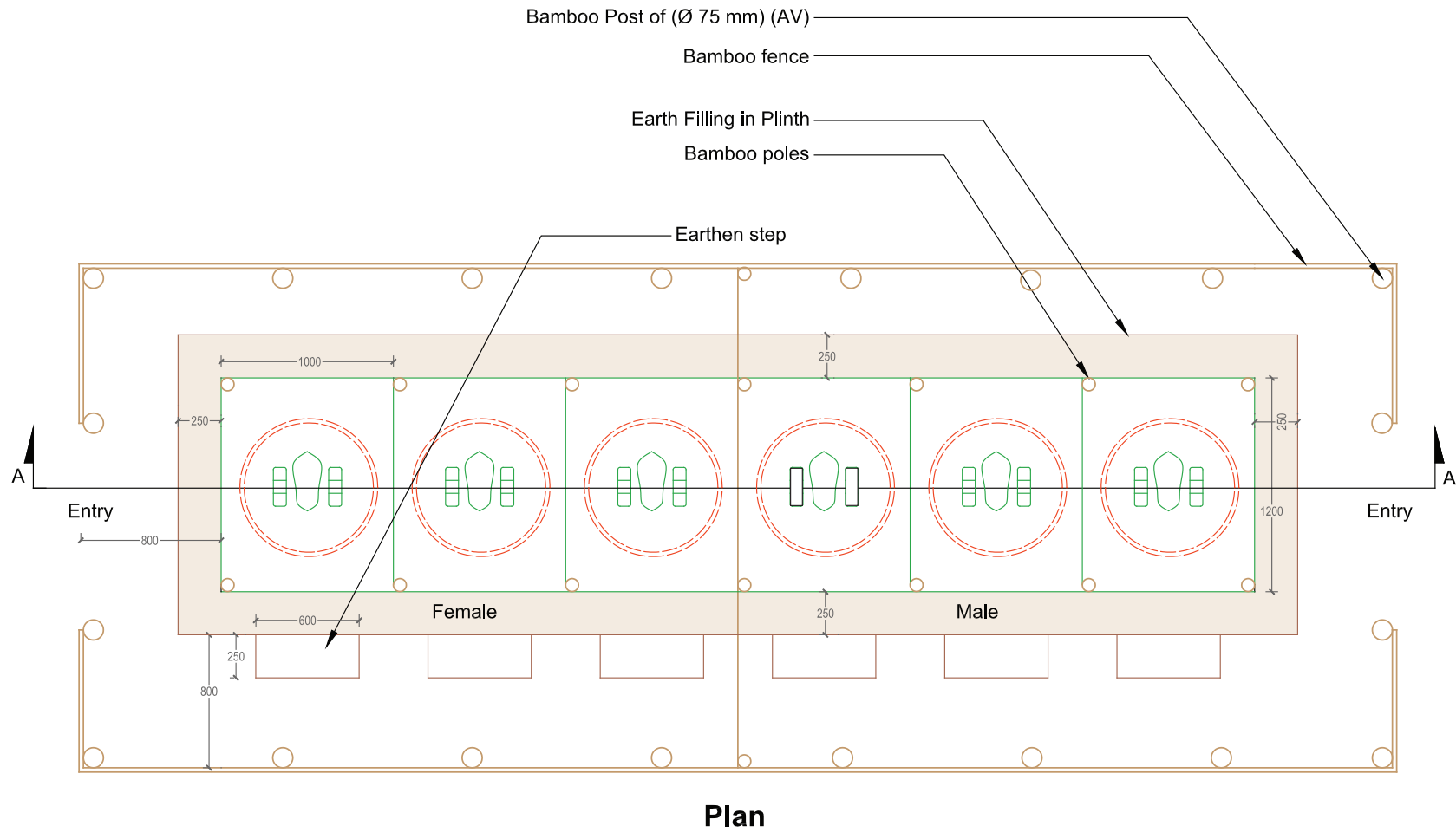
- > Possible groundwater contamination from liquid infiltration from pits of latrines, particularly during flood.
- > Fouling of latrine is common.

Operation and Maintenance

It is important to raise awareness among users about proper use of latrines. The system requires mechanical desludging of the pits when they become full (up to design level); the pits should be positioned such that they are easily accessible for mechanical desludging.

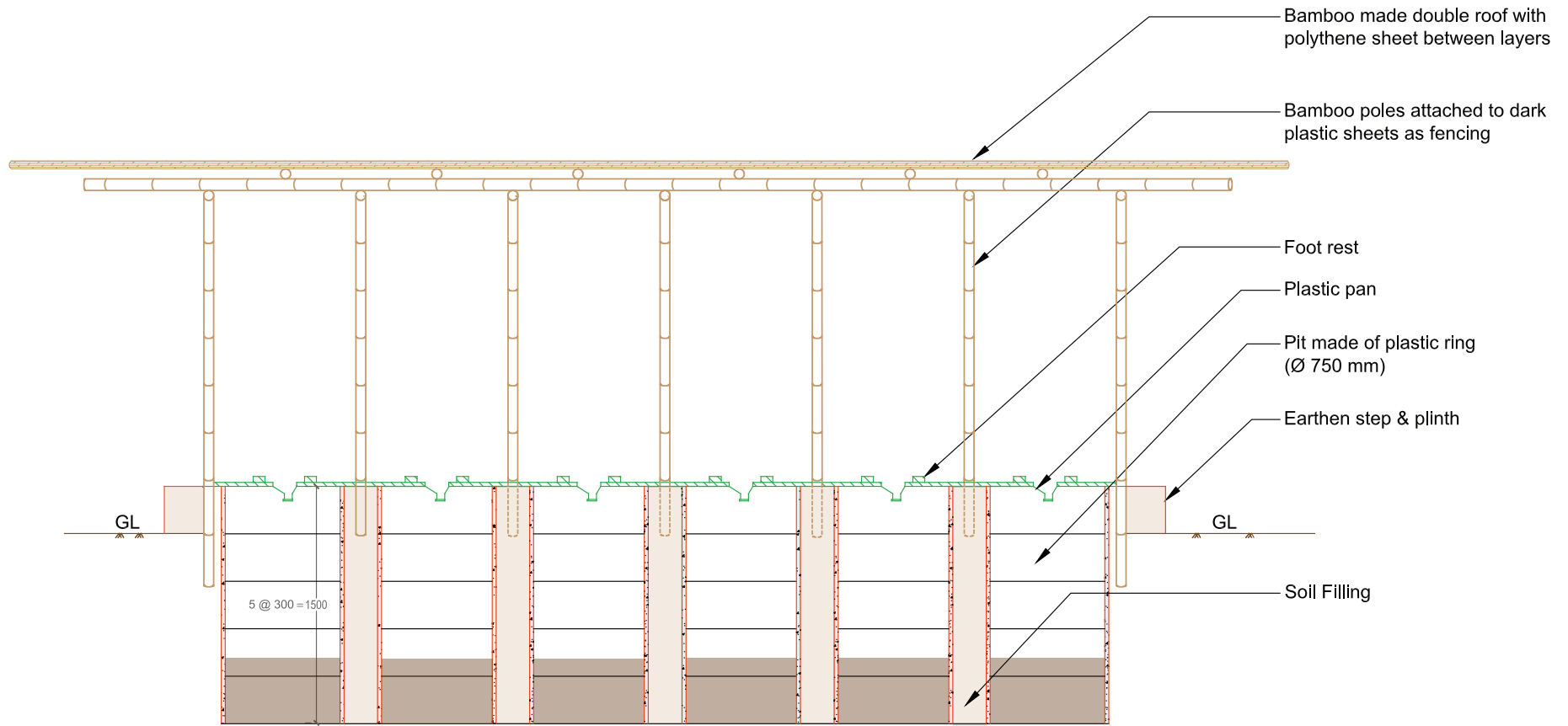
Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 35).

Design Drawings



Communal Latrine with Plastic Ring

Note: All dimensions are in mm



Section A-A

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	24	24	576
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	4.75	193	917
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	3.7	153	566
5	Earth filling in plinth and step with making clay of the excavated earth and placing in position as per drawing in 150 mm layer at the construction site including carrying watering, leveling, dressing, compacting to a specified percentage each layer and finishing at the design level etc. all complete and accepted by Engineer-in-charge.	cum	1.05	300	315
6	Supplying fitting and fixing approved quality (following DPHE practice) 750 mm inside dia 300mm height plastic ring in trenches as per design and drawing etc. all complete and accepted by Engineer-in-charge.	each	30	550	16,500
7	Supplying fitting and fixing approved quality (following DPHE practice) plastic slab and pan with water seal as per design and drawing etc. all complete and accepted by Engineer-in-charge.	each	6	1,000	6,000
8	Supplying fitting and fixing approved quality matured bamboo of 85 mm average dia for toilet post, purlin, rafter, fencing post and half size horizontal tie as per design and drawing including placing in position and binding with Nail and 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	meter	195	75	14,625
9	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet with two layers of sheet for roof including placing double layer thick polythene sheet between layers of sandwich sheet including binding the edges of roof with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	11.7	425	4,973

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet for Toilet fencing, door and outer fencing with bamboo sheet including binding the edges, two horizontal and 500mm vertically centre to center with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	76.00	155	11,780
11	One layer of brick flat soling in step and in approach road with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge.	sqm	10	454	4,540
12	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	6	700	4,200
13	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	6	100	600
14	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
15	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	577	577
Total					67,628
Total cost considering disaster context = 67,628 * 1.5 =					101,442

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources (Oxfam).

> During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.

Deep Trench Latrine

Context and Description

Emergency Context

This is the least preferred excreta disposal technology which is applicable for displaced population in emergency situation.

Major Components

- > Timber floor plates and foot rests
- > Poles (Bamboo, wood or metal)
- > Solid fence (as opaque as possible)
- > Roof if necessary and possible

Technology Description

- > This technology involves the setting of several cubicles above a single trench which is used to collect excreta.
- > Care is taken not to provide too many latrine side by side. The recommended maximum length of trench is 6m, providing six cubicles.
- > The trench is usually 0.8-0.9m wide and the top 0.5m of the pit can be lined with plastic sheeting for ease of cleaning and to ensure that the trench remain stable. There are a number of different pit-lining materials that can be used including concrete, bricks, blocks, sandbags and timber.
- > The cubicles have plastic sheeting attached to bamboo poles/ light wooden frames as privacy screen and a roof can be provided if necessary.

Suitability

In case of emergencies, trench latrines can be quickly implemented if there are sufficient tools, materials and human resource available.

Risks/Challenges

This toilet has a relatively short life span and requires considerable space. This may create odor problems if the feces are not covered by soil each day. Deep trench latrines are not suitable where the water table is high or the soil is too unstable to dig.



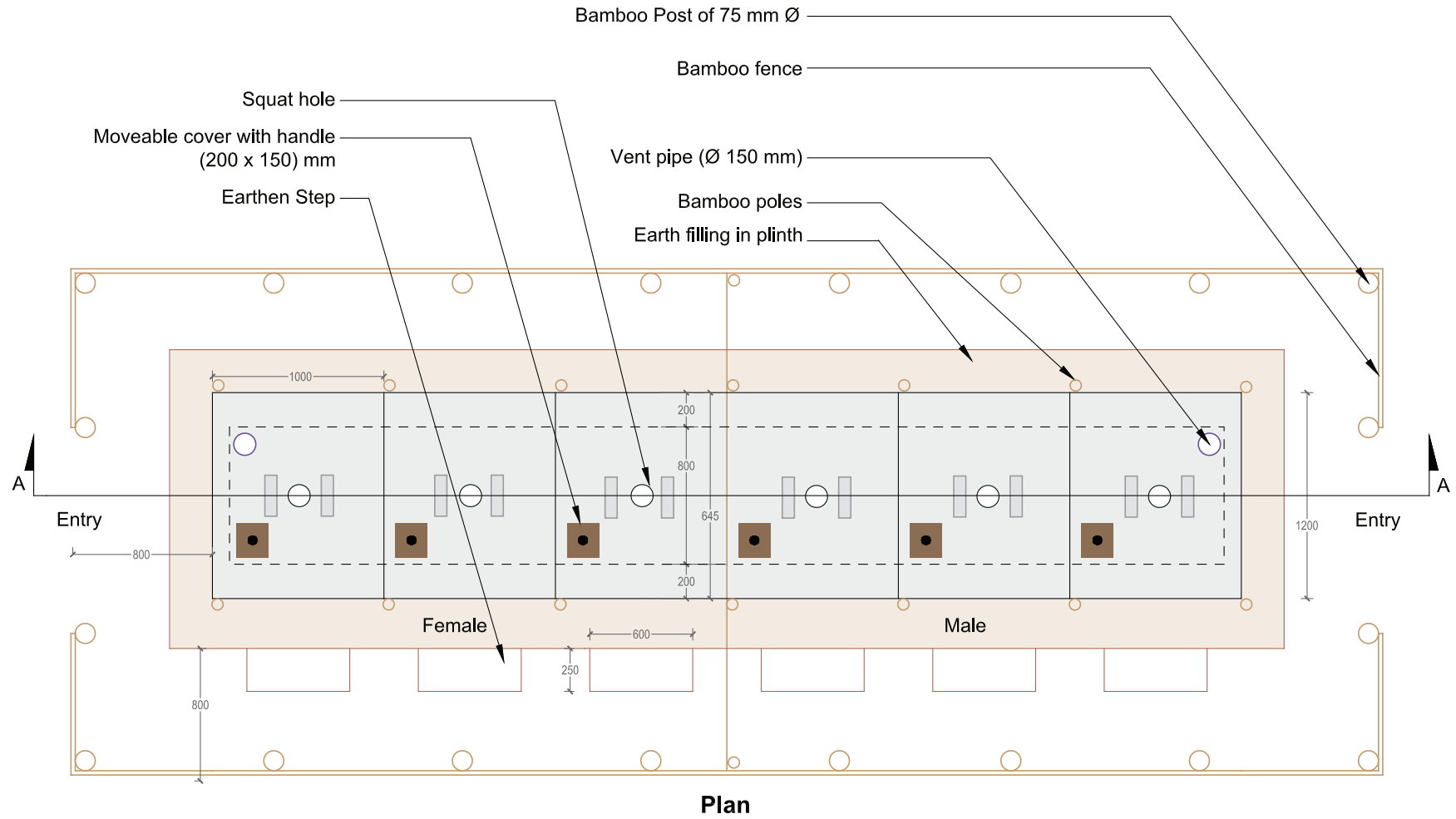
Figure 12: A Trench latrine in case of emergency (Courtesy: Oxfam).

Operation and Maintenance

This latrine requires covering of the fecal matter each day with soil. It is important to raise awareness among users about proper use of latrines.

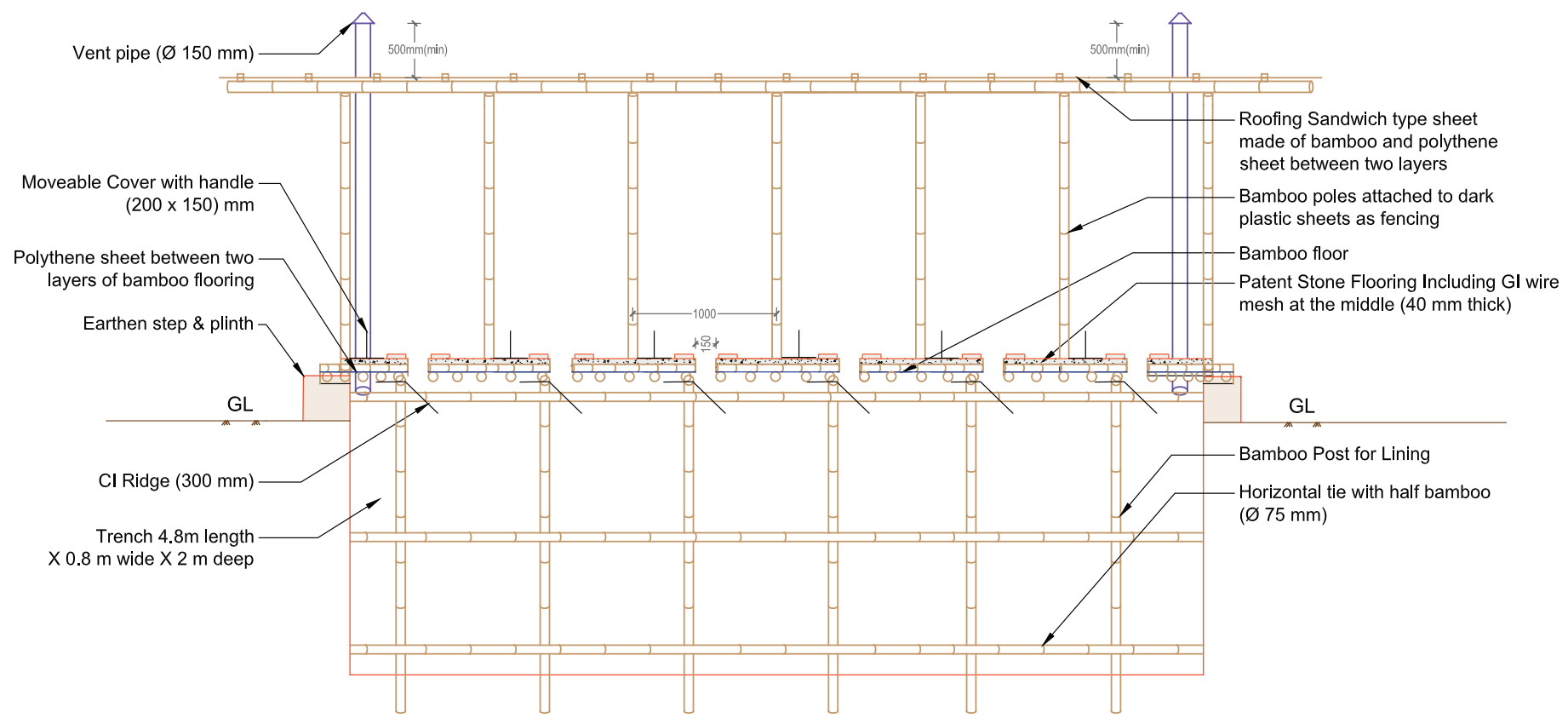
Note: Adapted from WHO-WEDC Technical Notes on Drinking Water, Sanitation and Hygiene in Emergencies (2013), Section: 14.2 and GOB-DPHE-UNICEF Operational Guidelines for WASH in emergencies- Bangladesh (2015), Page: 87.

Design Drawings



Deep Trench Latrine

Note: All dimensions are in mm



Section A-A

Deep Trench Latrine

Note: All dimensions are in mm

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	24	24	576
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	9.6	193	1,853
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	8.5	153	1,301
5	Earth filling in plinth and step with making clay of the excavated earth and placing in position as per drawing in 150 mm layer at the construction site including carrying watering, leveling, dressing, compacting to a specified percentage each layer and finishing at the design level etc. all complete and accepted by Engineer-in-charge.	cum	1.1	426	469
6	Supplying fitting and fixing approved quality matured bamboo of 85 mm average dia for post in trench lining, toilet post, purlin, rafter, fencing post and half size horizontal tie as per design and drawing including placing in position and binding with Nail and 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	meter	198	75	14,850
7	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet with two layers of sheet for roof including placing double layer thick polythene sheet (weighing one kilogram per 6.5 square meter) between layers of sandwich sheet including binding the edges of roof with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	11.7	425	4,973
8	Supplying fitting and fixing matured muli bamboo outer surface batten made sandwich sheet for Toilet fencing, door and outer fencing with bamboo sheet including binding the edges, two horizontal and 500mm vertically centre to center with approved quality muli batten as per design and drawing, placing in position, binding with supply of 16 mm GI wire etc. all complete and accepted by Engineer-in-charge.	sqm	76	155	11,780
9	One layer of brick flat soling in step and in approach road with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge.	sqm	10	454	4,540

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	40 mm thick artificial patent stone (1:2:4) flooring with cement, best quality coarse sand (50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2 and 50% best quality local sand of FM 1.2) and 12 mm down well graded brick chips including breaking chips, screening, laying the concrete in alternate panels , supplying and laying 14 BWG wire mesh at the center of the slab , compacting and finishing the top with neat cement finishing and curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	7.2	714	5,141
11	0.27 mm thick Coloured galvanized iron plain sheet ridging with 400 mm long and fitted and fixed with galvanized bolts and nuts etc.as per instruction and drawing etc. all complete and accepted by the Engineer-in-charge.	meter	7.2	490	3,528
12	Supplying fitting and fixing 150 mm inside dia best quality uPVC Class - 'D' ventilation pipe with supply of cowl having specific gravity 1.35 - 1.45, wall thickness 3.5 mm - 4.10 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, of uPVC Pipe with all accessories such as Round grating /domed roof grating bands, sockets etc. Including clamping approved and accepted by the Engineer- in- charge. (height 0.5m over roof)	meter	2.4	2,200	5,280
13	Movable cover made of 250mm x 400mm plain CI sheet and 25mm dia 300mm long garjan or any other approved quality wooden handle fixed with CI sheet with nail etc. all complete and accepted by the Engineer-in-charge.	each	6	250	1,500
14	Supplying, fitting and fixing of best quality 25 liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	6	700	4,200
15	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	6	100	600
16	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	6	460	2,760
17	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain).	each	6	577	3,462
Total					67,811
Total cost considering disaster context = 67,811 * 1.5 =					101,717

Note: > The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

- > During disaster, the cost for transportation, labour, material etc. increases and it varies considering the type of disaster. So, an average cost multiplying factor of 1.5 times is multiplied to the cost of normal situation to obtain the total cost during disaster context.*

HYGIENE TECHNOLOGIES

Tippy Tap

Context and Description

Emergency Context

Tippy taps can be established for handwashing for displaced population in the initial phase of an emergency.

Major Components

- > A container (5-liter capacity)
- > A bar of soap
- > Sticks and strings to attach the container and soap bar
- > Gravel or other porous material

Technology Description

- > Tippy taps are economical handwashing stations, made with commonly available materials and not dependent on a piped water supply.
- > The container is filled with water which flows out when the container is tipped.
- > The container is tipped using a foot paddle. Thus, this technology reduces the risk of recontamination of hands after washing them with soap.
- > The container is placed high enough so that taller users do not have to stoop to wash their hands. The container is tipped using a foot paddle, so the shorter users are able to use the facility as long as it is filled with water and the soap is stored low enough.
- > Bar soap, liquid soap or soapy water can be tied to the tippy tap with string.
- > The ground beneath the tippy tap should be covered in stones to help drainage of wastewater.

Suitability

In case of emergencies tippy taps can be made with locally available materials. This technology is cost-effective and can be easily implemented in low-income areas.



Figure 13: A tippy tap installed in a rural area (Courtesy: WaterAid Bangladesh).

Risks/Challenges

Tippy tap is less durable than other options and some parts may need to be replaced or reconstructed more often. The container needs to be filled with water manually.

Operation and Maintenance

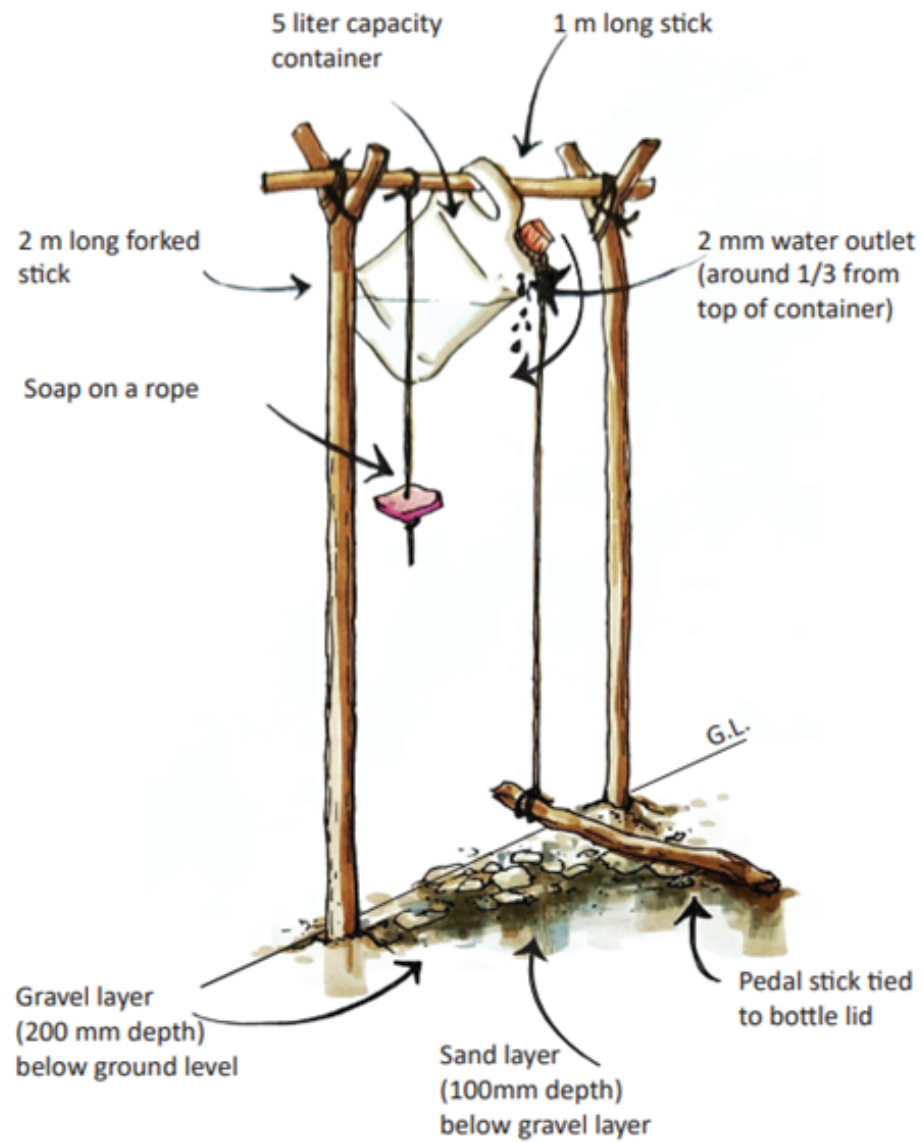
The outside of the container needs to be cleaned daily and the inside needs to be cleaned every week with clean water and disinfectant.

Cost for Installation

Considering that aggregates and loose soil are locally available, and tree branches are a supplement to sticks, it may cost approximately 200 BDT for device installation.

Note: Adapted from Handwashing Compendium for Low Resource Settings, IDS & the sanitation learning hub (2020).

Design Drawings



Tippy Tap

**WASH TECHNOLOGIES
POST DISASTER REHABILITATION**

WATER SUPPLY TECHNOLOGIES

Deep-set Hand Pump Tubewell

Context and Description

Emergency Context

Applicable in low groundwater table areas.

Major Components

- > Pump head
- > Pump rod
- > Piston
- > Cylinder
- > Casing pipe
- > Foot valve

Technology Description

- > The deep-set hand pump is a simple technology consisting of No. 6 hand pump on the top of a casing pipe, and works in force mode to lift groundwater beyond suction head (> 7.5 m) in low water table areas.
- > For Deep-set hand pump tubewell, 75 mm (3 inch) dia housing/ casing pipe is extended up to a certain depth depending on the water table, and piston assembly of the pump is set at that level by connecting a pump rod to the handle. The piston assembly remains in submerged condition below water table.
- > The lower casing is made of 38 mm PVC pipe and is attached to the well screen. The upper casing and lower casing are connected with each other with a reducer of 38 mm diameter.
- > The pump is operated by a person holding the handle fitted at the top end of the pump rod and pulling and pushing the pump rod vertically, which draws water from the well in both up and down strokes.

Suitability

Suitable for low water table areas.



Figure 14: A deep-set tubewell in operation in a low groundwater level area (Courtesy: Concern Worldwide)

Risks/Challenges

Care should be taken to keep the pump rod in a vertical position with the help of guiding support.

Operation and Maintenance

This technology requires regular cleaning of tubewell platform. It also demands replacement of spare parts of piston assembly, when required.

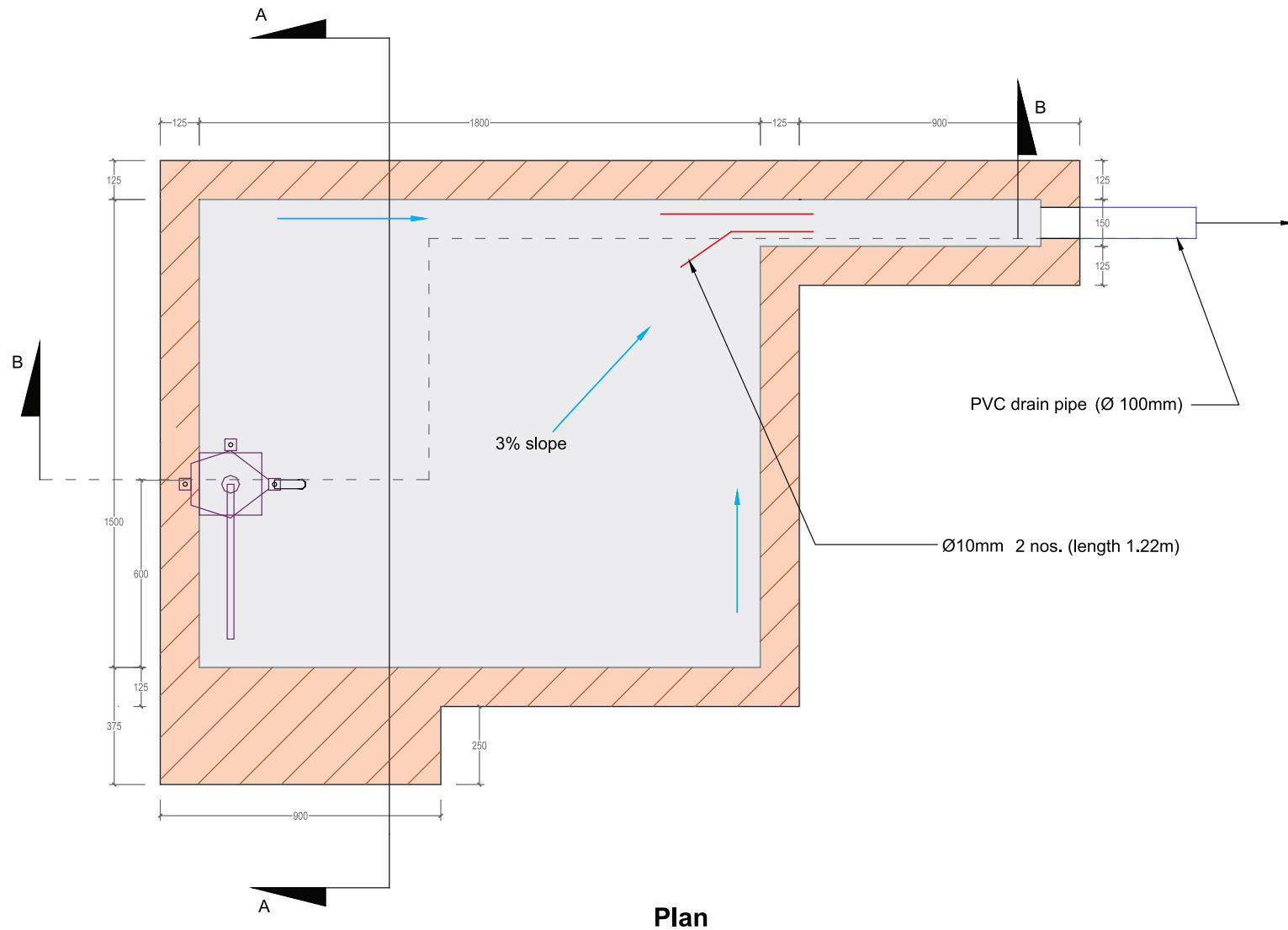
Tubewell Rehabilitation

- > For flooded tubewells, purging the tubewell to remove unsafe floodwater is mandatory before reuse. The amount of water that needs to be discharged to remove floodwater varies with depth of the tubewell. For instance, a 30-meter deep tubewell requires 33L to 35L of water to be discharged after flood. So, a 180-meter tubewell would require 200L of water to be manually pumped out as purging. Additionally, the pipes and seal should be checked to determine if there are cracks or leaks—if the tubewell is safe, check valves should be working properly.

- > In many cases only purging the well does not remove the pathogens. Disinfection should be done by shock chlorination method—a high dose of chlorine (about 200 mg/L) is added to the well, and retained for a specified time period before the well is purged again for pumping out the chemical.
- > A management committee should be formed after installing a tubewell in a neighborhood. At least 3 caretakers (including one female representative) should be versed in operation and maintenance guidelines, and should receive proper training. A tool box and a maintenance manual that allows repair work should be present, and be accessible to the caretakers.

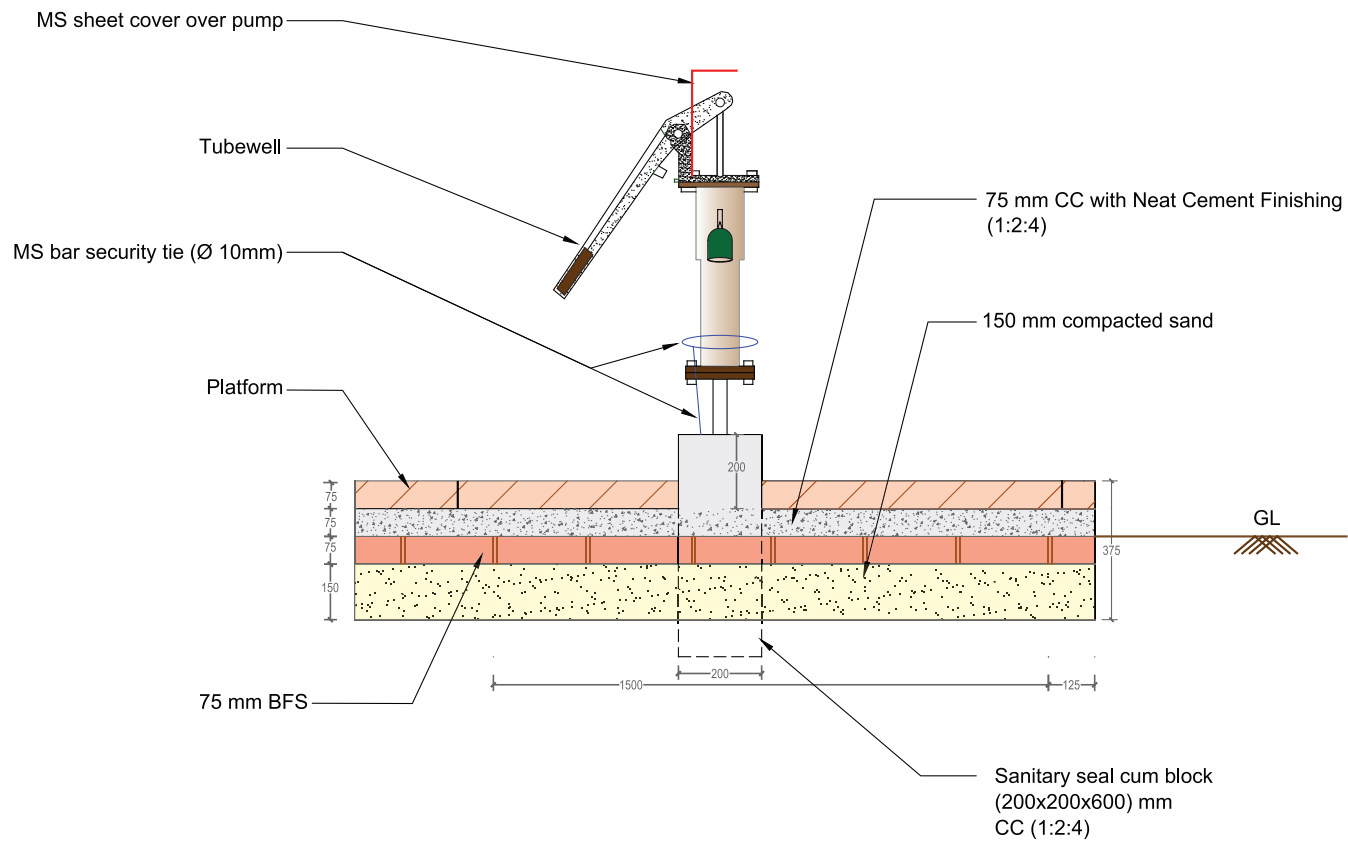
Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 72-74).

Design Drawings

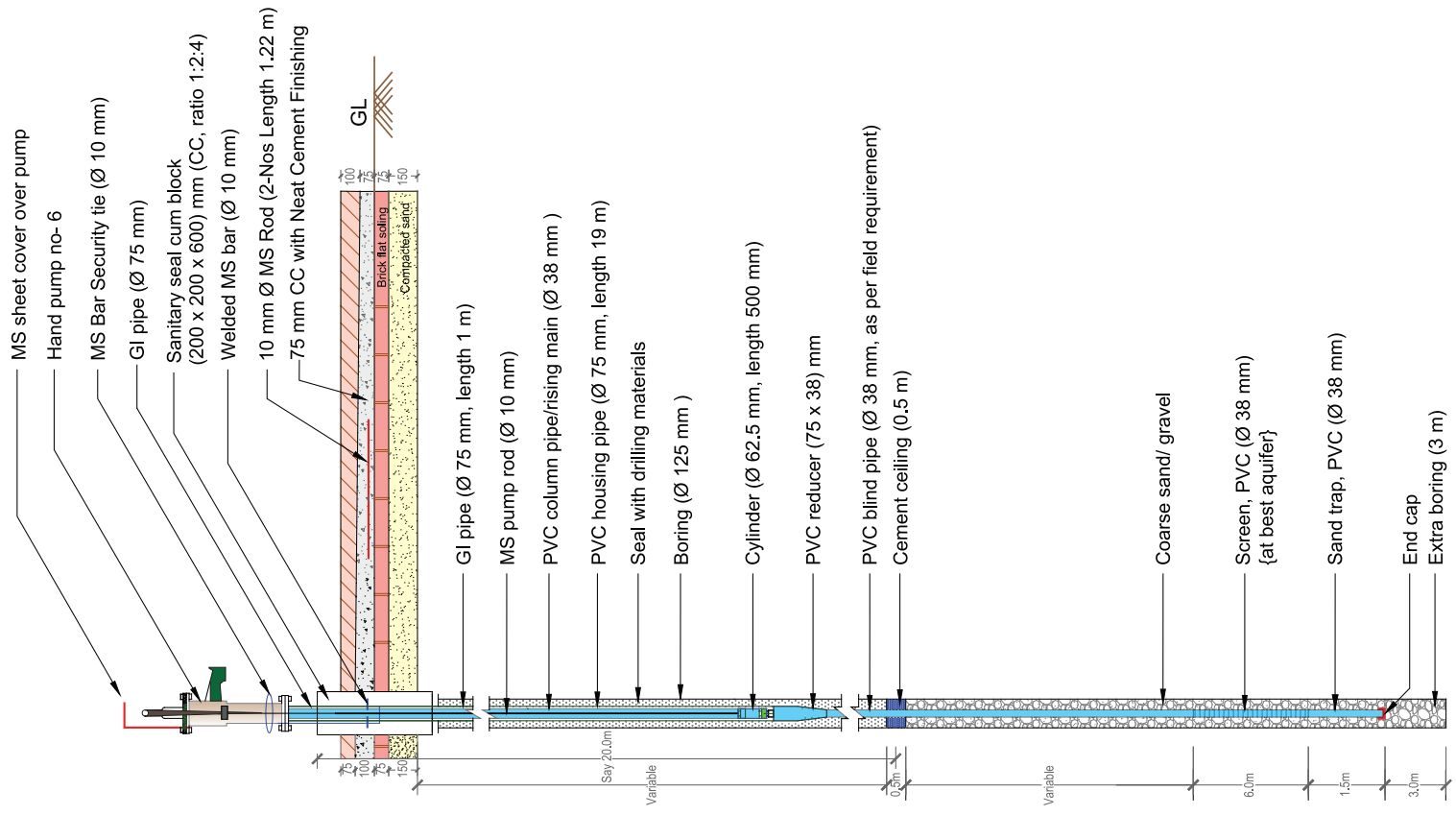


Deep-set Hand Pump Tubewell

Note: All dimensions are in mm



Section A-A



Section B-B

Deep-set Hand Pump Tubewell

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Transportation: Transportation of all kind of materials/ equipment to the site for installation of 75mmx38mm dia Tubewell with supplying of casing pipe, boring pipe, construction of derrick and dismantling the same, cleaning the site after completion of work etc. all complete as per direction of the Engineer-in-Charge.	LS	1	4,000	4,000
2	Drilling & Installation: Boring by using 150 mm diameter cutter up to 25 meter & rest of the hole by using 100 mm diameter cutter with 40 mm dia GI pipe (wall thickness 2.9mm, weight 3.517kg/meter, capable to withstand 50 kg/cm ² pressure) and other equipment capable of drilling up to required depth by water jet method or any other method approved by the EIC through all sorts of strata, pea gravel interference, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3 m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipes and casing pipes etc. complete, lowering of pipes for installation of all tubewells as per drawing, specification and direction of the EIC. Drilling & Materials including fitting & Fixing				
a)	75 mm dia GI pipe (wall thickness min 3.25, weight 7.22 kg/m, can withstand minimum 50 kg/m hydraulic pressure) including welded with 10mm dia MS rod for fixing in platform block.	m	1	1,705	1,705
b)	75 mm dia uPVC (Class-D, BS 3535, wall thickness min 3.5mm - max 4.10mm, socket length 125mm)	m	19.2	533	10,234
c)	38 mm dia uPVC (Class-D, BS 3535, wall thickness min 2.5mm - max 3.00mm, socket length 125mm) socketed blind Pipe.	m	40.24	226	9,094
d)	38 mm dia uPVC filter (Class-D, BS 3535, wall thickness min 2.5 mm, socket length 125mm, Robo filter length 2.00 meter)	m	6	288	1,728
e)	38 mm dia uPVC sand trap (Class-D, BS 3535, wall thickness min 2.5 mm, socket length 125mm)	m	0.75	187	140
f)	38 mm dia uPVC end cap.	piece	1	90	90
g)	38 mm dia uPVC socketed adopter (50mm long)	piece	1	90	90
h)	75 X 38 mm dia uPVC Reducer	piece	1	190	190
3	Clay Sealing, Sand Filling and Local/bored Soil Filling				
a)	Supplying and filling coarse sand (F.M-2.2) as shrouding materials. Filling the space between borehole and strainer from bottom of borehole to 10-meter top of strainer etc. all complete drawing and direction of the Engineer in Charge.)	m	17	66	1,122
b)	Clay Sealing: Filling up the 6 m annular space from the top of coarse sand with 3-5 mm diameter balls made of bentonite and local clay in a proportion of 1:1 etc. all complete drawing and direction of the Engineer in Charge.	m	6	78	468
c)	Supplying and filling bored soil between the space between borehole and blind pipe from top of shrouding materials to remaining borehole etc. all complete drawing and direction of the Engineer in Charge.	m	45.1	6	271
4	Pump Set: Supplying, fitting & fixing of best quality following materials and inspection of pump head and Cylinder Set should be satisfied from an authorized laboratory as per instruction and direction of the Engineer in Charge.				

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
a)	Pump Head: Heavy duty # 6 CI pump head set of approved quality with 75mm dia CI threaded base plate with intermediate flange of 50mm dia. and painting by one coat anti-corrosive paint and three coats synthetic enamel paint of green colour etc. (without base plate, plunger and rod with minimum weight of 30 ± 0.5 kg and use long of handle 900± 10 mm)	set	1	4,540	4,540
b)	Column pipe: 38 mm dia uPVC (Class-D, BS 3535, wall thickness min 2.5 mm - max 3.00 mm, socket length 125 mm, each pipe length 3.0 m)	m	18.29	200	3,658
c)	10 mm dia MS pump rod with hexagonal nut/ socket, each 3.0 m long	m	26.63	314	8,362
d)	62.5 mm dia cylinder of Khan or equivalent brand (500 mm long)	set	1	1,500	1,500
e)	38 mm dia GI nipple 300 mm long one end threaded	pcs	2	300	600
f)	38 mm dia GI nipple 225 mm long one end threaded	pcs	14	225	3,150
g)	38 mm dia GI socket heavy type (75 mm long)	pcs	13	200	2,600
h)	Wrench: Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 nos nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si = 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge).	Item	1	1,350	1,350
5	Well Development: Well development by air compressor (minimum 1 bar) until sand free, odour and turbidity free drinking water at a satisfactory yield etc. all complete as per technical specification and direction of the EIC.	Item	1	1,725	1,725
6	Disinfection: Disinfecting the well by supplying sufficient quantity bleaching powder (33% h), making chlorinated water having 150 ppm available free chlorine and applying to the tubewell, after 24 hours of retention, chlorinated well water to be pumped out until chlorine free clear water is reached etc. all complete as per specifications and direction of the EIC.	Item	1	750	750
7	Platform Construction : Construction of C.C (1:2:4) platform Size : 2050 mm x 1750 mm x 75 mm with 900 mm long drain over 150 mm thick sand cushioning, brick flat soling and laying polythene under cement concrete before casting concrete as per drawing including well block by making 200 mm x 200 mm x 300 mm block as per drawing and 12 mm thick plaster (1:4) with neat cement finishing of the concrete surface etc. all complete as per specification, drawing and direction of the Engineer in Charge.	LS	1	7,500	7,500
8	Supplying different inside dia best quality 75 mm uPVC pressure pipe for drainage line from platform to drain having specific gravity 1.35-1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating/domed roof grating, bends, sockets etc. including cutting earth laying pipe and filling earth etc. all complete as per direction and approval/ accepted by the Engineer-in-charge. 75 mm dia wall thickness 2.9 mm - 3.5 mm	meter	6	449	2,694
9	Furnishing Design of Tube Well: Furnishing Design of Tube Well by testing of water and soil samples Collected from the tubewell and submission it to the Engineer in Charge for his observation and approval for installation of the tubewell.	LS	1	1,500	1,500

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	Collection of water sample and testing: After ensuring proper well development, collection of water samples and sending the samples to the DPHE Zonal Laboratory for testing of Arsenic, Iron, Manganese, Chloride and Total coliform etc. parameters which will be tested at the laboratory. The cost of sampling, carrying to the laboratory and testing by DPHE laboratory has to be done by the contractor etc. all complete as per direction of the Engineer in Charge.	P/Test	5	600	3,000
11	Supply and fitting fixing following materials and tools as per specification and direction of the Engineer in Charge				
a)	20mm thick MS sheet for head cover of tubewell	LS	1	500	500
b)	10 mm dia MS rod for safety of pump (1.5meter long MS rod to be fitted as tie with pump and platform during construction of platform)	LS	1	150	150
c)	Spare parts (nuts & bolts of tubewell and kit of cylinder)	set	1	900	900
d)	Screw driver, big	Nos.	1	150	150
e)	Spanner/ plier, big	Nos.	1	250	250
				Total	74,011

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Normal Pond Sand Filter

Context and Description

Emergency Context

Applicable in areas with droughts, arsenic/iron contamination, surface water pollution, saline water intrusion, etc.

Major Components

- > Pond
- > Intake (which collects water from the pond)
- > Pumping unit (# 6 Handpump/Hand lift pump)
- > Filter unit
- > Disinfection system (e.g., bleaching powder)

Technology Description

- > PSF is mainly a slow sand filter unit constructed near or on the bank of a pond to treat no- or low-saline pond water to be used for domestic purposes.
- > The water from the pond is pumped to the filter bed of the PSF or the raw water tank. Water from the raw water tank is conveyed to the filtration chamber (roughing filter chamber followed by slow sand filter chamber).
- > Water from filtration chamber goes to a clear water reservoir tank, which is then disinfected, and users collect treated pond water from a tap.

Suitability

Suitable for coastal and arsenic contaminated areas where no or low-saline ponds are available and people are habituated or agree to drink treated pond water.

Risks/Challenges

- > Availability of suitable pond with low or no salinity, and protection of the pond
- > Regular operation to keep filter bed of PSF functional
- > Bacterial contamination of PSF water



Figure 15: A normal pond sand filter (Courtesy: ITN-BUET)

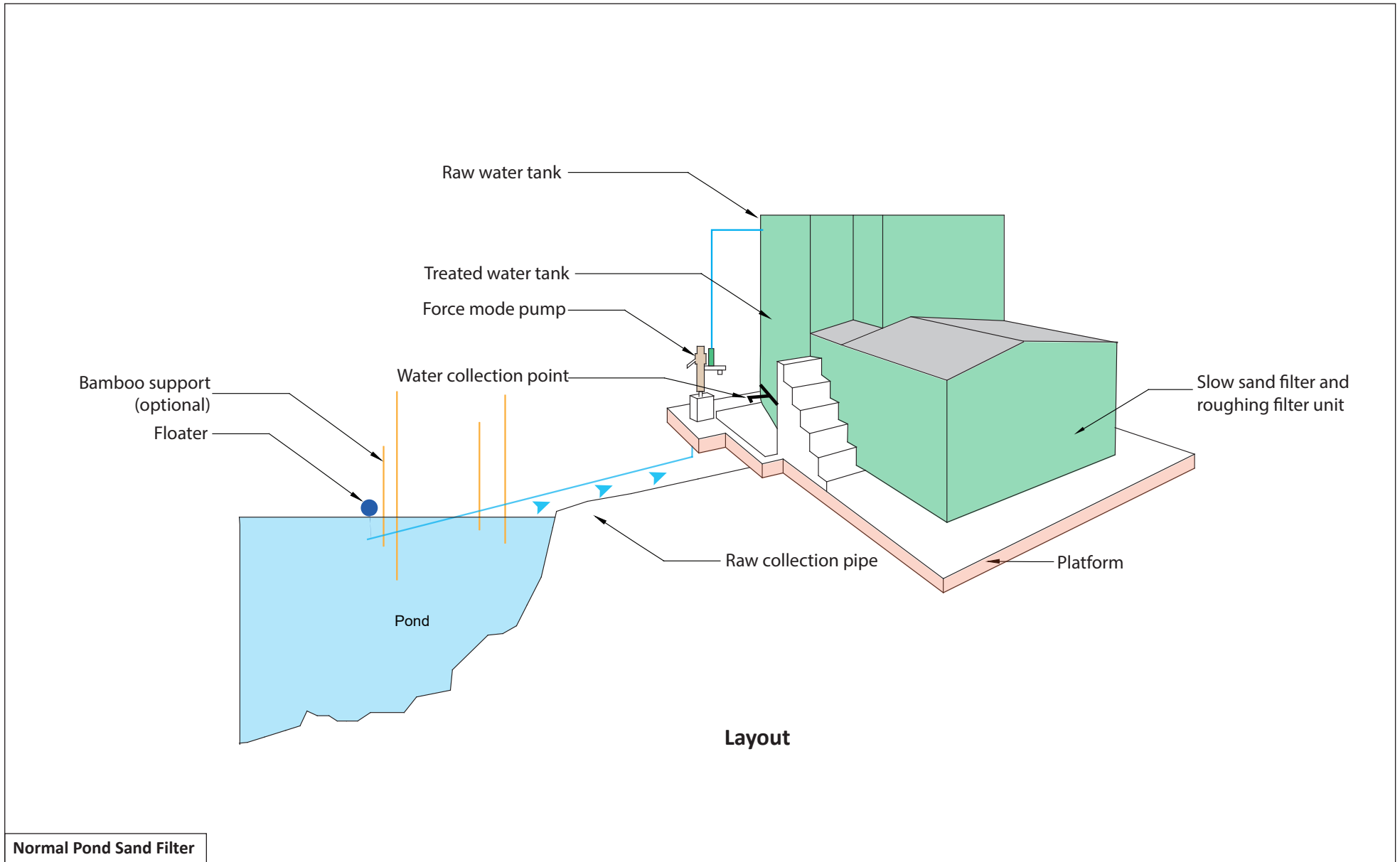
Pond Cleaning and Rehabilitation

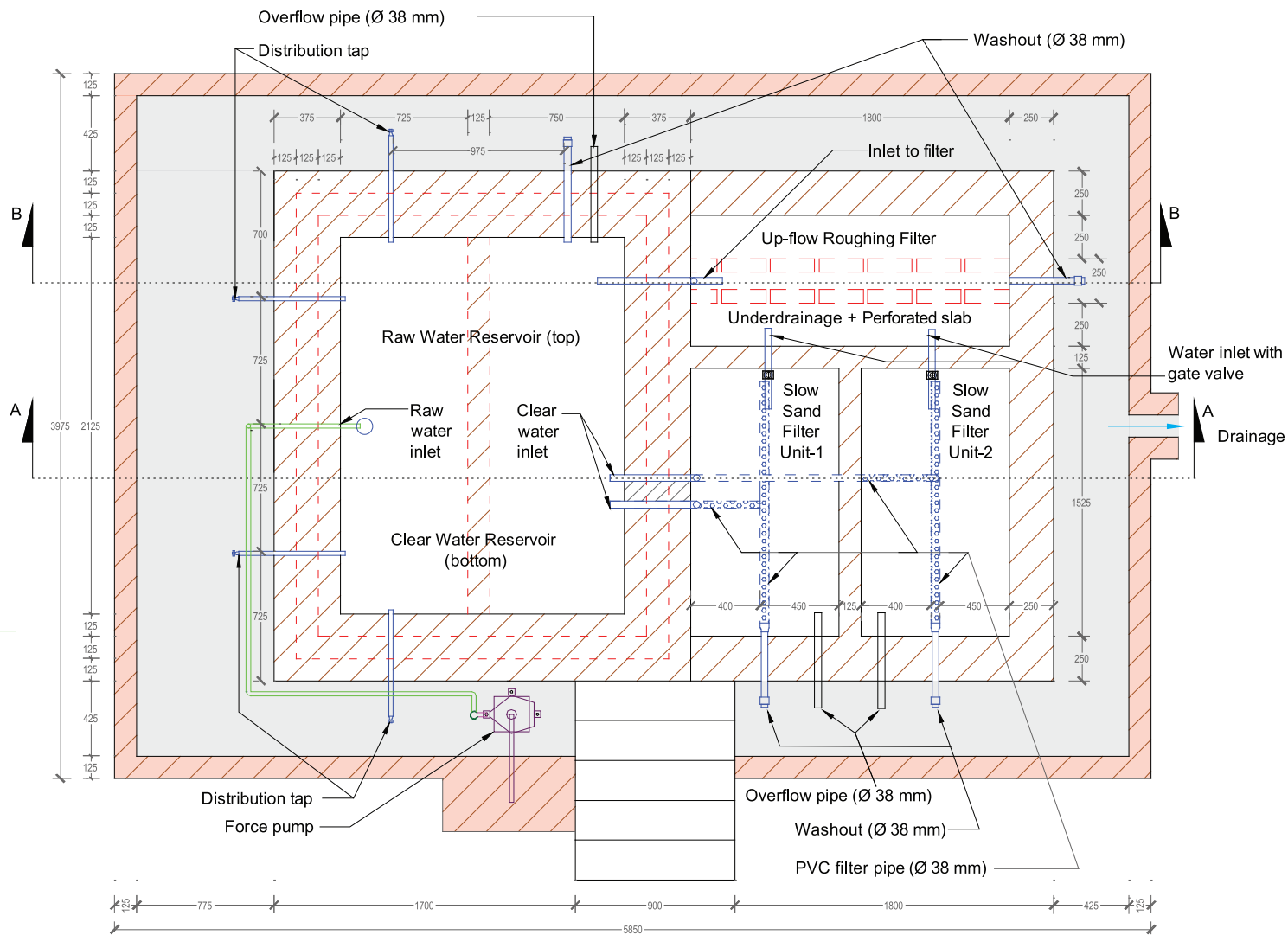
Before commencing the cleaning process, the source water pond's dimensions should be measured; along with mean depth and water level. Then the pond shall be screened for floating objects of all kinds, and any debris should be removed immediately. For treatment and turbidity removal, lime (or hard-lime) is required and the requirement is estimated based on the pond size and depth. Usually, 1 to 2 kg lime is needed to treat a pond. To begin with, half of the required lime is mixed with water. The solution is then spread across the pond equally, stirred and mixed well with the pond water. The water should then be kept undisturbed for 4-5 hours. This whole process is then repeated again, utilizing the rest of the lime. The entire process should last over 10 hours for effectiveness. If the pond is not visibly clean afterwards, the water of the pond should be drained entirely using a diesel pump and irrigation hose. Natural discharge from unconfined aquifers would refill the pond in some areas, or mechanical pumping from other rivers or lakes can be employed for refilling. Afterwards, if necessary, lime application as mentioned above can be performed to treat the newly refilled water.

Further instruction and details regarding pond cleaning and rehabilitation can be found in the "Operational Guidelines for WASH in Emergencies – Bangladesh" manual by GoB-Unicef-DPHE (Section 7.5.3, page 72 – 73).

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 77-78) and GoB-DPHE-UNICEF Operational Guidelines for WASH in Emergencies – Bangladesh; Section 7.5.

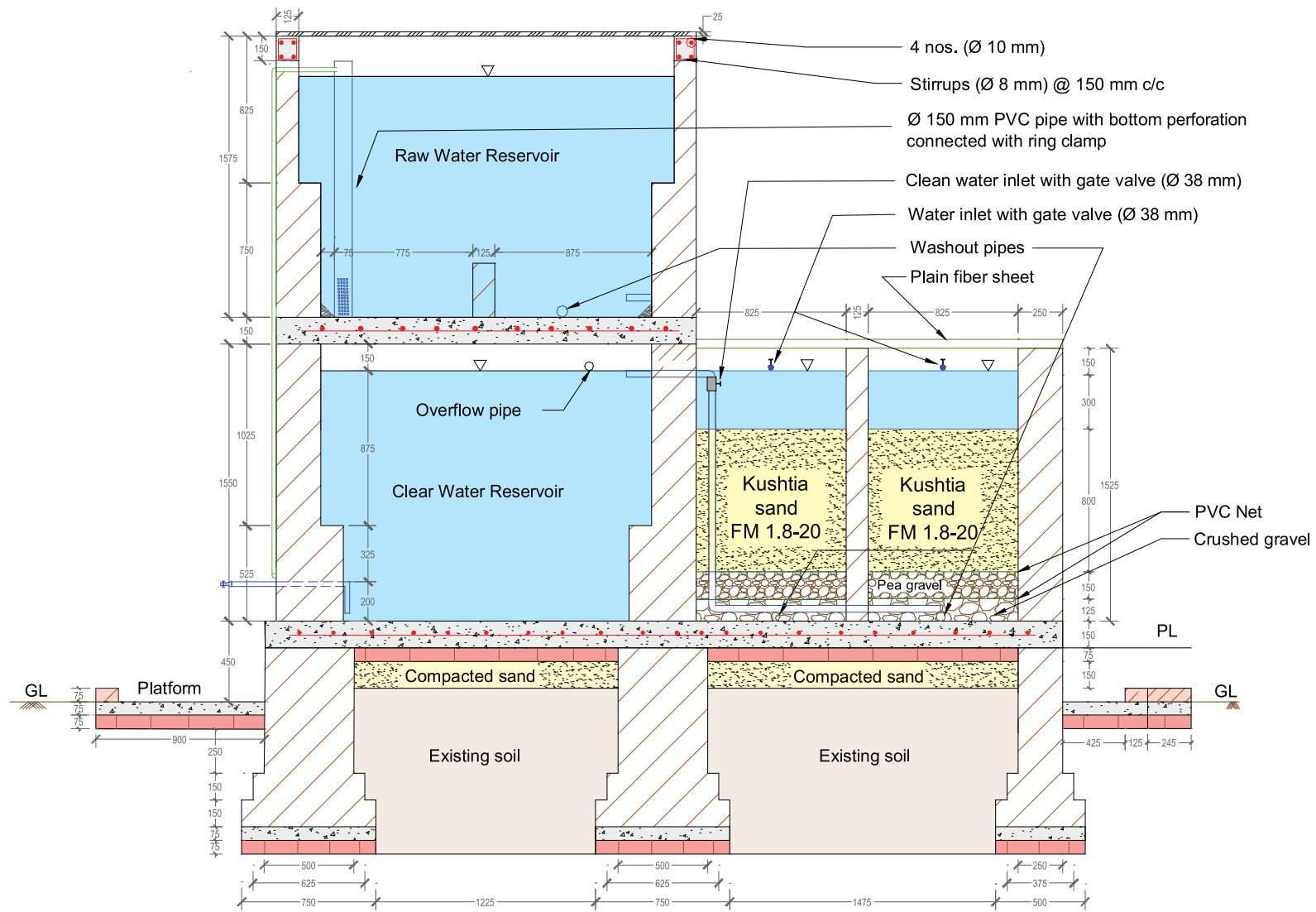
Design Drawings





Normal Pond Sand Filter

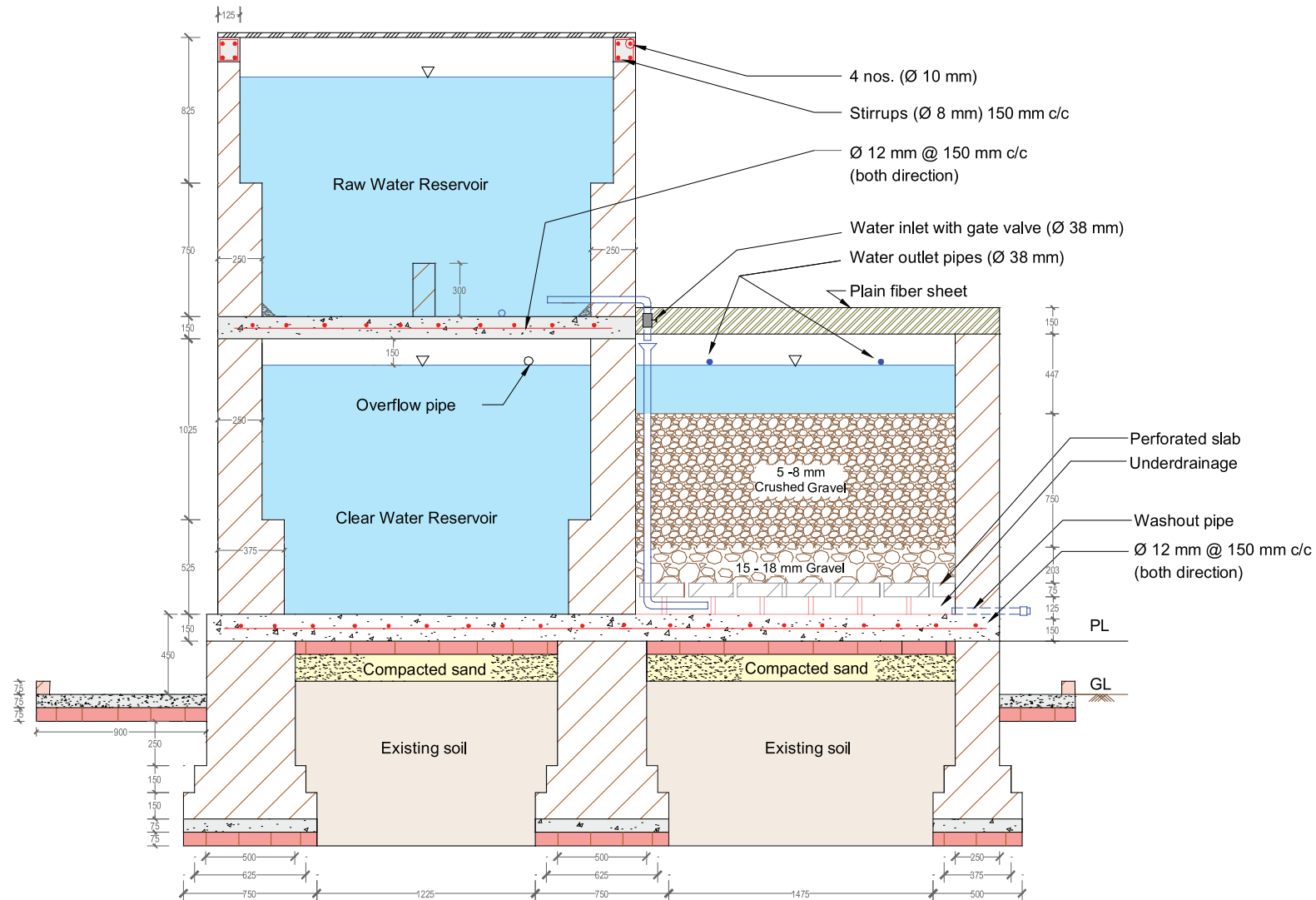
Note: All dimensions are in mm



Section A-A

Normal Pond Sand Filter

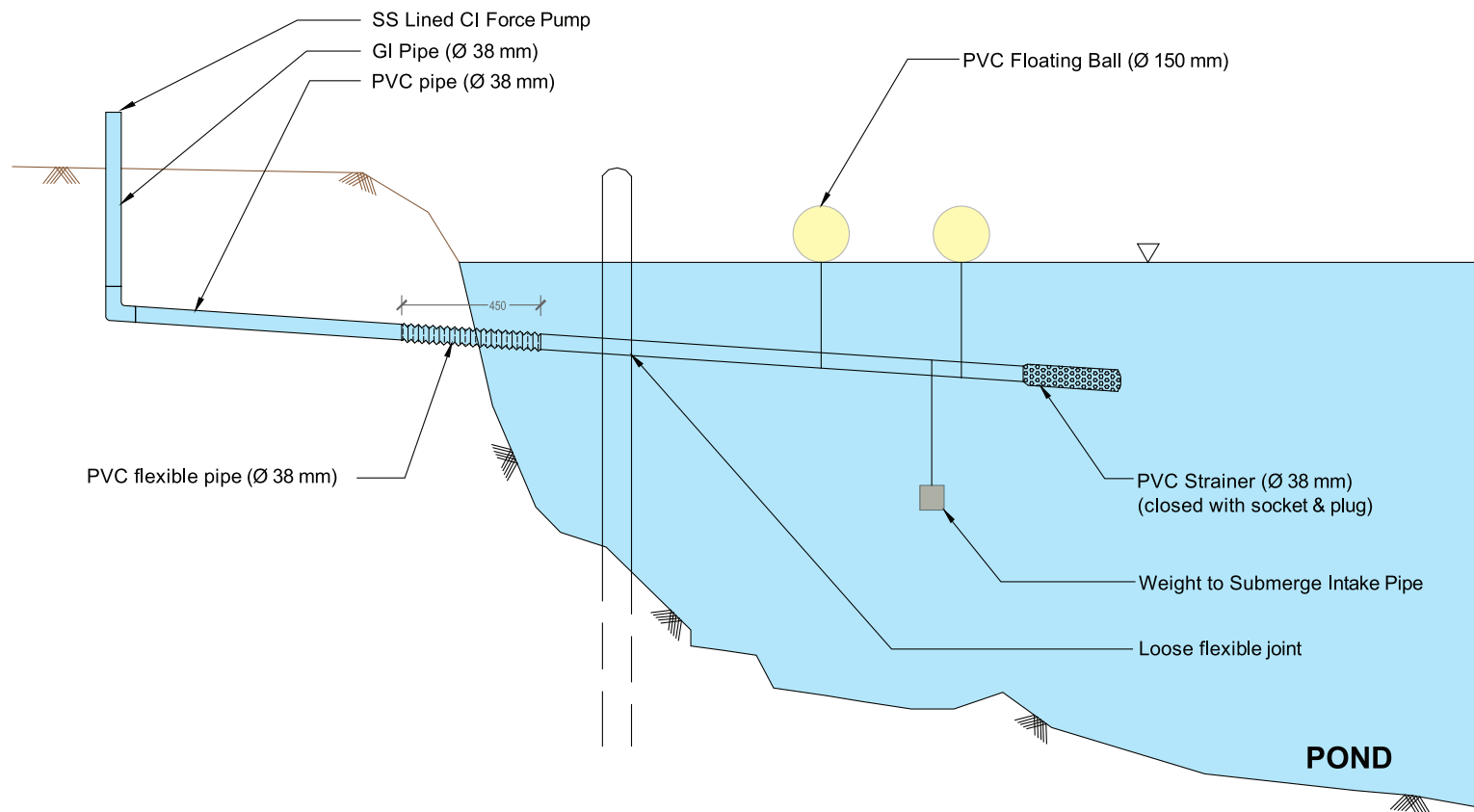
Note: All dimensions are in mm



Section B-B

Normal Pond Sand Filter

Note: All dimensions are in mm



Water Collection arrangement for PSF

Normal Pond Sand Filter

Note: All dimensions are in mm

Cost Estimate

Part A: Construction of PSF

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	2,000	2,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	30	24	720
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	8	193	1,496
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	8	153	1,186
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	18	454	8,286
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	20	42	840
7	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.8	8,330	6,664
8	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	15	7,292	105,734

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	125 mm brick works with first class bricks with cement sand (F.M. 1:2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	21	1,023	21,227
10	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 24$ MPa, satisfying a specified compressive strength $f'_{c} = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming to ASTM C-33 including breaking chips and screening, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering), In floor slab	cum	3	8,346	25,539
11	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form for: In floor slab.	sqm	10	486.5	4,865
12	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (ReH)= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.	kg	285	94	26,790
13	Minimum 20 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to inside wall with cement (1:4) with 1% padloo including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	61	550	33,275
14	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	61	311	18,971
15	Mild steel, Grade 250 with minimum $f_y = 250$ MPa, work in roof frame : supplying and fabrication of mild steel sections as per design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge (measurement to be given for truss member only). Outer frame in two parts over RWR and three parts over three filter should be used 40mm x 4mm x 03mm angles and inner 25mm x 25mm x 03 mm angles as per design, including setting handles made of 25 mm x 03 mm flat bar for easy handling as per instruction of the Engineer in Charge.	kg	130	153	19,890

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge. In RWR	sqm	8	566	4,245
17	Supply and installation of 2.0 mm thick fiber glass sheet (transparent sheet) for roof, wall etc. on M.S. purlin, angle etc. with 'J' hook or screws with washer and putty, all complete as per drawing, specification and direction of Engineer-in-charge. In Filter	sqm	6	1414	8,131
18	Supplying and placing of filter media in SSF and UFRF including screening, washing with water before installation in filter bed. The aggregates should be round, hard, durable and free from loam, sand, clay or other materials following instruction of the Engineer in Charge.				
a)	Supplying and placing of 25 mm - 16 mm downgraded pea gravel as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	2	9,750	18,525
b)	Supplying and placing of 20 mm - 06 mm downgraded khoa as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	0.30	6,000	1,800
c)	Supplying and placing of coarse sand of FM 1.2 as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	2	840	1,680
d)	Supplying laying double layer under drainage brick structures in filter bed as per drawing and direction of the Engineer in Charge.	sqm	1.7	1,000	1,700
19	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	3	705	2,115
Sub-total of Part A					315,678

Part B: Plumbing work

1	Supplying, Lowering, Installation & fitting-fixing of 38 mm dia. G.I Pipe, uPVC Pipe, uPVC Strainer, uPVC Sand Trap, uPVC Socket Adaptor, uPVC Reducer, uPVC End cap in/c solvent Cement Jointing etc. & C.I Hand Pump No. 6 to the site and installation completely as per the direction of E/C.				
a)	Best quality heavy type Hand Pump No-6, (Weight= 30 kg ± 0.5 kg) with 900 mm long handle.	set	1	4,540	4,540
b)	38 mm dia. G.I pipe for tube well. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	3	884	2,652
c)	38 mm dia. G.I pipe for washout. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	3	884	2,652
d)	38 mm dia uPVC tube well pipe. BS 3505, (Class-D, Wall Thickness 2.5 mm- 3.00 mm) including the cost of solvent cement, socket adopter etc.	meter	30	168	5,040
e)	38 mm dia. uPVC Robo strainer of any required size slot.10, BS 3505 (Class -D, wall thickness min. 3 mm, length - 2 meter).	meter	4	260	1,040

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
f)	38 mm dia GI socket	each	8	125	1,000
g)	38 mm dia GI end plug	each	4	100	400
h)	38 mm dia brass valve	each	1	1,075	1,075
i)	38mm dia GI Elbow / 90-degree bend	each	4	150	600
2	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in-charge. 12.5 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 17.8 mm, weight 1.31 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	meter	5	336	1,680
3	Supplying, fitting and fixing of best quality 12mm dia brass bib cock with sealant etc. complete approved and accepted by the Engineer-in-charge.	each	4	400	1,600
4	Disinfection of the PSF with 1 Kg bleaching powder in water and bailing out water after one day until smell of bleaching powder is gone. All complete as direction of the Engineer-in-charge.	item	1	240	240
5	Water Sample Collection and Test: Collection of water sample and testing for fecal coliform by DPHE lab as per direction of Engineer-in-charge.	P/test	2	600	1,200
6	Wrench : Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 nos nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si= 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge.	set	1	1,350	1,350
Sub-total of Part B					25,069

C. Supply and Installation of 100 mm uPVC Tubewell (Avg. depth 15 m)

1	Mobilization of materials, equipment, tools and plants, boring rig at the work site, assembling of derrick, demobilization after completion of work and cleaning the site of work etc. all complete as per direction of the Engineer-in Charge.	LS	1	1,000	1,000
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Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
2	Boring by using at least 200 mm dia cutter with 38mm dia G.I. pipe and other equipment capable of drilling to a depth of 0- 150 m to install 100 mm dia uPVC well by water jet method or any other method approved by the Engineer-in-Charge through all sorts of strata, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipe and casing pipes etc. complete work, (including cost of materials, labour and transportation, contractor's profit and VAT/ IT) (From 0 m to 60 m)	p/m	10	250	2,500
3	Earth work in excavation in all kinds of soil for placing horizontal pipe and filter connecting with the vertical portion of pipe to collect water from pond with submersible pump. Trench should be done at the bottom about 1000mm invert level of pond, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout, earth filling for protecting water during digging and removing total soil after laying filter and sand etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in clayey soil.	cum	15	1,000	15,000
4	Supplying, fitting and fixing 100 mm of D-class blind pipe, G.I pipe, solvent cement, socked adopter and all other necessary materials etc. for lowering and installation of the well after analyzing the soil sample and if it is decided to install the well etc. all complete as per specification and direction of the Engineer- in-Charge.				
a)	100mm dia G.I pipe, (100 mm dia G.I. pipe with wall thickness 3.65 mm, outside diameter min 107.3 mm, weight 10.42 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.)	p/m	1	2,380	1,428
b)	100 mm dia uPVC blind pipe (D- class, wall thickness minimum 6.00 mm - 6.9 mm)	p/m	12	700	8,400
c)	100 mm dia uPVC strainer (E- class, wall thickness minimum 7.3mm - 8.40 mm, slot - 10) to place horizontally at the bottom of pond connecting the vertical pipe as per design.	p/m	3	950	2,850
d)	100 mm dia. end cap	each	1	215	215
e)	100 mm dia. top cap	each	1	160	160
f)	100 mm dia. Socketed adopter	each	1	610	610
5	First Case: Filling up of the annular space between bore hole at the vertical portion and strainer laid horizontally at the bottom of pond with coarse sand. Second Case: Filling the remaining bore hole spaces with bored soil, all complete as per direction of Engineer-in -Charge.				
a)	Filling with graded coarse sand (F.M 2.2) in pond trench covering 500mm surrounding horizontal pipe and filter	cum	8	7,700	61,600
b)	Filling with local /bored soil.	p/m.	5	15	75
6	Complete development of the tube well to obtain sand and turbidity free water at a satisfactory yield. The whole work has to be done as per specification and direction the Engineer in Charge.	item	1	1,000	1,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
7	Sanitary Sealing: Making sanitary seal up to 1.0 m depth around the well from GL or specified including supply of approved quality of cement, sand and brick chips (13 mm downgraded) in ratio 1:2:4 with 3% bentonite etc. all complete as per specification, drawing and direction of the Engineer in Charge.	item	1	350	350
8	Disinfection of the tubewell, necessary bleaching powder (30% - 33% strength), chlorinated water should be 150 mg/l free chlorine. The whole work has to be done as per specification and direction of the Engineer in Charge.	item	1	500	500
9	Water sample collection in an acidified HDP bottle and sending it to nearest DPHE Zonal lab /any recognized public lab for analysis and testing of selected parameter such as As, Mn, Cl, Fe, pH and fecal coliform etc. Water to be tested with field test kits on site as per instruction of the Engineer-in- charge (Collection of water sample in presence of EIC or his representatives, carrying cost to the laboratory and Laboratory test fee deposit by the contractor has been included in this item).	LS	1	4,000	4,000
10	Construction of Masonry pit as security chamber including M.S lid for maintenance and protection of the submersible pump motor. Masonry wall 125mm wall over 75mm thick cement concrete 1: 2: 4 over Brick flat soling foundation excavating soil up to 150 mm below GL around the tubewell for making a chamber inside size: 600mm x 600mm x 600mm including 12mm thick cement plaster with neat cement finishing in inside/ outside wall, floor etc. including 16 BWG MS sheet and MS angle floor cover with locking arrangement to be completed as per specification, drawing and direction of the Engineer in Charge.	LS	1	4,000	4,000
Sub-total of Part C					103,688
Total Cost for Normal PSF (A + B + C)					444,435

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Solar Power Operated Pond Sand Filter

Context and Description

Emergency Context

Applicable in areas with droughts, arsenic/iron contamination, surface water pollution, saline water intrusion, etc. for a larger group of users.

Major Components

- > Pond
- > Floating intake (which collects water from the pond)
- > Pumping unit (Solar operated pump and Hand lift pump (for emergency))
- > Solar panel
- > Controller for automatic solar pumping
- > Filter unit
- > Disinfection system (e.g., UV system).

Technology Description

- > PSF is mainly a slow sand filter unit constructed near or on the bank of a pond to treat no- or low-saline pond water to be used for domestic purposes.
- > The water from the pond is pumped using solar operated pump to the filter bed of the PSF or the raw water tank. Water from the raw water tank is conveyed to the filtration chamber (roughing filter chamber followed by slow sand filter chamber). Solar operated automatic pump ensures continuous pumping of raw water from pond to the raw water tank, once it gets empty. The provision of hand lift pump is kept for pumping during emergency, when the operation of solar operated pump remains non-functional.
- > Water from filtration chamber goes to a clear water reservoir tank, which is then disinfected, and users collect treated pond water from the taps.



Figure 16: A solar powered pond sand filter (Courtesy: ITN-BUET)

Suitability

Suitable for coastal and arsenic contaminated areas where no or low-saline ponds are available, and people are habituated or agree to drink treated pond water.

Risks/Challenges

- > Availability of suitable pond with low or no salinity, and protection of the pond
- > Regular operation to keep filter bed of PSF functional
- > Bacterial contamination of PSF water

Pond Cleaning and Rehabilitation

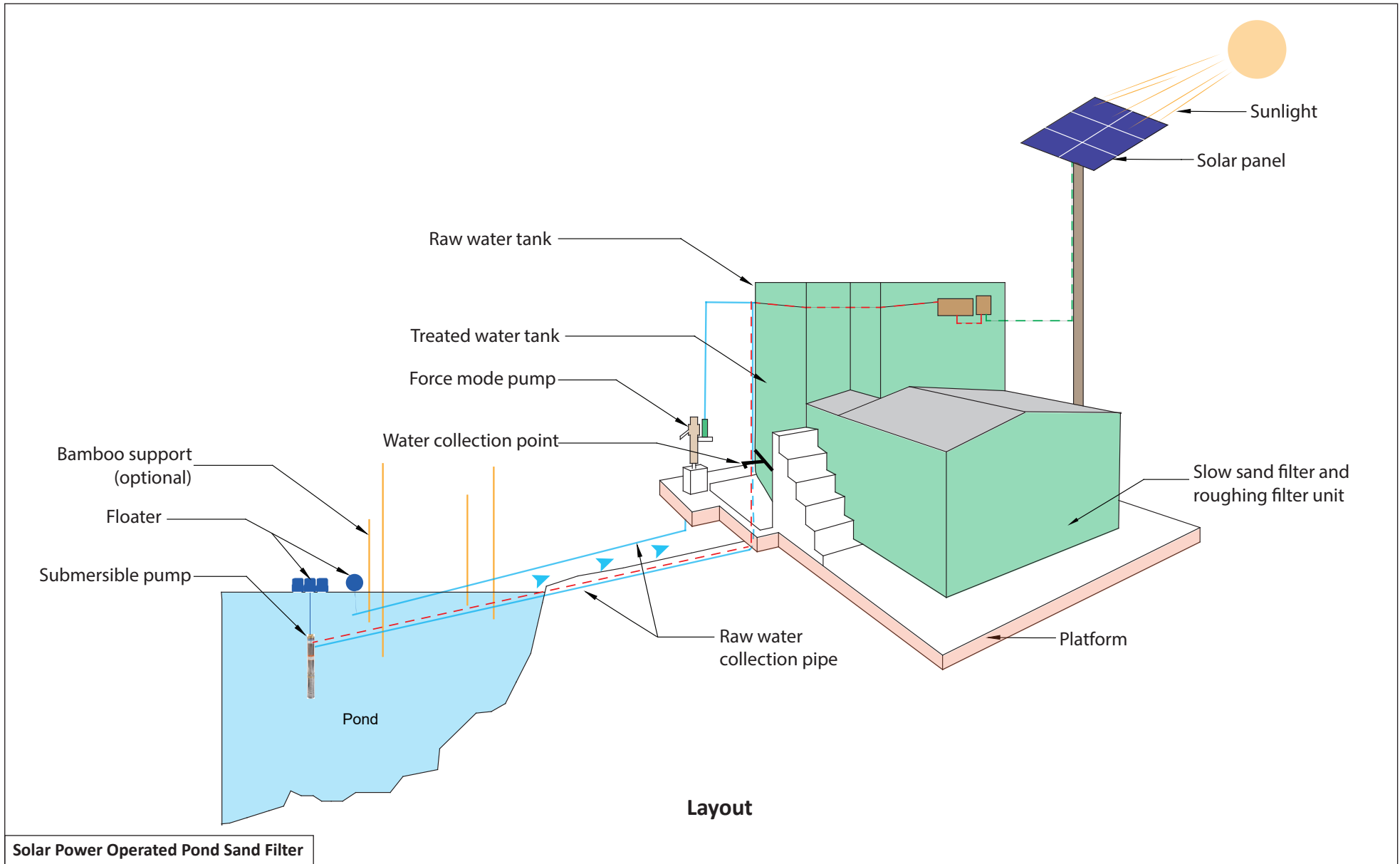
Before commencing the cleaning process, the source water pond's dimensions should be measured; along with mean depth and water level. Then the pond shall be screened for floating objects of all kinds, and any debris should be removed immediately. For treatment and turbidity removal, lime (or hard-lime) is required and the requirement is estimated based on the pond size and depth. Usually, 1 to 2 kg lime is needed to treat a pond. To begin with, half of the required lime is mixed with water. The solution is then spread across the pond equally, stirred and mixed well with the pond water.

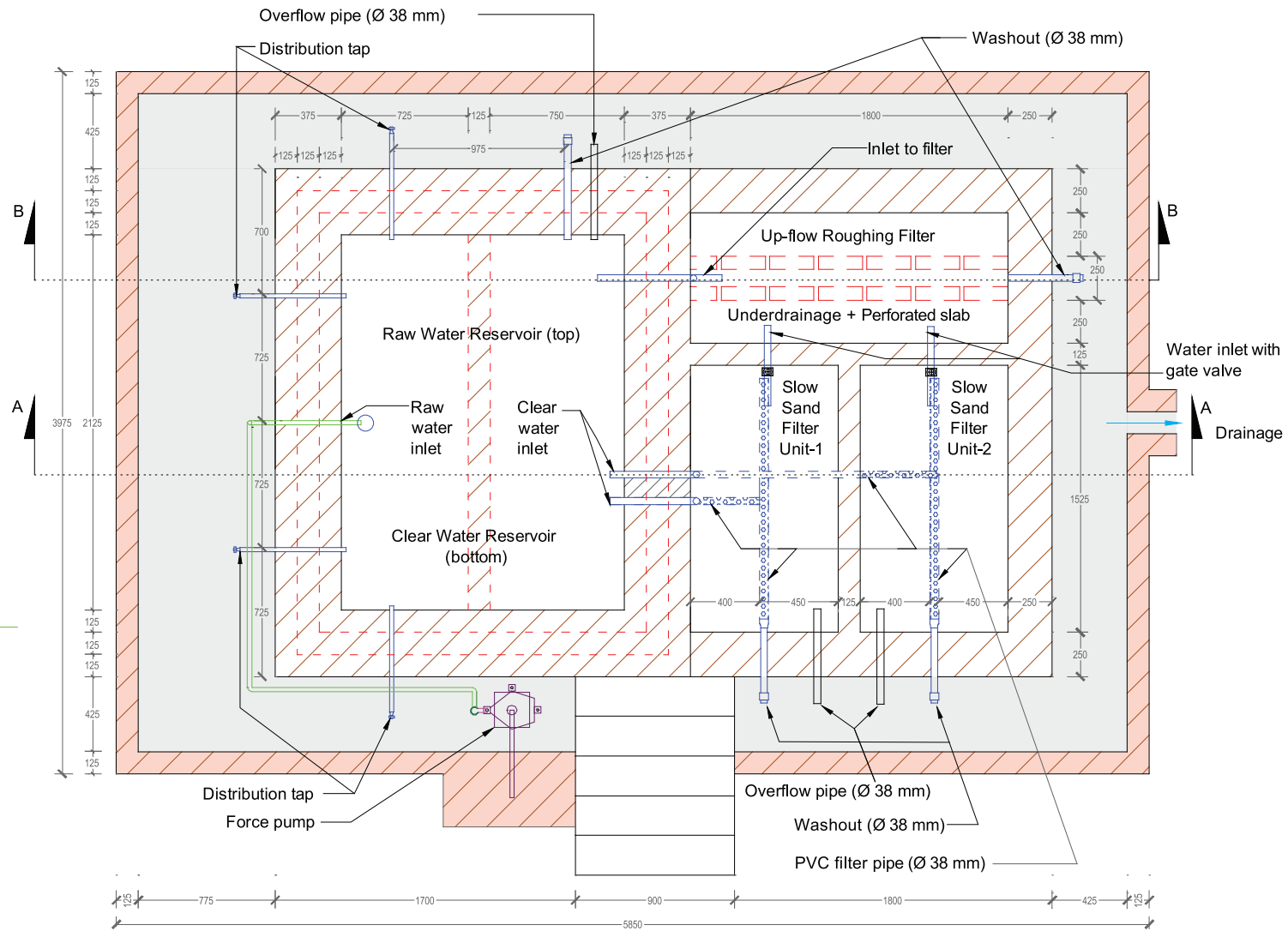
The water should then be kept undisturbed for 4-5 hours. This whole process is then repeated again, utilizing the rest of the lime. The entire process should last over 10 hours for effectiveness. If the pond is not visibly clean afterwards, the water of the pond should be drained entirely using a diesel pump and irrigation hose. Natural discharge from unconfined aquifers would refill the pond in some areas, or mechanical pumping from other rivers or lakes can be employed for refilling. Afterwards, if necessary, lime application as mentioned above can be performed to treat the newly refilled water.

Further instruction and details regarding pond cleaning and rehabilitation can be found in the “Operational Guidelines for WASH in Emergencies – Bangladesh” manual by GoB-Unicef-DPHE (Section 7.5.3, page 72 – 73).

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 77-78) and GoB-DPHE-UNICEF Operational Guidelines for WASH in Emergencies – Bangladesh; Section 7.5.

Design Drawings

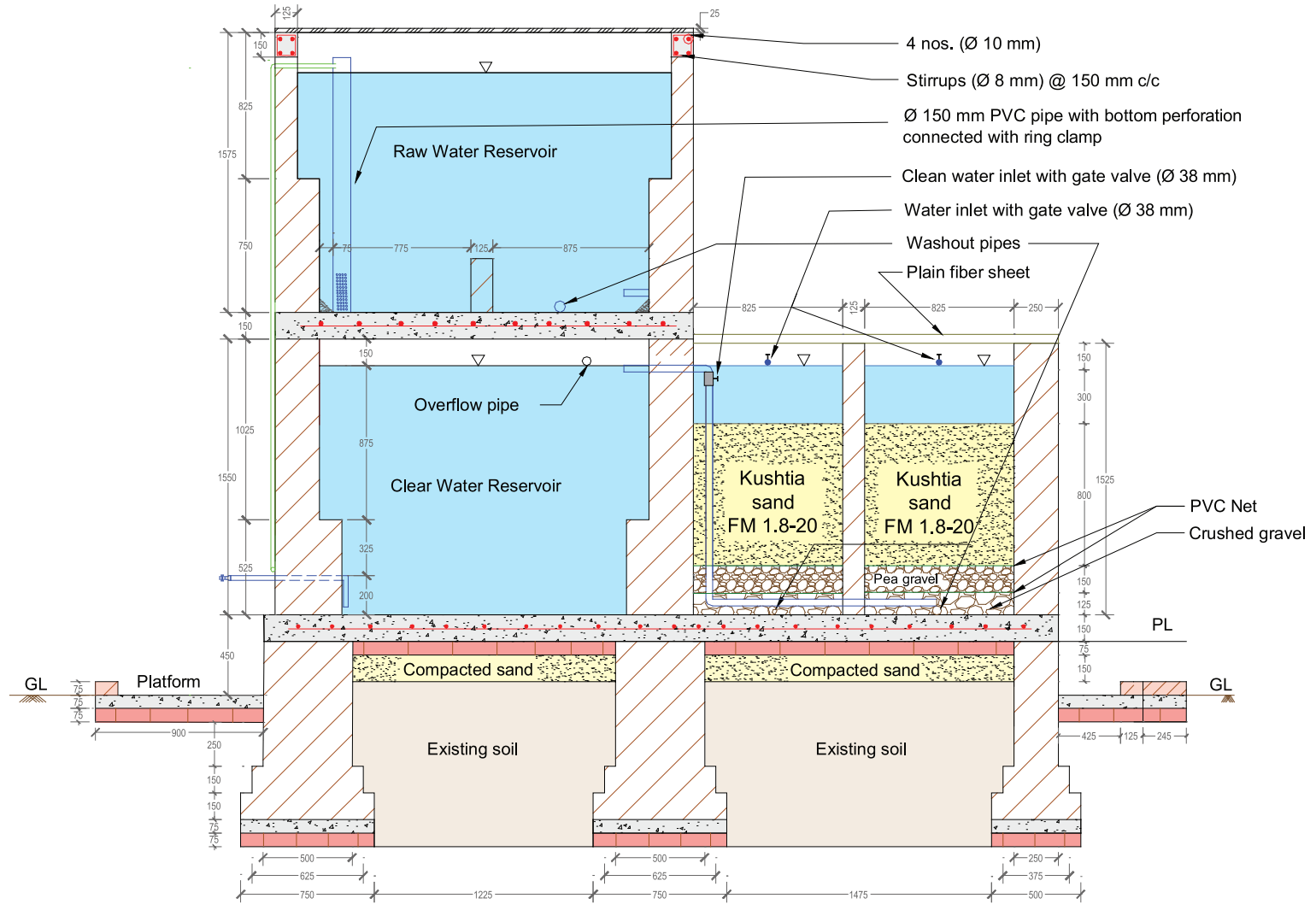




Plan

Solar Power Operated Pond Sand Filter

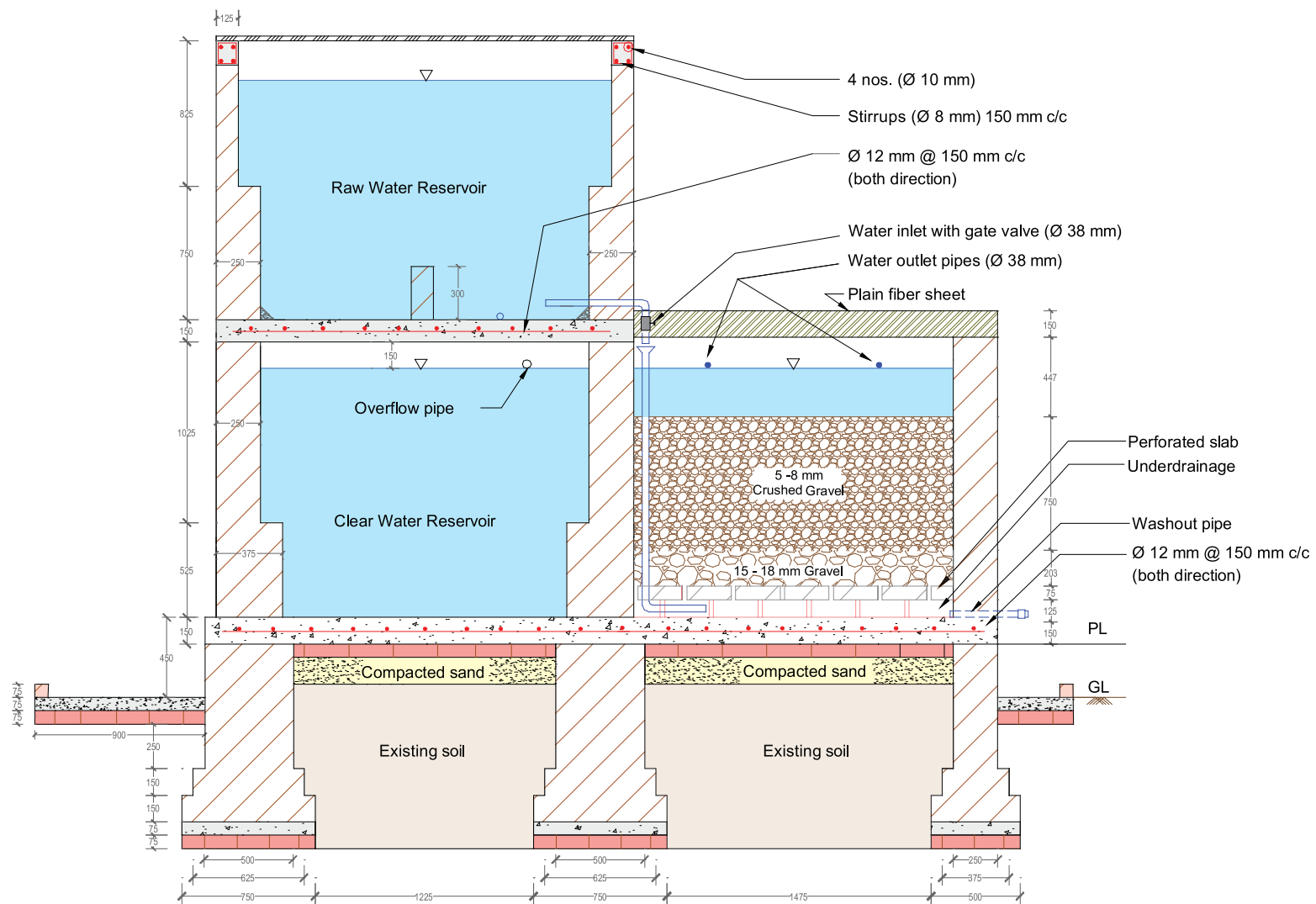
Note: All dimensions are in mm



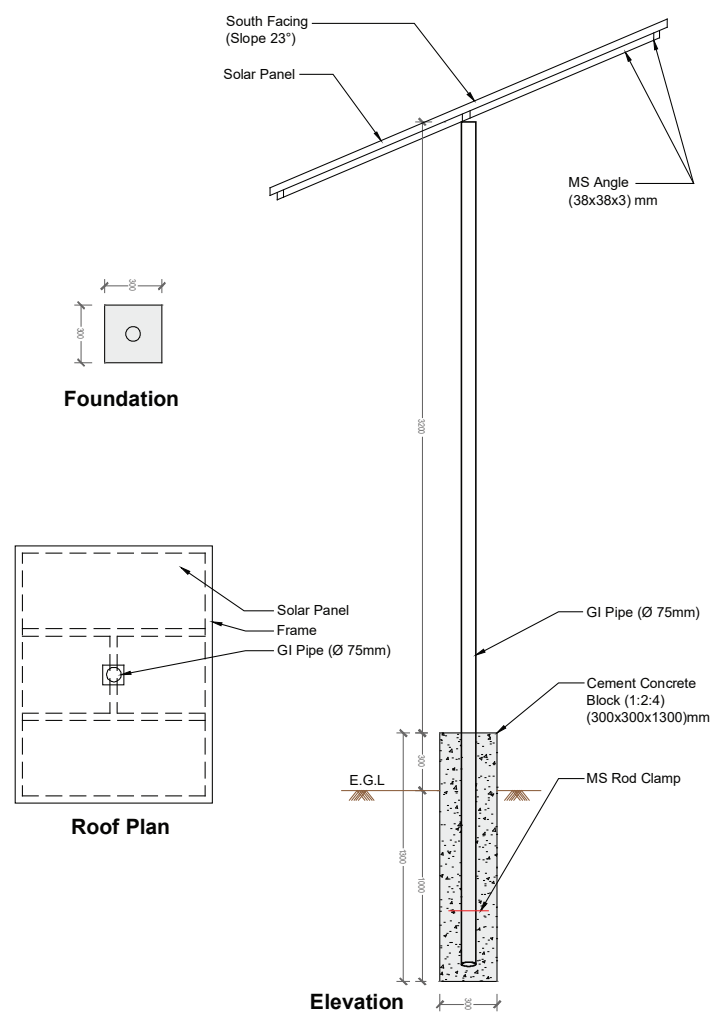
Section A-A

Solar Power Operated Pond Sand Filter

Note: All dimensions are in mm



Section B-B



Detail Design of Solar Panel

Solar Power Operated Pond Sand Filter

Note: All dimensions are in mm

Cost Estimate

Part A: Construction of PSF

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	2,000	2,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	30	24	720
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	8	193	1,496
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	8	153	1,186
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	18	454	8,286
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	20	42	840
7	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.8	8,330	6,664
8	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	15	7,292	105,734

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	125 mm brick works with first class bricks with cement sand (F.M. 1:2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	21	1,023	21,227
10	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 24$ MPa, satisfying a specified compressive strength $f'_{c} = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming to ASTM C-33 including breaking chips and screening, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering), In floor slab.	cum	3	8,346	25,539
11	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form for: In floor slab.	sqm	10	499	4,865
12	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (ReH)= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.	kg	285	94	26,790
13	Minimum 20 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to inside wall with cement (1:4) with 1% padloo including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	61	550	33,275
14	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	61	311	18,971
15	Mild steel, Grade 250 with minimum $f_y = 250$ MPa, work in roof frame : supplying and fabrication of mild steel sections as per design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge (measurement to be given for truss member only). Outer frame in two parts over RWR and three parts over three filter should be used 40mm x 4mm x 03mm angles and inner 25mm x 25mm x 03 mm angles as per design, including setting handles made of 25mm x 03mm flat bar for easy handling as per instruction of the Engineer in Charge.	kg	130	153	19,890

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 ft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge. In RWR	sqm	8	566	4,245
17	Supply and installation of 2.0 mm thick fiber glass sheet (transparent sheet) for roof, wall etc. on M.S. purlin, angle etc. with 'J' hook or screws with washer and putty, all complete as per drawing, specification and direction of Engineer-in-charge. In Filter	sqm	6	1,414	8,131
18	Supplying and placing of filter media in SSF and UFRF including screening, washing with water before installation in filter bed. The aggregates should be round, hard, durable and free from loam, sand, clay or other materials following instruction of the Engineer in Charge.				
a)	Supplying and placing of 25mm - 16 mm downgraded pea gravel as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	2	9,750	18,525
b)	Supplying and placing of 20 mm - 06 mm downgraded khoa as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	0.30	6,000	1,800
c)	Supplying and placing of coarse sand of FM 1.2 as filter materials as shown in drawing and direction of the Engineer in Charge.	cum	2	840	1,680
d)	Supplying laying double layer under drainage brick structures in filter bed as per drawing and direction of the Engineer in Charge.	Sqm	1.7	1,000	1,700
19	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	3	705	2,115
Sub-total of Part A					315,678

Part B: Plumbing work

1	Supplying, Lowering, Installation & fitting-fixing of 38 mm dia. G.I Pipe, uPVC Pipe, uPVC Strainer, uPVC Sand Trap, uPVC Socket Adaptor, uPVC Reducer, uPVC End cap in/c solvent Cement Jointing etc. & C.I Hand Pump No. 6 to the site and installation completely as per the direction of E/C.				
a)	Best quality heavy type Hand Pump No-6, (Weight= 30 kg ± 0.5 kg) with 900 mm long handle.	set	1	4,540	4,540
b)	38 mm dia. G.I pipe for tube well. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	3	884	2,652
c)	38 mm dia. G.I pipe for washout. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	3	884	2,652
d)	38 mm dia uPVC tube well pipe. BS 3505, (Class-D, Wall Thickness 2.5 mm- 3.00 mm) including the cost of solvent cement, socket adopter etc.	meter	30	168	5,040

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
e)	38 mm dia. uPVC Robo strainer of any required size slot.10, BS 3505 (Class -D, wall thickness min. 3 mm, length - 2 meter).	meter	4	260	1,040
f)	38 mm dia GI socket	each	8	125	1,000
g)	38 mm dia GI end plug	each	4	100	400
h)	38 mm dia brass valve	each	1	1,075	1,075
i)	38mm dia GI Elbow / 90-degree bend	each	4	150	600
2	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in-charge. 12.5 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 17.8 mm, weight 1.31 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	meter	5	336	1,680
3	Supplying, fitting and fixing of best quality 12mm dia brass bib cock with sealant etc. complete approved and accepted by the Engineer-in-charge.	each	4	400	1,600
4	Disinfection of the PSF with 1 Kg bleaching powder in water and bailing out water after one day until smell of bleaching powder is gone. All complete as direction of the Engineer-in-charge.	item	1	240	240
5	Water Sample Collection and Test: Collection of water sample and testing for fecal coliform by DPHE lab as per direction of Engineer-in-charge.	P/test	2	600	1,200
6	Wrench : Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 nos nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si= 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge	set	1	1,350	1,350
Sub-total of Part B					25,069

Part C: Supply and Installation of 100 mm uPVC Tubewell (Avg. depth 15 m)

1	Mobilization of materials, equipment, tools and plants, boring rig at the work site, assembling of derrick, demobilization after completion of work and cleaning the site of work etc. all complete as per direction of the Engineer-in Charge.	LS	1	1,000	1,000
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Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
2	Boring by using at least 200 mm dia cutter with 38mm dia G.I. pipe and other equipment capable of drilling to a depth of 0- 150 m to install 100 mm dia uPVC well by water jet method or any other method approved by the Engineer-in-Charge through all sorts of strata, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipe and casing pipes etc. complete work, (including cost of materials, labour and transportation, contractor's profit and VAT/ IT) (From 0 m to 60 m)	p/m	10	250	2,500
3	Earth work in excavation in all kinds of soil for placing horizontal pipe and filter connecting with the vertical portion of pipe to collect water from pond with submersible pump. Trench should be done at the bottom about 1000mm invert level of pond, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout, earth filling for protecting water during digging and removing total soil after laying filter and sand etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in clayey soil.	cum	15	1,000	15,000
4	Supplying, fitting and fixing 100mm of D-class blind pipe, G.I pipe, solvent cement, socked adopter and all other necessary materials etc. for lowering and installation of the well after analyzing the soil sample and if it is decided to install the well etc. all complete as per specification and direction of the Engineer- in-Charge.				
a)	100mm dia G.I pipe, (100 mm dia G.I. pipe with wall thickness 3.65 mm, outside diameter min 107.3 mm, weight 10.42 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.)	p/m	1	2,380	1,428
b)	100 mm dia uPVC blind pipe (D- class, wall thickness minimum 6.00 mm - 6.9 mm)	p/m	12	700	8,400
c)	100 mm dia uPVC strainer (E- class, wall thickness minimum 7.3 mm - 8.40 mm, slot - 10) to place horizontally at the bottom of pond connecting the vertical pipe as per design.	p/m	3	950	2,850
d)	100 mm dia. end cap	each	1	215	215
e)	100 mm dia. top cap	each	1	160	160
f)	100 mm dia. Socketed adopter	each	1	610	610
5	First Case: Filling up of the annular space between bore hole at the vertical portion and strainer laid horizontally at the bottom of pond with coarse sand. Second Case: Filling the remaining bore hole spaces with bored soil, all complete as per direction of Engineer-in -Charge				
a)	Filling with graded coarse sand (F.M 2.2) in pond trench covering 500mm surrounding horizontal pipe and filter	cum	8	7,700	61,600
b)	Filling with local /bored soil.	p/m	5	15	75
6	Complete development of the tube well to obtain sand and turbidity free water at a satisfactory yield. The whole work has to be done as per specification and direction the Engineer in Charge.	item	1	1,000	1,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
7	Sanitary Sealing: Making sanitary seal up to 1.0 m depth around the well from GL or specified including supply of approved quality of cement, sand and brick chips (13 mm downgraded) in ratio 1:2:4 with 3% bentonite etc. all complete as per specification, drawing and direction of the Engineer in Charge.	item	1	350	350
8	Disinfection of the tubewell, necessary bleaching powder (30% - 33% strength), chlorinated water should be 150 mg/l free chlorine. The whole work has to be done as per specification and direction of the Engineer in Charge.	item	1	500	500
9	Water sample collection in an acidified HDP bottle and sending it to nearest DPHE Zonal lab /any recognized public lab for analysis and testing of selected parameter such as As, Mn, Cl, Fe, pH and fecal coliform etc. Water to be tested with field test kits on site as per instruction of the Engineer-in-charge (Collection of water sample in presence of EIC or his representatives, carrying cost to the laboratory and Laboratory test fee deposit by the contractor has been included in this item).	LS	1	4,000	4,000
10	Construction of Masonry pit as security chamber including M.S lid for maintenance and protection of the submersible pump motor. Masonry wall 125mm wall over 75mm thick cement concrete 1: 2: 4 over Brick flat soling foundation excavating soil up to 150 mm below GL around the tubewell for making a chamber inside size: 600mm x 600mm x 600mm including 12mm thick cement plaster with neat cement finishing in inside/ outside wall, floor etc. including 16 BWG MS sheet and MS angle floor cover with locking arrangement to be completed as per specification, drawing and direction of the Engineer in Charge.	LS	1	4,000	4,000
Sub-total of Part C					103,688

Part D. Solar Panel, Solar Pump, & Solar structure

1	Supply, installation, testing & commissioning of 373 Watt, 8000 Liter per day discharge, 40m head capacity solar DC pump with dual type controller(DC as well as conventional AC power) of Lorentz or equivalent brand with 1" dia flow meter, 1" dia GI check valve, 1" dia GI gate valve, 25mm x 25mm x 25mm Tee, air release valve etc Origin: UK/ Japan or EU Countries etc. all complete and direction of Engineer in charge	set	1	200,041	200,041
2	Supply & installation of Teflon tape, cable tie, socket, short nipple, union socket, M seal etc. all complete and direction of Engineer in charge	set	1	2,065	2,065
3	Supply, installation, testing & commissioning of 4x4 sq.mm NYY motor cable, 2x1.5 NYY sq.mm sensor cable, 1x4 sq.mm NYY module cable, float switch cable etc. all complete and direction of Engineer in charge	set	1	66,101	66,101
4	Supply, installation, testing & commissioning of well probe sensor & float switch etc. all complete and direction of Engineer in charge	set	1	6,742	6,742
5	Supply, installation, testing & commissioning each of 330 Wp solar panel, TIER-1 etc. all complete and direction of Engineer in charge. Warranty: At least 20 yrs.	Wp	990	75	74,250
6	Supply of splice kit, PIB tape, royal bolt, industrial channel, PBC tape for motor cable latching, screw with washer, royal plug etc. all complete	set	1	2,323	2,323
7	Supply & fixing 500-volt grade, 15 Amps rating rewirable fuse link porcelain carrier cutout (foreign made) on prepared board of the following ratings.	each	8	50	400

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
8	Providing & fixing on a prepared board 250-volt grade 5 - 40 Amps. single pole miniature circuit breaker (SPMCBS) having minimum breaking capacity 6-KA with thermal over-current and instantaneous electromagnetic short circuit release provision. SPMCBS of DORMAN SMITH / MEM / SIEMENS / VIRTZRO /HAGER / FEDERAL / KAWAMURA / ABB / HAVELLS / LEGRAND / MERLIN GERIN / SCHNEIDER or equivalent brand accepted / approved by the engineer.	each	3	640	1,920
9	Supplying, fitting and fixing Distribution board made of 18 SWG steel sheet metal enclosed with double cover, gray hammer painted on outside and enamel paint on inside on rust proof prime coat with hinged front door with lock and key arrangement for half concealed mounted board having knock out for conduit entry and exit for 415/230V TP&N/ SP&N operations. The board shall have solid neutral and earth copper bus bar and also required size off 3 phase copper bus bars covering transparent fiber glass. All bars shall have required number of holes of 5mm for cable connections etc. all complete as per drawing, design and direction of E-I-C.	sqm	1	9,257	9,257
10	Earthing the electrical installation with 40 mm (1.5”) dia G.I. pipe (earth electrode) having 6.35 mm. dia hole across the pipe at 305 mm. interval securely bonded by soldering with 2 nos. of No-2 SWG HDDB earth leads (at the top of the electrode) with its protection by 20 mm. (3/4”) dia G.I. pipe up-to plinth level run at a depth of 609.6 mm (2 ft.) below G.L up-to main board to be earthed including necessary connecting copper sockets, bolts, nuts, etc. complete for maintaining earth resistance within 1 ohm. Depth of bottom of main electrode at 6858 mm. (22.5 ft) from GL & length of electrode 6096 mm. (20 ft).	set	1	15,697	15,697
11	Supply and installation of electrolytic annealed copper/PVC single core green earth continuity conductor along with cable in pre-installed conduit/cable tray including connection to various metallic parts etc. all complete as per drawings, specifications and direction of the Engineer of the following: <i>2.5mm² Green</i>	m	10	45	453
12	Supply and install module mounting structure according to the detailed drawing provided and approved by the Engineer. Fixed Panel Structure mounting on pole with 23 degree south facing. Rate should include Aluminum anodized /HD galvanized angle structure of 38mm x 38mm x 3mm and the pole is 75mm dia GI two supports, plates & screw, bracing and angles for dividers etc to complete the structure. Rate shall include excavation, concentrating and fixing of structure. all complete as per direction of the engineer in charge.	set	1	40,000	40,000
13	Supply, installation of 100Wp of solar module/panel for LED light and UV system with necessary electrical cables to the DB's as well as controller to have a complete operational circuit, conduits, cable trays, earthing system and complete main junction box according to the drawing and engineer instruction and approval. all complete as per direction of the engineer in charge. solar panel would be from the same brand as pump, motor and controller. Warranty: 5 Years warranty for complete system	Item	1	7,000	7,000
Sub-total of Part D					426,249
Total Cost for Solar Operated PSF (A + B + C + D)					870,684

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Rainwater Harvesting System

Context and Description

Emergency Context

Drought-prone areas, low-rainfall, contaminated surface and/or groundwater sources, salinity-affected areas and in flood-prone areas (during emergency).

Major Components

- > Catchment
- > Gutter and conveyance pipes
- > First flush device/filtration system
- > Storage tank
- > Disinfection system (UV or bleaching powder/chlorination system)

Technology Description

- > Rainfall over the catchment surface is collected through a system via gutters and pipes. Before the commencement of the wet season, catchment is cleaned.
- > If first flush device is used, then discard the initial rainfall for about 3-5 minutes through the first flush device since it contains particulate matter and other dirt. After 3-5 minutes of rainfall, the rainwater is collected and stored in a clean storage tank of about 3000L.
- > Sometimes a filter unit (sand filter) is placed in place of first flush device before the storage tank to filter out any dirt and other impurities. For use, the stored rainwater is collected in a small container, which is disinfected by different means (e.g., UV disinfection/bleaching powder).

Suitability

Mostly suitable for water scarce areas (salinity, arsenic contaminated areas), coastal and hilly areas.

Design Consideration

At the household level, a moderate sized rainwater harvesting system can provide drinking water for a 5- member family during wet months of the year.

Risks/Challenges

- > Improper catchment cleaning before harvesting rainwater
- > Chances of contamination of stored water
- > Unhygienic water collection/use practice



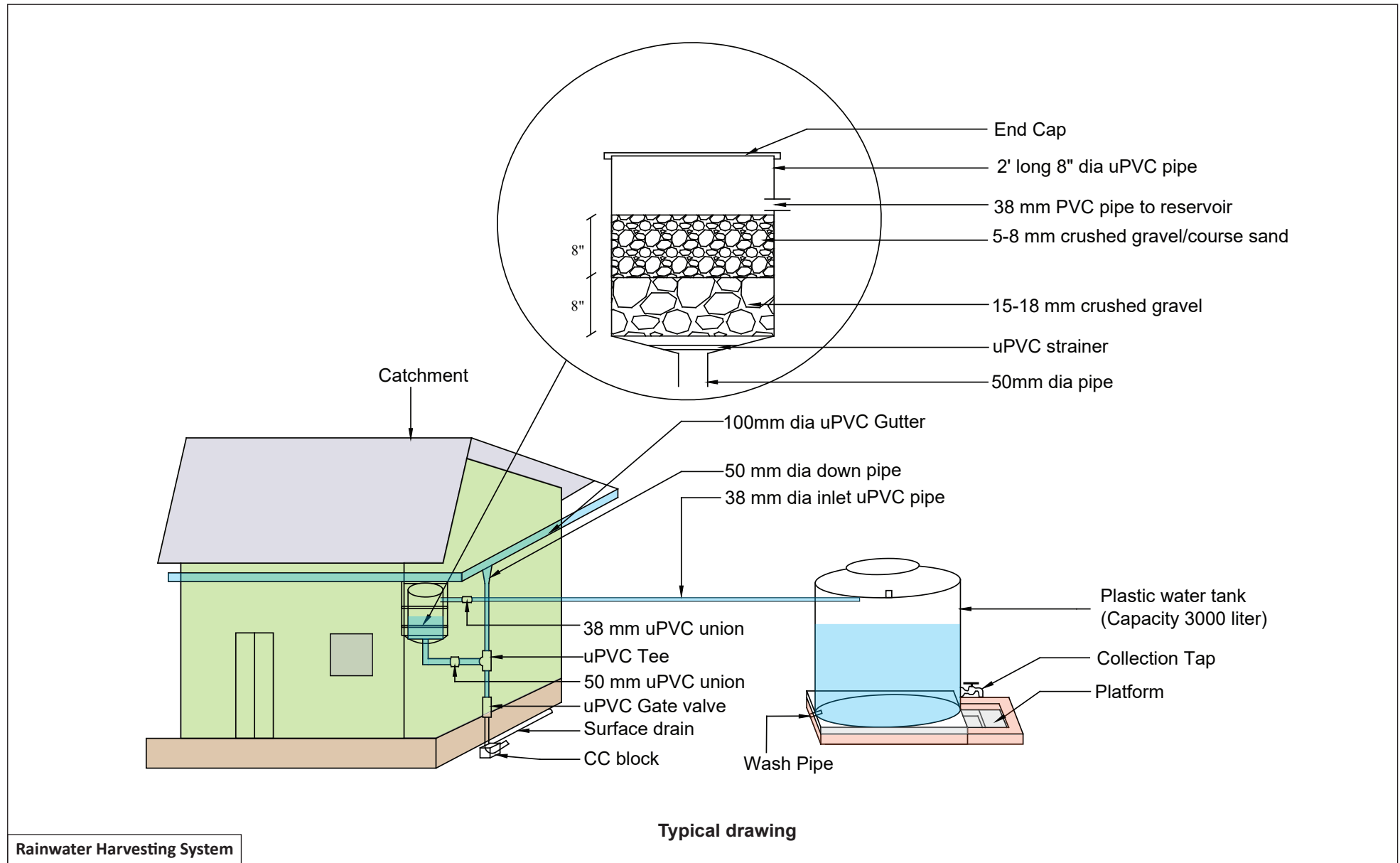
Figure 17: (A) Rainwater harvesting system (Courtesy: Concern Worldwide), (B) Rainwater UV disinfection system (Courtesy: ITN-BUET)

Operation and Maintenance

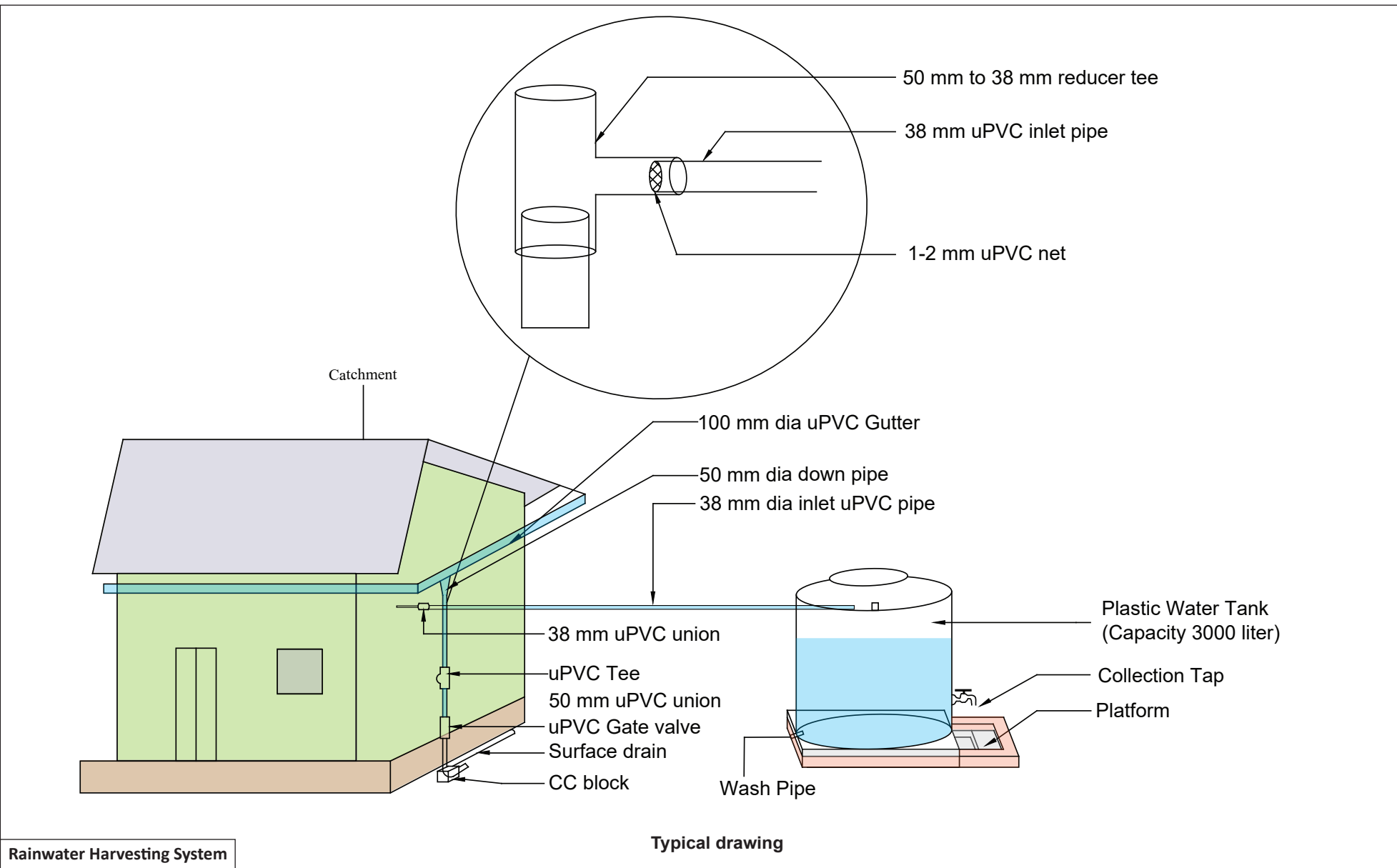
- > Regular cleaning of catchment, conveyance system and storage system, especially before the commencement of rainy season.
- > Regular checking the functionality of disinfection systems, when rainwater is stored for drinking purposes.

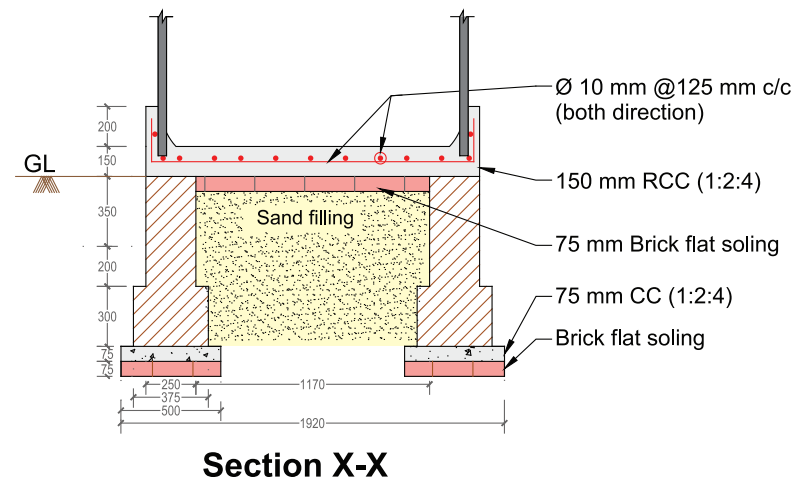
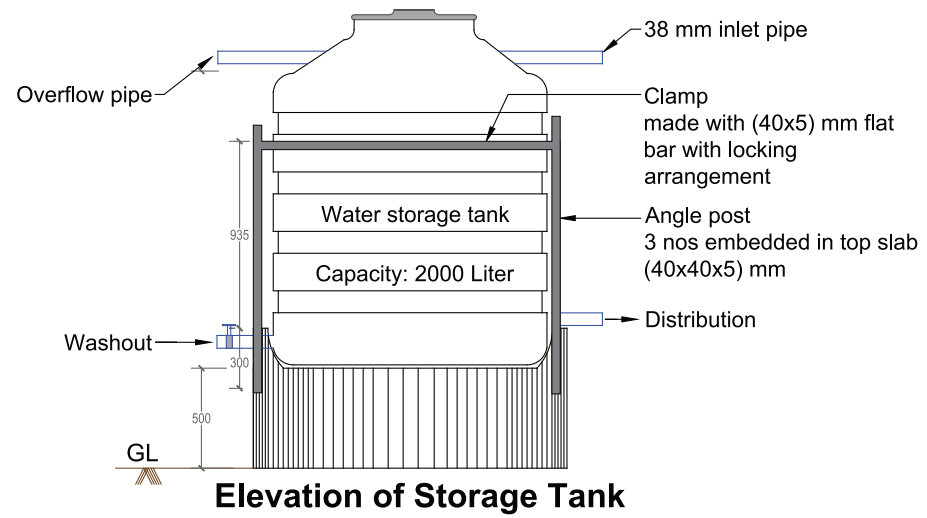
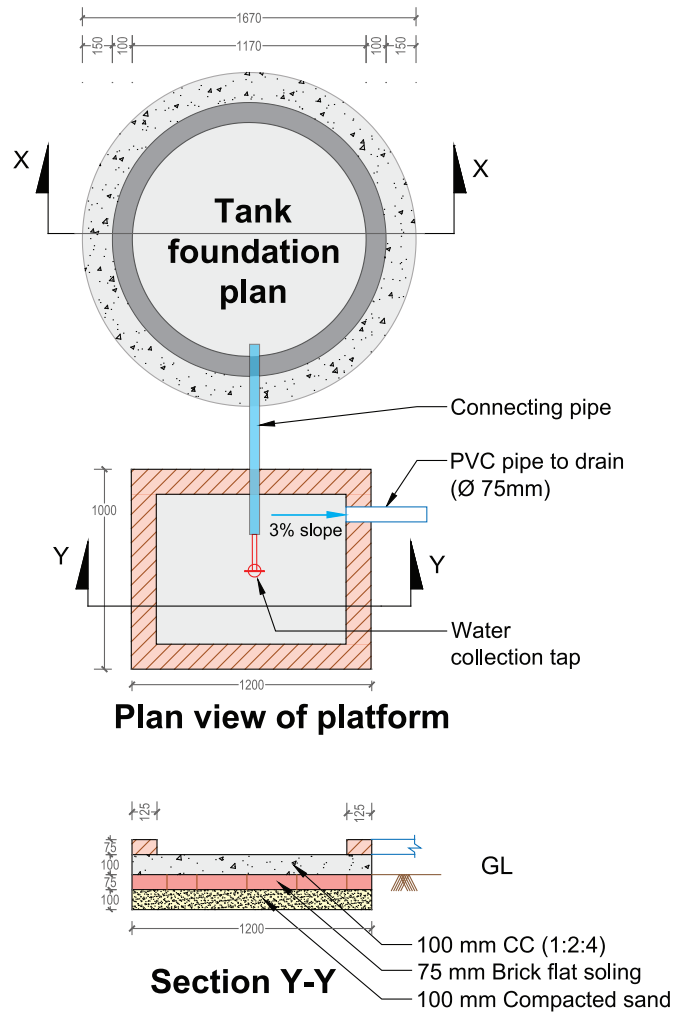
Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 81-82)

Design Drawings



Rainwater Harvesting System





Cost Estimate

Sl. No.	Item of Works	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all construction materials, equipment and manpower, preparation and dressing of the site before and after construction, demobilization etc. all complete as per direction of the Engineer-in-charge.	1	L.S	1,000	1,000
2	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, leveling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in medium stiff clayey soil.	0.69	cum	178	124
3	Sand filling in foundation trenches and plinth with coarse sand having min. F.M. 1.2 in 150mm in layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming Each layer up to finished level as per design supplied by the design office only etc. all complete and accepted by the Engineer-in-charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Base of Tank and Platform)	0.394	cum	1,086	428
4	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Platform)	0.92	sqm	479	440
5	Mass concrete (1:2:4) in foundation or floor with cement, sand (F.M. 1.2) and picked jhama chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days including the supply of water, electricity and other charges and costs of tools and plants etc. all complete and accepted by the E/C. (Cement: CEM-II/A-M) (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	0.28	cum	8,702	2,400
6	250 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in exterior walls including filling the interstices with mortar, raking out joints, cleaning and soaking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Base of tank)	0.24	cum	7,728	1,855
7	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Platform)	0.49	sqm	1,091	539

Sl. No.	Item of Works	Unit	Quantity	Rate (BDT)	Amount (BDT)
8	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to plinth wall (1:4) with cement up to 150 mm below ground level with neat cement finishing including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity and other charges etc. all complete in all respect as per drawing and accepted by the E/C. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). (Cement: CEM-II/A-M) Ground floor. (Platform and base of tank)	3.32	sqm	352	1,169
9	Supplying of different components and fittings of approved quality for installation of Rainwater Harvester including fabrication, carrying, screening, washing, placing, jointing, making all joints leak proof using thread seal/Teflon/cement mortar/solvent cement as applicable as per drawing and direction of the Engineer -in -charge.				
	i) 100 mm dia PVC gutter with flat bar hangers (600 mm x25 mm x 6 mm @2 m)	6.00	m	650	3,900
	ii) 100mm x 50 mm uPVC reducer T, good quality	1.00	No.	300	300
	iii) 50 mm dia PVC pipe (down pipe)	3.00	m	85	255
	iv) 38 mm dia PVC pipe (Inlet pipe)	4.50	m	85	383
	v) uPVC Gate valve (50 mm dia) for using as first flash switch.	1.00	no.	550	550
	vi) Tee (50 mm X 50 mm X 38 mm)	1.00	No.	95	95
	vii) 50 mm elbow (90°)	2.00	No.	25	50
	viii) Supply, fitting and fixing of PVC net (200 mm x 200 mm) for with a mesh size 1-3 mm to set in between 2” and 1.5” PVC reducer joint.	1.00	pc	40	40
	ix) 1/2” Brass bibcock with GI pipe	1.00	pc	200	200
	x) 18 no. G.I. wire, good quality	1.00	Kg	85	85
	xi) uPVC Gate valve (50 mm dia) for using as reservoir wash valve	1.00	No.	285	285
11	Supplying, fitting and fixing of food graded 3000 liter capacity plastic water reservoir tank including all necessary fittings, hardware and consumables etc. all complete approved and accepted by the Engineer- in- charge. (This item includes Labour charge, carrying charge with VAT, Income Tax & Profit).	1	No.	30,179	30,179
12	Supply and installation of 300X300X12.5 mm size GEO CODE plate made of stone as per drawing and instruction of E-I-C	1	No.	600	600
Total Cost for 1 No. RWH (Including VAT, Tax & Profit)					44,876

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Ring well/Dug well with Sealed and Expanded Top

Context and Description

Emergency Context

Applicable in areas with contamination of groundwater, or in flood-prone areas.

Major Components

- > Dug well
- > Water tight concrete sealing slab
- > Handpump to withdraw water
- > Tubewell platform with sanitary seal

Technology Description

- > Dug wells (DWs) are the oldest method of groundwater withdrawal for water supplies in Bangladesh. The water from dug well usually have low dissolved arsenic and iron even in locations where aquifers are contaminated.
- > Water in a DW is very easily contaminated if the well is open and the water is drawn using bucket and rope. Satisfactory protection against bacteriological contamination is possible by sealing the well top with a watertight concrete slab. Extended top would provide protection against intrusion of water from outside. Water may be withdrawn by installing a handpump. In a completely closed DW, the inflow of water is actuated by suction created by the withdrawal of water from the well.

Suitability

Mostly suitable for areas having groundwater contaminated with arsenic, iron and particularly for hilly areas.

Risks/Challenges

- > May be ineffective in few cases due to lowering of water table, especially during dry season
- > Bacterial contamination
- > Lack of expert mason
- > Relatively high initial cost.



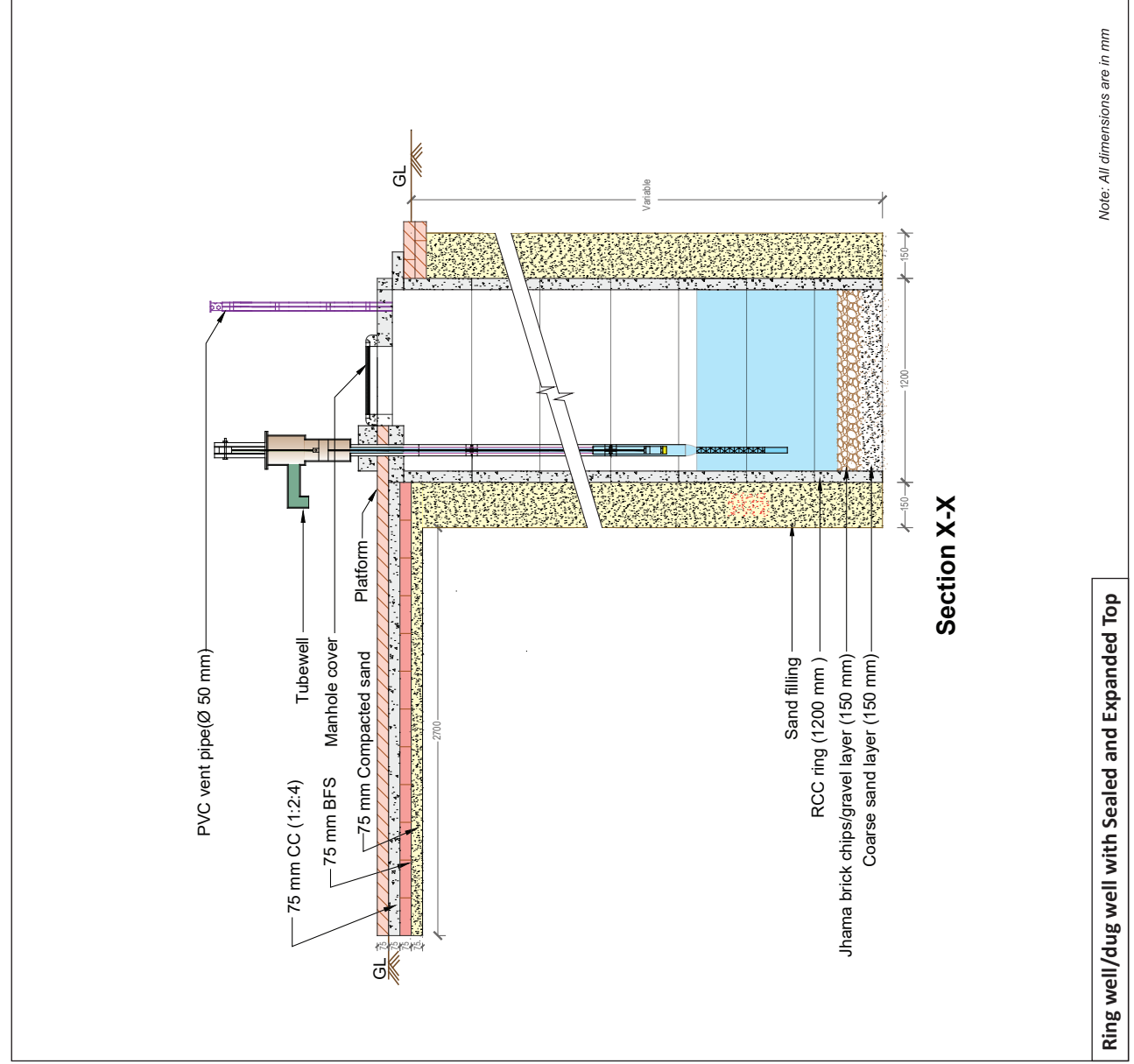
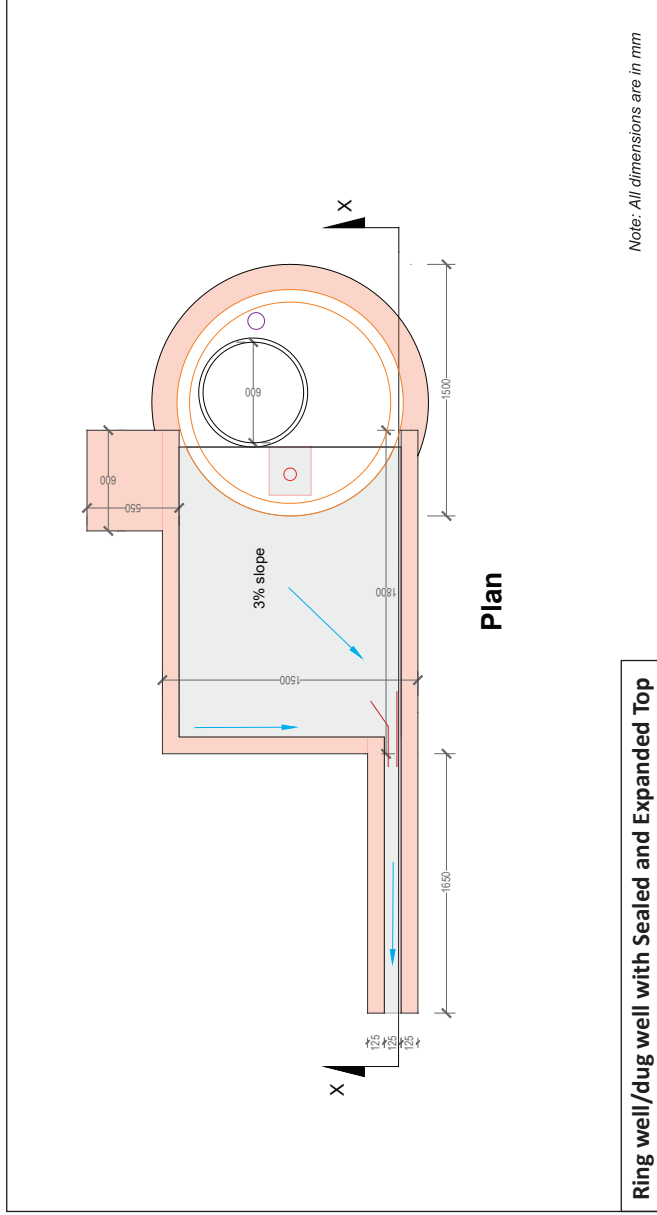
Figure 18: (A) Protected dug wells with tubewells to convey the water (B) Operational dug well in Assasuni, Satkhira (Courtesy: WaterAid and ITN-BUET).

Operation and Maintenance

Ensure protection against bacterial contamination.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 81-82).

Design Drawings



Cost Estimate

Part A: A Test tubewell for assuring quality water supply

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Carrying for drilling equipment and other necessary tools and tubewell materials (GI pipe, Brass filter, No.6 hand pump etc.) to selected site as per instruction of Engineer in Charge.	LS	1	600	600
2	Boring: by using 75 mm diameter cutter with 38 mm dia GI pipe and other equipment capable of drilling up to 15 meter depth to install 38 mm dia. Shallow test tubewell by water jet method or any other suitable method approved by the Engineer in Charge through all sorts of strata, pea gravel interference, protection of caving by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3 m interval in a white polyethene bag/wooden compartmental box and preserving them for analysis, identification of appropriate aquifer for Ring Well, withdrawal of boring pipes and casing pipes etc. complete as per specification, drawing and direction of the Engineer in Charge.	meter	15	45	675
3	Supplying and lowering of 38mm dia. GI pipe up to the desired depth fitted with 2-meter-long brass filter as per specification, drawing and direction of the Engineer in Charge. (Except the cost of materials)	meter	15	20	300
4	Supplying, fitting and fixing hand pump no. 6 in position and development of the tubewell till water is sand and turbidity free as per specification, drawing and direction of the Engineer in Charge. (Except the cost of materials)	LS	1	500	500
5	Testing of water: Collection of water sample for Testing of water from the Tube-well for Arsenic, Chloride, Iron from DPHE central / zonal lab as per direction of the Engineer in Charge.	LS	1	2,000	2,000
6	Withdrawing of the installed test tubewell and filling the bore hole by withdrawn soil, compacting, dressing, levelling, cleaning the site and removing unused and debris to a safe place as per direction of the Engineer in Charge.	meter	15	15	225
Sub-total of Part A					4,300

Part B: Construction of Ring well and Platform

1	Mobilization of all required equipment and materials to the working site for installation of a Ring well if the aquifer and quality of water is found suitable as decided by the Engineer, making arrangement for using the equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	P/item	1	2,640	2,640
2	Digging 1.65 m dia vertical well of required depth after taking all kinds of safety measures in all kinds of soils /stony layers and stacking excavated soils at a safe place, protecting the well, bailing out of water etc., complete as per specification, drawing and instruction of Engineer -in- charge				
a)	0 - 7 m	P/m	6	1,640	9,840
b)	7 - 14 m	P/m	8	1,810	14,480

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	Supplying of Reinforced Cement Concrete (RCC) ring in proportion of (1:2:4) Outer dia 1350 mm, Inner. Dia : 1200 mm, height 450 mm Thickness : 75 mm with supply of Portland Composite Cement, (CEM-II/A-M 42.5N(42.5MPa) (6 -20% Constituents other than clinker):50 kg / bag, Coarse sand (50% F.M.-1.5 & 50% F.M-2.2), 12 mm downgraded brick chips after screening, 10 mm dia. MS rod @ 150 mm C/C Horizontally & 250 mm C/C Vertically)., Crude oil, 24 G.I wire in/c. shuttering & 7 days curing etc. all complete as per drawing, specification and direction of the Engineer-in-Charge.	Each	31	4,100	1,27,100
4	Placing of RCC ring into 1650 mm dia well with all sorts of precautionary measures and supplying all necessary equipment. Alignment of the ring must be vertical, leaving equal space outside of the rings. One ring should be placed upon another and joint of rings should be filled up and plastering the joints with 1:2 ratio of mortar with fresh Portland cement and clean 1.6 FM sand etc. all complete as per drawing, specification and direction of Engineer-in-charge.	Each	30	200	6,000
5	Supplying and placing of Sylhet sand FM 2.0 of 150 mm thick as filter materials at the bottom of ring well as shown in drawing and direction of the Engineer in Charge.	cum	0.17	2,260	384
6	Supplying and placing of 12 mm and downgraded khoa as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.17	7,000	1,190
7	Supplying and placing of 20 mm downgraded khoa as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.17	5,700	969
8	Backfilling sand FM minimum 0.8 at the outside around rings from the bottom of the ring well up to 1.0 m down from top of the ring well including compacting properly layer by layer with water etc. as per direction of the Engineer in Charge.	cum	9.25	705	6,521
9	Mass concrete for construction of platform with drain, block, Sanitary Seal with (1:1.5:3) outside of the rings from ground level up to 10 meters depth from ground including supply of cement, sand, khoa (12mm downgraded) as per specification and direction of the Engineer-in -charge.	cum	1	8,300	8,300
10	Construction and setting of 1350 mm dia. 100 mm thick RCC (1:2:4) cover/ slab including fabrication of 10 mm dia MS rod @150mm c/c in both directions, making provisions for 70 mm dia hole in the slab including supplying all the materials with 12mm thick plaster with neat cement finishing, curing at least for 14 days etc. all complete as per drawing and direction of the Engineer-in-Charge.	No's	1	6,185	6,185
11	Supplying, fitting and fixing 2nos. 12mm dia M.S rod for holding of PVC pipe vertically including 50mmx6mm and 25mmx6mm M.S plate with nut-bolt and making circular clamp with welding in 2 nos 12mm dia M.S rod both ends. Clamp with M.S rod joint in ring well climbing rod and PVC pipe with nut-bolt according to drawing etc. all complete as per drawing and direction of the Engineer-in-Charge	set	2	450	900
12	One-layer brick flat soling in foundation or in floor with first class/picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-charge	sqm	3.75	454	1,703

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
13	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in Foundation and plinth walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	1	6,917	6,917
14	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	0.1	1,023	102
15	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to plinth wall with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	5	311	1,555
16	Supplying fitting fixing 50 mm dia. made of PVC class - C pipe 2.15meter long, elbow, plug and mosquito water net etc. and fitting on the top slab of ring well as per drawing and accepted by the Engineer-in-charge.	LS	1	1,500	1,500
17	Supplying fitting fixing 450 mm dia. Heavy type CI manhole cover with locking arrangement on the top slab of ring well as per drawing and accepted by the Engineer-in-charge.	LS	1	4,712	4,711
18	Supplying different inside dia best quality uPVC pressure pipe for drainage line from platform to drain having specific gravity 1.35 - 1.45, and other physical, chemical, themal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in position with sockets, bends, with all accessories such as Round grating/domed roof grating, bends, sockets etc. including cutting earth laying pipe and filling earth etc. all complete as per direction and approval/ accepted by the Engineer-in-charge. 75 mm dia wall thickness 2.9 mm - 3.5 mm	meter	6	449	2,694
Sub-total of Part B					203,722

Part C: Installation of Tubewell

1	Supplying, Lowering, Installation & fitting-fixing of 38 mm dia. G.I Pipe, uPVC Pipe, uPVC Strainer, uPVC Sand Trap, uPVC Socket Adaptor, uPVC Reducer, uPVC End cap in/c solvent Cement Jointing etc & C.I Hand Pump No. 6 to the boring site and to be done installation completely as per the direction of E/C.				
a)	Best quality heavy type Hand Pump No-6, (Weight= 30 kg± 0.5 kg) with 900 mm long handle.	set	1	4,540	4,540
b)	38 mm dia. G.I tube well pipe. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	2	884	1,768
c)	38 mm dia uPVC tube well pipe. BS 3505, (Class-D, Wall Thickness 2.5 mm- 3.00 mm) including the cost of solvent cement, socket adopter etc.	meter	10	160	1,600
d)	38 mm dia. uPVC strainer of any required size slot.10, BS 3505 (Class -D, wall thickness min. 3 mm, length - 3 meter).	meter	3	260	780

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
a)	38mm dia GI Elbow / 90-degree bend	each	2	100	200
b)	38 x 38 x 38 mm dia GI Tee	each	1	170	170
c)	38 mm dia Brass check valve	each	1	1,075	1,075
2	Disinfection of the ring well with 1 Kg bleaching powder in water and bailing out water after one day until smell of bleaching powder is gone. All complete as direction of the Engineer-in-charge.	item	1	240	240
3	Water Sample Collection and Test: Collection of water sample and testing for arsenic and fecal coliform by DPHE lab as per direction of Engineer-in-charge.	P/test	2	600	1,200
4	Wrench: Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 no's nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si= 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge	set	1	1,350	1,350
Sub-total of Part C					12,923
Total Cost (A+B+C)					220,945

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Rainwater Storage in Protected Pond

Context and Description

Emergency Context

Applicable in saline coastal areas, and also in areas with contaminated groundwater.

Major Components

- > Catchment
- > Gutter and rainwater convey pipes up to storage pond
- > First flush device
- > Inspection chamber with interconnecting pipes
- > Raised protected ponds with lining
- > Water collection assembly from pond to tubewell

Technology Description

- > Rainfall falling over the catchment surface is collected and conveyed to an inspection chamber through gutter, piping and first flushing system, where preliminary settlement of particles takes place. Inspection chamber of several catchments may be interconnected with pipes.
- > Rainwater from inspection chamber is discharged to the pond through underground pipes.
- > Sides of the pond is raised through constructing embankment and protected with fencing system. The pond is lined with cement and bentonite clay mix.
- > The rainwater stored in the pond is abstracted through a pumping tubewell which is installed near the pond, outside the embankment. The pipe of tubewell through which water is abstracted is placed horizontally in the pond at a height slightly lower than the height of rainwater discharge pipes.
- > Users collect water by pumping tubewell.

Suitability

Mostly suitable for water scarce areas where pond is available, and people are used to drinking rainwater.



Figure 19: (A) Treated Pond for storing rainwater; (B) Users collecting stored water using a hand pump (Courtesy: Oxfam Bangladesh)

Risks/Challenges

- > Clogging of inspection chamber and possibility of turbidity of pond water.
- > Bacterial contamination.

Important O&M Requirement

Periodical cleaning of catchment and inspection chamber, monitoring the embankment and fencing system.

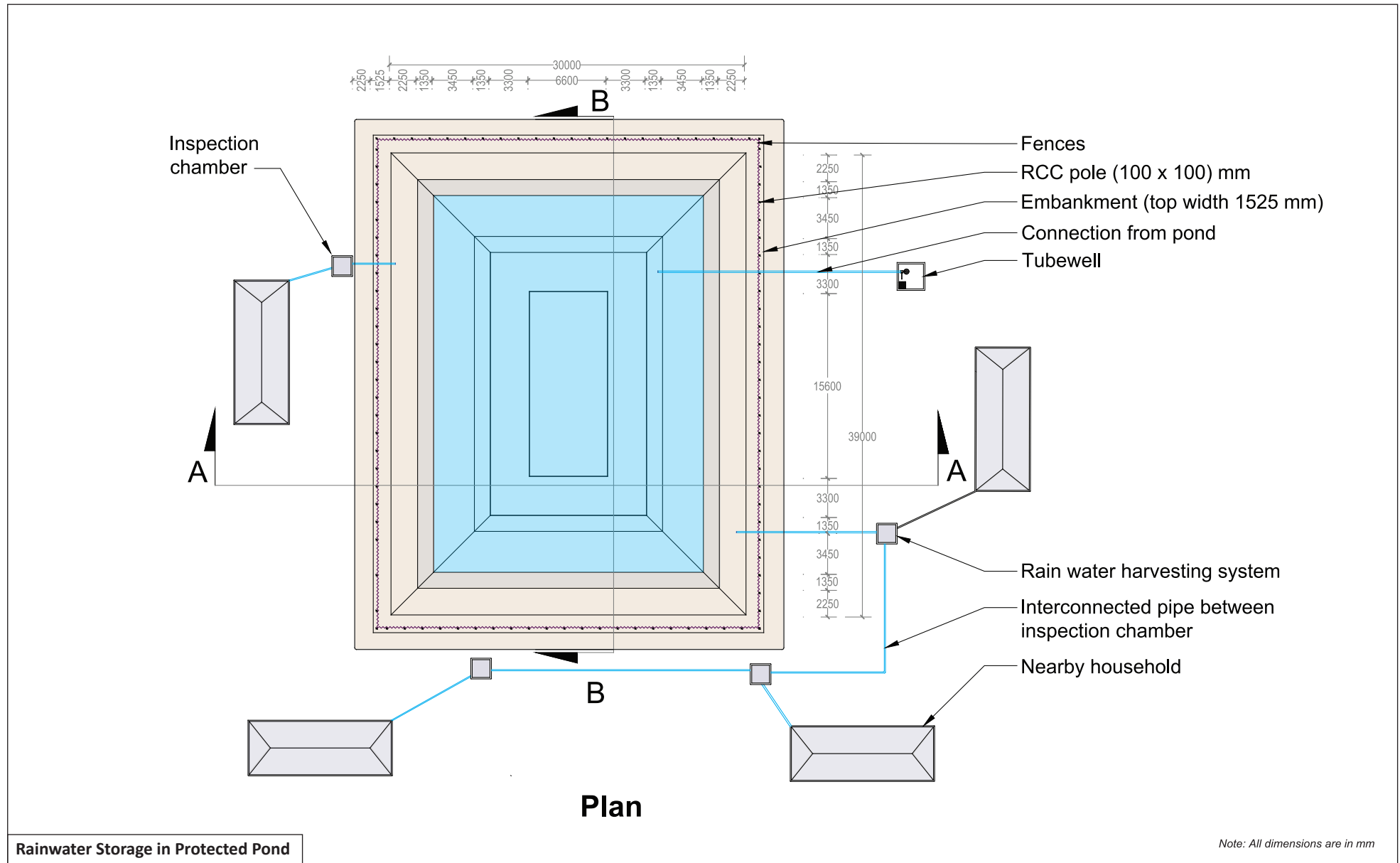
Pond Cleaning and Rehabilitation

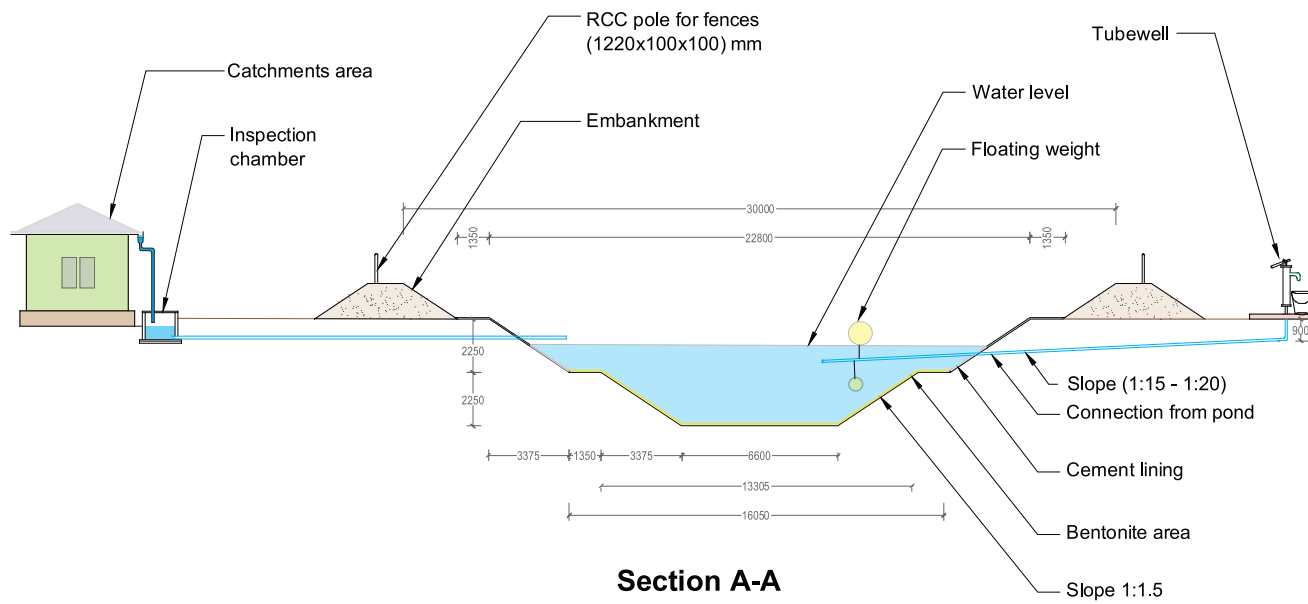
Before commencing the cleaning process, the source water pond's dimensions should be measured; along with mean depth and water level. Then the pond shall be screened for floating objects of all kinds, and any debris should be removed entirely. For treatment and turbidity removal, lime (or hard-lime) is required and the requirement is estimated based on the pond size and depth. Usually, 1 to 2 kg lime is needed to treat a pond. To begin with, half of the required lime is mixed with water. The solution is then spread across the pond equally, stirred and mixed well with the pond water. The water should then be kept undisturbed for 4-5 hours. The process is then repeated again, utilizing the rest of the lime. The entire process should last over 10 hours for effectiveness. If the pond is not visibly clean afterwards, the water of the pond should be drained entirely using a diesel pump and irrigation hose. Natural discharge from unconfined aquifers would refill the pond in some areas, or mechanical pumping from other rivers or lakes can be employed for refilling. Afterwards, if necessary, lime application as mentioned above can be performed to treat the newly refilled water.

Further instruction and details regarding pond cleaning and rehabilitation can be found in the “Operational Guidelines for WASH in Emergencies – Bangladesh” manual by GoB-Unicef-DPHE (Section 7.5.3, page 72 – 73).

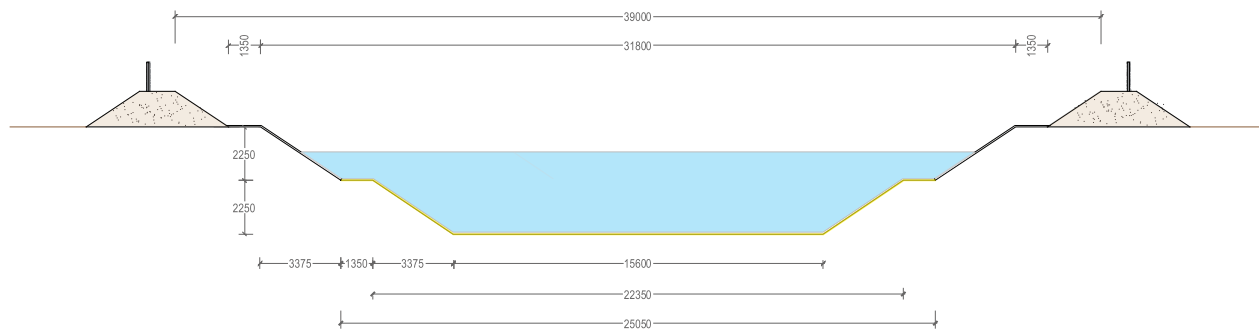
Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 77-78) and GoB-DPHE-UNICEF Operational Guidelines for WASH in Emergencies – Bangladesh; Section 7.5.

Design Drawings





Section A-A



Section B-B

Cost Estimate

Part A: Construction of new pond

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	5,000	5,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	682	24	16,368
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, leveling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	1,787	193	344,891
4	Earth filling to create embankments around the pond as per design in 150 mm layer with excavated earth available from pond site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	1,787	153	273,411
5	Bentonite 50% and clay 50% mixed lining 06mm thick in bottom portion of pond as per drawing including levelling, dressing, ramming, filling the porch in surface etc. all complete and accepted by Engineer-in-charge.	sqm	400	150	60,000
6	Minimum 06 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing with cement (1:4) at the upper portion of pond as per drawing including levelling, dressing, ramming, filling the porch in surface, washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	470	311	166,170
7	Construction masonry inspection pit with 125mm thick brick work in cement mortar (1:4) over one-layer brick flat soling and 75mm thick (1:2:4) base concrete for making invert channel, 12 mm thick (1:2) cement plaster with neat cement finishing at the floor, walls etc. including necessary earth cutting and side filling after construction etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. Size of inside of inspection pit, clear 450mm x 450mm x 600mm depth.	pcs	4	2,500	10,000
8	Construction masonry inspection pit cover (slab) including concrete (1:2:4) with 08mm dia MS reinforcement 125mm center to center both ways etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. Size of pit cover, 750mm x 750mm x 100mm.	pcs	4	1,500	6,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Providing Gate and barbed wire fencing with R.C.C (1:2:4) pillars @ 2.43 m c/c. and of section 100 mm x 100 mm at top and 150 mm x 150 mm at bottom of 2.13 m total height (1.37 m above G.L. and 0.76 m below G.L.) including 150 mm thick, 450 mm square spread footings (pillars reinforced with 4 Nos. 10 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 5 Nos. 10 mm dia rod both ways) supplying, fitting and fixing 8 lines of barbed wire horizontally (fixed with the post through 6 mm dia rods embedded in to the post) and 2 lines diagonally from post to post with 12 BWG 2 ply barbed wire, with 4 points barbs @ at least 112 mm c/c including 6 mm thick (1:4) cement plaster up to 1500 mm length of the pillars etc. complete and accepted by the Engineer-in-charge. (Rate is excluding the cost of concrete and reinforcement which is to be paid as per corresponding items in the schedule)	sqm	195	190	37,050
10	Cost of RCC pillar as mentioned in item of barbed wire fencing	pcs	62	2,400	148,800
11	Platform Construction: Construction of C.C (1:2:4) platform size 2050mm x 1750 mm x 75 mm with 900 mm long drain over 150 mm thick sand cushioning, brick flat soling and laying polythene under cement concrete before casting concrete as per drawing including well block by making 200mm x 200 mm x 600mm block as per drawing and 12 mm thick plaster (1:4) with neat cement finishing of the concrete surface etc. all complete as per specification, drawing and direction of the Engineer in Charge.	pcs	1	7,500	7,500
Sub-total of Part A					1,055,190*

Part B: Plumbing Work

1	Conveyance pipe for rainwater: Supplying, Lowering, Installation & fitting-fixing of 38 mm dia. G.I Pipe, uPVC Pipe, uPVC Strainer, uPVC Socket Adaptor, uPVC Reducer, solvent Cement Jointing etc. & C.I Hand Pump No. 6 to the site and installation completely as per the direction of E/C.				
a)	Best quality heavy type Hand Pump No-6, (Weight= 30 kg ± 0.5 kg) with 900 mm long handle.	set	1	4,540	4,540
b)	38 mm dia. G.I pipe for tube well. conforming to standard BS-1387 & BDS-1031 having wall thickness 2.9 mm, weight 3.517 kg/m capable to withstand 50 kg/cm ² hydraulic pressure.	meter	3	884	2,652
c)	38 mm dia uPVC tube well pipe. BS 3505, (Class-D, Wall Thickness 2.5 mm- 3.00 mm) including the cost of solvent cement, socket adopter etc.	meter	150	168	25,200
d)	38 mm dia. uPVC Robo strainer of any required size slot.10, BS 3505 (Class -D, wall thickness min. 3 mm, length - 2 meter).	meter	4	260	1,040
e)	38 mm dia GI socket	each	2	125	250
f)	38 mm dia brass gate valve for cleanout plug for flushing	each	4	1,075	4,300
g)	38 mm dia brass check valve	each	1	1,025	1,025
h)	38mm dia GI Elbow / 90-degree bend	each	1	150	150
i)	38 mm dia uPVC Tee	each	8	150	1,200

* Cost of construction of new pond may vary, if the upper portion of the pond is lined with clay or flexible PVC sheet, instead of cement.

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
j)	0.27 mm thick galvanized iron plain sheet gutter of 760mm width of V shaped with 300 mm lap on either side fitted and fixed with galvanized bolts and nuts including fitting with roof and the outlet point should be fixed with 38mm dia. rain water down pipe which will be one outlet of storage tank with supply of all materials etc. all complete and accepted by the Engineer-in-charge.	meter	24	449	10,776
k)	Mosquito net - Nylon and fitting fixing as per instruction	LS	5	200	1,000
l)	GI net for inlet gutter and fitting fixing as per instruction	sqm	1	1,200	600
2	Disinfection of pond and tubewell with necessary quantity of bleaching powder in water etc. all complete as direction of the Engineer-in-charge.	item	1	1,500	1,500
3	Collection of water sample and testing: After ensuring proper well development, collection of water samples and sending the samples to the DPHE Zonal Laboratory for testing of Arsenic, Iron, Chloride and TTC parameters which will be tested at the laboratory. The cost of sampling, carrying to the laboratory and testing by DPHE laboratory has to be done by the contractor etc. all complete as per direction of the Engineer in Charge.	P/test	4	600	2,400
4	Wrench: Supplying of Pipe wrench 350 mm long forged carbon steel the side faces of jaw and back jaw shall be polished (Minimum gross weight 1.3 kgs.) and adjustable single ended slide wrench 300 mm long (Minimum gross weight 0.67 kg.) made of carbon steel chromium plated (glossy finished/ silky smooth) and free from all kinds of defects. Name of brand and manufacturing country should be embossed on the body for maintenance of No. 6 hand pumps including 8 no's nuts & bolts. The alloy steel should be following approximate compositions: C = 0.42-0.50%, Si = 0.37%, Mn = 0.50-0.80%, Cr < 0.25%. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit). The whole work has to be done as per specification, drawing and direction of the Engineer in Charge	set	1	1,350	1,350
Sub-total of Part B					57,983
Total Cost (A+B)					1,113,173

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Desalination System: Reverse Osmosis (RO) Plant

Context and Description

Emergency Context

Applicable in areas with high salinity water (especially after a cyclone or storm surge, affecting existing water supply system); or in areas with acute arsenic/iron contamination.

Major Components:

- > Feed Pump, transfer pump
- > Iron Removal Filter/Multi Media Filter (MMF)
- > Activated Carbon Filter (ACF)
- > Micron Cartridge Filter (MCF)
- > Reverse Osmosis Membrane
- > UV Disinfection system
- > Safe Shed/Room for storage of unit.

Technology Description

- > A 1000 LPH capacity RO plant operating for 6-8 hours per day can provide 6000-8000 L water per day, which could supply drinking water to almost 800-1000 people per day.
- > The processes involved in RO plant include pretreatment of raw water using different filtration systems, then treatment through RO membrane and finally disinfection of treated water using UV system to make water completely safe for drinking.
- > At the beginning of the process/operation, raw water (directly withdrawn from ground or surface water sources or from raw water tank) is fed to iron removal pressure tank, where iron removal filter (IRF) consisting of “manganese green sand” and coarse sand is placed to remove iron, suspended material and physical impurities.
- > Water filtered through IRF is passed to granular activated carbon filter (ACF) to remove bad smell, color and chlorine, and through micron cartridge filter (MCF) of 1-5-micron porosity to arrest particulate matters. For IRF and ACF, daily backwash



Figure 20: Reverse Osmosis (RO) plant (Courtesy: DPHE)

after end of operation is needed, and for MCF, weekly or requirement-based cleaning by citric acid solution is needed.

- > Raw water pretreated using IRF, ACF and MCF is finally filtered through RO membrane to remove chemical and microbial contaminants. RO membrane filtered water is finally disinfected using UV system to make it completely safe for drinking.

Requirements

Typical RO feed water quality requirements are

- > pH: 5-9;
- > Turbidity: preferably <0.2 NTU, max. 1.0 NTU;
- > Temperature: 55-85 °F;
- > SDI (Silt Density Index): preferably <3, up to 5 acceptable;
- > Iron: <0.005 ppm;
- > Manganese: <0.005ppm; Aluminum: <0.1 ppm;
- > TOC: < 3 ppm;
- > SiO₂: < 40 ppm.

Suitability

Suitable for places where surface/ground water is saline, and no other feasible option is available.

Design consideration

Performance of RO membrane and pre-filters depends on source water quality.

Risks/Challenges

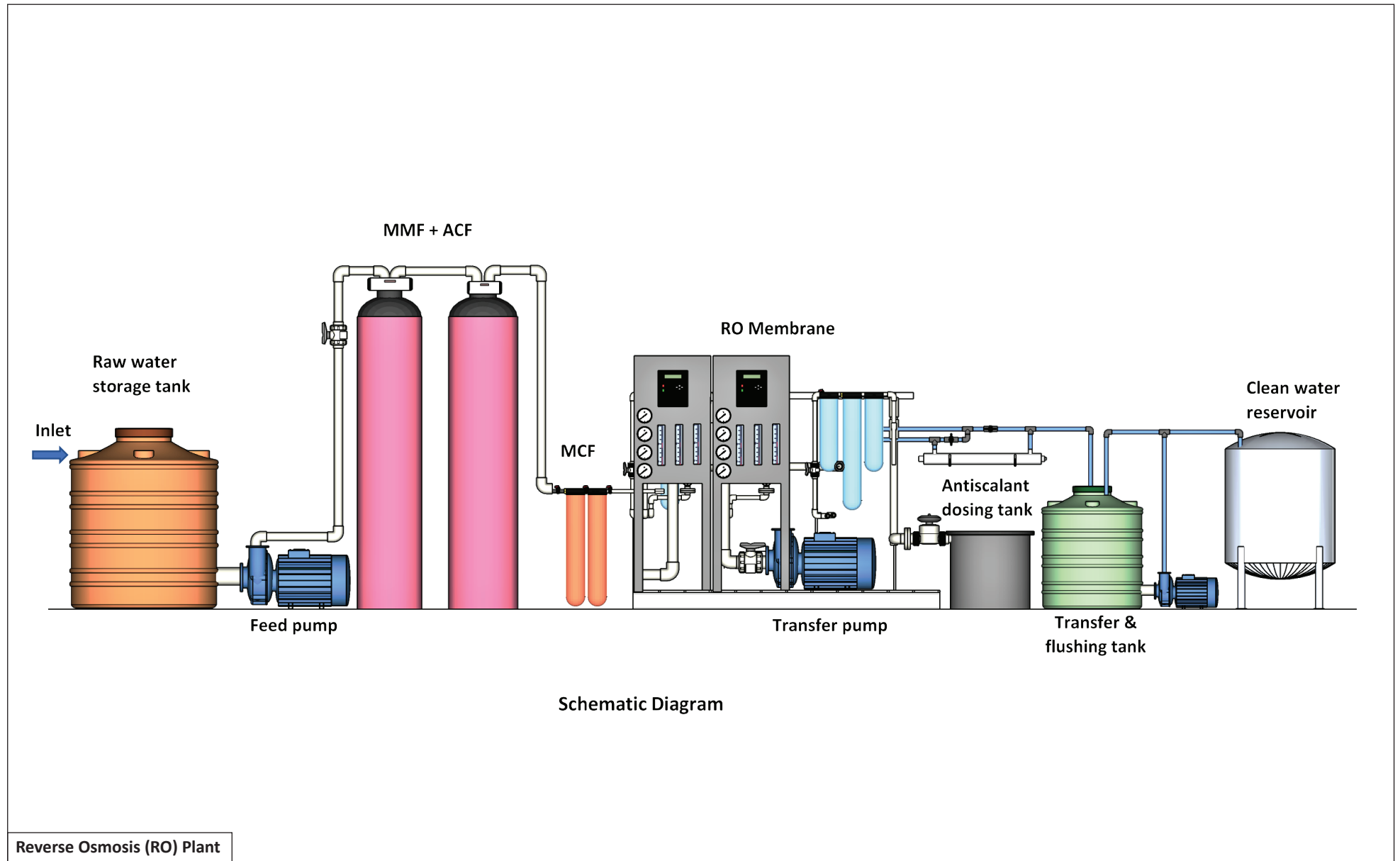
Low production of treated water (40% of the raw water is treated), and a high discharge of effluent (60% of the raw water).

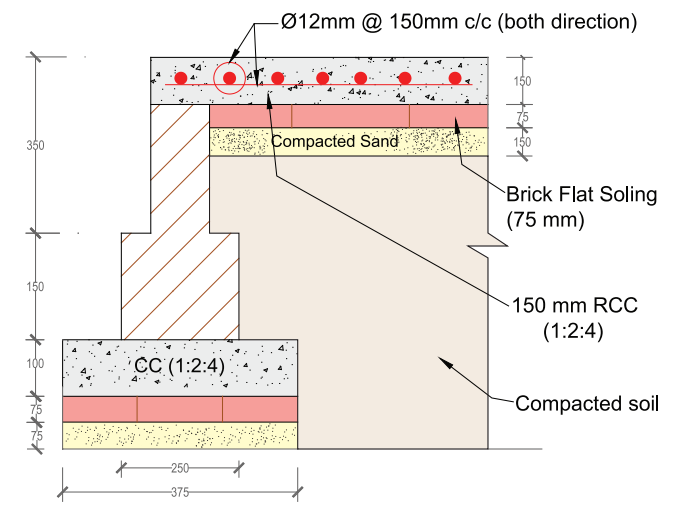
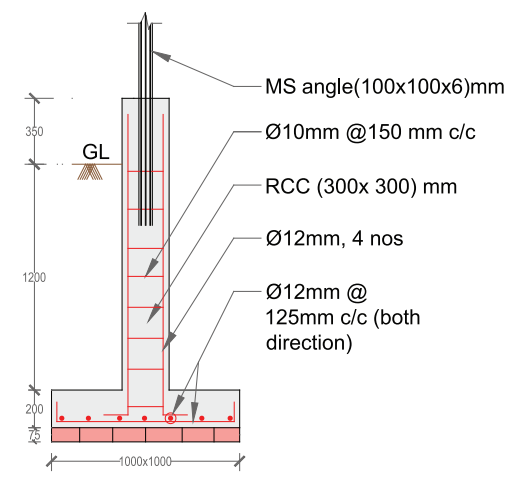
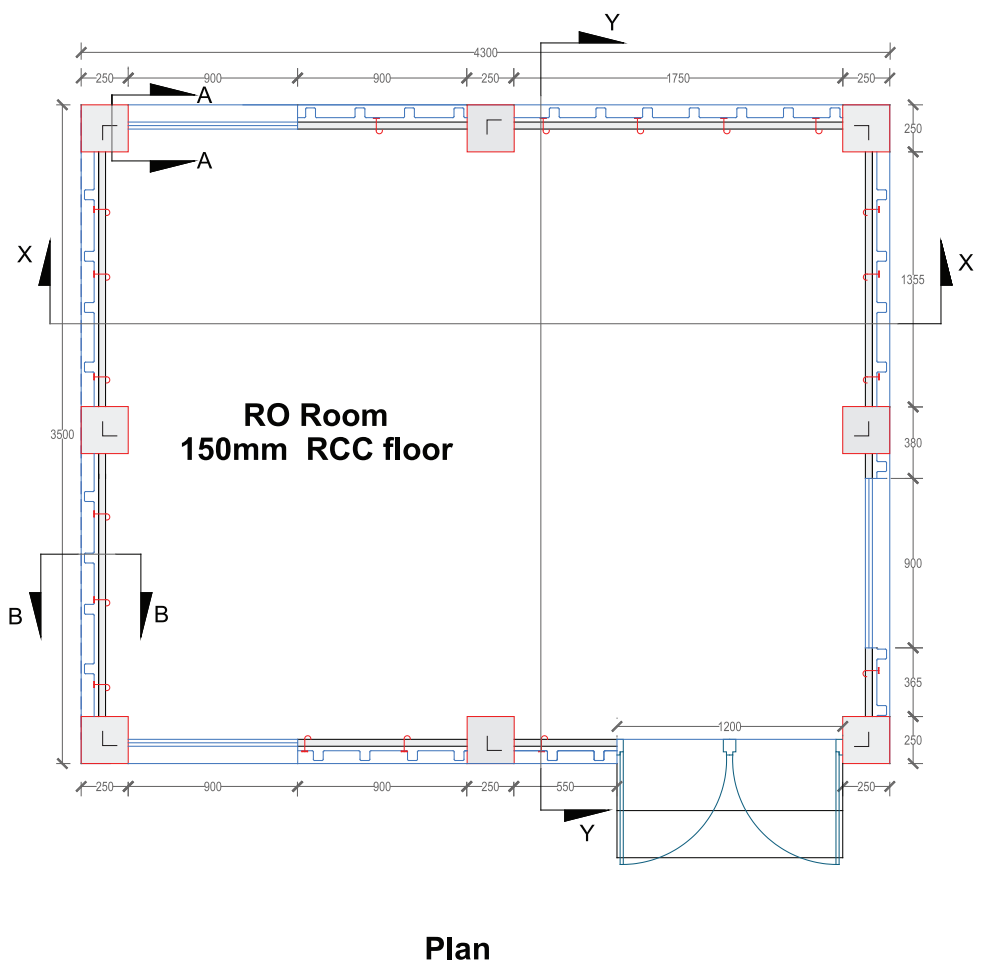
Operation and Maintenance

Periodic backwashing of pre-filter units, replacement of RO membrane at regular operational period due to fouling, and management of brine water produced as waste water.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 89-91).

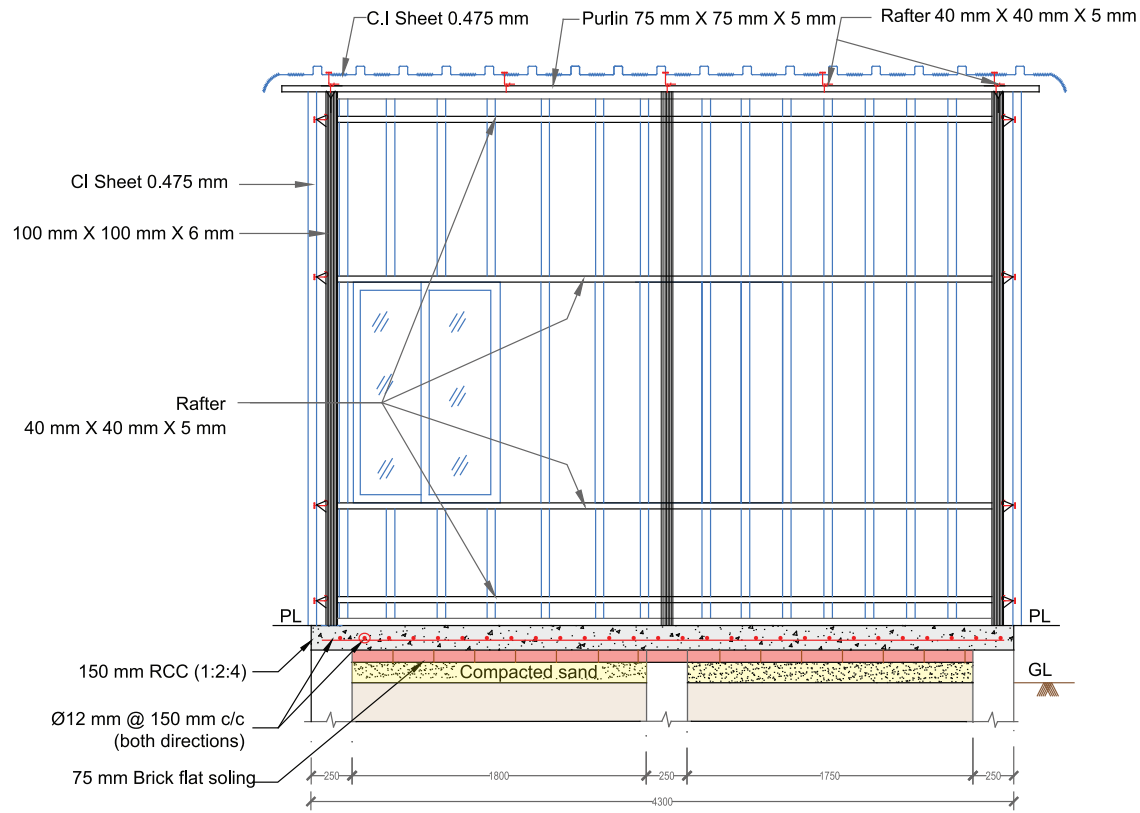
Design Drawings



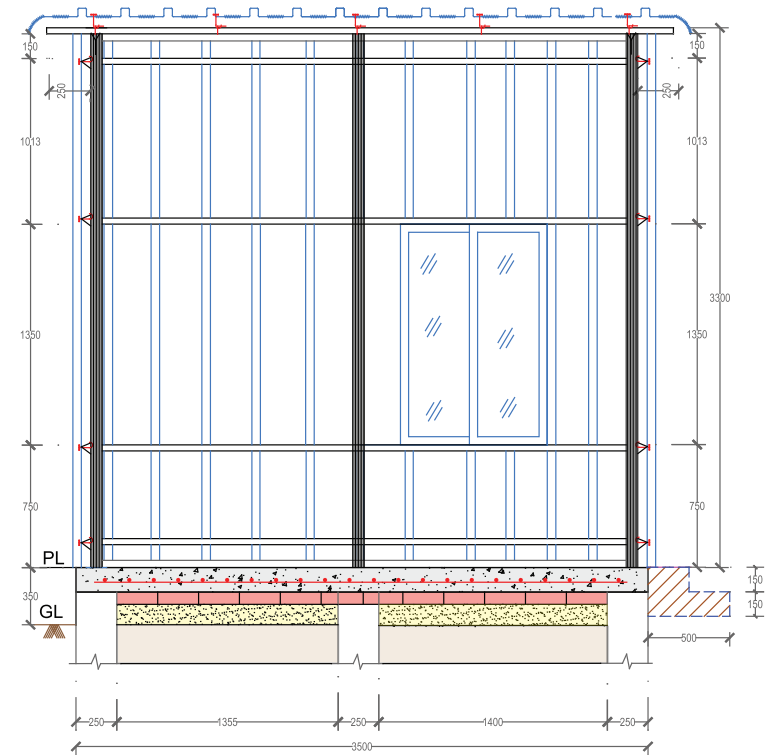


Reverse Osmosis (RO) Plant

Note: All dimensions are in mm



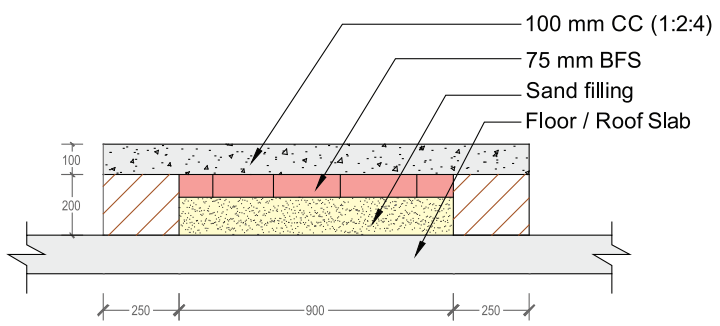
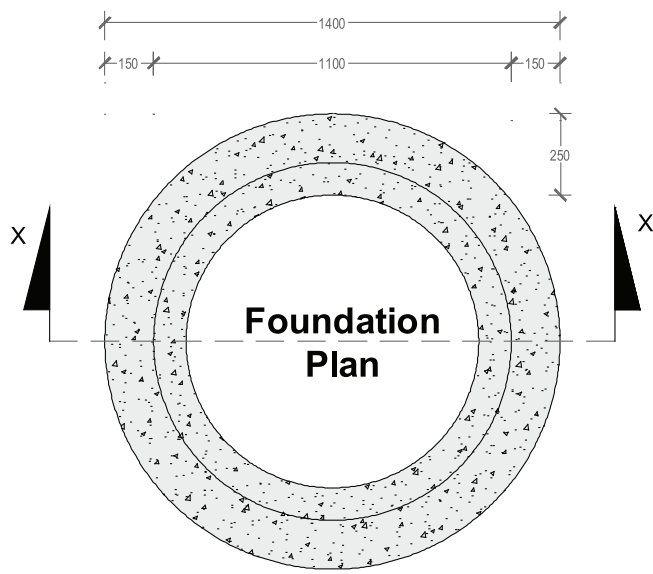
Section X-X



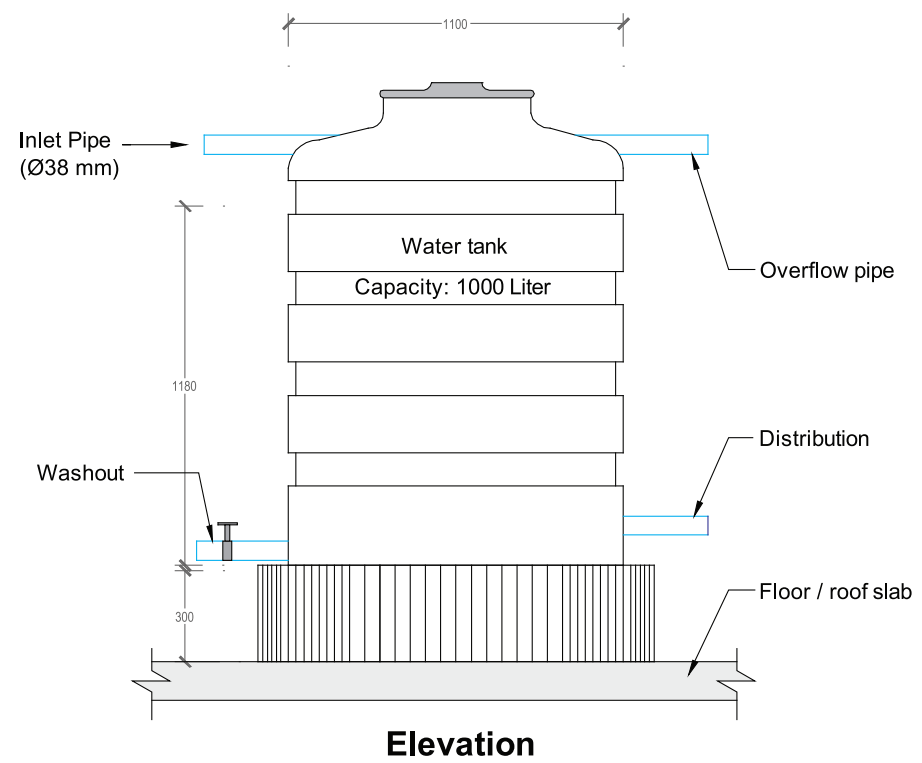
Section Y-Y

Reverse Osmosis (RO) Plant

Note: All dimensions are in mm



Foundation: Section X-X



Raw Water Reservoir

Note: All dimensions are in mm

Reverse Osmosis (RO) Plant

Cost Estimate

Part A: Shed for RO

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	17	24	408
2	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	18	193	3,378
3	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	18	153	2,678
4	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers as per drawing and design, including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	4	705	2,468
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	26	454	11,691
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	26	42	1,092
7	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.75	8,330	6,248

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 24$ MPa, satisfying a specified compressive strength $f'_c = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming to ASTM C-33 including breaking chips and screening, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering).				
i	Individual & combined footing, pile cap, raft/mat, floor slab, ramp and foundation beam, lintel up to GF.	cum	6	8,346	45,903
9	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form for.				
i	Individual & combined footing, floor slab, lintel etc.	sqm	21	438	9,329
10	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (ReH)= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.	kg	450	94	42,300
11	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in exterior walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	0.5	7,292	3,646
12	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	3	1,023	2,619
13	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to plinth wall with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	28	311	8708

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
14	Site development/Improvement by supplying carted earth or dredged sand, sandy silt (free from any organic, foreign, environmental hazardous substances) carried by head or by truck or by any other means including cost of cutting or by dredging of sand, sandy silt, all; including local carrying, placing the earth/sand, sandy silt in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only etc. all complete as per direction and accepted by the engineer in charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	cum	10	556	5,560
15	Mild steel, Grade 250 with minimum fy = 250 MPa, work in roof truss : supplying and fabrication of mild steel sections as per design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge. (Measurement to be given for truss member only).	kg	655	138	90,390
16	Supply and installation of 0.457 mm thick corrugated galvanized iron sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. all complete and accepted by the Engineer-in-charge.	sqm	67	547	36,649
17	Supplying and fitting, fixing steel door with the use of 38mm x 38mm x 5mm M.S. angle frame fixing 250mm long 6 nos. iron clamps of same size with the vertical frame, fixing the frame in wall with (1:2:4) cement concrete, mending good damages, fixing 3 nos. of 100 mm size iron lings with the vertical member of the frame and 18 BWG M.S. sheet angle leaf shatter with all round 25mm x 3mm M.S. flat bar and cross wise flat bar welding and fitting fixing and 19mm dia M.S. handle with locking arrangement etc., all complete as per direction of the Engineer-in-charge.	sqm	2	4,700	10,857
18	Supplying fitting and fixing steel window shutter with frames of 25mm x 25mm x 5mm angle section for choked and 25mm x 25mm x 5mm angle section used for vertical member and 25mm x 25mm flat bar for making box 18BWG M.S. sheet used for window shutter, including all costs of charges for welding, reverting etc., supplying all fittings like iron hinges, handle, adjustable cleat and clips etc. fitting fixing the frame in walls, mending good the damages etc., all complete as per direction of the Engineer-in-charge.	sqm	3	4,115	13,333
19	Supplying, fitting, fixing window grills of any design made with F.I. bar (25mmx6mm) in/c fabricating, welding, painting with two coats of synthetic enamel paint over a coat of anticorrosive priming etc. all complete for all floor as per direction of the E-I-C. (Total wt. per m2 should be 29.38 kg. For each kg excess or less add or deduct, as the case may be, @Tk. 140.00 per kg)	sqm	3	2,398	7,770
20	Painting to door and window frames and shutters in two coats with synthetic enamel paint of best quality and approved colour over a coat of priming in/c cleaning, finishing and polishing with sand paper, necessary scaffolding etc. all complete in all floors as per direction of the E-I-C.	sqm	15	232	3,364
21	Electrical items				
a)	Light point with 1 x 1.5 rm BYA single core cables through concealed PVC conduit of adequate size.	no	3	700	2,100
b)	2 pin 5 amps socket point	no	1	125	125
c)	Fan point with 1 x 1.5 rm BYA single core cables through concealed PVC conduit of adequate size.	no	1	700	700

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
d)	Tube light with complete setting	no	1	1,200	1,200
e)	Switch board, 350 x 450mm size	no	1	160	160
22	Supplying, fitting and fixing 300 mm depth surface type double based meter board made of 16 SWG sheet metal with gray hammer paint on outside and enamel paint on inside surface over rust proof prime coat. Second base shall be part by part hinged type of required width fixing arrangement, MCCB/MCB's, bus bars and also to height of connecting cable. Outside sheets shall be fixed on 38 mm x 38 mm M.S angle frame. Front cover shall be of hinged type with lock and key arrangement. The board shall have knockout for cable entry and exit and also to dispose heat produced inside. There shall be transparent plastic in the front door over the meter for meter reading. Copper bus bars for three-phase, neutral and earthing shall be supplied by the contractors. The meter board shall be fixed on proper clamping with nuts and bolts etc. all complete as per drawing, design and direction of the E-I-C.	sqm	0.5	400	200
23	Supplying, fitting and fixing best quality wall paper along with 12 mm thick PVC solid board in walling with furring channel frame of section 75 mm x 38 mm at 600 mm x 600 mm in grid, fitted and fixed to wall by plugs, nails, screws etc. including treatment of inner surface with termite and damp proofing agent maintaining leveled and finished exposed faces including making holes in wall and mending good the damages, if any during execution of the work, also including cost and carriage of wall paper and other materials, electricity, accessories, labour for installation, scaffolding, screws, nails etc. all complete as per design, approved and accepted by the Engineer-in-charge.	sqm	16	3,706	59,296
Sub-total of Part A					372,169

Part B: Supply and Installation of 100mm dia PVC Tubewell. (Avg. Depth: 150 m)

1	Mobilization of materials, equipment, tools and plants, boring rig at the work site, assembling of Derick, demobilization after completion of work and cleaning the site of work etc. all complete as per direction of the Engineer-in Charge.	LS	1	8,000	8,000
2	Boring by using at least 200 mm dia cutter with 38mm dia G.I. pipe and other equipment capable of drilling to a depth of 0- 150 m to install 100 mm dia uPVC well by water jet method or any other method approved by the Engineer-in-Charge through all sorts of strata, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipe and casing pipes etc. complete work, (including cost of materials, labour and transportation, contractor's profit and VAT/ IT)				
a)	From 0 m to 40 m	p/m	40	250	10,000
b)	From 40 m to 100 m	p/m	60	290	17,400
b)	From 100 m to 155 m	p/m	55	350	19,250
3	Supplying, fitting and fixing 100mm of D-class blind pipe, sand trap of necessary length, strainer (E-class), G.I pipe, solvent cement, socked adopter and all other necessary materials etc. for lowering and installation of the well after analyzing the soil sample and if it is decided to install the well etc. all complete as per specification and direction of the Engineer- in-Charge.				
a)	100 mm dia G.I pipe	p/m	1	2,380	1,428

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
b)	100 mm dia uPVC blind pipe (D- class, wall thickness minimum 6.00 mm - 6.9 mm)	p/m	135	700	94,500
c)	100 mm dia uPVC strainer (E- class, wall thickness minimum 7.3 mm - 8.40 mm, slot - 10)	p/m	12	950	11,400
d)	100 mm dia uPVC sand trap (D- class, wall thickness minimum 6.00 mm - 6.9 mm)	p/m	3	700	2,100
e)	100 mm dia. end cap	each	1	215	215
f)	100 mm dia. top cap	each	1	160	160
g)	100 mm dia. Socketed adopter	each	1	610	610
4	First Case: Filling up of the annular space between bore hole and strainer with coarse sand from end cap up to a level 10m above the strainer (30.00 m) Second Case: Filling up of the annular space from the top of coarse sand with 3.5 mm dia clay balls made of bentonite and local clay in proportion of 1:1. Third Case: Filling the remaining bore hole spaces with bored soil, all complete as per direction of Engineer-in -Charge				
a)	Filling with graded coarse sand (F.M 2.2)	p/m	30	180	5,400
b)	Filling with clay balls made of bentonite and clay (1: 1)	p/m	6	359	2,154
c)	Filling with local /bored soil.	p/m.	116	15	1,740
5	Complete development of the tube well to obtain sand and turbidity free water at a satisfactory yield. The whole work has to be done as per specification and direction the Engineer in Charge.	item	1	4,000	4,000
6	Sanitary Sealing: Making sanitary seal up to 3 m depth around the well from GL or specified including supply of approved quality of cement, sand and brick chips (13 mm downgraded) in ratio 1:2:4 with 3% bentonite etc. all complete as per specification, drawing and direction of the Engineer in Charge.	item	1	1,000	1,000
7	Disinfection of the tubewell, necessary bleaching powder (30% - 33% strength, chlorinated water should be 150 mg/l free chlorine. The whole work has to be done as per specification and direction of the Engineer in Charge.	item	1	1,500	1,500
8	Water sample collection in an acidified HDP bottle and sending it to nearest DPHE Zonal lab /any recognized public lab for analysis and testing of selected parameter such as As, Mn, Cl, Fe, pH and fecal coliform etc. Water to be tested with field test kits on site as per instruction of the Engineer-in- charge (Collection of water sample in presence of EIC or his representatives, carrying cost to the laboratory and Laboratory test fee deposit by the contractor has been included in this item).	LS	1	4,000	4,000
9	Construction of Masonry pit as security chamber including M.S lid for maintenance and protection of the submersible pump motor. Masonry wall 125mm wall over 75mm thick cement concrete 1: 2: 4 over Brick flat soling foundation excavating soil up to 150 mm below GL around the tubewell for making a chamber inside size: 600mm x 600mm x 600mm including 12mm thick cement plaster with neat cement finishing in inside/ outside wall, floor etc. including 16 BWG MS sheet and MS angle floor cover with locking arrangement to be completed as per specification, drawing and direction of the Engineer in Charge.	LS	1	4,000	4,000
Sub-total of Part B					188,857

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
Part C: Storage Tank					
1	Supply and installation of food-graded plastic internal mini water tank for raw water storage and supply of water manufactured from liner low density polyethylene (ILDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables, fittings etc. all complete approved and accepted by the Engineer- in- charge. 1000 Liter capacity	no	1	12,000	12,000
2	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in exterior walls for tank platform including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	1	7,292	7,292
3	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	0.63	454	288
4	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	1	42	42
5	Mass concrete (1:2:4) in foundation or in floor of platform with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.5	8,330	4,165
6	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outside wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	8	311	2,333
7	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	0.15	705	106
8	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in- charge. 20 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 25.3 mm, weight 1.7 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	m	6	375	2,250

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Supplying different inside dia best quality CPVC pressure pipe for water supply having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating, bends, sockets etc. approved and accepted by the Engineer-in-charge (length: 6000 mm each). 19 mm dia wall thickness 2.9 mm - 3.4 mm	meter	6	351	2,106
Sub-total of Part D					30,582

Part D: DESIGN BASIS RO ITEMS

Supply, installation and Commissioning of Community based Desalination Plant for treating brackish feed water from well complying the following water quality parameters at site in coastal areas through direct supervision and instruction of the Engineer in charge. The Components of the plant are of following specification:

Feed Water Quality (Input of desalination Plant): TDS: 7000 mg/l, Chloride: 5000 mg/l, Iron: 5mg/l

Feed water source: Groundwater

Treated Water Quality (Output from desalination Plant): TDS: <450 mg/l, Chloride: c 25 mg/l, Iron :0.1 mg/l, Arsenic: 0.01 ppm

Fresh water production: 1500-2000 LPH.

Power supply inputs: Single Phase Operation. The plant will be operated automatically for start-up and shutdown both by Electricity & Generator (Single phase)

Warranty: Warranty must be provided 05 (Five) years for servicing, operation and maintenance (including spares). During the Warranty period no Payment shall be made for the service and spares.

Fresh water shall be reserved in food grade plastic tank required for smooth operation of the treatment plant.

Supply, installation and Commissioning of Community based Desalination Plant for treating brackish feed

1	Pre-treatment				
a)	Feed Pump: Supply, fitting, fixing and commissioning of Feed Pump of following specification: Type: Centrifugal, Capacity: 4000 LPH, Pump Head: 30-40 m, Housing material: SS316, Impeller materials; SS316, Power: 220V, 50 Hz, 0.75KW/1 KW, Brand: Wile/Ebara/Grundfos/CNP or Equivalent, Country of origin: EU / USA. All complete as per instruction of Engineer-in charge. (including cost of all materials labor and transportation, VAT and ID)	No	1	30,000	30,000
b)	Multimedia Filter: Supply, fitting, fixing and commissioning of MMF filter of following specification: Capacity: 4000 LPH , Dimension: 600 mm X 1800 mm (24" X72"), Operation: Continuous service with Manual Multiport backwash device, Sheet materials: FRP, Pipes and fittings: uPVC, Size of Inlet and Outlet pipes: 50mm (2.0 inch), Media: Graded Sand/Birm/ Manganese, Pressure meter: 0-100 psi, 2.5-inch dial, Operating Pressure: 100 - 150 psi, Testing Pressure: 200 - 300 psi, Cycle test: 100,000 cycles, Operating Temperature: 1 °C to 49 °C, Bursting Pressure: 750 -500, Brand: MINTECH/HTCOM , County of origin: EU/USA. All complete as per instruction of Engineer-in charge. (including cost of all materials, labor and transportation, VAT and IT)	No.	1	107,750	107,750

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
c)	Activated Carbon filter: Supply, fitting, fixing and commissioning of ACF filter of following specification: Capacity: 4000 LPH, Dimension: 600 mm X 1800 mm (24" X72"), Operation: Continuous service with Manual Multiport backwash device, Sheet materials: FRP, Pipes and fittings: uPVC, Size of Inlet and Outlet pipes: 50mm (2.0 inch), Media: Activated Carbon, Pressure meter: 0-100 psi, 2.5-inch dial, Operating Pressure: 100 - 150 psi, Testing Pressure: 200 - 300 psi, Cycle test: 100,000 cycles, Operating Temperature: 1 °C to 49 °C, Bursting Pressure: 750 -500, Brand: MINTECH/HTCOM, County of origin: EU/USA All complete as per instruction of Engineer-in charge. (including cost of all materials, labor and transportation, VAT and IT)	No.	1	117,750	117,750
d)	Water softener (1st): Supply, fitting, fixing and commissioning of WS filter of following specification: Capacity: 4000 LPH, Dimension: 530 mm X 1550 mm (21" X62"), Operation: Continuous service with Manual Multiport backwash device, Sheet materials: FRP, Pipes and fittings: uPVC, Size of Inlet and Outlet pipes: 50mm (2.0 inch), Media: Cation Resin, Pressure meter: 0-100 psi, 2.5-inch dial, Operating Pressure: 100 - 150 psi, Testing Pressure: 200 - 300 psi, Cycle test: 100,000 cycles, Operating Temperature: 1 °C to 49 °C, Bursting Pressure: 750 -500, Brand: MINTECH/HTCOM, County of origin: EU/USA. All complete as per instruction of Engineer-in charge. (including cost of all materials, labor and transportation, VAT and IT)	No.	1	152,000	152,000
e)	Water softener (2nd): Supply, fitting, fixing and commissioning of WS filter of following specification: Capacity: 4000 LPH, Dimension: 530 mm X 1550 mm (21 X62"), Operation: Continuous service with Manual Multiport backwash device, Sheet materials: FRP, Pipes and fittings: uPVC, Size of Inlet and Outlet pipes: 50mm (2.0 inch), Media: Cation Resin, Pressure meter: 0-100 psi, 2.5-inch dial, Operating Pressure: 100 - 150 psi, Testing Pressure: 200 - 300 psi, Cycle test: 100,000 cycles, Operating Temperature: 1 °C to 49 °C, Bursting Pressure: 750 -500, Brand: MINTECH/HTCOM, County of origin: EU/USA. All complete as per instruction of Engineer-in charge. (including cost of all materials, labor and transportation, VAT and IT)	No.	1	152,000	152,000
Total for Pre-treatment					559,500
2	Reverse Osmosis (RO) Unit				
a)	Cartridge Filter: Supply, fitting, fixing and commissioning of Cartridge Filter of following specification: Capacity: 5000 LPH, Accuracy 5 Micron, Housing materials: SS 304, Filter Materials: PP, No. of filter; 05, Filter Size: Length-500mm (20"), Country of Origin: EU/USA/China. All complete as per instruction of Engineer-in charge. (Including cost of all materials, labor and transportation, VAT and IT)	No.	1	35,000	35,000
b)	High Pressure Pump: Supply, fitting, fixing and commissioning of High-Pressure Pump of following specification: Type: Vertical Multistage Centrifugal, Capacity: 3000 LPH, Pump Head: 200 m, Housing Material: SS316, Impeller materials: SS316, Power: 220V, 50 Hz. 3 KW, Brand: KSB/Grundfos/CNP/Apex or Equivalent, County of origin: EU/USA/China. All complete as per instruction of Engineer-in charge. (Including cost of all materials, labor and transportation, VAT and IT)	No.	2	180,000	360,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
c)	<p>RO Pressure Tube: Supply, fitting, fixing and commissioning of RO Pressure Tube of following specification: Type End Entry Design, Operating Pressure: 300psi, Materials: FRP, Size: 100mm X 1016 mm (4”X 40”), Brand: Code line/ROPV/MINTECH, Country of origin: EU/ USA/China All complete as per instruction of Engineer-in charge. (Including cost of all materials, labor and transportation, VAT and IT)</p>	Pc	6	20,000	120,000
d)	<p>RO membrane: Supply, fitting, fixing and commissioning of RO membrane of following specification: Type: TFC (0.12 Micron), Size: 100mm X 1016mm (4”X 40”), Brand: Filmteh/ Toray/MINTECH/Hydraulics/Equivalent Specification: Performance: Permeate Flow: 9.1 m3pd, Salt Rejection: Nominal 99.7%, Minimum 99.5% Type: Configuration: Spiral Wound, Membrane Polymer: Composite Polyamide, Active Area:78 sq. ft Application Data: Maximum Applied Pressure: 600 psi, Maximum Chlorine Concentration: <0.1 PPM, Maximum Operating Temperature:113 F (45 C), Feed water pH Range:3.0 – 10.0, Maximum Feed Water Turbidity:1.0 NTU, Maximum Feed Water SDI (15 mins):5.0, Maximum Feed Flow: 1.6 GPM, Minimum Ratio of Concentrate to, Permeate Flow for any Element: 5:1, Maximum Pressure, Drop for each Element:10 psi Test Conditions: The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions: 2000 PPM NaCl solution, 150-225 psi (1.55 Mpa) Applied Pressure, 77 F (25 C) Operating Pressures, 15% Permeate Recovery, 6.5 – 7.0 pH Range, Country of origin: EU/USA/Japan/China/Equivalent. All complete as per instruction of Engineer-in Charge. (Including cost of all materials, labor and transportation, VAT and ID)</p>	Pc	6	40,000	240,000
e)	<p>Pipe fittings with others accessories Pipe and fittings High pressure side: should be SS304 pipe with fittings, (1.5 Inch), Low pressure side: uPVC fittings, (1 inch) Supply, fitting, and fixing of “T”, “L-bow” and others fittings and pipes made of (80 Schedu1e). Other accessories: Inlet solenoid valve 1pc, automatic flush valve 1pc, flow meter 2pcs, pressure meter 4pcs, pressure switch 1 pc, etc. All complete as per instruction of Engineer-in Charge. (Including cost of all materials, labor and transportation, VAT and IT)</p>	Lot	1	100,000	100,000
f)	<p>Electric Control Panel Supply, fitting, fixing and commissioning of Electric Control Panel Box (MOC: SS304) including Circuit breaker, magnetic contact, thermal overload relay, timer, digital Conductivity monitor, indicator lamp, selector switch and any other related accessories, All complete as per instruction of Engineer-in Charge. (Including cost of all materials, labor and transportation, VAT and IT) Brand: Schneider / Tokaimi / ABB / Simens /LS Origin: USA/EU/Japan/China</p>	Set	1	70,000	70,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
g)	Skid for Desalination plant MOC: SS 304 hollow box (Thickness- 1.5mm) Box Size: 1.5”X 1.5” inch	No	1	30,000	30,000
Total for RO Unit					955,000

Treated pure water section

1	Drinking Water Tank: Supply, fitting and fixing of food grade Stainless Water Tank Capacity 1,000 liter to preserve pure drinking water including all cost of materials, fittings labour etc. all complete as direction of the Engineer-in-charge.	Set	2	20,000	40,000
2	Supply, fitting, fixing and commissioning of Water Level Controller with electric cable	Set	3	3,000	9,000
3	Supply, fitting, fixing and commissioning of drinking water collection pipeline with U PVC pipe, SS Tap and clamp etc.	Lot	1	5,000	5,000
4	Drinking Water Quality Test water samples in a recognized public laboratory for Arsenic, Iron, TDS, fecal coliform and Chloride including collection, transportation and submission of water sample as per direction of the Engineer-in-charge. (Including VAT & IT)	L.S	1	5,000	5,000
5	Providing 5(Five) years warranty service including, Operation and maintenance 1 year no cost will be borne by the Project. For the 5 year the cost for the Operation (Chemical & Filter) and Maintenance will be Provided (at least 1 visit in every two months and also as and when required by the client) (Cost included all taxes & VAT.)	L.S	1	150,000	150,000
6	Providing necessary training (local) arranged by the supplier at the installation site for 7 (seven) persons of DPHE, Upazila Parishad/ Union Parishad having full demonstration of the equipment both in class room and in the field for at least 3 (Three) days as per direct supervision and instruction of the engineering in charge. Cost included all taxes & VAT.	L.S	1	40,000	40,000
Total for Pure Water Section					249,000
Total for Part D					1,763,500

Part E: Consumables Item:

1	Salt: NaCl used for water softener recharge, country of origin: Local	Kg	7,000	15	105,000
2	Cartridge Filter: 1. Filter Size: Length, 500mm (20”), Outer diameter 63.5 mm (2.5”) 2. Brand: Any Brand 3. Country of Origin: EU/USA	Pc	600	120	72,000
Sub-total of Part E					177,000

Part F: Electrification:

1	Internal Electrical Works: Surface channel wiring for the following point looping at the switch board with earth terminal, including circuit drilling with 1 C-2 x 1.5 sq. nun PVC insulated and sheathed standard cable (BYM) and 1.5 sq. mm Green! White colored PVC insulated ECC wire (BYA) through minimum 1 mm thick PVC channel complete with 18 SWG OP sheet switch board with 3mm thick ebonite sheet cover, circular box, 5 amps piano switch, ceiling rose, fixing materials, accessories etc., and mending the damaged goods, cable manufactured by BRIB/Sunshine Cables Limited complete in and accepted by the Engineer-in -charge (Including cost of alt materials, labor and transportation, VAT and IT):				
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Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
a)	Light Point with 2-Energy Saving Light	No.	2	836	1,672
b)	Fan Point with switch	No.	1	927	927
c)	2 pin 5 Amps socket point: Gang type	No.	1	90	90
d)	Tube light with complete setting	No.	2	476	952
e)	Sealing Fan including fitting and Fixing with good quality. (Size: 56"; No. of Blade: 03)	No.	1	2,832	2,832
2	Transformer: (1 Phase) Supply and installation of a 10 KVA transformer Including all fittings and others -Necessary materials (Including cost of all materials, labor and transportation, VAT and IT)	No.	1	106,258	1,672
3	Electric connection from Local REB/PDB (Including cost of all materials, labor and transportation, VAT and IT)	No.	1	70,000	70,000
4	<p>Solar System</p> <p>Supply mid instillation of Solar Hybrid Electric-system with 04 (Four) hours Battery backup as following specification including all fitting and other necessary materials (Including cost of all materials, labor and transportation)</p> <p>Assumption on Design: load power factor: 60%, Battery charging acceptance efficiency: 90%, Temperature effect: 90%, Battery Dept of discharge: 60%, Operating hours of load: 04 Hours, Autonomy: 01 day</p> <p>High Quality Solar Module: High efficiency solar cells to ensure high performance of solar module. EVA laminate & water proof TPT yield long life time white, ensuring cell performance. Bypass diodes to avoid fat effect, 20 years limited power warranty. Capacity: 20 WP; Solar Cell: Germany/China; Solar panel Certification: IEC, CE, ROHS.</p> <p>Battery: Heavy duty low maintenance Battery with 5 years Warranty for DC system or 2 years for AC system; Capacity: 30 AH- 1 pc, brand Name: Volvo /Hamko/Lumen/Euro (Made in Bangladesh)</p> <p>Other Accessories: Battery Cable, Junction Box, steel structure, cable clips etc.</p>	wp	20	950	1,672
5	<p>Supply and installation of Single-Phase diesel generator set with canopy as per Instruction of Engineer- In charge</p> <p>Capacity: 15 KVA, Output Type: AC Single Phase, Speed: 1500/1800 rpm</p> <p>Frequency: 50 Hz, Stand by Power: 15 KVA, Prime Power: 14 KVA, Rated Voltage: 220V/230V, Cooling System: Water/Air</p>	Set	1	650,000	650,000
Sub-total of Part F					729,817
Grand Total (A+B+C+D+E+F)					3,261,925

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019), and other sources.

SANITATION TECHNOLOGIES

Raised Direct Single Pit Latrine

Context and Description

Emergency Context

This technology is applicable in the areas affected by floods and water logging or in areas with high water table.

Major Components

- > Latrine pan with water seal (U-trap) or Sato pan
- > A pit constructed on raised ground
- > Suitable steps or slope for accessing the toilet
- > Vent pipe
- > A suitable superstructure

Technology Description

- > After each use, the latrine is manually flushed with 2-5 L of water. In the pit, the liquid infiltrates into the soil, while the solids accumulate in the pit and undergo decomposition.
- > When the pit becomes full (up to the design level), it needs to be desludged.
- > The water seal of the pan (or trap door of Sato pan) maintains a barrier between user and pit contents, and help eliminate insect and odor problem.
- > The vent pipe removes obnoxious gas from the pit.
- > Mechanical desludging would greatly facilitate continued operation of the latrine; the fecal sludge emptied from the pit should be carried to a treatment plant (where available) or safely buried in a shallow pit.
- > The raised pit facilitates continued use of the toilet even during a flood event.
- > The pit is usually lined with concrete rings, especially in unstable soil or water-logged areas. Plastic rings or sheets, bricks, soil blocks, bamboo sticks or mats, or old drums could also be used in the absence of concrete rings, which strengthens it against collapse.

Suitability

This technology is suitable in all areas where flooding during wet season interferes with toilet use, and there is a risk of groundwater pollution due to liquid infiltration. The distance from the pit to water wells and surface water should be at least 10 m to



Figure 21: A raised direct single pit latrine installed in coastal areas (Courtesy: Concern Worldwide).

decrease the risk of groundwater pollution and the inlet of the pit should be at least 2 m above the groundwater table. The design is suitable for one or two families.

Desludging

Desludging should be avoided during flood or water logging condition, and should be carried out during normal condition. When the pit fills to within about 0.5 m from the top, it should be emptied. A five-ring pit is expected to serve a family of 5 (members) for about 2 years, after which the pit would have to be desludged. This can be achieved by using various types of sludge pumps to extract the excreta from the latrine pit, then disposing it of in a new pit and cover it with soil. If sludge pumps are not available, manual desludging could be carried out ensuring adequate safety measures.

Risks/Challenges

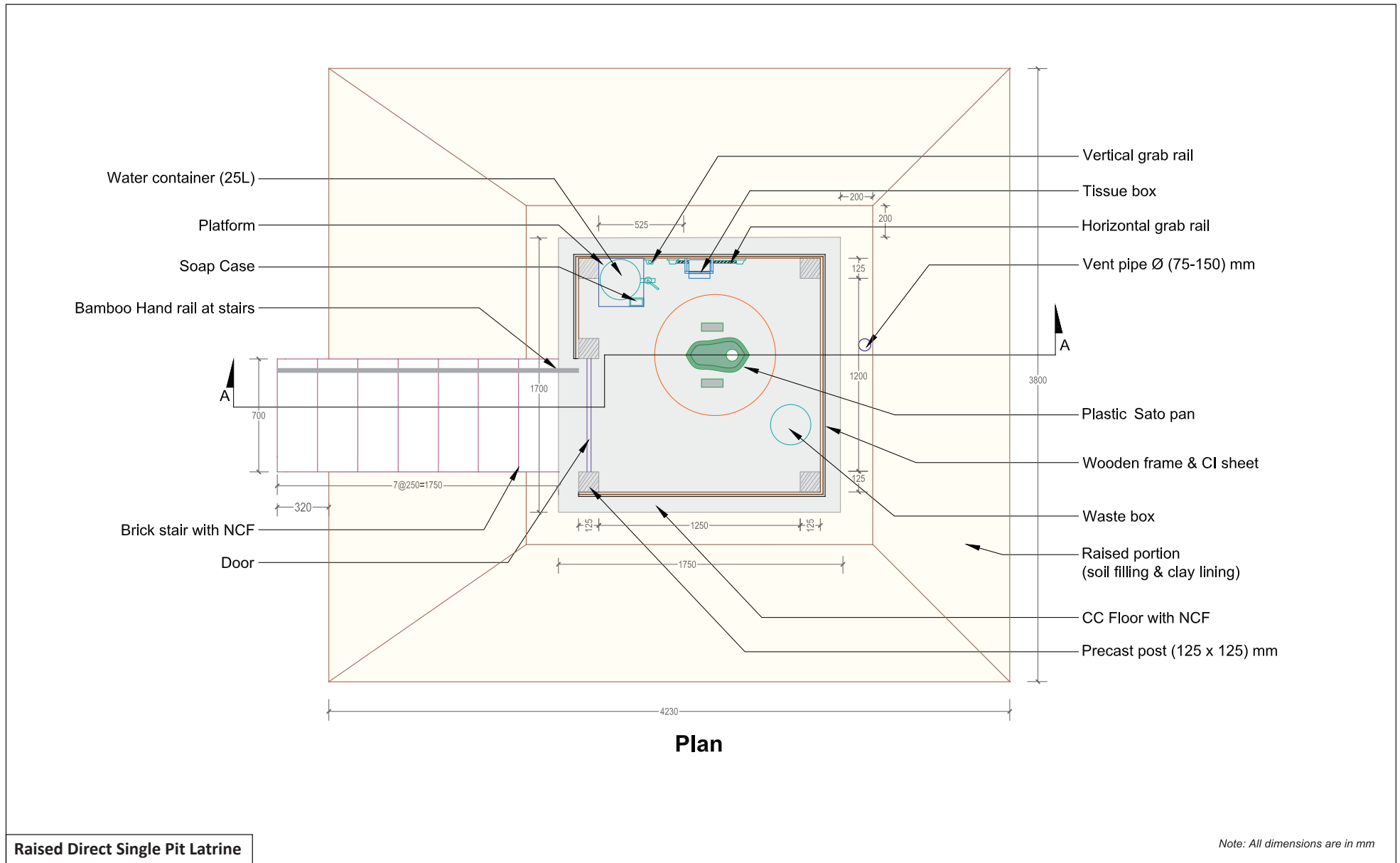
Possible groundwater contamination from liquid infiltration from pits of latrines, particularly during flood.

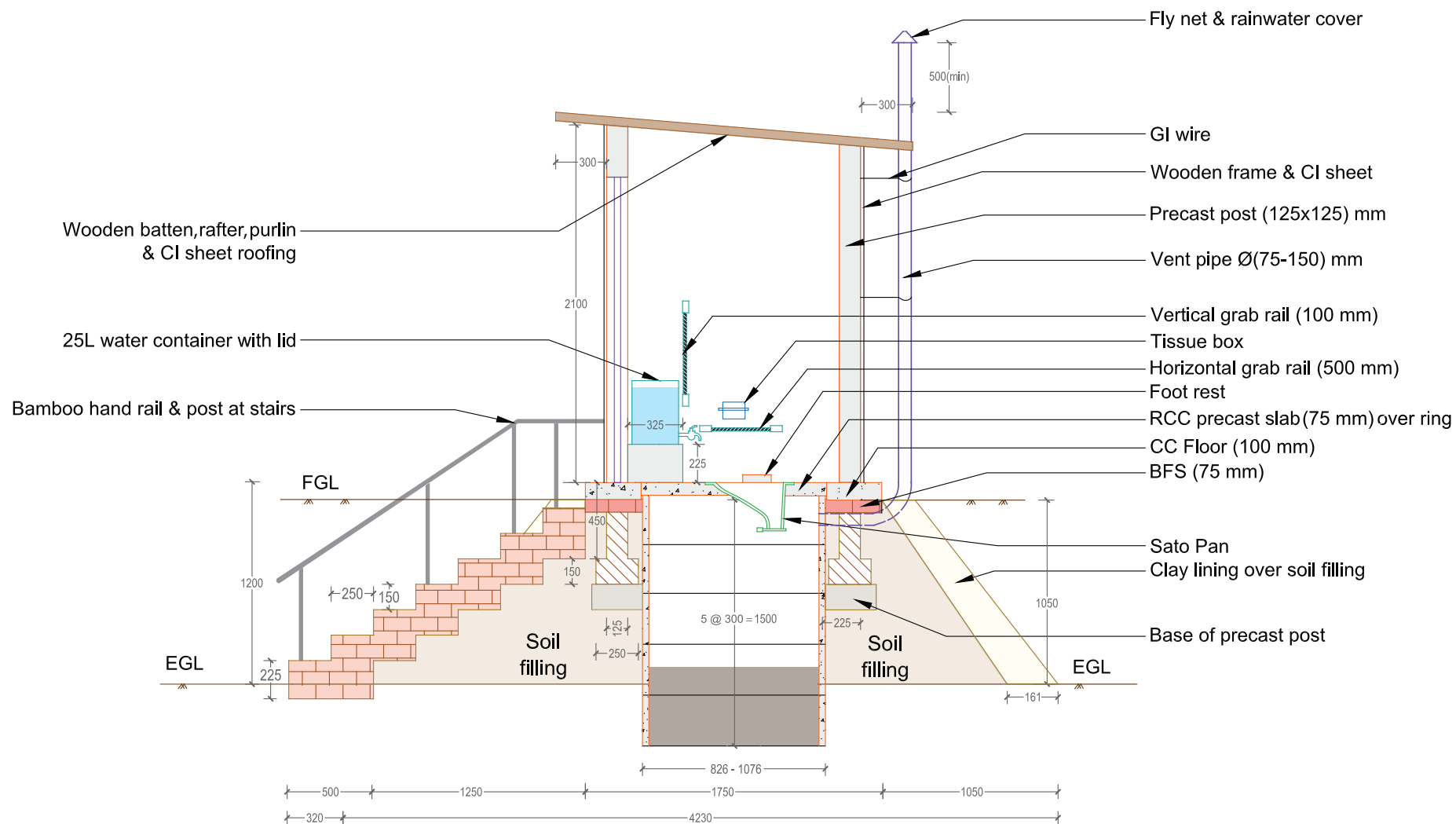
Operation and Maintenance

Require mechanical desludging when the pit becomes full (up to design level); offset pits are easier to desludge.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 15-18).

Design Drawings

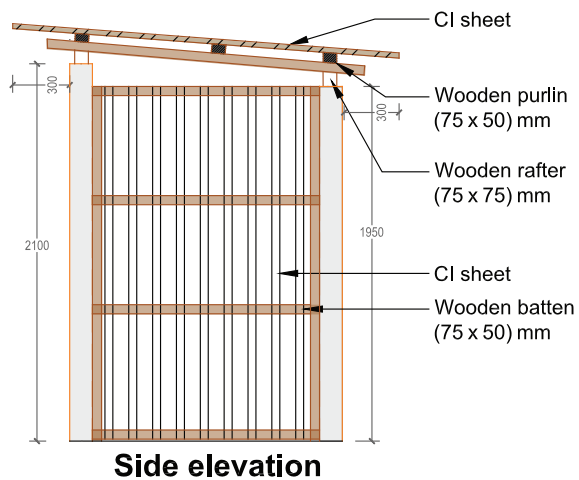




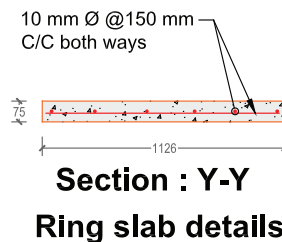
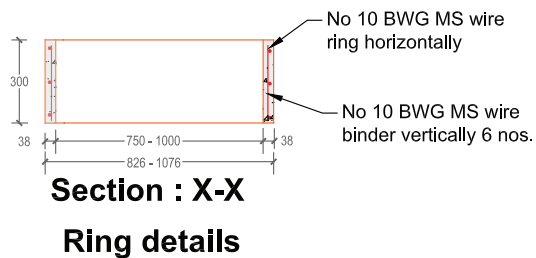
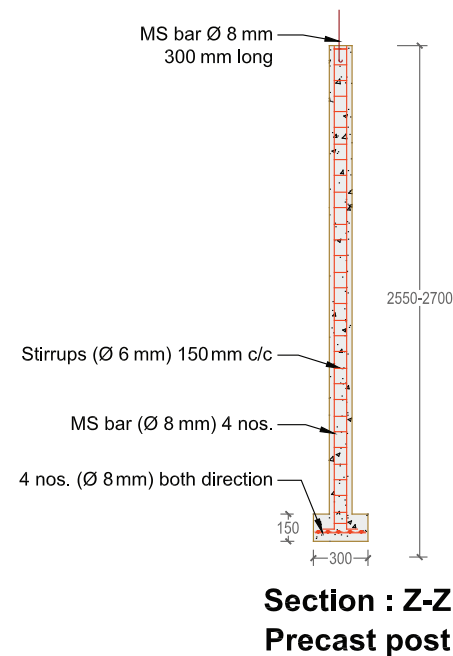
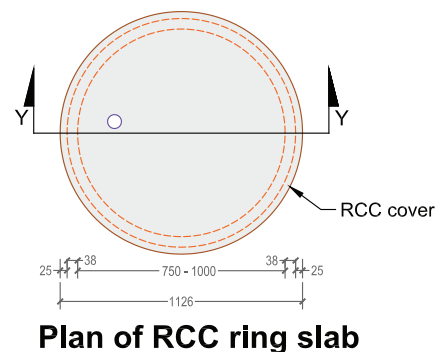
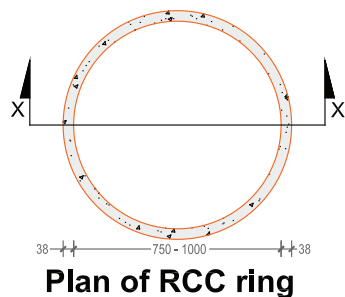
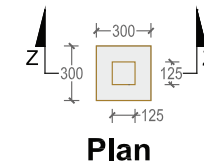
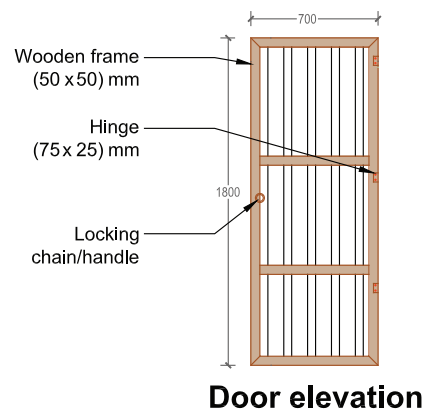
Section A-A

Raised Direct Single Pit Latrine

Note: All dimensions are in mm



Side elevation



Cost Estimate

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	500	500
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	20	24	480
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.36	193	69
4	Earth filling in foundation trenches and plinth with excavated earth to raise the plinth and site development 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.36	153	55
5	Sand filling in foundation trenches in raising toilet plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	8.83	705	6,225
6	Site development/Improvement by supplied carted earth (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means including cost of cutting or by dredging all; including local carrying, placing the earth, silt in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	4.5	393	1,769
7	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	2	454	908
8	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	2.5	42	105

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.2	8,330	1,666
10	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and soaking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	0.63	6,917	4,358
11	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	1.62	1,023	1,657
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	7.5	311	2,333
13	Supplying and making door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.19	125,177	23,784
14	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 ft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge.	sqm	15.4	566	8,716
15	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	5	1,900	9,500

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 no's No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally).	each	5	800	4,000
17	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	1,750	1,750
18	Supplying fitting fixing best quality appropriate size well matured bamboo as supporting pole, stair hand rail and design etc. with supply of all fixing and binding materials etc. complete as per instruction and satisfaction of the Engineer in Charge.	meter	6	60	360
Sub -Total of Part A					68,235

Part B: Plumbing Work

1	Supplying, fitting and fixing best quality uPVC long pan with sato pan , fitting with RCC precast slab during casting of slab, install foot- rest with two bricks etc., placing over RCC ring in position with provision to remove the slab for desludging fecal sludge from the well, filling the gaps between floor slab and precast slab with cement mortar (1:6) with marking the joints for removing and placing slab for the next time, including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in- charge. cement, filling bore hole with coarse sand up to 10.0 m above the top of strainer and remaining portion with available withdrawn soil from boring in/c sealing the top of coarse sand pack etc. all complete as per standard practice and direction of Engineer.	set	1	500	500
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Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700
3	Supplying 100 mm inside dia best quality uPVC ventilation pipe having specific gravity 1.35-1.45, wall thickness 3.4- 4.0 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating bands, sockets etc. approved and accepted by the Engineer- in- charge.	meter	3	750	2,250
4	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/ elbows, jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	1.5	500	750
5	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
6	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	577	577
7	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
8	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
9	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	2	125	250
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	4	125	500
c)	Nail of different size	kg	1.5	125	188
d)	Hinges	Nos	3	75	225
e)	Screw for hinges	dozen	2	100	200
f)	Lock chain for door lock inside and outside	Nos	2	40	80
Sub-total of Part B					7,280
Total (A+B)					75,515

Note: The BoQs have been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Raised Offset Single Pit Latrine

Context and Description

Emergency Context

This technology is applicable in the areas affected by floods and water logging or in areas with high water tables.

Major Components

- > Latrine pan with water seal (U-bend type or P-trap)
- > A pit made of concrete rings
- > Vent pipe (one for each pit)
- > A suitable superstructure

Technology Description

- > After each use, the latrine is manually flushed with 2-5 L of water. In the pit, the liquid infiltrates into the soil, while the solids accumulate in the pit and undergo decomposition.
- > When the pit becomes full (up to the design level), it needs to be desludged.
- > The water seal of the pan (or trap door of Sato pan) maintains a barrier between user and pit contents, and help eliminate insect and odor problem.
- > The vent pipe removes obnoxious gas from the pit.

Mechanical desludging would greatly facilitate continued operation of the latrine; the fecal sludge emptied from the pit should be carried to a treatment plant (where available) or safely buried in a shallow pit.

- > The raised pit facilitates continued use of the toilet even during a flood event.
- > The pit is usually lined with concrete rings, especially in unstable soil or water-logged areas. Plastic rings or sheets, bricks, soil blocks, bamboo sticks or mats, or old drums could also be used in the absence of concrete rings, which strengthens it against collapse.

Suitability

This technology is suitable in all areas where flooding during wet season interferes with toilet use, but there is a risk of groundwater pollution due to liquid infiltration. The distance from water wells and surface water should be at least 10 m to decrease the



Figure 22: A raised offset single pit latrine
(Courtesy: Oxfam)

risk of groundwater pollution and the inlet of the pit should be at least 2 m above the groundwater table. The design is suitable for one or two families.

Desludging

Desludging should be avoided during flood or water logging condition, and should be carried out during normal condition. When the pit fills to within about 0.5 m feet from the top, it should be emptied. A five-ring pit is expected to serve a family of 5 (members) for about 2 years, after which the pit would have to be desludged. This can be achieved by using various types of sludge pumps to extract the excreta from the latrine pit, then disposing it of in a new pit and cover it with soil. If sludge pumps are not available, manual desludging could be carried out ensuring adequate safety measures.

Risks/Challenges

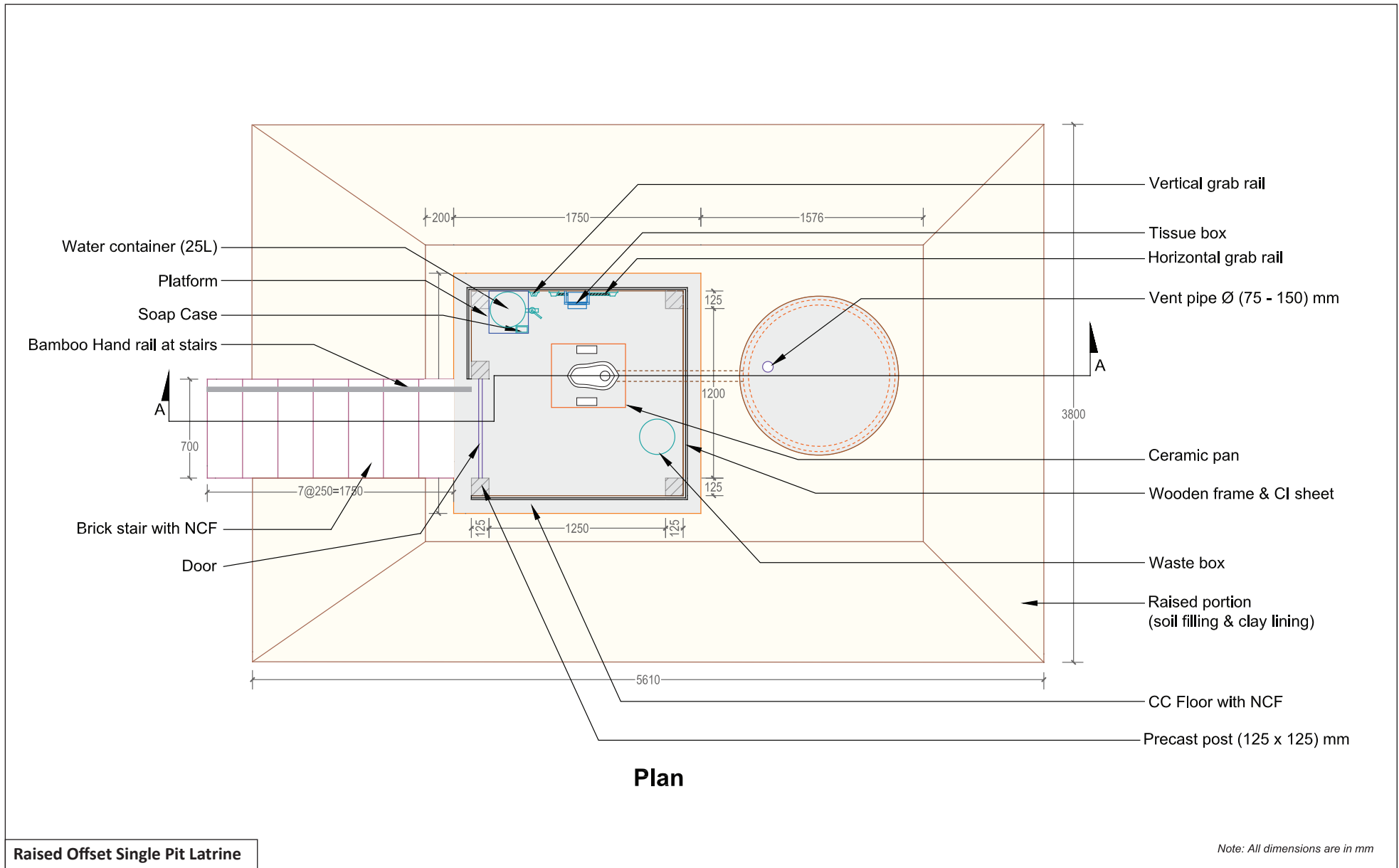
Possible groundwater contamination from liquid infiltration from pits of latrines, particularly during flood.

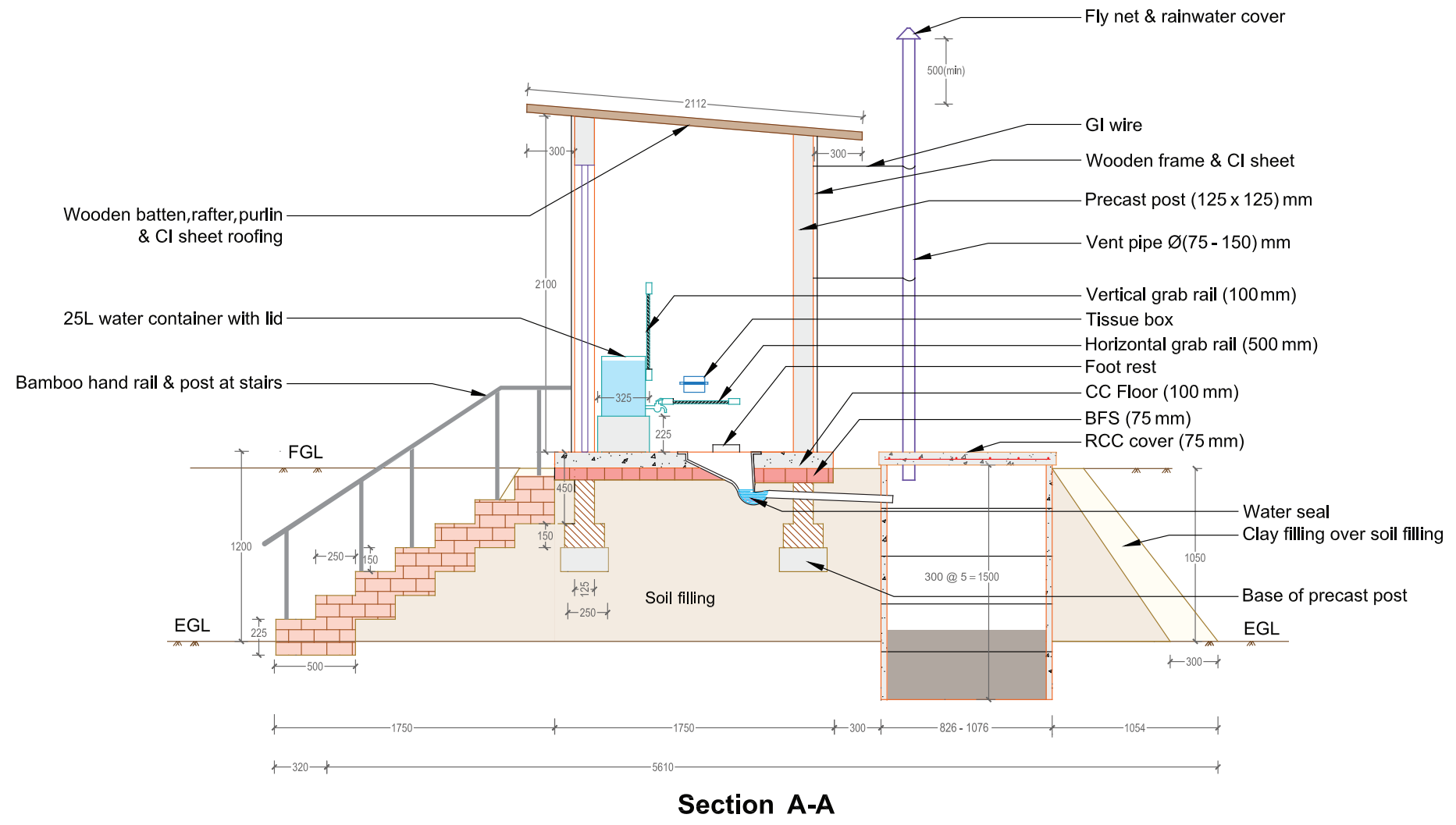
Operation and Maintenance

Require mechanical desludging when the pit becomes full (up to design level); offset pits are easier to desludge than direct pits.

Note: > Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 5-6).

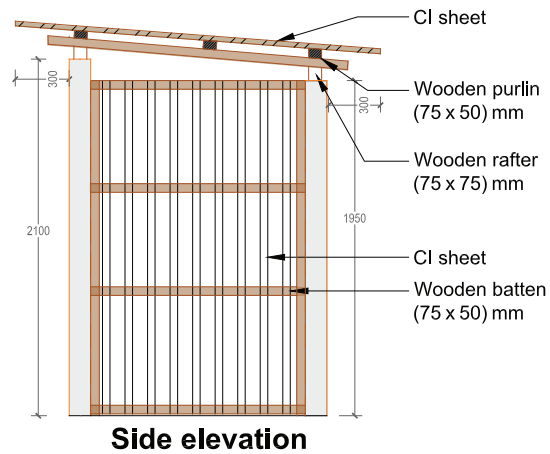
Design Drawings



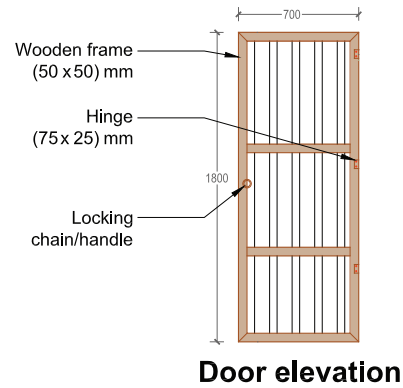


Raised Offset Single Pit Latrine

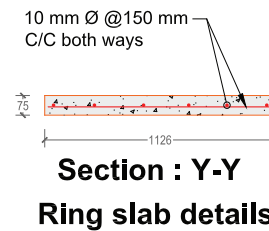
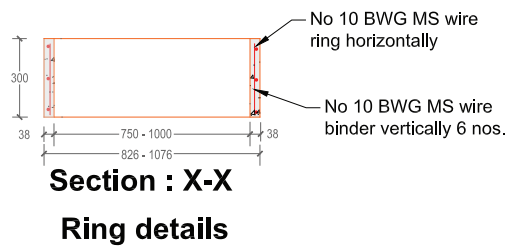
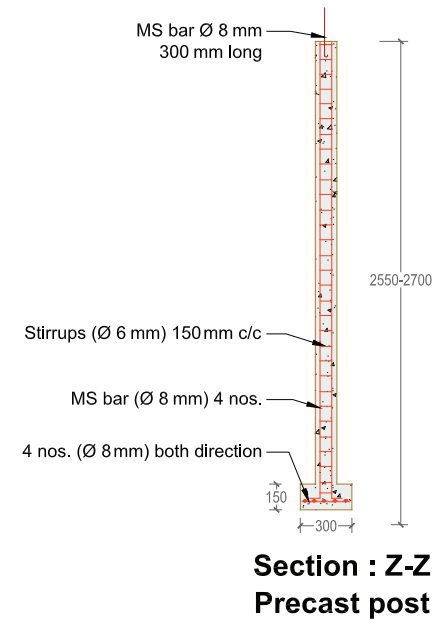
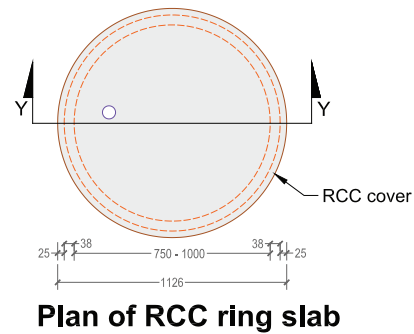
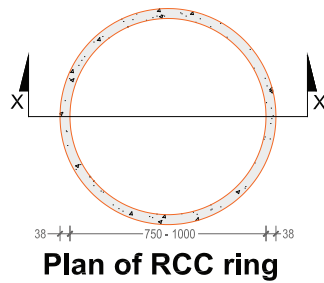
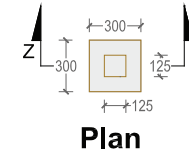
Note: All dimensions are in mm



Side elevation



Door elevation



Cost Estimate

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	750	750
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	25.	24	600
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.36	193	69
4	Earth filling in foundation trenches and plinth with excavated earth to raise the plinth and site development 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.36	153	55
5	Sand filling in foundation trenches in raising toilet plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	13.21	705	9,313
6	Site development/Improvement by supplied carted earth (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means including cost of cutting or by dredging all; including local carrying, placing the earth, silt in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	5.36	393	2,106
7	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	3	454	1,362
8	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	3.2	42	134

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.3	8,330	2,499
10	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	0.63	6,917	4,358
11	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	1.62	1,023	1,657
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	7.5	311	2,333
13	Supplying and making door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.19	125,177	23,784
14	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge.	sqm	15.4	566	8,716
15	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	5	1,900	9,500
16	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally).	each	5	800	4,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
17	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	1,750	1,750
18	Supplying fitting fixing best quality appropriate size well matured bamboo as supporting pole, stair hand rail and design etc. with supply of all fixing and binding materials etc. complete as per instruction and satisfaction of the Engineer in Charge.	meter	6	60	360
Sub -Total of Part A					73,347

Part B: Plumbing Work

1	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in-charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	1	2,119	2,119
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700
3	Supplying 100 mm inside dia best quality uPVC ventilation pipe having specific gravity 1.35-1.45, wall thickness 3.4- 4.0 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating bands, sockets etc. approved and accepted by the Engineer- in- charge.	meter	3	750	2,250
4	Supplying inside dia best Quality u PVC B-grade soil 100mm inner dia, wall thickness 3.40 mm ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	3	450	1,350

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
5	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/elbows, jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	1.5	500	750
6	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
7	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	577	577
8	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
9	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
10	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	2	125	250
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	4	125	500
c)	Nail of different size	kg	1.5	125	188
d)	Hinges	Nos	3	75	225
e)	Screw for hinges	dozen	2	100	200
f)	Lock chain for door lock inside and outside	Nos	2	40	80
Sub-total of Part B					10,249
Total (A+B)					83,596

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily DPHE Schedule of rates (2019) and other sources.

Raised Offset Twin Pit Latrine

Context and Description

Emergency Context

This technology is applicable in the areas affected by floods and water logging or in areas with high water tables.

Major Components

- > Latrine pan with water seal (U-bend type or P-trap)
- > Two pits made of concrete rings
- > A Y-junction (diversion box)
- > Vent pipe (one for each pit)
- > A suitable superstructure

Technology Description

- > Pits are used alternately; only one pit is used at a time. After each use, the latrine is manually flushed with 2-5 L of water. In the pit, the liquid infiltrates into the soil, while the solids accumulate in the pit and undergo decomposition.
- > When one pit becomes full (up to design depth), flow of waste is diverted (at the Y-junction) to the second pit using the Y-junction, and the filled pit is covered with soil.
- > Contents of filled pit decompose to safe, pathogen-free humus within 18 to 24 months.
- > Contents of the first pit is then dug out (and used as soil conditioner) and the pit becomes ready for re-use.
- > The water seal of the pan (or trap door of Sato pan) maintains a barrier between user and pit contents, and help eliminate insect and odor problem. The vent pipe removes obnoxious gas from the pit.

Suitability

This is the most preferred option among the different pour-flush technologies, because it eliminates the requirement of desludging of raw fecal matter and recovers resources in the form of “soil conditioner”.



Figure 23: A raised offset twin pit latrine (Courtesy: Oxfam).

Desludging

One pit of the toilet is used at a time. When the pit in use fills to within about 0.5 m of the top, the Y-junction (diversion box) is used to divert the passage of blackwater to the other pit. The filled pit is then covered with soil and left for at least 1.5 to 2.0 years. After this period, the contents of this pit could be dug out manually (without any health risk) and could be used as soil conditioner; the emptied pit then becomes ready for reuse.

Risks/Challenges

Possible groundwater contamination, particularly in high water table areas during wet season. The Y-junctions need to be checked for clogging on a periodic basis. Also, both pits must not be used simultaneously.

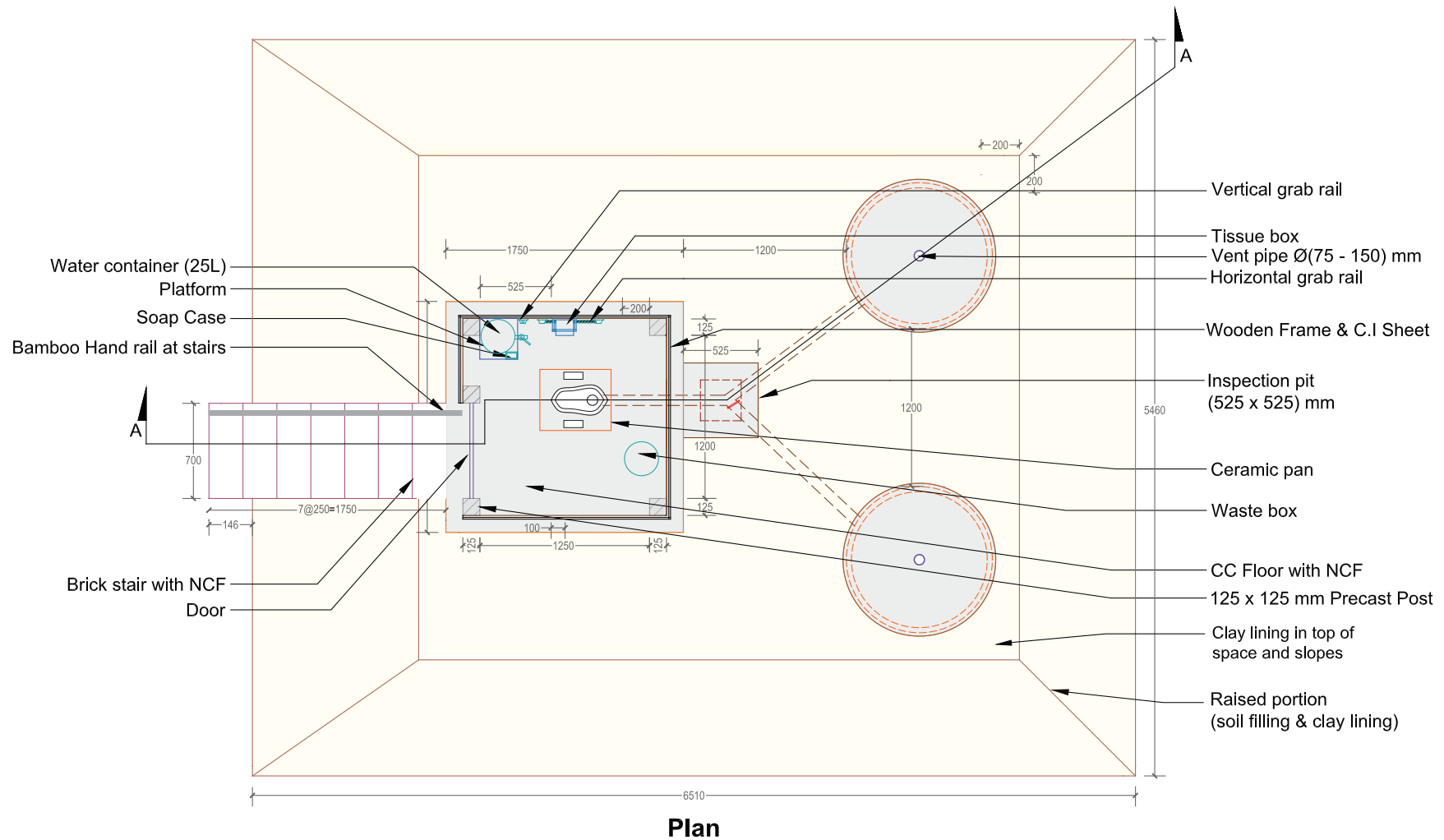
Operation and Maintenance

One five-ring pit is expected to serve a family of 5 (members) for about 2 years, after which the flow of waste should be diverted (at the Y-junction) to the second pit.

When one pit becomes full (up to design level), the flow of waste needs to be diverted to the second pit, and the old pit needs to be covered with soil.

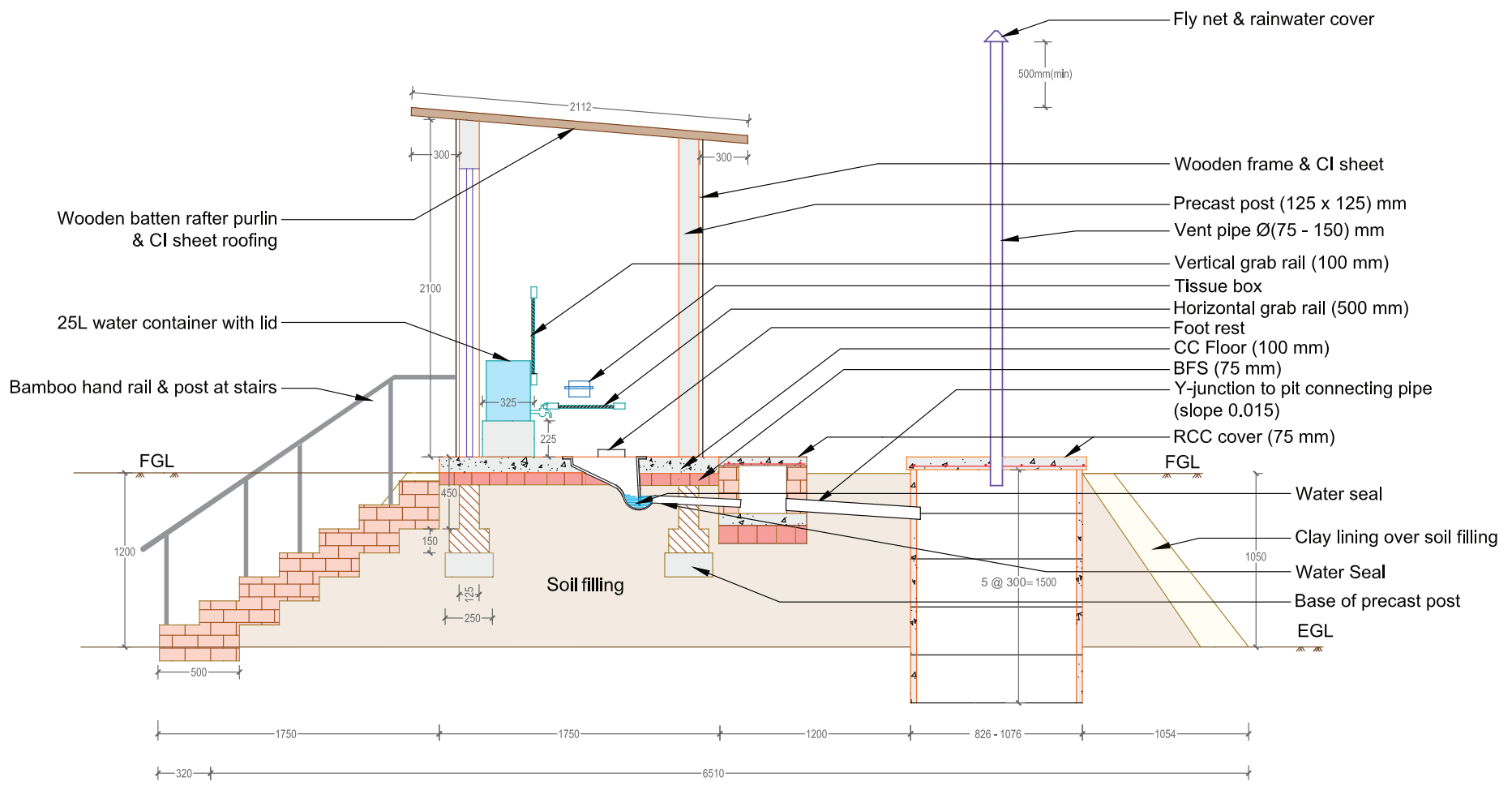
Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 9-11).

Design Drawings



Raised Offset Twin Pit Latrine with Inspection Pit

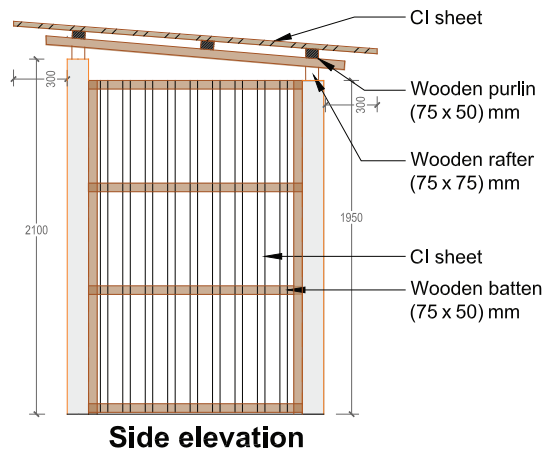
Note: All dimensions are in mm



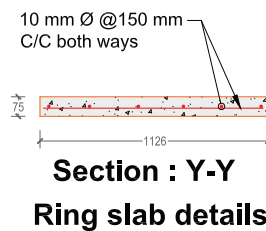
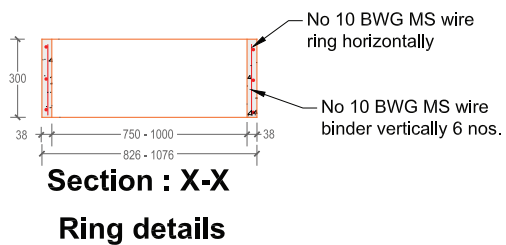
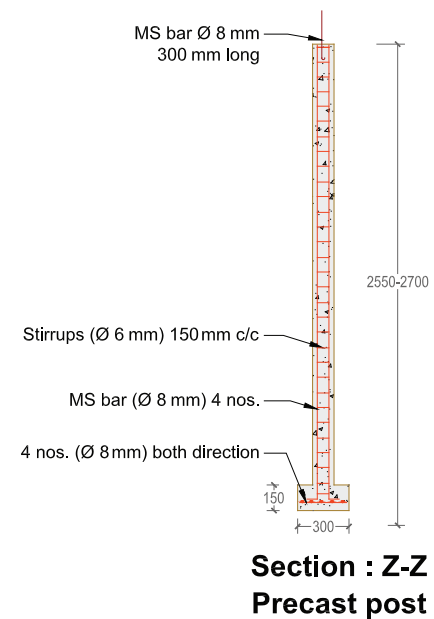
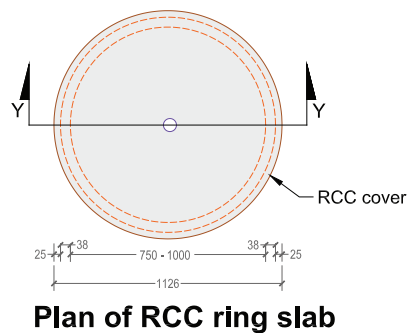
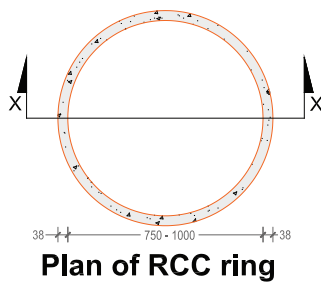
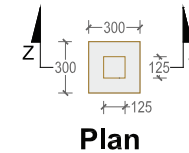
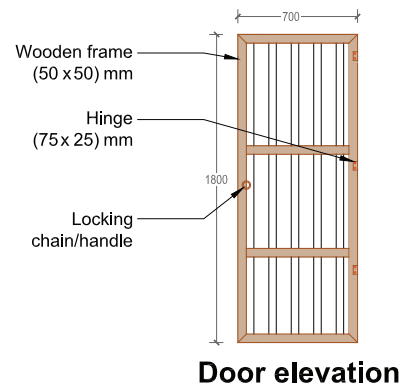
Section A-A

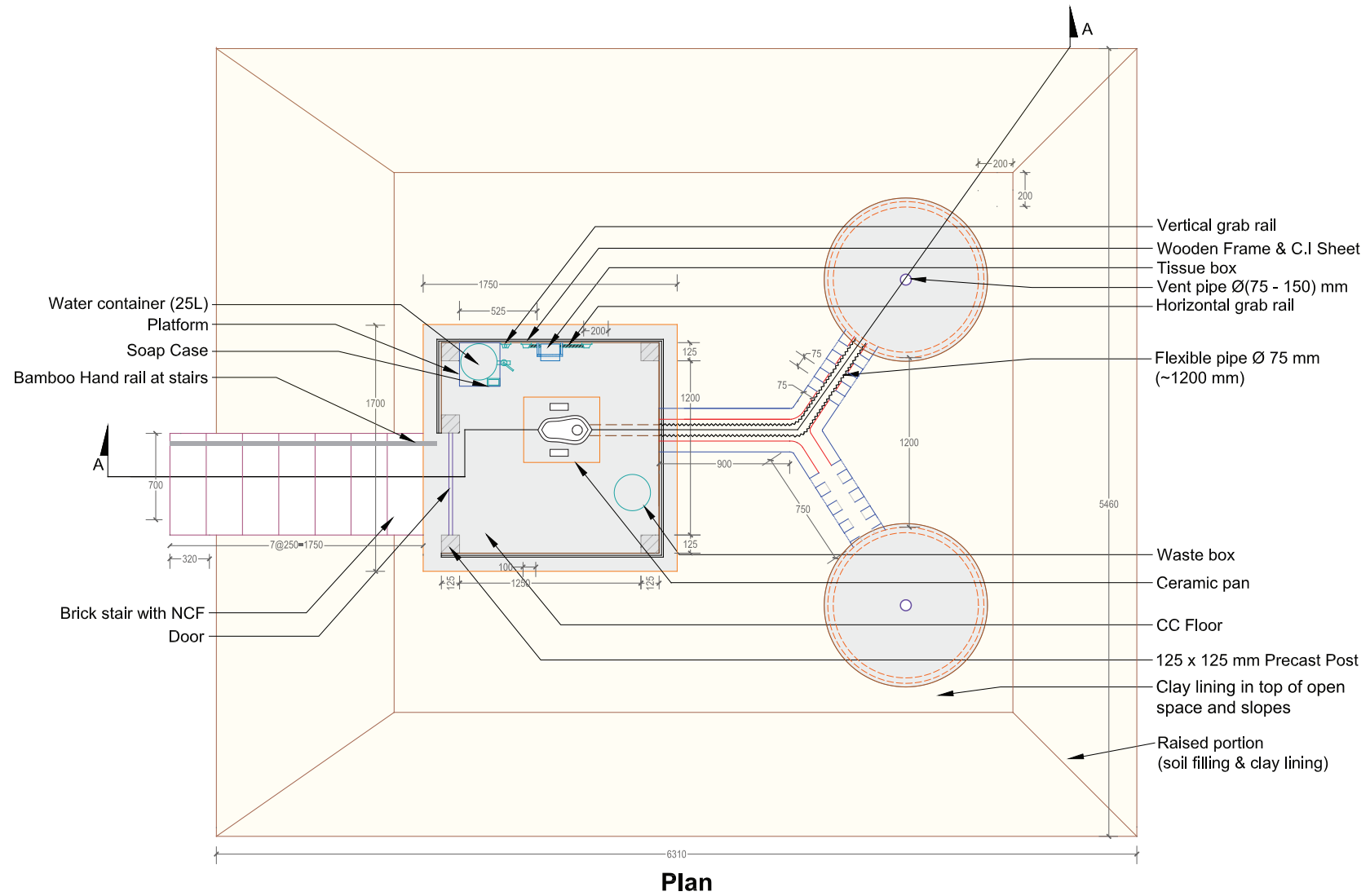
Raised Offset Twin Pit Latrine with Inspection Pit

Note: All dimensions are in mm



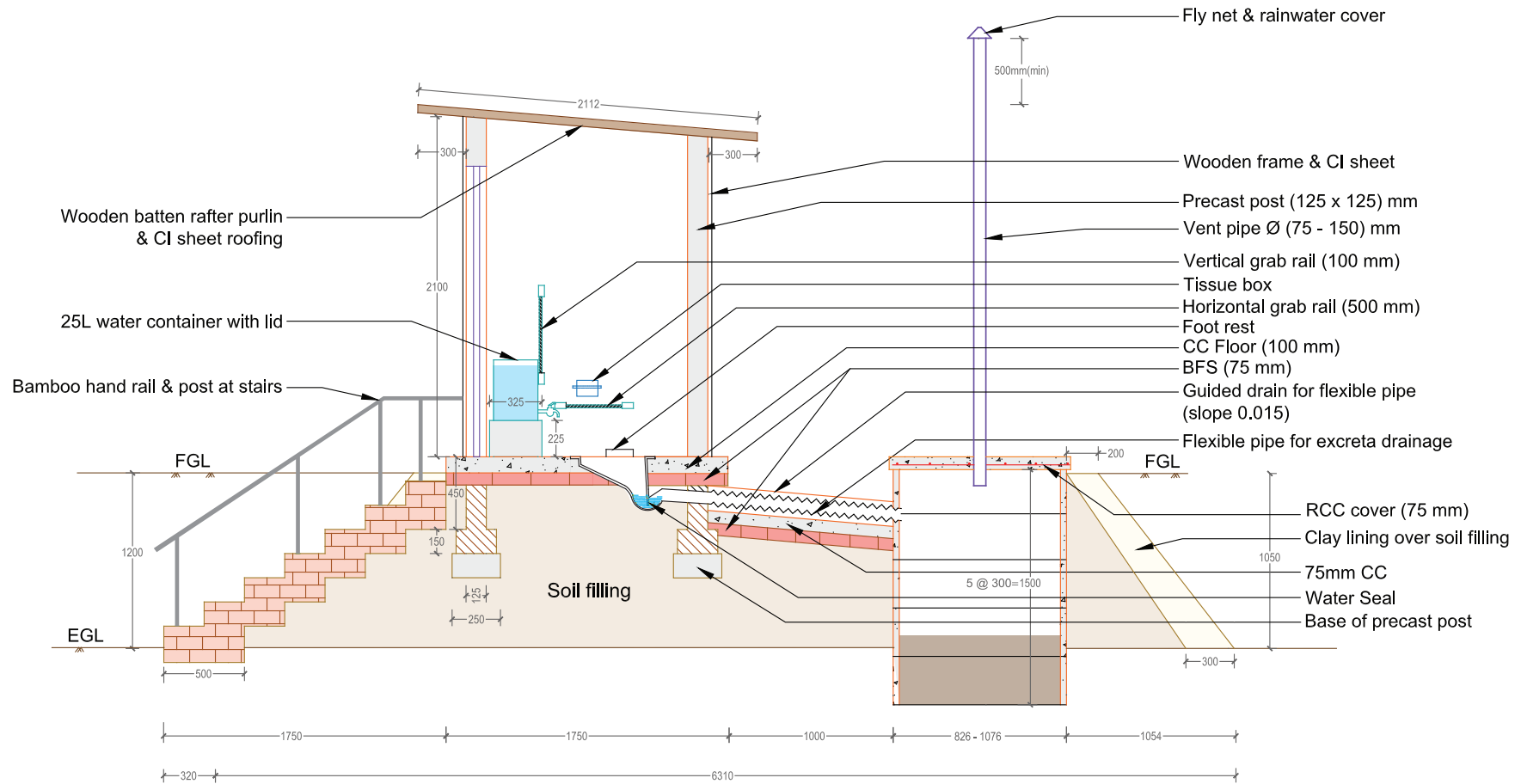
Side elevation





Raised Offset Twin Pit Latrine with Flexible Pipe Connection

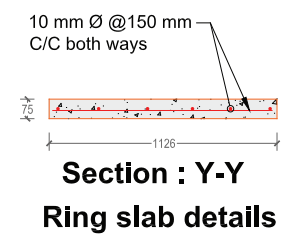
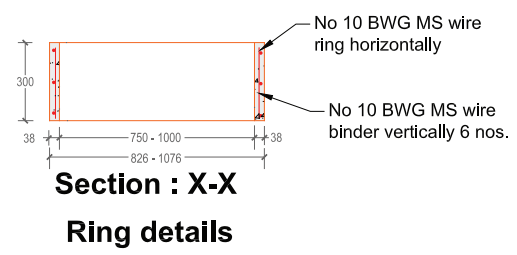
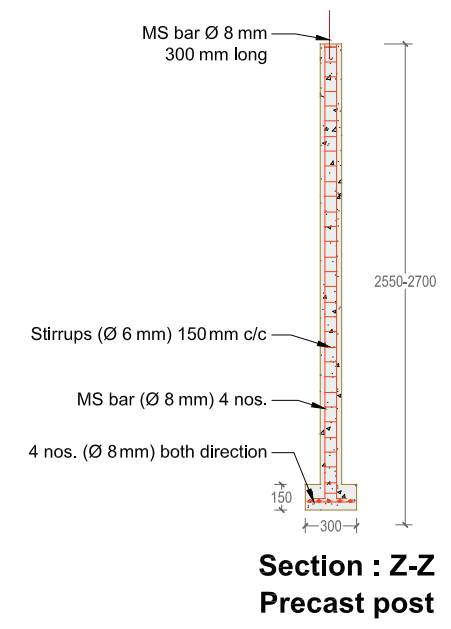
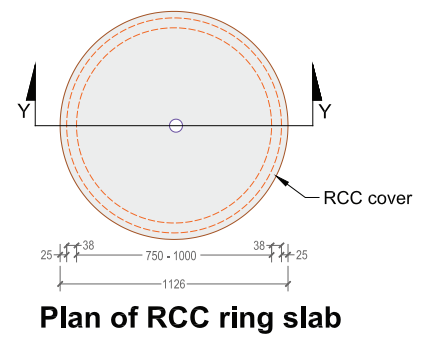
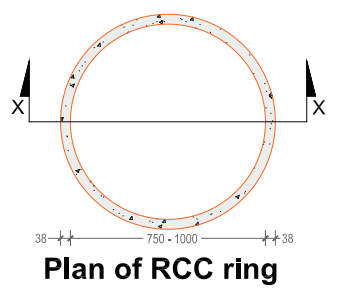
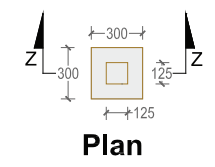
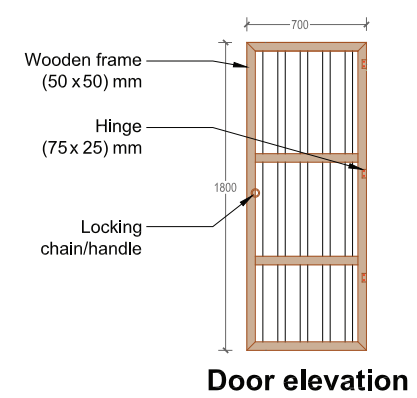
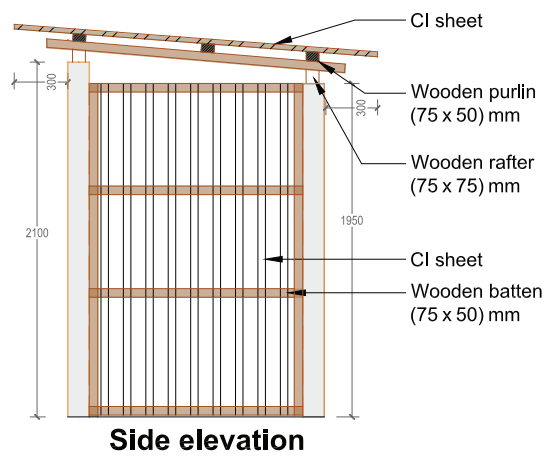
Note: All dimensions are in mm



Section A-A

Raised Offset Twin Pit Latrine with Flexible Pipe Connection

Note: All dimensions are in mm



Raised Offset Twin Pit Latrine with Flexible Pipe Connection

Note: All dimensions are in mm

Cost Estimate: Type-1: Raised Offset Twin Pit Latrine with Inspection Pit

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1.00	750	750
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	40.00	24	960
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.73	193	141
4	Earth filling in foundation trenches and plinth with excavated earth to raise the plinth and site development 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.73	153	112
5	Sand filling in foundation trenches in raising toilet plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	18.50	705	13,043
6	Site development/Improvement by supplied carted earth (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means including cost of cutting or by dredging all; including local carrying, placing the earth, silt in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	8.90	393	3,498
7	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	3.25	454	1,476
8	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	3.50	42	147

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.32	8,330	2,666
10	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and soaking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	0.63	7,293	4,595
11	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	2.26	1,023	2,312
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	8.25	311	2,566
13	Supplying and making door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.19	125,177	23,784
14	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 ft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge.	sqm	15.40	566	8,716
15	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	5.00	1,900	9,500

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally).	each	10.00	800	8,000
17	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	2.00	1,750	3,500
18	Supplying fitting fixing best quality appropriate size well matured bamboo as supporting pole, stair hand rail and design etc. with supply of all fixing and binding materials etc. complete as per instruction and satisfaction of the Engineer in Charge.	each	1.00	600	600
Sub - Total of Part A					86,723

Part B: Plumbing Work

1	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in-charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	1	2,119	2,119
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	Supplying 100 mm inside dia best quality uPVC ventilation pipe having specific gravity 1.35-1.45, wall thickness 3.4- 4.0 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating bands, sockets etc. approved and accepted by the Engineer- in- charge.	meter	6	750	4,500
4	Supplying inside dia best Quality u PVC B-grade soil 100mm inner dia, wall thickness 3.40 mm ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO/ IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating/ domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	5	450	2,250
5	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/ elbows, jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	1.5	500	750
6	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
7	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	577	577
8	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
9	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
10	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	2	125	250
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	4	125	500
c)	Nail of different size	kg	1.5	125	188
d)	Hinges	Nos	3	75	225
e)	Screw for hinges	dozen	2	100	200
f)	Lock chain for door lock inside and outside	Nos	2	40	80
Sub-total of Part B					13,399
Total (A+B)					100,122

Cost Estimate: Type-2: Raised Offset Twin Pit Latrine with Flexible Pipe Connection

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	750	750
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	36	24	864
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.73	193	141
4	Earth filling in foundation trenches and plinth with excavated earth to raise the plinth and site development 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.73	153	112
5	Sand filling in foundation trenches in raising toilet plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	17.5	705	12,338
6	Site development/Improvement by supplied carted earth (free from any organic, foreign, environmental hazardous substances) carried by head or truck or any other means including cost of cutting or by dredging all; including local carrying, placing the earth, silt in the designated area, maintaining slopes, breaking lumps, levelling and dressing in layers up to finished level etc. all complete as per direction and accepted by the engineer in charge.	cum	8	393	3,144
7	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	3.6	454	1,634
8	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	4	42	168

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	0.38	8,330	3,165
10	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and soaking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	0.63	6,917	4,358
11	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	1.62	1,023	1,657
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	14.5	311	4,510
13	Supplying and making door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.19	125,177	23,784
14	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 ft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. over reservoir all complete and accepted by the Engineer-in-charge.	sqm	15.4	566	8,716
15	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	5	1,900	9,500

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 no's No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally).	each	10	800	8,000
17	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	2	1,750	3,500
18	Supplying fitting fixing best quality appropriate size well matured bamboo as supporting pole, stair hand rail and design etc. with supply of all fixing and binding materials etc. complete as per instruction and satisfaction of the Engineer in Charge.	meter	6	60	360
Sub -Total of Part A					86,700

Part B: Plumbing Work

1	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in-charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	1	2,119	2,119
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	Supplying 100 mm inside dia best quality uPVC ventilation pipe having specific gravity 1.35-1.45, wall thickness 3.4- 4.0 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating bands, sockets etc. approved and accepted by the Engineer- in- charge.	meter	6	750	4,500
4	Supplying 75 mm inside dia best quality Flexible pipe and jointing inlet end of toilet to pit etc. approved and accepted by the Engineer-in- charge.	meter	2.5	250	625
5	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/elbows, jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	each	1.00	460	460
6	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1.00	577	577
7	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	500	500
8	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
9	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.				
10	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	2	125	250
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	4	125	500
c)	Nail of different size	kg	1.5	125	188
d)	Hinges	Nos	3	50	150
e)	Screw for hinges	dozen	2	100	200
f)	Lock chain for door lock inside and outside	Nos	2	40	80
Sub-total of Part B					11,699
Total (A+B)					98,399

Note: The BoQs have been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Mobile Toilet

Context and Description

Emergency Context

Mobile toilets are applicable for the first phase of emergencies, both in rural and urban areas where, a large population loses sanitation facilities.

Major Components

- > Latrine pan with water seal (U-trap) or Sato pan
- > Sewage holding tank
- > Vent pipe
- > A rickshaw pulling van

Technology Description

- > The mobile toilets can be easily transported from one place to another, requires small space, small investment, and fewer number of workers for maintenance.
- > The toilets have running water and solar electricity connection, hand washing facility, toilet paper, mirror, and waste bin.

Suitability

This toilet technology is particularly suitable for the crowded places where public toilet is not available nearby, and also at places of occasional gathering of people (e.g., near a playground).

Desludging

The storage tank has a valve to connect a hose pipe for removing its contents. Usually when the tank is filled, the hose pipe is connected to discharge the waste in the available sewerage system or a pit.

Risks/Challenges

This toilet technology requires frequent desludging. If not cleaned, serviced or transported in safe way, can increase the risk of infections and diseases.



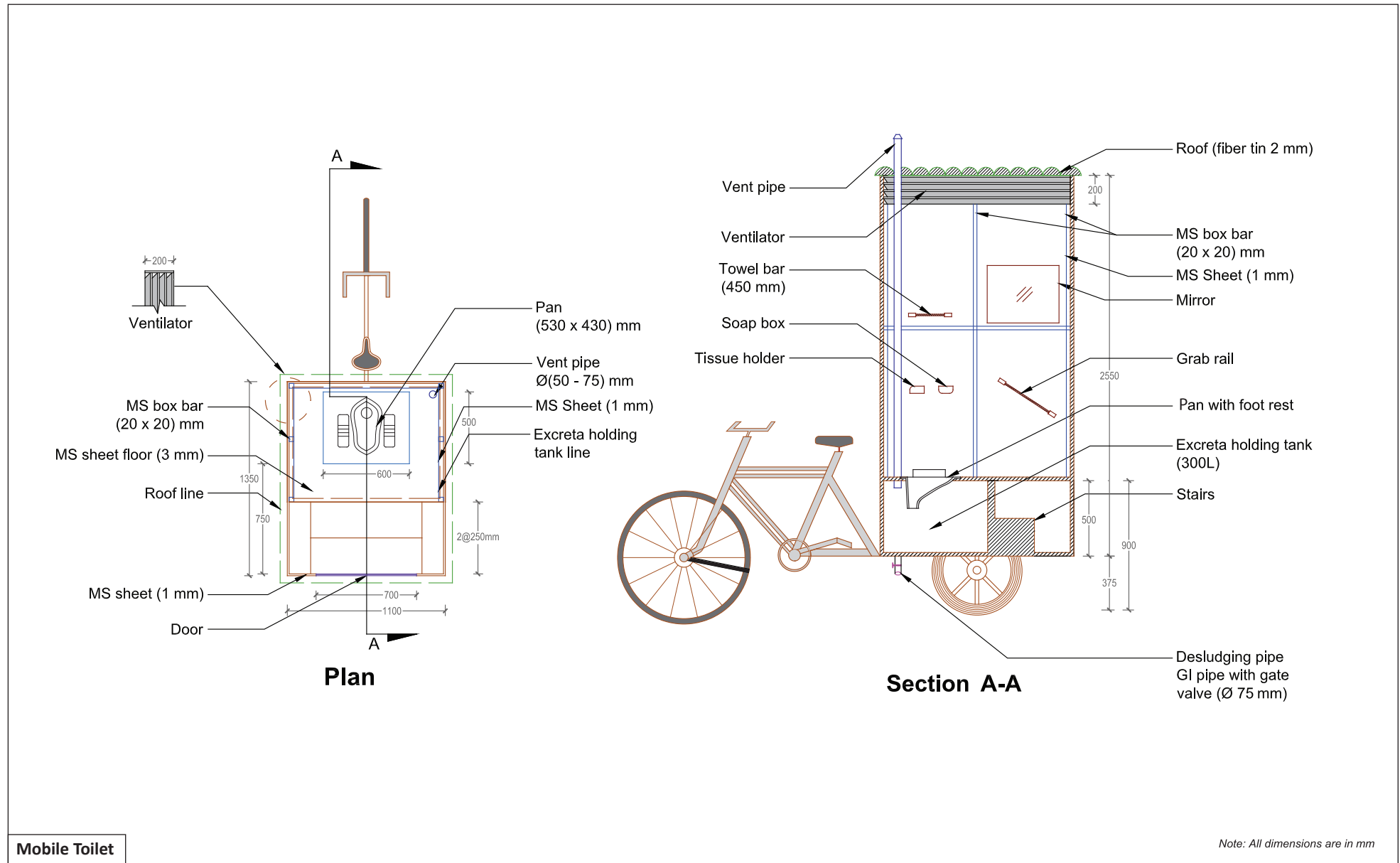
Figure 24: (A) Mobile toilet is placed in front of National Assembly Bhavan; (B) Inside view of a mobile toilet (Courtesy: WaterAid).

Operation and Maintenance

Operational business model must be present for ensuring proper O & M.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 46).

Design Drawings



Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Supplying best quality heavy type Rickshaw van cheshish, the rear wheels will be of Motorcycle tiers with rim and all other accessories etc. all complete as per drawing design and full satisfaction of the Engineer in Charge.	item	1	35,000	40,000
2	Supplying making and fitting fixing Fecal storage chamber, Toilet platform, Step etc. made of 3mm thick stainless steel with arrangement of placing and fixing pan, vent pipe and wash out line etc. Cutting plate as per design, welding with SS electrodes etc. all complete as per drawing design and full satisfaction of the Engineer in Charge.	item	1	38,000	40,000
3	Supplying fitting fixing 20mm x 20mm x 03mm size angles to prepare square box for making 11 no's vertical and three no's horizontal frames in fencing, door and roof as per drawing design with proper welding including synthetic enamel paint over a coat of anticorrosive paint etc. all complete as per drawing design and full satisfaction of the Engineer in Charge.	item	1	20,000	20,000
4	Supplying fitting fixing 01mm thick MS sheet in fencing, door as per drawing design with proper welding including synthetic enamel paint over a coat of anticorrosive paint etc. all complete as per drawing design and full satisfaction of the Engineer in Charge.	item	1	18,000	18,000
5	Supplying fitting fixing ventilator made of 01mm thick MS sheet over fencing, door as per drawing design with proper welding including synthetic enamel paint over a coat of anticorrosive paint etc. all complete as per drawing design and full satisfaction of the Engineer in Charge.	item	1	7,000	7,000
6	Supply and installation of 2.0 mm thick fiber glass sheet (transparent sheet) for roof, wall etc. on M.S. purlin, angle etc. with 'J' hook or screws with washer and putty, all complete as per drawing, specification and direction of Engineer-in-charge.	sqm	1.8	1,325	2,319
7	Supplying, fitting and fixing of G.I. pipe and gate valve for wash water line including 75 mm dia 6 meter long flexible pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts and kawals etc. including cutting trenches where necessary and fitting the same with proper welding etc. all complete in all respects approved and accepted by the Engineer- in- charge. 75 -80 mm dia G.I. pipe with wall thickness 3.25 mm, outside diameter min 86.5 mm, weight 7.22 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	set	1	5,000	5,000
8	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest with sato pan , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in- charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	1	2,500	5,000
9	Supplying, fitting and fixing of super quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	950	950
10	Supplying, fitting and fixing of 450 mm x 600 mm size and 5 mm thick unframed super quality mirror with hard boards at the back with all necessary fitting including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer-in-charge. (Made in Japan or equivalent).	each	1	950	950

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
11	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700
12	Supplying, fitting and fixing of G.I. pipe vent pipe with kawal and mosquito net at the top with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts and kawals etc. including cutting trenches where necessary and fitting the same with proper welding etc. all complete in all respects approved and accepted by the Engineer- in- charge. 75 -80 mm dia G.I. pipe with wall thickness 3.25 mm, outside diameter min 86.5 mm, weight 7.22 kg/m, can withstand min 50 kg/cm ² hydraulic pressure.	meter	3.1	2,262	7,012
13	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/ elbows , jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	1	500	500
14	Supplying, fitting and fixing of Liquid soap dispenser (push-up type) to dispense 16 oz (0.47 liters) of soap, detergent or lotion. Unit shall be fabricated of tamper resistant, chrome plated plastic, a translucent white polyethylene soap container, and a corrosion resistant dispensing valve which can provide no more than 5 lbs (22.2 Newtons) pressure and unit can be reloaded by unscrewing base from bracket collar, inverting unit, and unscrewing soap container in which soap will continue to feed properly until empty with a continuously visible soap level etc. all complete approved and accepted by the Engineer- in- charge.	each	1	1,060	1,060
15	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	438	438
16	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
17	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
18	Other supplies & accessories fittings supplying & fixing				
a)	Hinges	Nos	4	75	300
b)	Lock chain for door lock inside and outside	Nos	2	75	150
				Total	149,979

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from PWD Schedule of rates (2018), DPHE Schedule of rates (2019) and other sources.

Bucket Latrine

Context and Description

Emergency Context

This excreta disposal system can be quickly implemented in an emergency situation if there are sufficient tools, materials and human resources available.

Major Components

- > Bucket (minimum 20 liters)
- > Plastic or wooden chair
- > Solid fence (as opaque as possible)
- > Roof if necessary and possible

Technology Description

- > This technology involves an elevated slab/chair and a bucket for excreta storage where faeces and urine are collected in the same bucket.
- > Bucket latrines do not require any pre-existing services or infrastructure, such as sewerage, but are completely self-contained.
- > The buckets must have tight-fitting lids and should be emptied at least once a day.
- > A privacy screen can be made of bamboo mats or plastic sheeting and a roof can be provided if necessary.

Suitability

This excreta disposal technology can be used in case of emergencies, such as during floods when regular toilets become inaccessible. In situations where there is limited space, it may be appropriate to provide buckets or containers in which people can defecate. In emergencies i.e., in natural disasters, this disabled-friendly latrine can be proven useful for its portability.



Figure 25: (A) Sketch of a bucket latrine for the disabled (Courtesy: DPHE); (B) A plastic commode chair (Courtesy: RFL)

Desludging

The bucket needs to be emptied frequently and safe transport and disposal of faeces need to be ensured. Containers could be emptied into pit.

Risks/Challenges

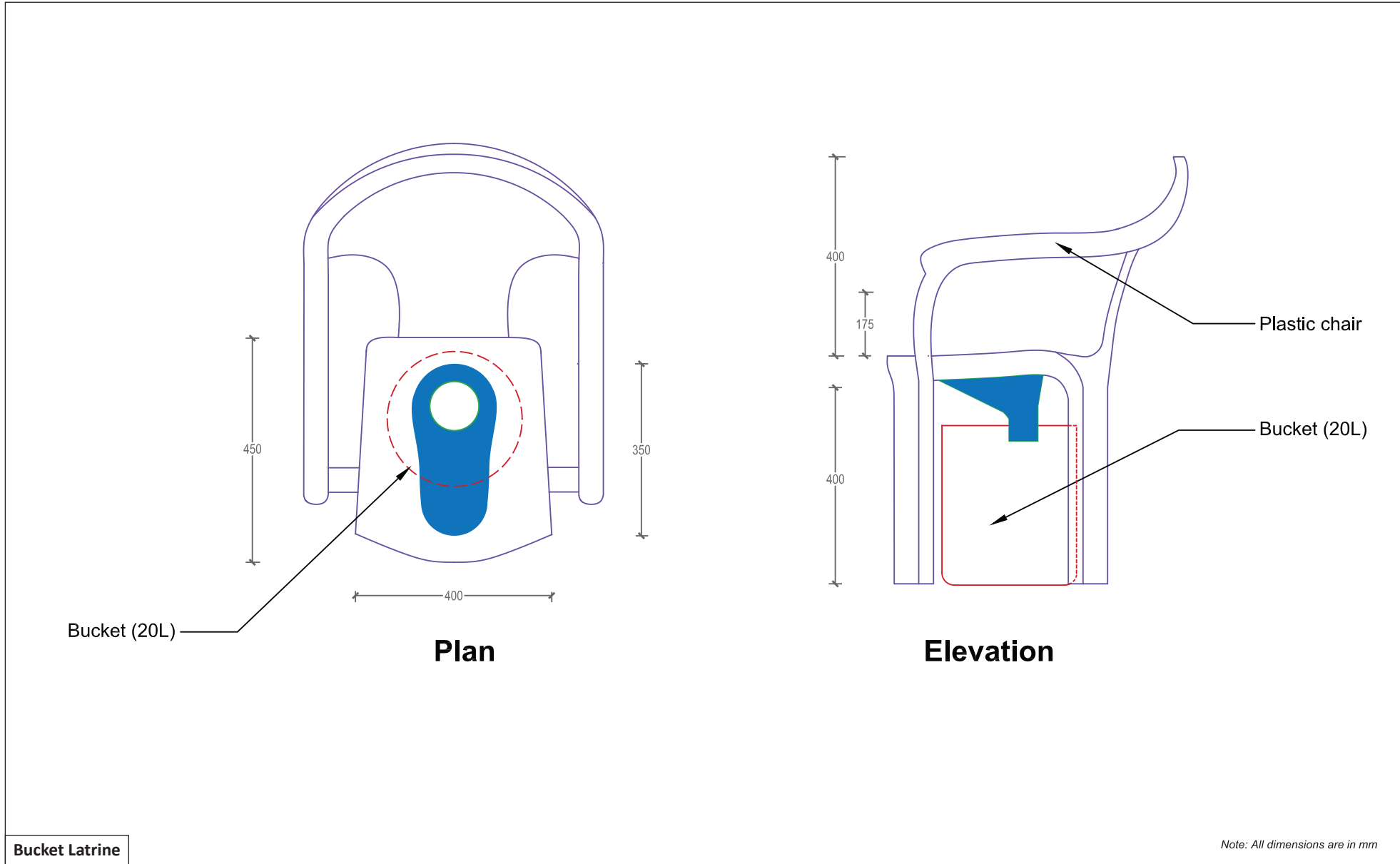
This excreta disposal system may not be acceptable to many people.

Operation and Maintenance

The buckets should be emptied at least once a day. Disinfectants may be added to reduce risk of contamination and odor.

Note: Adapted from GOB-DPHE-UNICEF Operational Guidelines for WASH in emergencies- Bangladesh (2015) Page: 94.

Design Drawings



Bucket Latrine

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Supplying best approved quality plastic chair fitted with plastic pan and sato pan as per drawing and design etc. all complete and accepted by Engineer-in-charge.	each	1	1,000	1,000
2	Supplying, fitting and fixing of best quality 20-liter capacity plastic water container with handle and lid (weight 790gm minimum RFL or equivalent) and making hole to insert plastic pan end point etc. complete approved and accepted by the Engineer- in- charge.	each	1	550	550
3	Supplying, fitting and fixing of best quality 20-liter capacity plastic water container with handle and lid (weight 790gm minimum RFL or equivalent) and fitted with 12mm dia heavy type bib cock with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	600	600
4	Supplying, fitting and fixing of best quality 20-liter capacity plastic water container with handle and lid (weight 790gm minimum RFL or equivalent) for storing waste water etc. complete approved and accepted by the Engineer- in- charge.	each	1	500	500
5	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
6	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
7	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	1	577	577
8	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	1	100	100
9	Supplying temporary fencing for privacy of the user made of wooden folding frame capable to cover 4 sqm area and 1.8 meter high covered with single layer dark polythene sheet weighing one kilogram per 6.5 square meter as privacy screen etc. all complete as approved and accepted by the Engineer- in- charge.	each	1	3,500	3,500
				Total	7,787

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from PWD Schedule of rates (2018) and other sources.

Multiple Cubicle Twin Pit Latrine

Context and Description

Emergency Context

This technology is applicable particularly for displaced population due to flood, riverbank erosion, tornadoes, earthquakes, or man-made conflicts.

Major Components

- > 4 Latrine pans with water seal (U-bend type or P-trap) or Sato pan for multiple users
- > Two pits made of concrete rings for each latrine cubicle. In total there are 8 pits
- > 4 Y-junctions (diversion box), one for each set to twin pits
- > 8 Vent pipes (one for each pit)
- > Superstructure with 4 cubicles for multiple users

Technology Description

- > Pits are used alternately; for each latrine cubicle, only one of the two pits connected to it is used at a time. After each use, the latrine is manually flushed with 2-5 L of water. In the pit, the liquid infiltrates into the soil, while the solids accumulate in the pit and undergo decomposition.
- > When one pit becomes full (up to design depth), flow of waste is diverted (at the Y-junction) to the second pit, and the pit is covered with soil.
- > Contents of first pit decompose to safe, pathogen-free humus within 18 to 24 months.
- > Contents of the first pit may then be dug out (and used as soil conditioner) and the pit becomes ready for re-use.
- > The water seal of the pan (or trap door of Sato pan) maintains a barrier between user and pit contents, and help eliminate insect and odor problem. The vent pipe removes obnoxious gas from the pit.

Suitability

This multi-chamber facility can be adopted for a large number of the population. Multiple cubicles facilitate use by many users, and alternating twin pits ensure continued operation without the need to empty, transport and treat fecal sludge. This is the most preferred option among the different pour-flush technologies, because it eliminates the requirement of desludging and recovers resources in the form of “soil conditioner”.



Figure 26: A multiple cubicle twin pit latrine in construction in Cox's Bazar (Courtesy: Devex)

Desludging

When a pit fills to within about 0.5 m from the top, the flow of waste should be diverted using the Y-junction, and the filled pit should be covered with soil for at least 1.5 to 2.0 years. After this period, the contents of this pit could be dug out manually without any health risk and used as soil conditioner.

Risks/Challenges

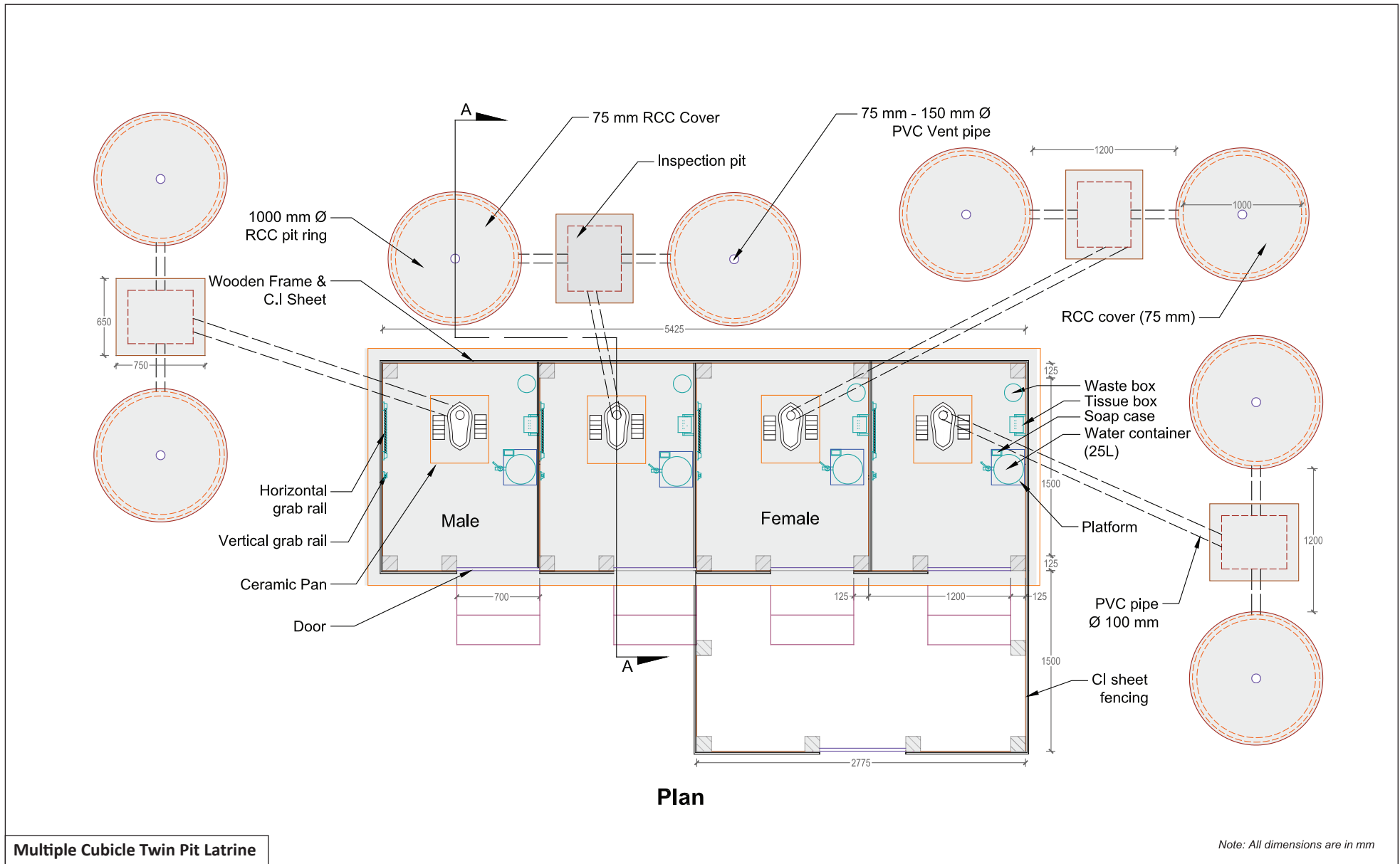
There is a risk of possible groundwater contamination, particularly in high water table areas during wet season. The Y-junctions need to be checked for clogging on a periodical basis. Also, both pits must not be used simultaneously. The number of users of each cubicle of the latrine should be such that each pit could be used for at least 1.5 years.

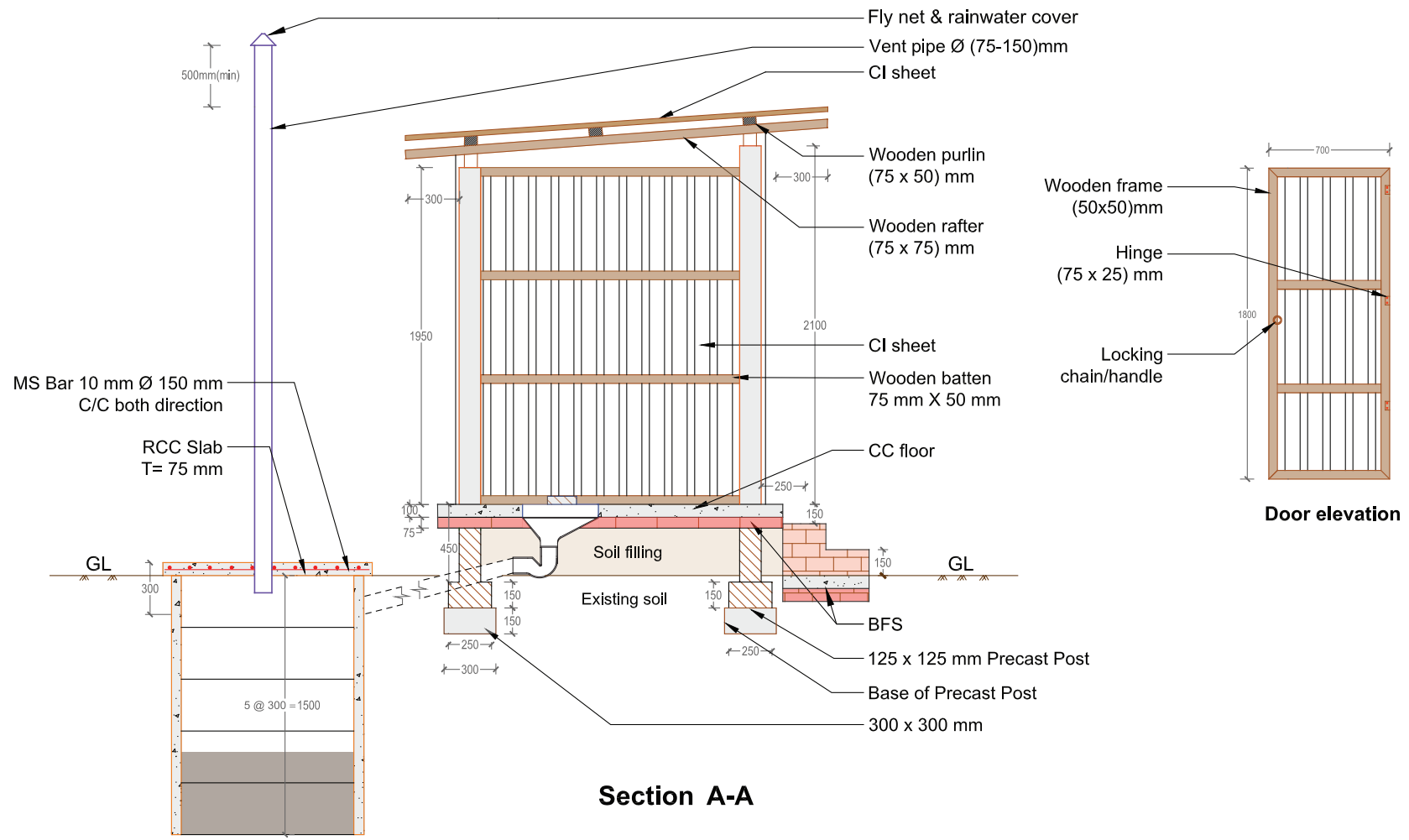
Operation and Maintenance

A five-ring pit is expected to serve a family of 5 (members) for about 2 years, after which the flow of waste is diverted (at the Y-junction) to the second pit. The contents of the filled pit should be covered by soil and its contents should be left to decompose for at least 1.5 years.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 9). UNHCR, WASH Technical Designs for Refugee Settings (Option 01B).

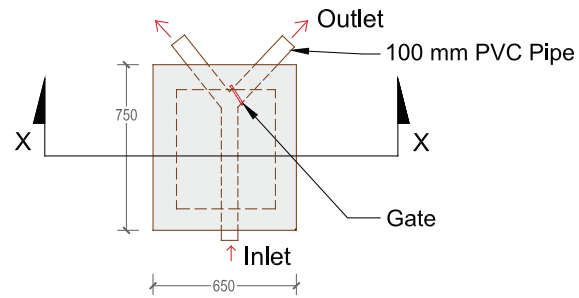
Design Drawings



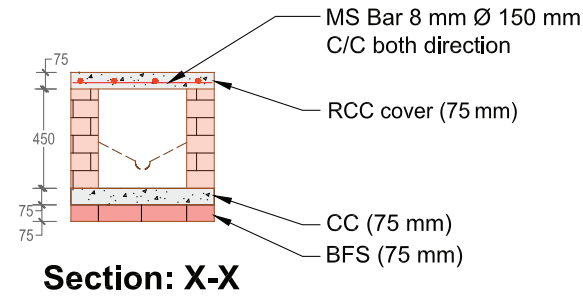


Multiple Cubicle Twin Pit Latrine

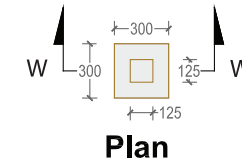
Note: All dimensions are in mm



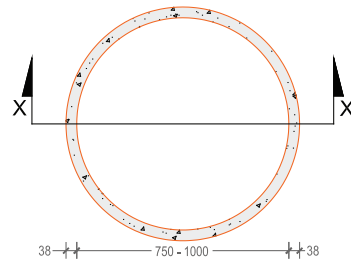
Plan: "Y" junction box



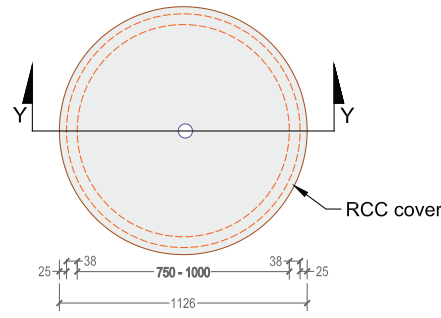
Section: X-X



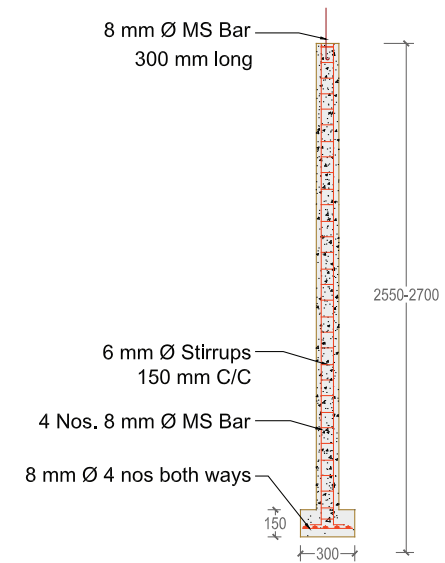
Plan



Plan of RCC ring

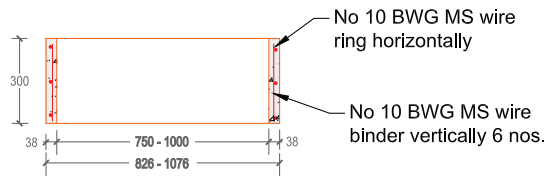


Plan of RCC ring slab



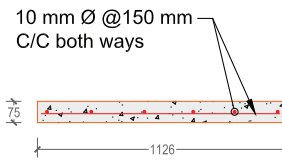
Section : W-W

Precast post



Section : X-X

Ring details



Section : Y-Y

Ring slab details

Cost Estimate

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including location, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	40	24	960
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	12	193	2,316
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	12	153	1,836
5	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	2.5	705	1,763
6	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	18.5	454	8,399
7	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	20	42	840
8	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	1.5	8,330	12,495

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	1.00	6,917	6,917
10	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	13.5	1,023	13,811
11	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, platform etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	22	311	6,842
12	Supplying and making door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.5	125,177	62,589
13	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. all complete and accepted by the Engineer-in-charge.	sqm	78	566	44,148
14	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	20	1,900	38,000
15	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1200 mm inner & 1276 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	40	955	38,200

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
16	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 1326 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 10 mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	8	2,500	20,000
17	Manufacturing and supplying 1:2:4 proportion RCC precast slab over IP with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 0.700 mm x 0.800 mm as per drawing. Placing of reinforcing materials in position, casting as per drawing and design, curing for requisite period, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufactures locally)	each	4	1,225	4,900
Sub -Total of Part A					265,015

Part B: Plumbing Work

1	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in-charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	4	2,119	8,476
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	1	700	700
3	Supplying 75 mm inside dia best quality uPVC Class - 'C' ventilation pipe with supply of cowl having specific gravity 1.35 - 1.45, wall thickness 3.5 mm - 4.10 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, of uPVC Pipe with all accessories such as Round grating /domed roof grating bands, sockets etc. Including clamping approved and accepted by the Engineer- in- charge. (height 0.5m over roof)	meter	24	750	18,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
4	Supplying inside dia best Quality u PVC B-grade soil 100 mm inner dia, wall thickness 3.40 mm ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	18	450	8,100
5	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/ elbows , jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	6	500	3,000
6	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	4	460	1,840
7	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	4	577	2,308
8	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	4	500	2,000
9	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	4	100	400
10	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	8	125	1,000
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	16	125	2,000
c)	Nail of different size	kg	6	125	750
d)	Hinges	Nos	12	50	600
e)	Screw for hinges	dozen	8	100	800
f.)	Lock chain for door lock inside and outside	Nos	8	40	320
Sub-total of Part B					50,294
Total (A+B)					315,309

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Multiple Cubicle Latrine with Septic Tank

Context and Description

Emergency Context

This technology is applicable for displaced population due to flood, riverbank erosion, tornadoes, earthquakes, or man-made conflicts.

Major Components

- > 4 Latrine pans with water seal (U-bend type or P-trap) for multiple users
- > A septic tank (usually 2-chamber) with properly designed and properly positioned inlet and outlet devices
- > Drain field or soakage pit
- > Vent pipe
- > Superstructure with 4 cubicles for multiple users
- > Water Tank

Technology Description

- > The system consists of two components: Septic tank and drainage field or soakage pit. The septic tank receives wastewater from the toilet cubicles. Within the septic tank, solids settle down and scum (oil/grease, etc.) rises up. The tank stores the solids and scum, and allows limited decomposition of solids, scum and liquid wastewater. The outlet device (Sanitary Tee) allows only liquid to flow out of the chamber, and keeps settled solids and scum for continued decomposition.
- > The liquid effluent from the septic tank flows to a drainage field or soakage pit, from which the liquid infiltrates into the subsurface.
- > The vent pipe removes obnoxious gas that accumulates within the septic tank.
- > When the septic tank becomes full (up to the design level), it needs to be desludged and the emptied fecal sludge needs to be properly disposed (either transported to a treatment plant or safely buried in a shallow pit).

Suitability

This design has also been successfully used in communal toilets in urban slums and



Figure 27: A multiple cubicle latrine with septic tank (Courtesy: UNHCR)

low-income communities (LICs) with pour-flush toilets. In cases of refugee or displaced people settlements, this system (with multiple cubicles) can act as a long-term solution.

Desludging

Desludging frequency of a septic tank primarily depends on the size/volume of the tank and number of users. Septic tanks are usually designed for a desludging period of 2 to 5 years. The BNBC guidelines may be followed for proper design of septic tanks. Desludging using mechanical means (pumps) is preferred.

Risks/Challenges

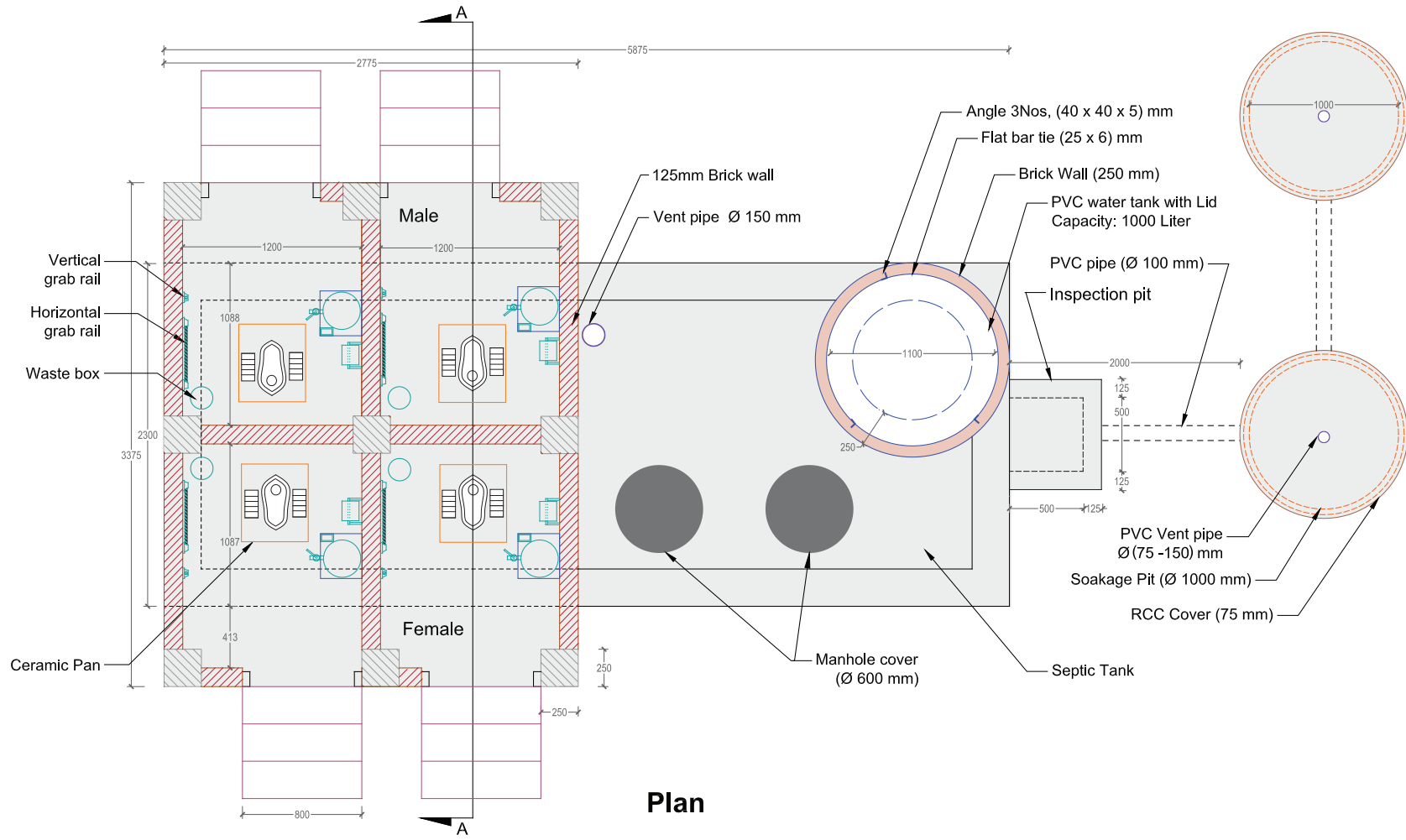
Overflow of drain field or soakage pit in high density areas with low soil infiltration capacity is a concern. There is risk of groundwater contamination, particularly in high water table areas during wet season. The inlet Tee may be removed (and replaced with just an inlet pipe) for septic tanks built for pour-flush systems (because of risk of clogging at the Tee by cloth/ polythene, etc.).

Operation and Maintenance

Require mechanical desludging of the septic tank when it becomes full (up to design level); the tank should be positioned such that it is easily accessible for mechanical desludging.

Note: Adapted from Resilient and Inclusive WASH Technology Album, OXFAM, ITN-BUET, Australian Aid (Page: 23) and UNHCR, WASH Technical Designs for Refugee Settings (Option 3B).

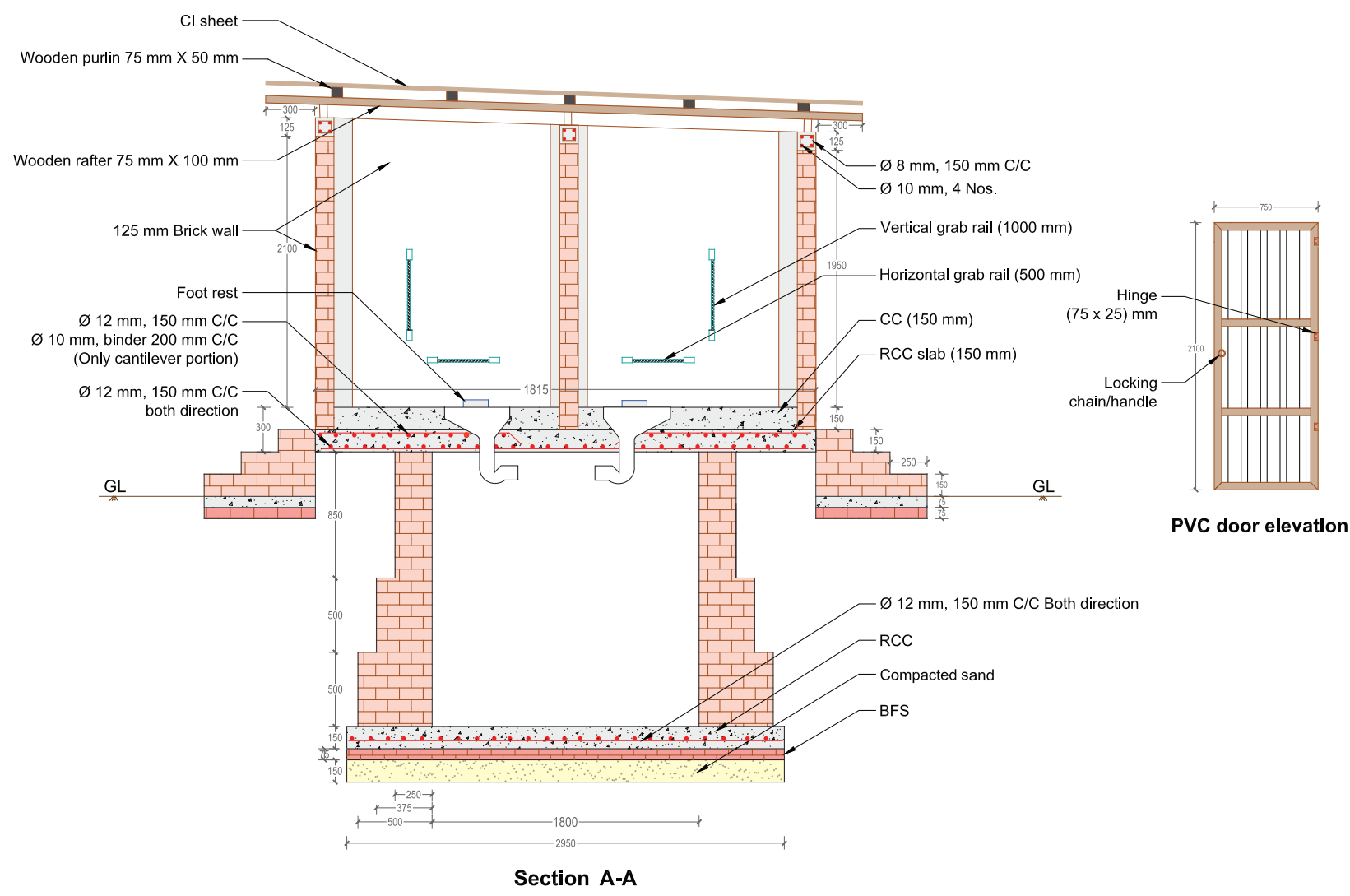
Design Drawings



Plan

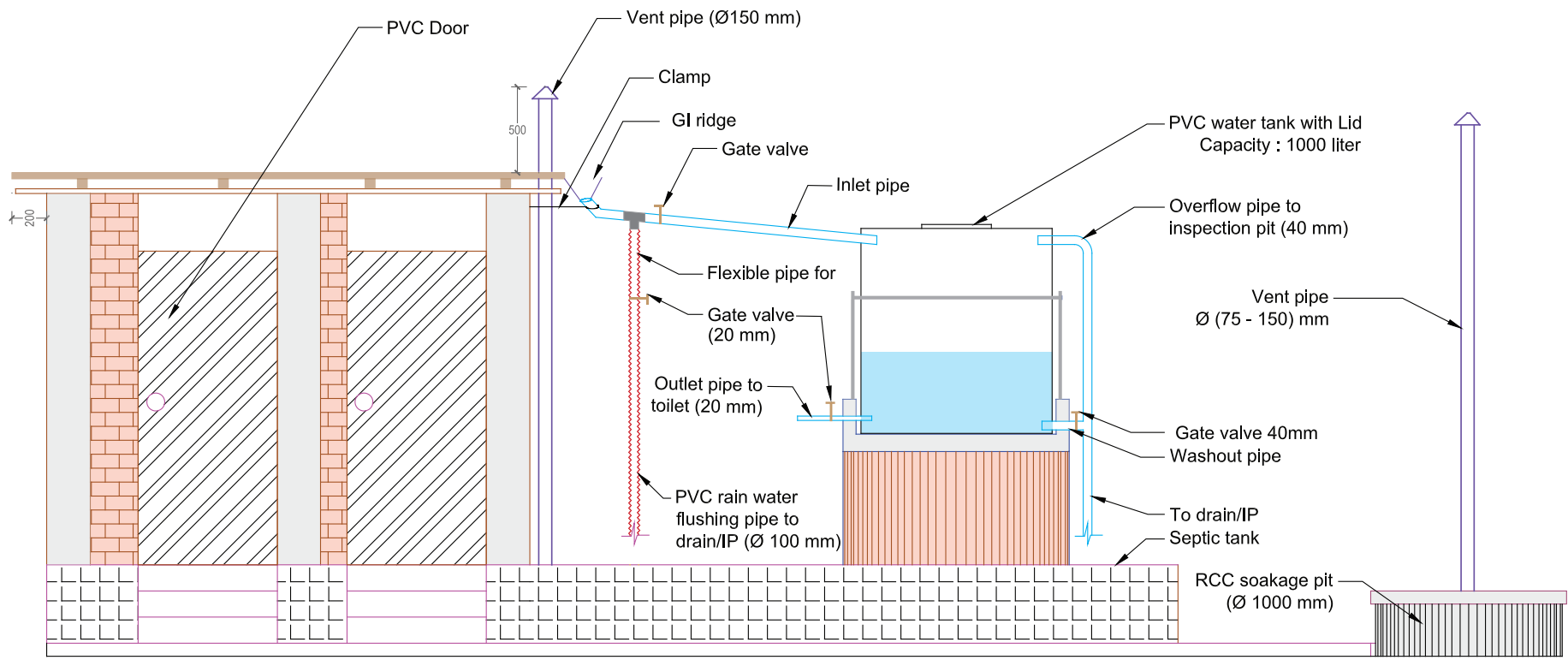
Multiple Cubicle Latrine with Septic Tank

Note: All dimensions are in mm



Multiple Cubicle Latrine with Septic Tank

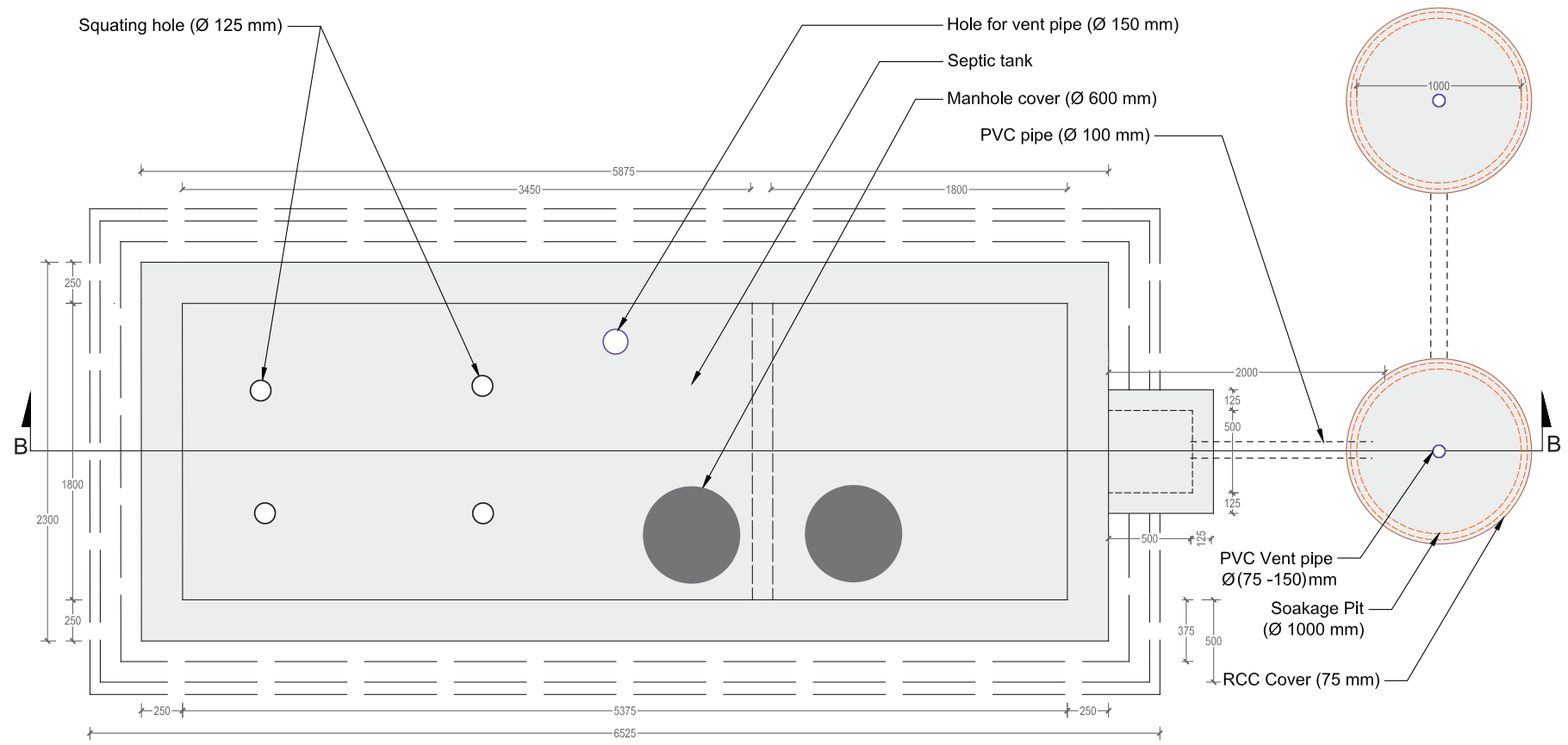
Note: All dimensions are in mm



Elevation

Multiple Cubicle Latrine with Septic Tank

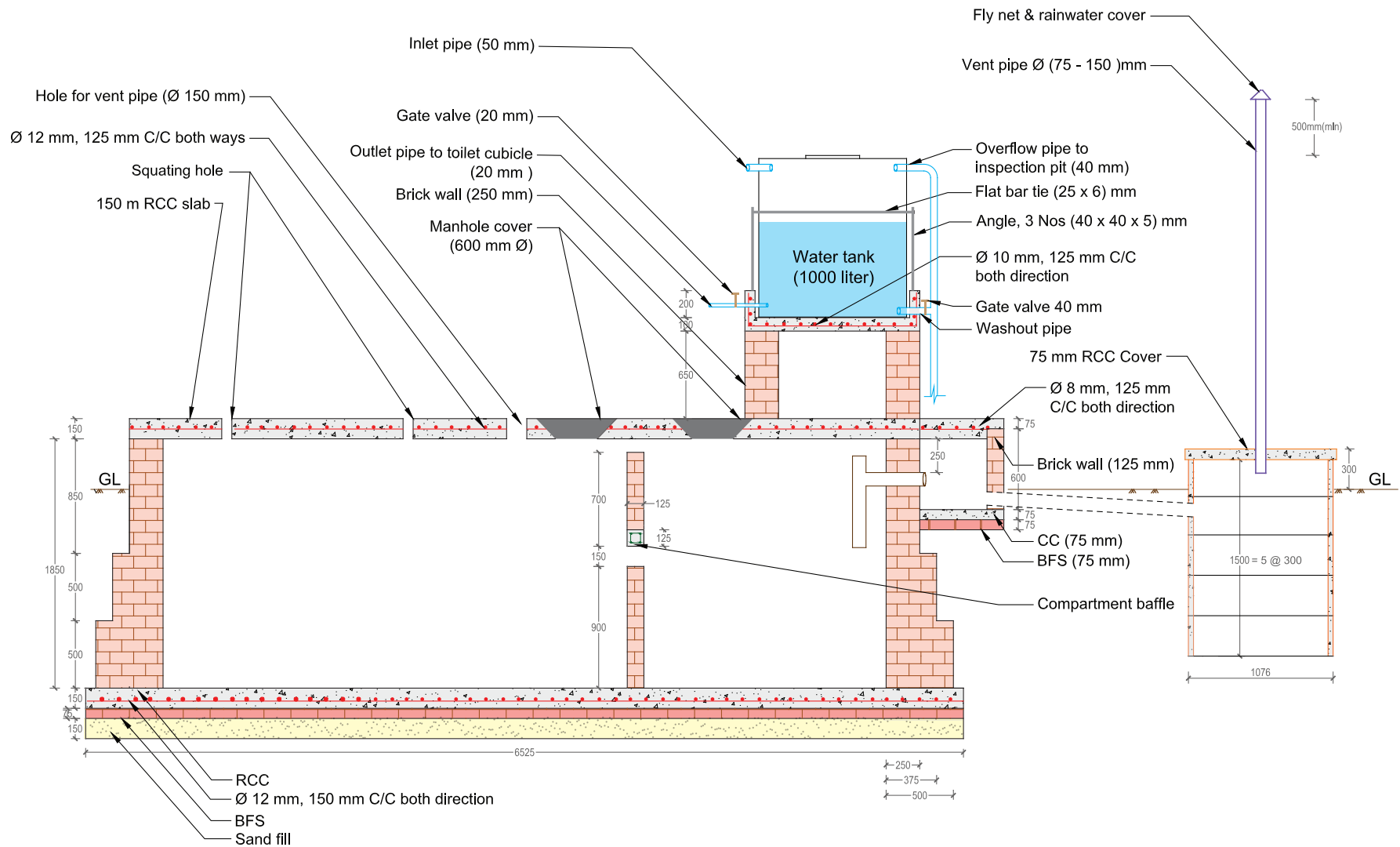
Note: All dimensions are in mm



Plan of Sptic Tank and Soakage Pit

Multiple Cubicle Latrine with Septic Tank

Note: All dimensions are in mm



Section B-B

Multiple Cubicle Latrine with Septic Tank

Note: All dimensions are in mm

Cost Estimate

Part A: Construction of Latrine

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using this equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	40	24	960
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	46	193	8,878
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	46	153	7,038
5	Sand filling in foundation trenches and plinth with sand having F.M. 0.5 to 0.8 in 150 mm layers including leveling, watering and compaction to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office only, all complete and accepted by the Engineer-in-charge.	cum	3.5	705	2,468
6	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	24	454	10,896
7	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	26	42	1,092
8	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	1.2	8,330	9,996
9	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	cum	13.25	6,917	91,650

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	125 mm brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor.	sqm	30.5	1,023	31,202
11	Minimum 20 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to inside wall and floor of septic Tank with cement (1:4) with 1% padloo including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	37	500	18,500
12	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outer wall, plinth, floor of toilet etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	38.5	311	11,974
13	Minimum 12 mm thick cement sand (F.M. 1.2) plaster (1:4) with fresh cement to ceiling, wall inside and outside surface, finishing the corners and edges including washing of sand cleaning the surface, scaffolding and curing at least for 7 days, cost of water, electricity and other charges etc. all complete in all respect as per drawing and accepted by the Engineer. (Cement: CEM-II/A-M).	sqm	62	253	15,686
14	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum $f'_{cr} = 24$ MPa, satisfying a specified compressive strength $f'_{c} = 19$ MPa at 28 days on standard cylinders as per standard practice of Code ACI/BNBC/ASTM, cement conforming to BDS EN-197-1-CEM-I, 52.5N (52.5 MPa) / ASTM-C 150 Type – I, best quality sand [50% quantity of best local sand (F.M. 1.2) and 50% quantity of Sylhet sand or coarse sand of equivalent F.M. 2.2] and 20 mm down well graded picked jhama brick chips conforming to ASTM C-33 including breaking chips and screening, making and placing shutter in position maintaining true to plumb, making shutter water-tight properly, placing reinforcement in position; mixing in standard mixer machine with hopper fed by standard measuring boxes or in batching plant, casting in forms, compacting by vibrator machine and curing at least for 28 days, removing centering-shuttering after specified time approved; including cost of water, electricity, testing charges of materials and cylinders as required, other charges etc. all complete, approved and accepted by the Engineer-in-charge. (Rate is excluding the cost of reinforcement and its fabrication, placing, binding etc. and the cost of shuttering & centering), In foundation, floor slab.	cum	6	8,346	50,076
15	Centering and shuttering, including strutting, propping etc. (The formwork must be rigid enough both in and out of plane, to make the concrete surface true to the designed shape and size by using necessary MS sheets of minimum 16 BWG, angles of minimum size 40 mm x 40 mm x 5 mm, flat bars etc.) and removal of form for: In floor slab	sqm	32	499	15,968
16	Grade 400 (RB 400 /RB 400W: complying BDS ISO 6935-2:2006) ribbed or deformed bar produced and marked according to Bangladesh standard, with minimum yield strength, f_y (ReH)= 400 MPa but f_y not exceeding 450 MPa and whatever is the yield strength within allowable limit as per BNBC/ ACI 318, the ratio of ultimate tensile strength f_u to yield strength f_y , shall be at least 1.25 and minimum elongation after fracture and minimum total elongation at maximum force is 16% and 8% respectively : up to ground floor.	kg	625	94	58,750

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
17	Supplying and making Rafter, Purlin etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. (All sizes of wood are finished). Mehgoni wood.	cum	0.16	125,177	20,028
18	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. all complete and accepted by the Engineer-in-charge.	sqm	15	566	8,490
19	Supplying, fitting and fixing of 0.27 mm thick coloured galvanized iron plain sheet ridging with 300 mm lap on either side fitted and fixed with galvanized bolts and nuts including supply of 3 nos 'U' clamp made of 25mm x 06mm MS flat bar etc. all complete and accepted by the Engineer-in-charge.	meter	3	490	1,470
20	Supplying, fitting and fixing of 1000-liter capacity food graded plastic overhead water reservoir tank including all necessary fittings, hardware and consumables etc. all complete approved and accepted by the Engineer- in- charge.	No	1	125,177	125,177
21	Mild steel, Grade 250 with minimum fy = 250 MPa, work in binding water tank: supplying and fabrication of mild steel sections as per design, hoisting, fitting and fixing in position with bolt and nuts or rivets or welds and providing two coats of anti-corrosive paint over a prime coat of red oxide paint etc. complete and accepted by the Engineer-in-charge (measurement to be given for truss member only).	kg	17	142	2,414
22	Supplying different inside dia best quality CPVC pressure pipe for collection of rain water pipe to tank for water supply having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, with all accessories such as round grating/domed roof grating, bends, sockets etc. approved and accepted by the Engineer-in-charge (length: 6000 mm each). 50 mm dia wall thickness 3.9 mm - 4.5 mm	meter	6	1,374	8,244
23	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally).	each	10	600	6,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
24	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 1126 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Enterpriser (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally) .	each	2	1,650	3,300
25	Supplying fitting & fixing of uPVC plastic door or window frame having specific gravity 1.35 - 1.45, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitted and fixed in brick wall/ R.C.C wall with 6 Nos. GI clamp, 4 no's inner joint GI clamp, 2 nos. outer GI joint clamp, 16 nos. rivet making necessary grooves and mending good the damages, finishing, curing, carriage etc. complete in all respect accepted by the Engineer-in-charge.	meter	19.84	278	5,516
26	Supplying, fitting, fixing of uPVC hollow or solid plastic door shutter having specific gravity of 1.35 - 1.45, thickness 1.7 mm-2.2 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards of different sizes, fitted fixed with uPVC plastic door frame weighing 5.82 kg/m ² with at least 3 Nos. SS hinges by min 64 Nos. Ø 3.17 mm and 3.97 mm 12.7 mm long rivets, 12 nos. 25.4 mm SS screws, Ø 9.38 mm, 150 mm long SS tower bolts 2 nos., 146 mm SS handle by rivet 2 Nos., G.I inner joint, 234.95 mm x 127 mm clamp, 76.2 mm x 57.15 mm, 25 mm dia 1 no ss hasp bolt, special type round lock, carrying the same to the site and local carriage etc. complete in all respect and accepted by the Engineer-in-charge. 760 mm x 2130 mm uPVC plastic shutter (solid).	each	4	3,762	15,048
27	Supplying, fitting and fixing best quality heavy type 600mm dia CI manhole cover round solid plate made with locking / unlocking arrangement (Brand: MANCO or equivalent). All other remaining cost including all accessories; their carriages, wages of labour, technician and incidental charges etc. including cutting RCC surface, laying and hire charge of machine, mending good the damages with Cement concrete 1: 1.5: 3 and finishing with care etc. including water, electricity and other charges complete in all respect and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M). In ground floor	each	2	4,712	9,424
28	Exterior standard acrylic emulsion paint of approved best quality and color having water resisting properties and resistance properties against fungi, fading & flaking delivered from authorized local agent of the manufacturer (Berger weather coat smooth/ Elite smooth exterior/ Asian apex weather coat or equivalent brand) in a sealed container; applying to exterior surface with surface preparation including cleaning, drying, making free from dirt, grease, wax, removing all chalked and scaled materials, fungus, mending good the surface defects using sand paper and necessary scaffolding; applying 1 coat of exterior sealer of specified brand on prepared surface; then applying 1 coat of exterior putty of specified brand for levelling, spot filling, crack filling and cutting by sand paper/zero water paper; finally applying 2 coats of exterior emulsion paint spreading by brush/roller/spray & necessary scaffolding etc. up to desired finishing, elapsing specified time for drying or recoating; all complete in all floors and accepted by the Engineer-in-charge.	sqm	26.50	238	6,307
29	Standard Synthetic Enamel paint of approved best quality and colour delivered from authorized local agent of the manufacturer (Berger jhulik synthetic enamel/Elite quick drying/Asian decora synthetic enamel or equivalent brand) in a sealed container, having high water resistance, high bendability, flexibility property; using specified brand thinner applying to metallic or wooden surface by brass/roller/spray in 2 coats over single coat anti-corrosive coating including cleaning, drying, making free from dirt, grease, wax, removing all chalked and scaled materials, all complete in all floors and accepted by the Engineer-in-charge.	sqm	34.50	189	6,521
Sub -Total of Part A					554,071

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
Part B: Plumbing Work					
1	Supplying, fitting and fixing of Bangladesh pattern, long pan with foot-rest , made of vitreous China clay and preparing the base of pan with cement mortar (1:4) and with wire mesh or rods, if necessary, in all floors including making holes wherever required and mending good the damages and fitting, fixing, finishing etc. complete with all necessary fittings and connections approved and accepted by the Engineer- in-charge. 530 mm x 430 mm x 210 mm size & 12.5 kg of weight with water seal arrangement.	set	4	1,950	15,600
2	Supplying, fitting and fixing of best quality 25-liter capacity plastic water container with lid and fitted with 12mm dia plastic bib cock RFL or equivalent with sealant etc. complete approved and accepted by the Engineer- in- charge.	each	4	700	2,800
3	Supplying, fitting and fixing of 20 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 25.3 mm, weight 1.7 kg/m, can withstand min 50 kg/cm² hydraulic pressure. all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	6	336	2,016
4	Supplying, fitting and fixing of 12.5 mm dia G.I. pipe with wall thickness 2.65 mm, outside diameter min 17.8 mm, weight 1.31 kg/m, can withstand min 50 kg/cm² hydraulic pressure with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	4	259	1,036
5	Supplying, fitting & fixing of PP-R Pipe meeting the performance and long-tem strength requirements as per DIN 8077 /78 or ASTM F 2983 including nipple, elbow, reducers, Tee, end cap, plug, socket etc. as per manufacturer instruction. approved and accepted by the Engineer-in-charge.				
i)	12 mm dia, minimum wall thickness 2.8 mm, sustaining minimum water pressure PN 16, standard dimension ratio (SDR) 7.4	meter	18	249	4,482
ii)	19 mm dia, minimum wall thickness 3.5 mm, sustaining minimum water pressure PN 16, standard dimension ratio (SDR) 7.4	meter	6	278	1,668
iii)	38 mm dia, minimum wall thickness 6.9 mm, sustaining minimum water pressure PN 16, standard dimension ratio (SDR) 7.4	meter	6	506	3,036
iv)	50 mm dia wall thickness 8.6 mm sustaining minimum water pressure PN 16, standard dimension ratio (SDR) 7.4.	meter	12	700	8,400
6	Supplying, fitting & fixing of PP-R Gate Valve meeting the performance and long-tem strength requirements of ASTM F 2389 in accordance with the manufacturer's specifications all complete accepted by the Engineer-in-charge.				
i)	12 mm PP-R Gate Valve	each	4.00	336	1,344
ii)	12 mm PP-R Gate Valve	each	2.00	459	918
iii)	38 mm PP-R Gate Valve	each	1.00	868	868
iv)	50 mm PP-R Gate Valve	each	2.00	1,128	2,256

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
7	Supplying fitting and fixing 150 mm inside dia best quality uPVC Class - 'D' ventilation pipe with supply of cowl having specific gravity 1.35 - 1.45, wall thickness 8.8 mm 10.20 mm, and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards fitting and fixing in position with sockets, bends, of uPVC Pipe with all accessories such as Round grating /domed roof grating bands, sockets etc. Including clamping approved and accepted by the Engineer- in- charge. (height 0.5m over roof)	meter	9	2,200	19,800
8	Supplying inside dia best Quality u PVC B-grade soil 100 mm inner dia, wall thickness 3.40 mm ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	6	450	2,700
9	Supplying, fitting and fixing of grab rail at the inside of toilet as per drawing made of 25 mm dia G.I. pipe with wall thickness 3.35 mm, outside diameter min 31.7 mm, weight 2.59 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends/ elbows, jam-nuts, nut and bolts and making clamps and other necessary fittings etc. all complete in all respects approved and accepted by the Engineer- in- charge.	meter	6	500	3,000
10	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	4	460	1,840
11	Supplying, fitting and fixing of special toilet paper holder with cover of size (150 mm x 150 mm x 126 mm) including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. white (porcelain)	each	4	577	2,308
12	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	4	500	2,000
13	Supplying of best quality plastic Bodna of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	4	100	400
14	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	4	125	500
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	16	125	2,000
c)	Nail of different size	kg	6	125	750
d)	Hinges	Nos	12	50	600
e)	Screw for hinges	dozen	8	100	800
f)	Lock chain for door lock inside and outside	No's	8	40	320
Sub-total of Part B					86,048
Total (A+B)					640,119

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources (UNHCR).

HYGIENE TECHNOLOGIES

Basin Type Handwashing Station

Context and Description

Emergency Context

Applicable as the early recovery stage of an emergency such as disease epidemics, displacement of large populations, or for the homeless.

Major Components

- > Bib cock
- > CI sheet basin/sink
- > MS angle 25 mm by 25 mm frame
- > Plumbing fittings and pipe
- > Drainage pipe (magic pipe)
- > Piped water supply or large water container

Technology Description

- > Running water supply or a water reservoir is connected to a uPVC pipe fitted with multiple bib cocks (taps) for several users to wash their hands simultaneously.
- > A 25 mm by 25 mm MS angle frame of size 3000 mm (L) x 760 mm (W) x 500 (H) should be made. The water pipe should be fitted in the top-middle of the frame (see the picture on the right).
- > A basin, preferably made of CI sheet, should be placed underneath the taps to accommodate safe drainage of the grey water. The sink should maintain a slope towards the drainage pipe.
- > Soap, liquid soap or soapy water should be kept adjacent to the handwashing stations and should be available at all times.

Suitability

Suitable in public areas with many users at a time. A running water supply ensures ease of use.

Risks/Challenges

The water supply should have sufficient pressure for multiple taps to operate at the



Figure 28: Basin type handwashing station in use (Courtesy: WaterAid)

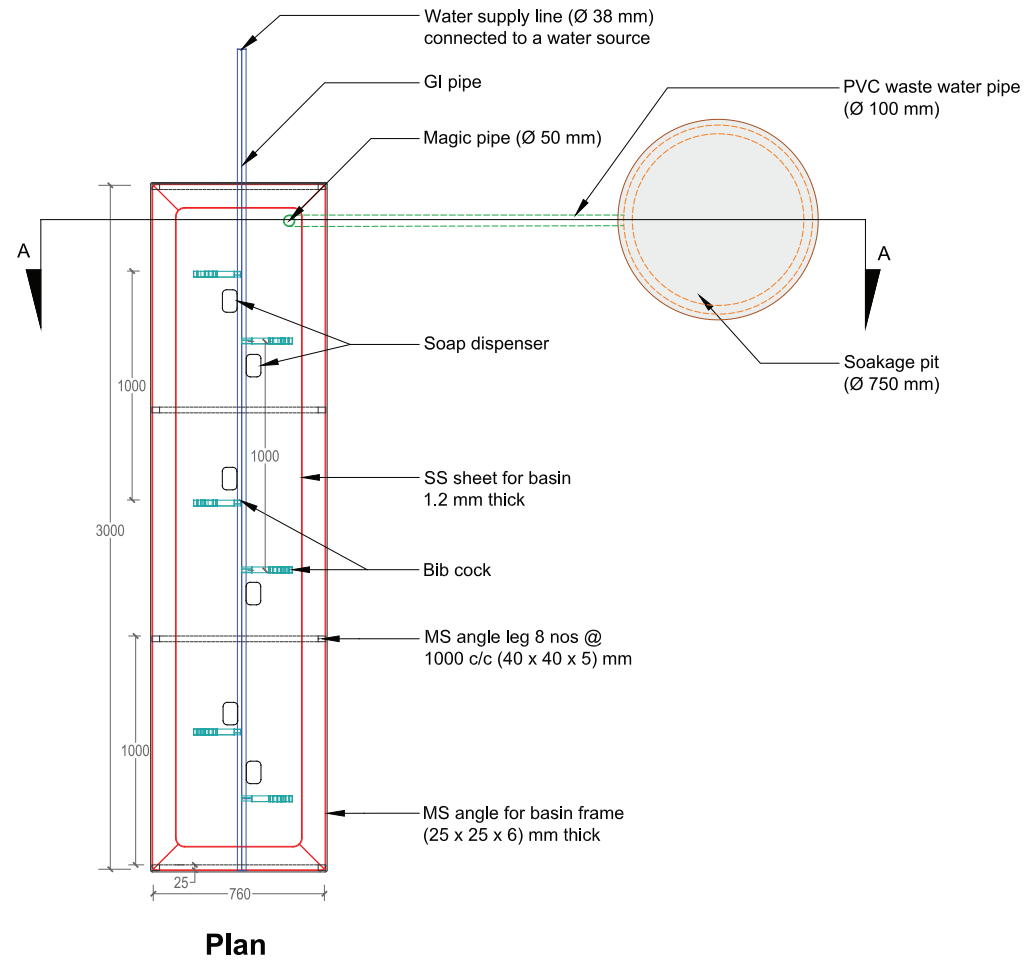
same time. If the water is coming from a reservoir, there should be sufficient height between the taps and the reservoir. Additionally, taps should be adequately spaced so that users are physically distanced during disease outbreaks.

Operation and Maintenance

Drains should be checked for clogging. Caretakers/facilitators should ensure soap/soapy water to be present near the basin. The pipes can be vulnerable to leakages, so regular inspection is required as well.

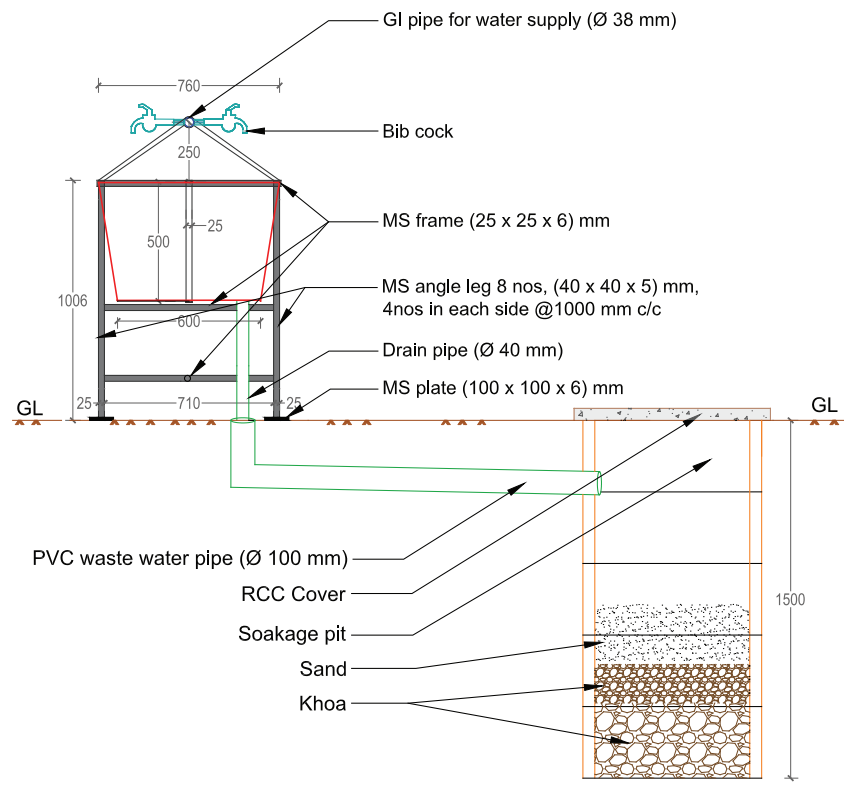
Note: Adapted from Handwashing Stations by WaterAid in Bangladesh and Handwashing Compendium for Low Resource Settings by IDS & the sanitation learning hub.

Design Drawings

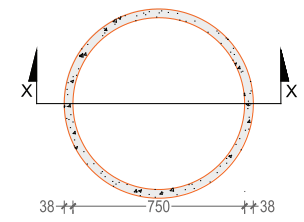


Basin Type Handwashing Station

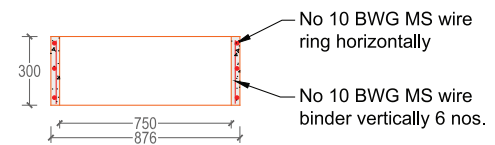
Note: All dimensions are in mm



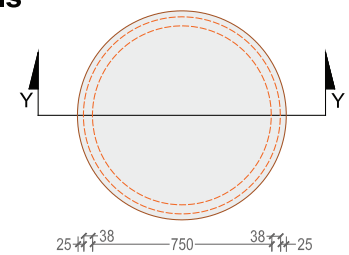
Section A-A



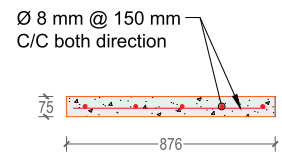
Plan of RCC ring



**Section : X-X
Ring details**



Plan of RCC ring slab



**Section : Y-Y
Ring slab details**

Note: All dimensions are in mm

Basin Type Handwashing Station

Cost Estimate (without the cost for water source and supply system)

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Making, supplying and placing Moveable community type handwashing basin made of Stainless-Steel sheet and MS angle as per specification, drawing, design and direction of the Engineer in Charge. Basin frame will be made with 08 no's leg of 1.00 meter long with 40mm x40mm x05mm MS angle, 100mm x 100mm x 06 mm size MS plate at the base of leg to be fitted by welding for setting in a firm base and basins stability, 25mm x 25mm x 06mm size MS angle frames to be fitted at the top, middle at the adjacent to the bottom of basin and other in 150mm above from the leg plate, all the frames to be welded with the leg. Triangular frame made of 25mm x 25mm x 06mm size MS angle to be fitted at the top as per drawing for setting the 40mm dia Service GI pipe with proper welding. Best quality 1.2 mm thick Stainless-Steel sheet should be used in making basin, all the joints of sheet should be folded at each end of sheet and welded with SS electrode maintaining good finishing. Two no's 40 mm dia outlet holes should be provided and to be fitted 12 mm dia C.P. chain plug, 40 mm dia C.P. waste, 40 mm dia PVC waste pipe with brass coupling (750 mm length) and connected with 100mm dia soil pipe for entering the waste water in the soak pit. 40 mm dia G.I. pipe with wall thickness 3.25 mm, outside diameter min 46.5 mm, weight 3.83 kg/m, can withstand min 50 kg/cm ² hydraulic pressure with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. and should be set up over the triangular frame as per design and to be fitted 06 no's 12mm dia CP bib cock, 06 no's soap dispenser holder and one 40 mm dia brass gate valve. Cutting holes in platform and mending good the damages, finishing, curing, necessary painting two coats with approved quality of epoxy paint over a coat of priming of anticorrosive paint over all the MS and GI surface etc. all complete in all respects approved and accepted by the Engineer- in- charge.	each	1	85,000	85,000
2	Supplying different inside dia best quality 100 mm dia uPVC 'P' or 'S' trap 100 mm dia uPVC 'P' or 'S' trap having specific gravity 1.35 -1.45 and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards, fitting and fixing in position etc. complete approved and accepted by the Engineer- in- charge.	each	1	611	611
3	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 750 mm inner & 826 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneur (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	5	600	3,000

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
4	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneur (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	1,650	1,650
5	Supplying and placing of Sylhet sand FM 2.0 of 150 mm thick as filter materials at the bottom of ring well as shown in drawing and direction of the Engineer in Charge.	cum	0.1	2,350	235
6	Supplying and placing of 12 mm and downgraded khoa 150mm thick as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.1	6,250	625
7	Supplying and placing of 20 mm downgraded khoa 150mm thick as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.1	5,700	570
8	Supplying, fitting and fixing of G.I. pipe with all special fittings, such as bends, elbows, sockets, reducing sockets, Tee, unions, jam-nuts etc. including cutting trenches where necessary and fitting the same with earth duly rammed and fixing in walls with holder bats and making hole in floors, walls and consequent mending good the damages etc. all complete in all respects approved and accepted by the Engineer-in- charge. 40 mm dia G.I. pipe with wall thickness 3.25 mm, outside diameter min 46.5 mm, weight 3.83 kg/m, can withstand min 50 kg/cm² hydraulic pressure.	meter	6	506	3,036
9	Supplying, fitting and fixing of best quality G.I. gate valve with sealant etc. complete approved and accepted by the Engineer- in- charge. 40 mm brass gate valve.	each	1	868	868
10	Supplying inside dia best Quality u PVC B-grade soil 100 mm inner dia, wall thickness 3.40 mm ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	6	450	2,700
11	Supplying, fitting and fixing of Liquid soap dispenser (push-up type) to dispense 16 oz (0.47 liters) of soap, detergent or lotion. Unit shall be fabricated of tamper resistant, chrome plated plastic, a translucent white polyethylene soap container, and a corrosion resistant dispensing valve which can provide no more than 5 lbs (22.2 Newtons) pressure and unit can be reloaded by unscrewing base from bracket collar, inverting unit, and unscrewing soap container in which soap will continue to feed properly until empty with a continuously visible soap level etc. all complete approved and accepted by the Engineer- in- charge.	each	6	1,060	6,360
Total					104,655

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from PWD Schedule of rates (2018) and other sources.

Fixed Type Handwashing Basin

Context and Description

Emergency Context

Applicable at the early recovery stage of an emergency such as disease epidemics, displacement of large populations at a fixed point.

Major Components

- > Brass-made angle stop cock
- > uPVC pipe and trap
- > Brick walls and tiles
- > Plumbing fittings and pipe
- > Drainage pipe (magic pipe)
- > Soap dispenser or tray
- > Piped water supply or large water container

Technology Description

- > Running water supply is connected to a uPVC pipe fitted with Brass-made angle stop cocks (taps), for several users to wash their hands simultaneously.
- > A handwashing basin having size (LxWxH) of 2.75 m x 0.625 m x 1.325 m should be made of bricks over a concrete base. The basin floor and brick walls should be covered by plaster and/or floor tiles. Three water taps should be fitted at a height of 1.175 m from the ground level. Connection of water to the taps would be made from the piped water supply or large water container through uPVC pipe.
- > The floor of the handwashing basin should be sloped towards the outlet holes having a filter net/grating to drain the wastewater from the handwashing basin to the soakage pit by a drainage pipe/drain.
- > Soap, liquid soap or soapy water should be kept adjacent to the handwashing stations, and should be available at all times.

Suitability

Suitable in public gathering areas with many users at a time. A running water supply ensures ease of use.



Figure 29: Fixed type handwashing basin (Courtesy: DPHE)

Risks/Challenges

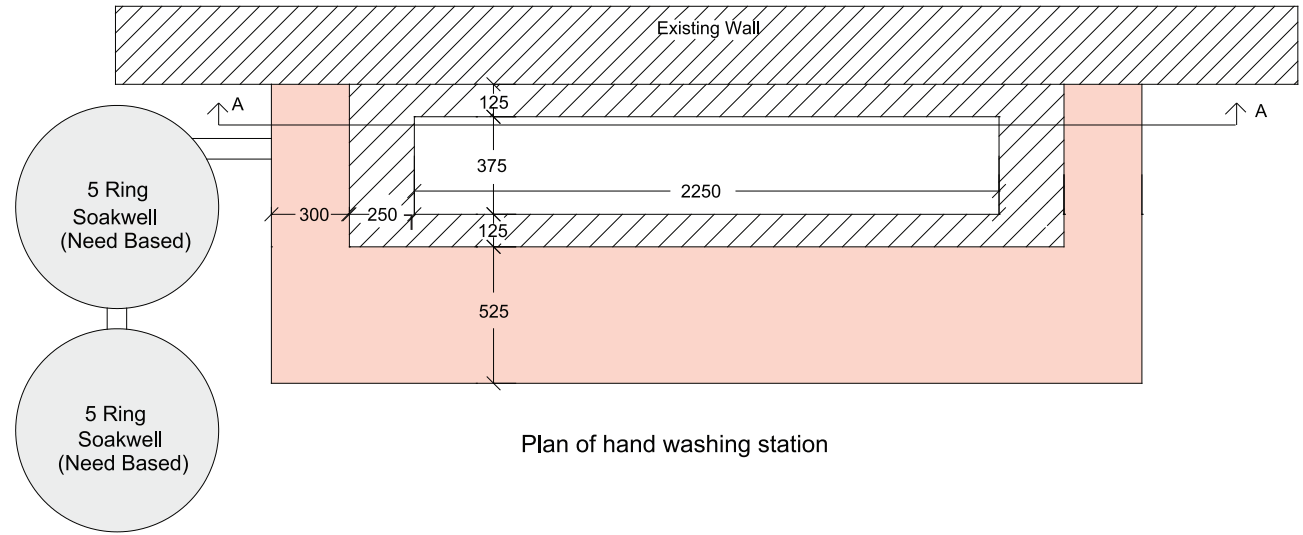
The water supply should have sufficient pressure for multiple taps to operate at the same time. Additionally, taps should be adequately spaced so that users are physically distanced during disease outbreaks.

Operation and Maintenance

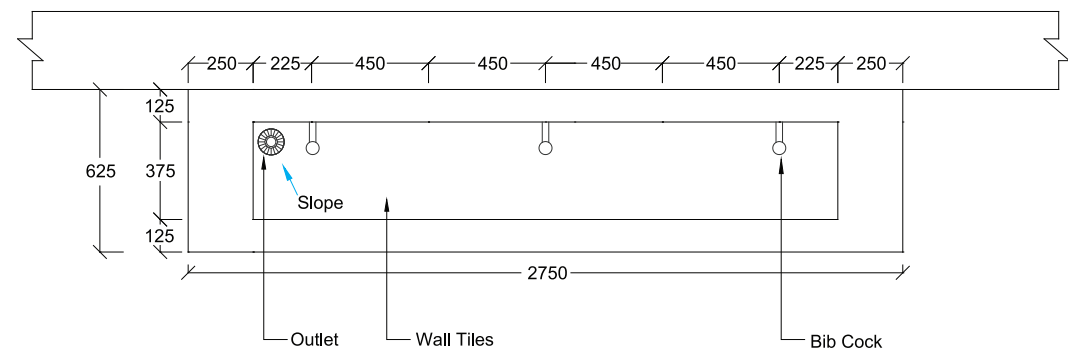
Drains/drainage pipe should be checked for clogging. Caretakers/facilitators should ensure soap/soapy water near the basin. The pipes can be vulnerable to leakages, so regular inspection is required.

Note: Adapted from Handwashing Stations by WaterAid in Bangladesh and Handwashing Compendium for Low Resource Settings by IDS & the sanitation learning hub.

Design Drawings



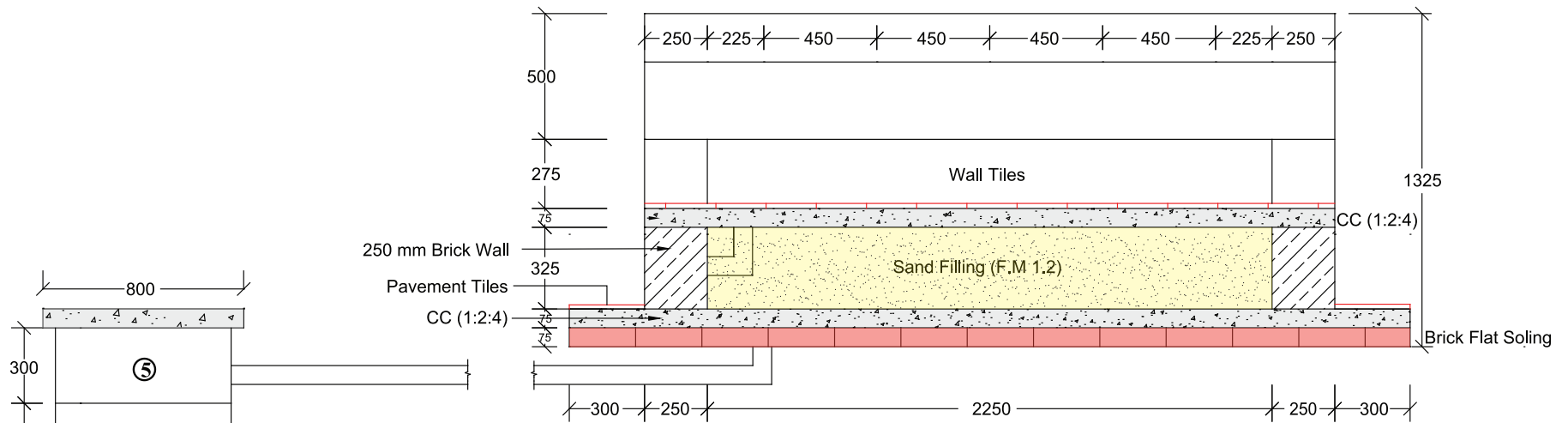
Plan of hand washing station



Plan

Fixed Type Hand Washing Basin

Note: All dimensions are in mm



Section A-A

Fixed Type Hand Washing Basin

Note: All dimensions are in mm

Cost Estimate (without the cost for water source and supply system)

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization and cleaning of site before commencing the actual physical work.	item	1	1,000	1,000
2	Single layer brick flat soling with 1st class bricks in/c preparation of bed and filling the interstices with local sand, leveling in/c the supply of water, electricity and other charges and costs of tools and plants as per direction of the Engineer in charge .	sqm	1.53	420	643
3	Mass concrete (1:2:4) with cement Sand (F.M. 1.2) and picked jhama chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days in/c the supply of water, electricity and other charges and costs of tools and plants etc. all complete in/c as per direction of Engineer in charge.	cum	0.23	7,643	1,758
4	250 mm & above thick brick work with 1st class brick and cement mortar (1:4) using sand of F.M. 1.2 for filling the interistices fully with mortar including soaking the bricks at least for 24 hours prior to use and curing of constructed wall at least for 7 days. All complete as per direction of the Engineer in charge.	cum	0.74	6,769	5,009
5	125 mm brick work to be used in the outer with first class brick in cement sand (FM 1.2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand and curing at least for 7 days including cost of water, electricity and other charges. All complete as per acceptance of the Engineer in charge.	sqm	2.51	948	2,379
6	Sand filling in foundation trenches, plinth with sand having F.M of 1.2 in 150 mm layers including leveling, watering and compaction to achieve minimum 90% dry density with optimum moisture content (Modified proctor test) by ramming each layer up to finished level as per design supplied by the design office. All complete up to the acceptance of Engineer in charge .	cum	0.51	913	466
7	Supplying, fitting and fixing 20mm to 25mm thick machine-made cement pavement tiles having minimum compressive strength of 27 MPa, irrespective of color &/or design, with 20 mm thick cement sand (F.M. 1.2) mortar (1:4) base and making the joints carefully in true straight line including cutting, laying and hire charge of machine and finishing with care etc. including water, electricity and other charges complete in all respect and accepted by the Engineer-in-charge. (Cement: CEM-11/A- M).				
a)	Pavement tiles of size 300 mm x 300 mm	sqm	2.44	2,481	6,054
8	Supplying, fitting and fixing of Wall Tiles (local made) (RAK/FU-WANG /AKIJ) with 20 mm thick cement sand (F.M. 1.2) mortar (1:3) base and raking out the joints with white cement including cutting, laying and hire charge of machine and finishing with care etc. including water electricity and other charges complete in all aspect upon acceptance of the Engineer in charge.				
a)	Colored wall tiles less than, equal or equivalent to 250 X 330 mm size	sqm	6.04	1,271	7,677
9	Making plumbing line with special grade I thread uPVC pipe 'E' class- all according to BS-3505,1968 including supplying necessary clamps, screws, royal plug, El-bow, bends, Tees etc. All complete as per specifications and direction of the Engineer in charge.				
a)	19 mm dia.	m	8.00	70	560
b)	50 mm dia. uPVC drainage pipe	m	8.00	136	1,088

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
10	Supplying, fitting and fixing of best quality faucets etc. complete approved and accepted by the Engineer in charge. 12 mm CP bib cock. (RFL/ANWAR/STELLA)	Nos.	2.00	700	1,400
11	Supplying, fitting and fixing Brass made concealed/Surface Angle stop cock etc. complete approved and accepted by the Engineer in charge 12 mm CP surface mounted angle stop cock (general)	Each	2.00	500	1,000
12	Supplying fitting and fixing 100mm dia uPVC Trap (Siphon or 'P' Trap) including making holes in floor and mending good the damages etc. all complete as per direction of the Engineer-in-Charge .	Each	1.00	100	100
13	Inscribing (writing) necessary information in Bangla as directed in the supplied drawing on front face of the Basin with approved quality Marble stone, size 12"x10", Thickness 15 mm, color white and others according to the direction of the Engineer-in-charge.	item	1.00	800	800
14	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer-in-Charge .	Each	1.00	242	242
				Total	30,175

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

Handwashing Basin with Overhead Tank and Submersible Pump

Context and Description

Emergency Context

Applicable for handwashing in the school-cum cyclone shelter for regular use by the students and displaced people during a disaster event.

Major Components

- > Submersible pump
- > Overhead tank
- > Bib cock
- > Brick walls and tiles
- > Plumbing fittings and pipe
- > Drainage pipe (magic pipe)
- > Soap dispenser or tray
- > GI pipe for water supply line

Technology Description

- > Groundwater is pumped to the overhead tank (500 Liter capacity) through the submersible pump to ensure water supply for handwashing basin. Water stored in an overhead tank is connected to the Bib cock (tap) through different sized GI pipes for several users to wash their hands simultaneously.
- > A handwashing basin having size (LxWxH) of 6 ft x 2 ft 9 inch x 5 ft should be made of bricks over a concrete base. The basin floor and brick walls should be covered by plaster and/or floor tiles. Three water taps should be fitted at a height of 3.5 ft from the ground level. Connection of water to the taps would be made using uPVC pipe.
- > The floor of the handwashing basin should be sloped towards the outlet holes having a filter net/grating to drain the wastewater from the handwashing basin to the soakage pit by a drainage pipe/drain.
- > Soap, liquid soap or soapy water should be kept adjacent to the handwashing stations, and should be available at all times.



Figure 30: Handwashing basin with overhead tank and submersible pump (Courtesy: DPHE)

Suitability

Suitable in WASH block or school wash facilities or emergency shelter of the public. A running water supply ensures ease of use.

Risks/Challenges

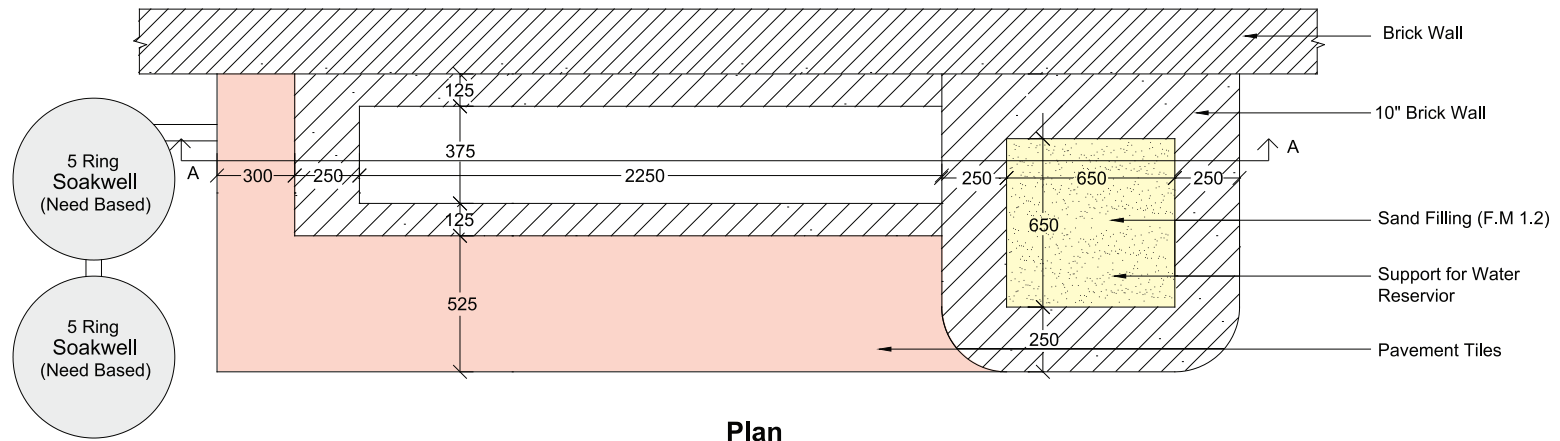
The water supply should have sufficient pressure for multiple taps to operate at the same time. As water is coming from a tank, there should be sufficient height between the taps and the tank. Additionally, taps should be adequately spaced so that users are physically distanced during disease outbreaks.

Operation and Maintenance

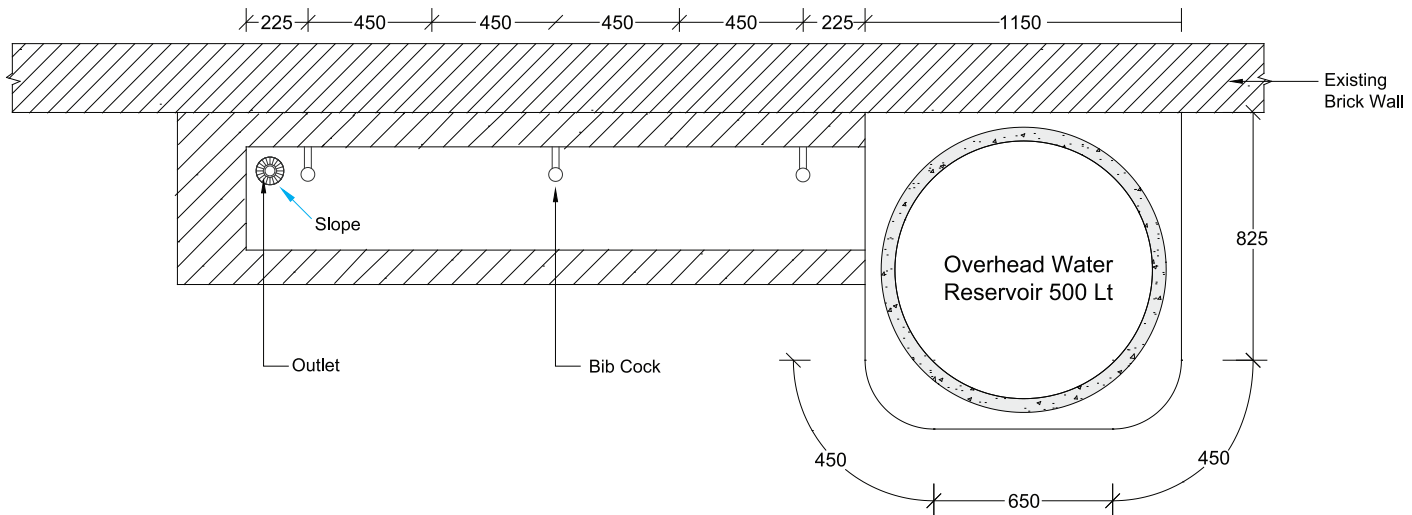
Drains/drainage pipe should be checked for clogging. Caretakers/facilitators should ensure soap/soapy water near the basin. The pipes can be vulnerable to leakages, so regular inspection is required as well.

Note: Adapted from Handwashing Stations by WaterAid in Bangladesh and Handwashing Compendium for Low Resource Settings by IDS & the sanitation learning hub.

Design Drawings



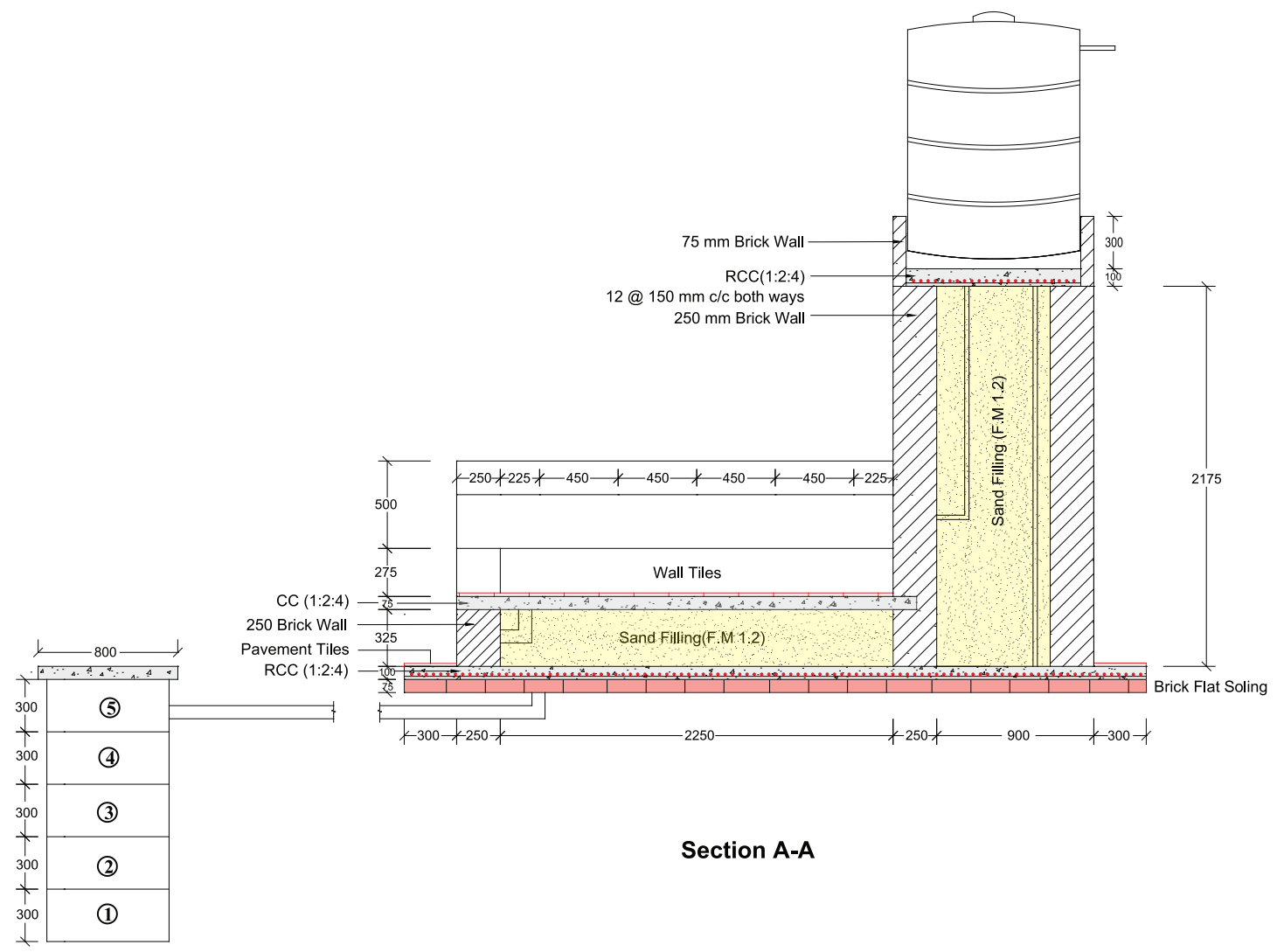
Plan



Plan

Handwashing Basin with Overhead Tank and Submersible Pump

Note: All dimensions are in mm



Section A-A

Handwashing Basin with Overhead Tank and Submersible Pump

Note: All dimensions are in mm

Cost Estimate

Part-A (100x50 mm dia deep tube well; Average Depth: 120.0 meter)

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization, transportation and de-mobilization of drilling equipment and accessories including erection of derrick, digging of mud pit, arrangement of water, electricity etc. All complete after completion of cleaning, levelling and dressing of the site as per direction of the Engineer in charge.	LS	1	5,000	5,000
2	Drilling & Installation: Boring by 150 mm diameter cutter with GI pipe and other equipment capable of drilling up to required depth by water jet method or any other method approved by the EIC through all sorts of strata, pea gravel interference, protection of caving in by supplying necessary MS casing pipe and use of bentonite slurry or similar, collection of soil samples at every 3 m interval and at every change of strata and preserving them for analysis, withdrawal of boring pipes and casing pipes etc. complete, lowering of pipes for installation of all tube wells as per specification and direction of the E/C. Brand of GI Pipe: National Tube/ Bashundhara Diamond/ Hatim Diamond/ RFL; Brand of uPVC: RFL/ National Plymex/ BRB/ Bengal/ Partex/ Lira/ Aziz/ A1	sqm	90	24	2,160
	(a) From 0.0 m to 30 m (100 mm dia uPVC Pipe class `D`)	m	30	1,150	34,500
	(b) From 30 m to 60 m (50 mm dia uPVC Pipe class `D`)	m	30	350	10,500
	(c) From 60 m to 106.5 m (50 mm dia uPVC Pipe class `D`)	m	46.50	375	17,438
	(d) From 106.5 to 118.5 m (50 mm dia uPVC Class-E) strainer	m	12	675	8,100
	(e) 100X50 mm dia uPVC Reducer	nos.	1	250	250
	(f) Sand trap (50 mm dia uPVC Pipe class `D`) 1.5 m long 50 mm dia. including PVC end cap in one end and socket in another end with fitting and fixing in proper position etc. all complete as per specifications and direction of the Engineer in charge.	m	1.50	425	638
3	Clay Sealing	cum	6.75	193	1,303
	First case: Filling up the space between bore hole & the tube well by coarse Sylhet sand (FM 2.00) from bottom of the bore hole up to 6 meters from top of the filter.				
	Second case: Filling up the space between bore hole and tube well from top of the clay layer up to 6m with clay balls of 3-5mm dia which is made of bentonite & sticky clay of 1:1				
	The remaining bore hole spaces have to be filled in with local clay/loose soil. all complete as per direction of Engineer-in-charge.				
	(a) Filling with clay ball made up with the mixture of Bentonite & sticky clay.	m	6	55	330
	(b) The remaining spaces are filled with local clay/loose soil.	m	269	5	1,345

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
4	Preparation and making of gravel pack 2-5 mm size with the supply of shrouding materials of recommended size, sieving for sorting & gradation, free of clay particles washing gradation test at DPHE Ground Water Division, sounding of gravel pack position etc. All complete as per design, specification instruction of the Hydro geologist/direction of the Engineer in charge. (20m)	cum	0.50	3,000	1,500
5	Complete development of the tube well to get sand, odor and turbidity free drinking water at a satisfactory yield, the tube well have to pump continuously to get the target quality of water (minimum 6 hours manually and 2 hours mechanically) etc. all complete as per specifications and direction of the Engineer in charge.	Item	1	1,500	1,500
6	Supply of best quality instrument including 12 inch sly-wrench (1 no.), 1 no. screwdriver, 1 no. Tester as per instruction of Engineer-in-charge and hand over the tools, water quality test report & tube well to the school authority. (This item includes material cost, labor charge and carrying charge).	LS	1	1,000	1,000
7	Disinfecting the well including supply of sufficient quantity of bleaching powder (33% strength), chlorinated water having 150ppm available free chlorine complete as per standard specification, etc. all complete as per specifications and direction of the Engineer in charge.	Item	1	600	600
8	Inscribing (writing) the name of the Project and other necessary information in English on outside front face of the DPHE -DPE, PEDP-4 with approved quality marble stone Italian Karaka special quality size 16inch x12inch thickness 15mm, color: white and others according to the direction of the Engineer in charge.				
Sub -Total of A					84,200

Part-B (1.5 HP capacity submersible pump with water tank for 1 nos. tube well)

1	(a) Submersible pump (Gazi/Partex/Madina/RFL premium quality with two years guarantee, delivery 25 mm dia.) to draw water at roof tank from TW, minimum 1.5 horse power as per standard specification, carrying, fitting & fixing (by 10 no. G.I. wire) within TW and suction & delivery pipe, commissioning etc. 90 meter Electric wire without any joint must be used (3/20) (Estern/BRB/Equivalent) for connection with electric service from power supply to pump including trial operation etc. all complete as per specifications and direction of the Engineer in charge.	Item	1	16,000	16,000
	(b) Protection for submersible pump by making 2 ft 4 inch Outside Length) x 2 ft 4 inch Outside Width x 1 ft 6 inch Height by making 125 mm brick wall supported on single layer 250 mm brick wall Constructed Masonry Box to be covered by 75 mm slab on top Outside of the box requires to be plastered All complete as per instruction and direction of the Engineer in Charge.	Item	1	2,000	2,000
2	a) Supplying, fitting and fixing of special hard grade/thread pipe (class 'E') 25 mm dia as column pipe each 3.0 m long having one end socket and another threaded etc. using necessary Tee's, bends, L-bows and sockets and fitted in position with all necessary accessories etc. all complete as per as per standard practice and accepted by the Engineer in charge.	m	85	55	4,675
	b) S.S wire	m	85	55	4,675

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
3	Supplying and fitting, fixing of flange of 100 mm dia. and 4 mm thick m.s plate having one hole for easy setting of 25 mm dia. uPVC suction pipe and for pump cable and copper heavy wire etc. all complete as per requirement and accepted by the Engineer in charge.	no.	1	500	500
4	Electric surface wiring for the following points looping at the switch board with earth terminal including circuit wiring with 2c-1.5 sq.mm PVC insulated and sheathed cable (BYFYE) with PVC batten complete with 18 SWG GP Sheet switch board with 3 mm thick ebonite sheet cover, 5 amps. wall switch, socket etc. including fixing materials, others accessories etc. all complete as per specifications and direction of the Engineer in charge.				
	a) Supplying and installation of combined switch and socket	no.	1	800	800
	b) Electric wire (3/20) (Eastern/BRB/Equivalent) for the connection with electric service including trial operation etc. all complete as per as per standard practice and accepted by the Engineer in charge.	m	25	80	2,000
	c) Circuit breaker 5 amps.	each	1	400	400
5	Food-grade plastic (color: Black) internal mini water tank (Gazi/RFL/Padma) for storage and supply of water having 1000 liters capacity manufactured from liner low density polyethylene (ILDPE) roto grade (ultra violet) established which complies FDA(Federal Department of Agriculture, USA) (Fazi)/regulations 21 CFR 1277, 152 having food grade quality where no recycled materials is used, union socket, bend nipple, over flow pipe and all accessories need for fitting & fixing in roof position, carrying & lifting to the site & position as per direction of Engineer in charge.	no	2	10,912	21,824
6	Making plumbing line with special hard grade / thread pipe 'E' class including supplying necessary clamps, screws, royal plug, Elbow, bends, Tees etc. all complete as per specifications and direction of the Engineer in charge.				
	i. 100mm dia GI pipe short piece	m	0.46	2,380	1,095
	ii. 25 mm dia pipe	m	15	110	1,650
	iii. 19 mm dia pipe	m	20	70	1,400
	iv. 13 mm dia pipe	m	12	60	720
	v. 25 mm dia gate valve	no	2	500	1,000
	vi. 19 mm dia gate valve	no	2	315	630
	vii. Clamp with screw	set	10	150	1,500
	viii. 50mm dia end cap	no	1	200	200
	ix. 50mm/25mm Elbow	no	6	125	750
	x. 50mm dia pipe	m	2	173	346
	xi. Supplying, fitting and fixing best quality plastic bib cock complete approved and accepted by the Engineer in charge. 12 mm Plastic bib cock.	no	6.00	150	900
				Sub-Total of B	63,065

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
Part-C (Civil works for construction of water collection basin)					
1	Earth work in excavation in all kinds of soil for foundation trenches in/c layout, providing center lines, bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes & making layout with chalk powder providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking the excavated earth at a safe distance of up to 60m lead, removing the spoils etc. all complete as per direction of the Engineer in charge.	Item	1.00	1,500	1,500
2	Single layer brick flat soling with 1st class or picked jhama bricks, true to level, in/c carrying bricks, filling the interstices tightly with sand of minimum F.M. 0.80, etc. all complete as per contract requirements and direction of the Engineer in charge.	sqm	3.24	317	1,027
3	(a) Mass concrete (1:2:4) in floor with cement Sand (F.M. 1.8) and picked jhama chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days in/c the supply of water, electricity and other charges and costs of tools and plants etc. all complete in/c as per direction of Engineer in charge.	cum	0.38	6,358	2,416
	(b) RCC slab of 1200x900x75mm size produced by 10mm GI wire including casting of concrete.	Item	1.00	400	400
4	125 mm thick brick work 1st class bricks in cement mortar (1:4) in wall, drain and plinth, filling the interstices tightly with mortar, in/c necessary scaffolding, raking out joints, cleaning and soaking bricks at least for 24 hours before use, washing of sand, curing for requisite period, etc. all complete as per contract requirements and direction of the Engineer in charge. (Sand of min F.M 1.2 be used).	sqm	6.07	697	4,231
5	Supplying, fitting and fixing of 300 x 300 mm colored homogenous floor tiles, RAK/Fu-ang or equivalent as per approved sample on 20 mm thick cement mortar (1:4) base and raking out the joints with white cement and colored pigment in/c cutting and laying the tiles in proper way and finishing with care, maintaining level etc. all complete as per direction of the Engineer in charge. (Sand of minimum FM. 1.2 to be used).	sqm	4.22	1,293	5,456
6	Supplying, fitting and fixing glazed wall tiles (local made) on 20mm thick cement mortar (1:3) base and raking out joints with white cement in/c cutting and laying the tiles in proper way and finishing with care, etc. all complete as per direction of the E.I.C. Sand of minimum FM 1.2 to be used. (200 x 300mm colored wall tiles, RAK/Fu-ang or equivalent).	sqm	5.08	1,012	5,141
Sub-Total of C					20,171

Part-D (Supply of water purifier/filter with a provision of maintenance for 02 years)

1	Supplying, fitting, fixing of foreign made best quality Reverse Osmosis Water Purifier (Kent/ Unilever/ Vapor water purifier or equivalent brand as per approval of Procuring Entity and Focal point) for purification of water by reverse osmosis method to have potable water conforming to Bangladesh standard including installation charge, carriage, sundries etc. RO filters should be positioned in such a manner that they are safer from the threat of theft and the location should be selected by SMC. Volume of water purification should be more than 200 gallon per day with a capacity of removing total and fecal coliform, Fe (<5mg/l), Cl (<600mg/l), Arsenic (0.005) etc. as per Bangladesh Standard. All complete, approved and accepted as per direction of the Engineer in charge.	Item	1.00	51,035	51,035
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Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
2	Change of filtration kit of installed RO filter for a period of two (02) years from the date of handover of tube well. Contractor will have to pay for the change of filter unit such as change of filtration kit and others monthly up to a period of two (02) years from the date of handover of the tubewell. All complete, approved and accepted by the Engineer in charge. [The amount related to this item will be released in favor of contractor only after successful maintenance of RO filter for 02 (two) years.]	Fixed	1.00	20,000	20,000
3	Protection for RO purifier/filter: Supplying, fitting and fixing of window grill of any design made with 20 mm x 5 mm F.I.bar as inner and outer section; including fabricating, welding, cost of electricity and tools and plants etc. Total weight per sqm should be min 12 kg. and bolted to the wall around the filter and having locking provision. All complete, approved and accepted by the Engineer in Charge.	Sqm	2.97	1,719	5,105
Sub-Total of D					76,140

Part-E (Fixed item for fixed quoted rate), All the items include cost with VAT, AIT etc.)

1	Collection of water sample by DPHE lab personnel (after complete development of the well till water becomes sand and turbidity free) for laboratory testing to identify the presence & quantity of Iron (Fe), Chloride (Cl) and Arsenic (As) in tube well water and also taking GPS reading as per instruction of Engineer-in-charge. [This item Includes both way conveyance of LAB personnel, preparation of sample collection bottle, GPS reading with machine, Government test fees, VAT, Tax]	Fixed	1.00	1,900	1,900
Sub-Total of E					1,900

Summary of Costs					
1	Part-A (100*50 mm dia Deep Tube Well)				84,200
2	Part-B (1.5 HP capacity submersible pump with Water Tank for DeepTube Well)				63,065
3	Part-C (Civil works for construction of water collection basin).				20,171
4	Part-D (Water purifier with a provision of maintenance for 02 years)				76,140
5	Part-E (Fixed item for fixed quoted rate)				1,900
Total Cost (A+B+C+D+E) BDT					245,477

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

Pedal-operated Handwashing Station

Context and Description

Emergency Context

Applicable during disease outbreaks that requires prevention of recontamination from faucets and soap dispensers.

Major Components

- > Pedal operated faucet/tap
- > Two foot pedals (levers)
- > MS frame and support
- > Basin (steel or plastic)
- > Soap dispenser
- > Reservoir or water container
- > Drainage

Technology Description

- > A hands-free design that helps prevent disease transmission and maintain hygiene guidelines.
- > A water tank (or container) is connected to a basin with a pedal operated faucet. The whole system is supported by MS frame angles and bars. A soap dispenser is also placed adjacent to the basin, which is also pedal operated.
- > Two separate foot paddles are installed, which are operated by iron bar levers and springs. The left pedal is connected to the soap dispenser and the right one is for the faucet. When the pedal is pressed, the spring is pulled downwards which creates pressure on the faucet or soap dispenser.
- > A magic pipe or proper drainage pipe needs to be present for grey water discharge.
- > Handwashing steps and instructions are additionally attached to the system (optional).
- > The container has a handle for easy transportation.



Figure 31: Pedal type handwashing system in Sakhipur, Tangail, Bangladesh (Courtesy: WaterAid)

Suitability

Suitable during epidemics where surface contamination is an issue. Useful in public areas or in emergency shelters/healthcare facilities etc. Ideally, the device should be connected to a running water supply.

Risks/Challenges

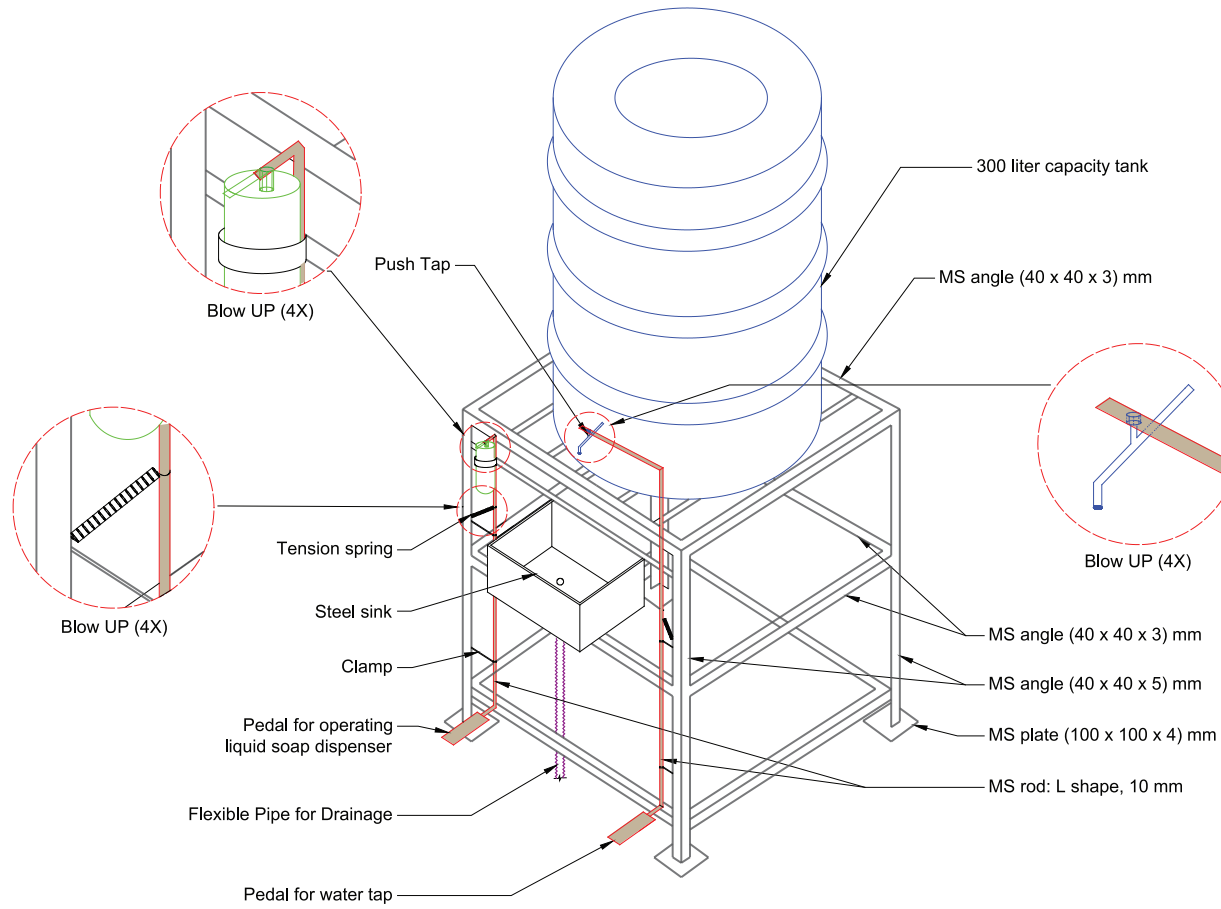
The pedals can get jammed, or springs may become non-functional due to rust/jamming etc.

Operation and Maintenance

Drains should be checked for clogging. Caretakers/facilitators should ensure soap/soapy water to be present in the soap dispenser. The pipes can be vulnerable to leakages, so regular inspection is required as well. Additionally, the mechanical parts should be oiled for smoothness.

Note: Adapted from Handwashing Stations by WaterAid in Bangladesh and Handwashing Compendium for Low Resource Settings by IDS & the sanitation learning hub (2020).

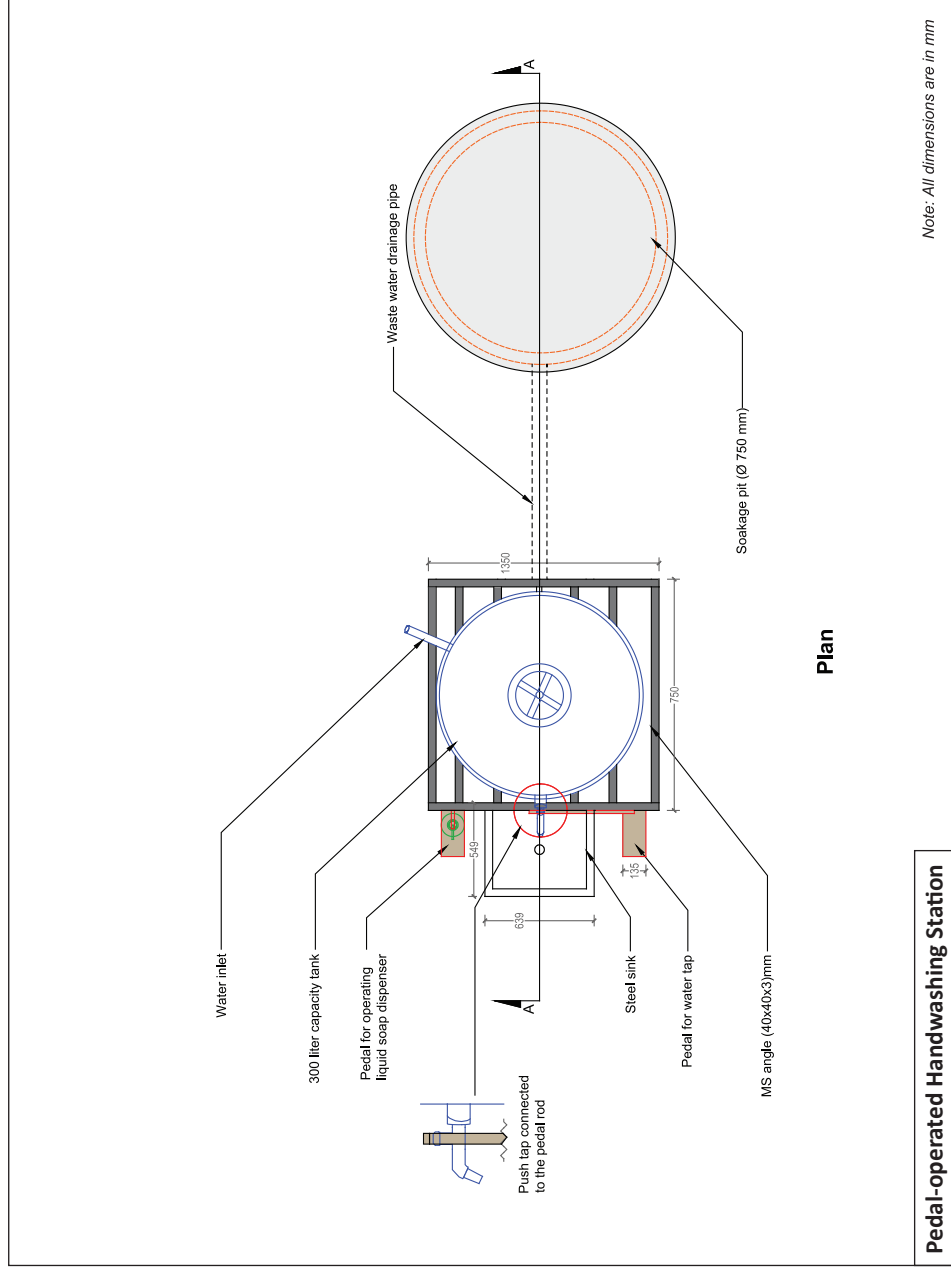
Design Drawings



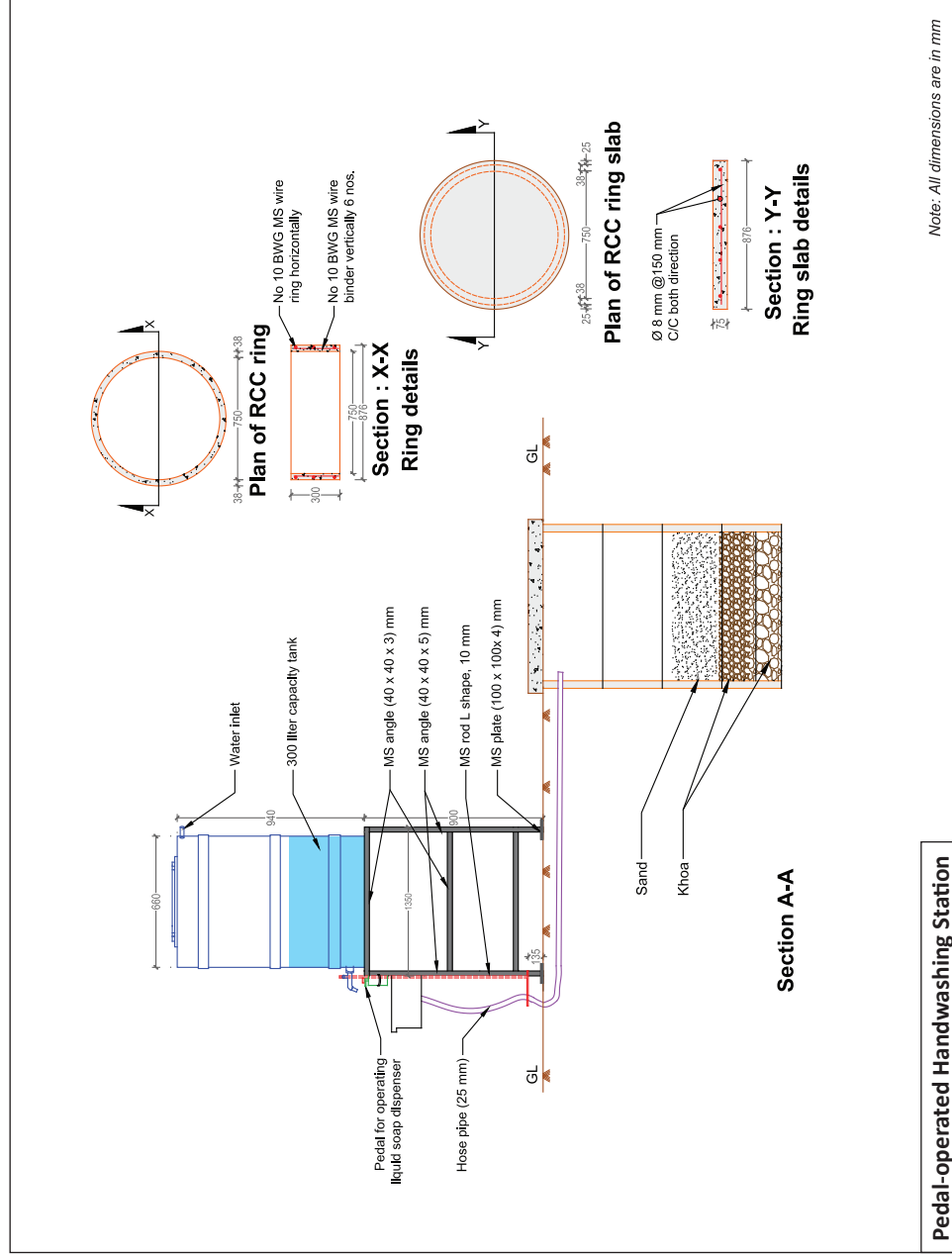
Isometric view

Pedal-operated Handwashing Station

Note: All dimensions are in mm



Pedal-operated Handwashing Station



Pedal-operated Handwashing Station

Cost Estimate (without the cost for water source and supply system)

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	0.70	193	135
2	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the construction site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	0.70	153	107
3	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 750 mm inner & 826 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneurs (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	5	600	3,000
4	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 876 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneurs (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	1	1,650	1,650
5	Supplying and placing of Sylhet sand FM 2.0 of 150 mm thick as filter materials at the bottom of ring well as shown in drawing and direction of the Engineer in Charge.	cum	0.10	2,350	235

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
6	Supplying and placing of 12 mm and downgraded khoa 150mm thick as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.10	6,250	625
7	Supplying and placing of 20 mm downgraded khoa 150mm thick as filter materials at the bottom of ring as shown in drawing and direction of the Engineer in Charge.	cum	0.10	5,700	570
8	Making, supplying and placing Readymade handwashing basin / sink made of Stainless-Steel sheet and MS angle as per specification, drawing, design and direction of the Engineer in Charge. Basin frame will be made with 04 no's leg of 0.90 meter long with 40mm x40mm x05mm MS angle, 100mm x 100mm x 06 mm size MS plate at the base of leg to be fitted by welding for setting in a firm base also tank stability, 40mm x 40mm x 03mm size MS angle frames to be fitted at the top, middle and bottom of basin frame and other in 150mm above from the leg plate, 05 (five) nos 40mm x 40mm x 03mm size MS angle to be fitted at the top as platform all the frames to be welded with the leg. 355mm x 305 mm x 180mm size best quality sink made of 1.2 mm thick Stainless-Steel sheet including fitting. One 40mm dia outlet hole should be provided and to be fitted 12 mm dia C.P. chain plug, 40 mm dia C.P. waste, 40 mm dia PVC waste pipe with brass coupling (750 mm length) and connected with 100mm dia soil pipe for entering the waste water in the soak pit. One no soap dispenser holder and one 20 mm dia brass gate valve to be fitted. Pedal: Two-foot pedal made of 38mm x 38mm x 4mm MS angle with necessary GI pipe & fitting for fixing in position to control the flow of clean water & soapy water for smooth operation, 2.5 ltr soapy water refill provision tank made of Galvanized steel with epoxy paint, Size: 100 mm Diameter, Height-300mm with SS cover on top with locking arrangements complete with necessary fittings to be fitted, discharge of soapy water should be of 5ml /press of pedal. One no soap holder and one 20 mm dia brass gate valve to be fitted. Cutting holes in platform and mending good the damages, finishing, curing, necessary painting two coats with approved quality of epoxy paint over a coat of priming of anticorrosive paint over all the MS and GI surface etc. all complete in all respects approved and accepted by the Engineer- in- charge.	each	1	17,500	17,500
9	Supplying, fitting and fixing of best quality 12mm dia CP bib cock etc. complete approved and accepted by the Engineer- in- charge.	each	1	1,014	1,014
10	Supply and installation of 300 Liter capacity food-graded plastic internal mini water tank for the use in kitchen, bathroom and toilet for emergency storage and supply of water manufactured from liner low density polyethylene (LDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables such as inlet pipe, outlet pipe, washout pipe etc. all complete approved and accepted by the Engineer- in- charge.	each	1	4,277	4,277
11	Supplying different inside dia best quality 100 mm dia uPVC 'P' or 'S' trap 100 mm dia uPVC 'P' or 'S' trap having specific gravity 1.35 -1.45 and other physical, chemical, thermal, fire resistivity properties etc. as per BSTI approved manufacturer standards or ASTM, BS/ISO/IS standards, fitting and fixing in position etc. complete approved and accepted by the Engineer- in- charge.	each	1	650	650
12	Supplying inside dia best Quality u PVC B-grade soil 100 mm inner dia, wall thickness 3.40 mm rain water down pipe ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	6	450	2,700

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
13	Supplying, fitting and fixing of 125 mm dia stainless steel floor grating in traps or in drains including making holes in walls/floors and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	257	257
15	Supplying, fitting and fixing of Liquid soap dispenser (push-up type) to dispense 16 oz (0.47 liters) of soap, detergent or lotion. Unit shall be fabricated of tamper resistant, chrome plated plastic, a translucent white polyethylene soap container, and a corrosion resistant dispensing valve which can provide no more than 5 lbs (22.2 Newtons) pressure and unit can be reloaded by unscrewing base from bracket collar, inverting unit, and unscrewing soap container in which soap will continue to feed properly until empty with a continuously visible soap level etc. all complete approved and accepted by the Engineer- in- charge.	each	1	1,060	1,060
				Total	33,780

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019).

Ready Made Handwashing Station

Context and Description

Emergency Context

This can be used in the initial stage of an emergency for displaced population.

Major Components

- > A container with a tight fitted lid
- > A tap
- > A handle attached to the container
- > Handwashing basin frame (optional)

Technology Description

- > This handwashing station is made of a container fitted with a tap at the base.
- > The lid of the container prevents dirt and debris from entering into the container.
- > The container has a handle for easy transportation.

Suitability

In case of an emergency, these could be readily purchased from the market or can easily be fabricated using locally available containers and taps.

Risks/Challenges

As the tap needs to be turned off after handwashing, touching the tap may re-contaminate clean hands. The container needs to be filled with water manually, if not connected to a nearby reservoir.

Operation and Maintenance

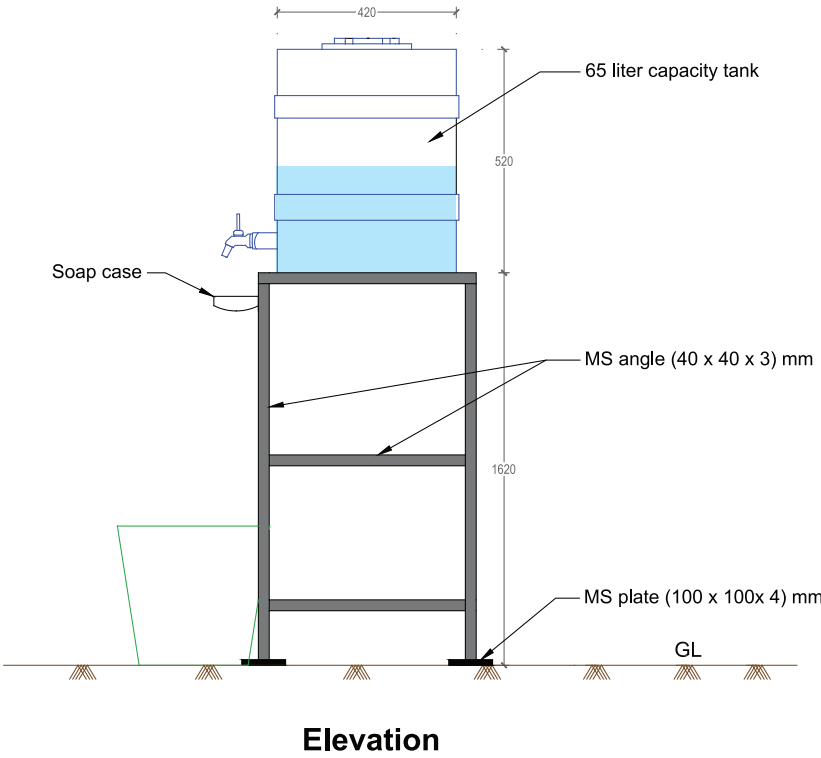
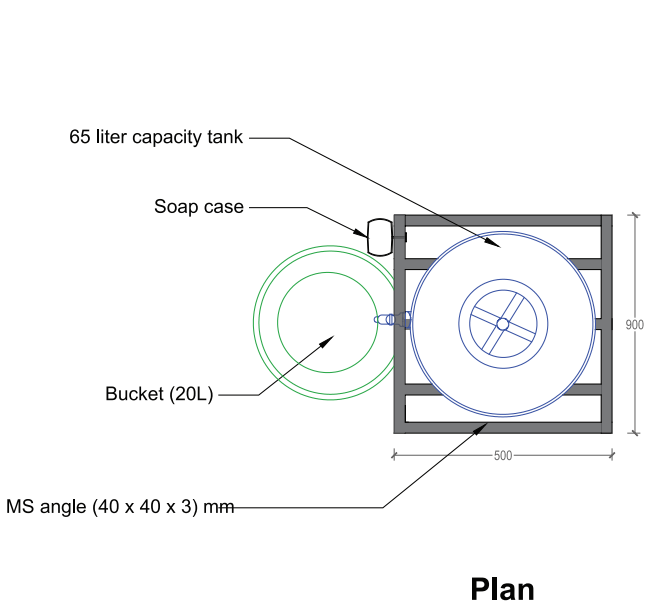
The tap needs to be cleaned regularly to reduce the risk of recontamination of hands after washing. The inside of the container needs to be cleaned every week with clean water and disinfectant. A bucket or bowl is placed under the tap to collect wastewater, or the ground under the tap is covered in stones to help drainage of wastewater.

Note: Adapted from Handwashing Compendium for Low Resource Settings, IDS & the sanitation learning hub (2020).



Figure 32: A 65-liter tank with tap and no handle over MS angle frame (Courtesy: Oxfam)

Design Drawings



Ready Made Handwashing Station

Note: All dimensions are in mm

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Making, supplying and placing Readymade handwashing basin frame made of 04 no's leg of 0.90 meter long with 40mm x40mm x03mm MS angle, 100mm x 100mm x 03 mm size MS plate at the base of leg to be fitted by welding for setting in a firm base also tank stability, 40mm x 40mm x 03mm size MS angle frames to be fitted at the top, middle and bottom of basin frame and other in 150mm above from the leg plate, 03 (three) nos 40mm x 40mm x 03mm size MS angle to be fitted at the top as platform all the frames to be welded with the leg, necessary painting two coats with approved quality of epoxy paint over a coat of priming of anticorrosive paint over all the MS surface etc. all complete in all respects approved and accepted by the Engineer- in- charge.	kg	21.50	138	2,967
2	Supply and installation of 65 Liter capacity food-graded plastic internal mini water tank with tap for the use in kitchen, bathroom and toilet for emergency storage and supply of water manufactured from liner low density polyethylene (ILDPE) roto-grade (ultra violet) stabilized which complies FDA (Federal Department of Agriculture, USA) regulations 21 CFR 1277. 152, having food grade quality where no recycled material is used carrying, lifting, fitting, fixing in position including supply of necessary hardware, consumables such as inlet pipe, outlet pipe, washout pipe etc. all complete approved and accepted by the Engineer- in- charge.	each	1	1,650	1,650
3	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	1	460	460
4	Supplying of best quality 20-liter capacity plastic bucket with lid and handle for disposing of waste water made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
				Total	5,577

Note: The BoQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from DPHE Schedule of rates (2019) and other sources.

Bath House

Context and Description

Emergency Context

Applicable for displaced population due to flood, riverbank erosion, tornadoes, earthquakes, or man-made conflicts.

Major Components

- > Three handpumps
- > Blind pipe
- > Strainer
- > Platform, sanitary seal
- > PVC drain pipe

Technology Description

- > Usually designed as private bathing facility for women and girls.
- > Cubicles are constructed around a tubewell or piped water, which can be used as water source for bathing.
- > Multi-cubicle designs would shorten queues.
- > Dustbin or collection chambers are placed in all the cubicles for menstrual items disposal.
- > Adequate space should be kept for washing reusable menstrual pads and cloths, and provision should be there for drainage of wastewater.

Suitability

These multi-cubicle bathing houses are suitable for women and girls in emergency settlements. Since women in these conditions are used to dumping their menstrual pads/cloths in the latrines, having a hygienic cleaning or disposal option in the bathing cubicles is mandatory (according to Sphere guidelines) for proper management.

Risks/Challenges

As the tap used needs to be turned off after handwashing, touching the tap may re-contaminate clean hands. The container needs to be filled with water manually, if not connected to a nearby reservoir.



Figure 33: Multiple cubicles bath house (Courtesy: UNHCR)

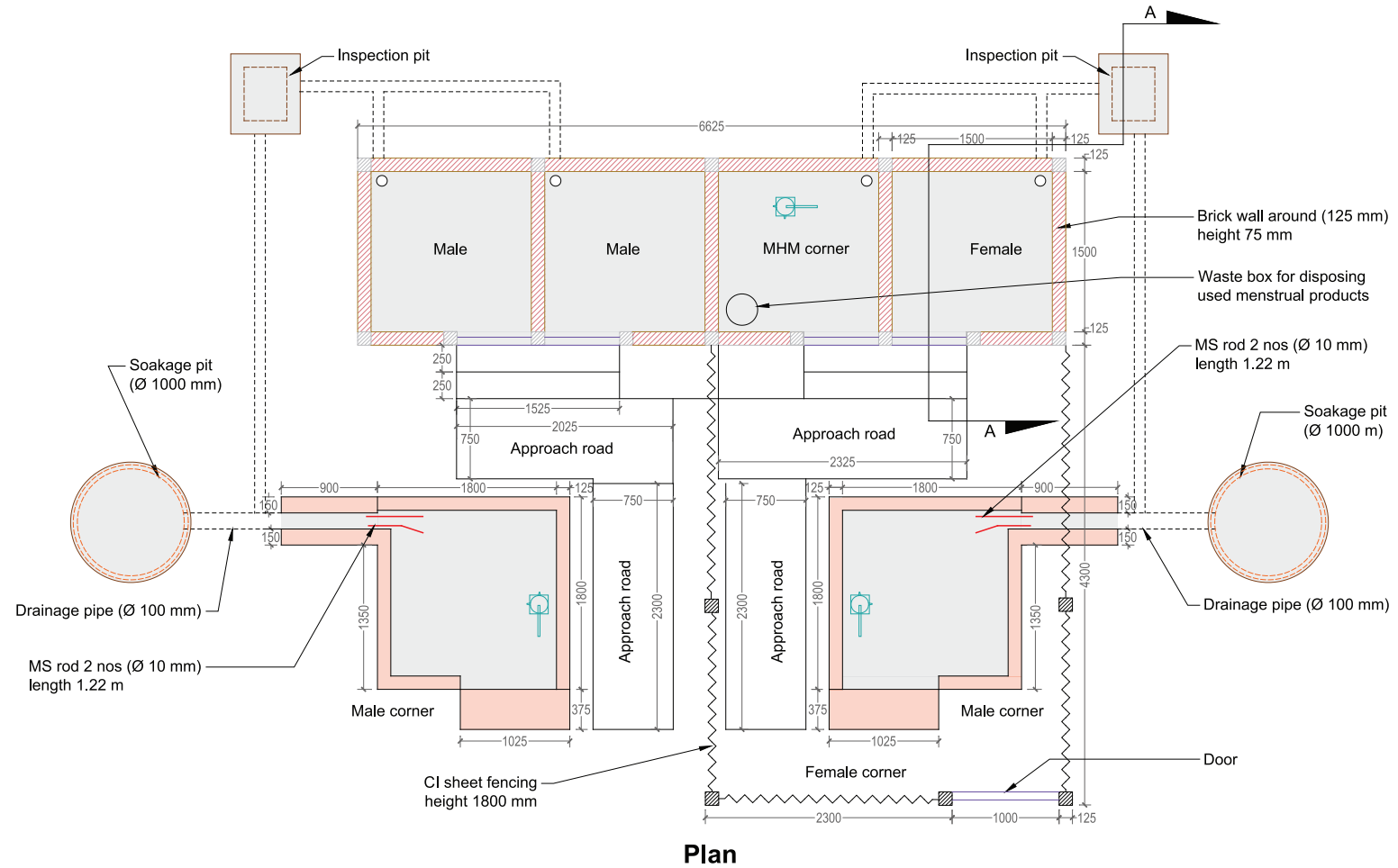
Operation and Maintenance

Regular cleaning of the floor of bathing cubicles to avoid any accident due to slippery floors and proper drainage of wastewater; there should not be any stagnant wastewater inside the bathing cubicle. Menstrual dustbins/chambers must be emptied periodically, and the contents are to be incinerated.

Note: > Adapted from *Resilient and Inclusive WASH Technology Album*, OXFAM, ITN-BUET, Australian Aid (Page: 47-48).

> Adapted from *Sphere Handbook, 2018* (<https://spherestandards.org/wp-content/uploads/Sphere-Handbook-2018-EN.pdf>)

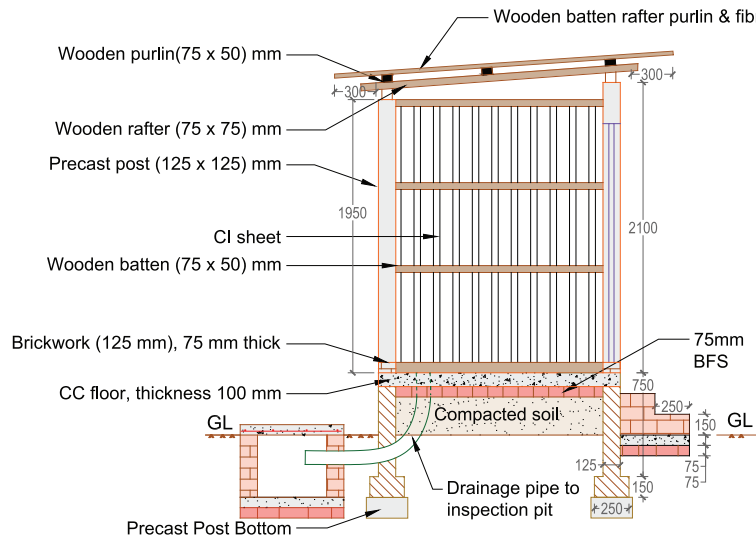
Design Drawings



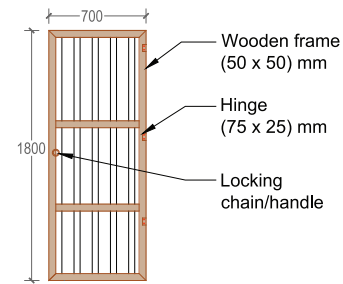
Plan

Bath House

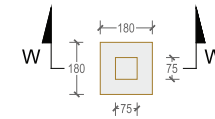
Note: All dimensions are in mm



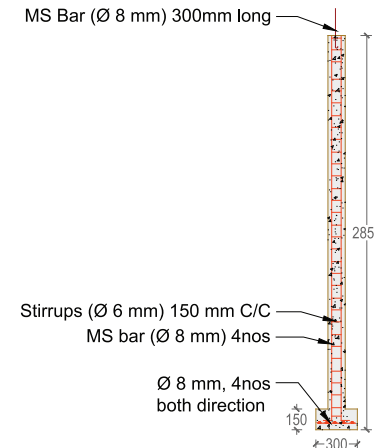
Section A-A



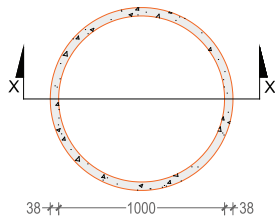
Door elevation



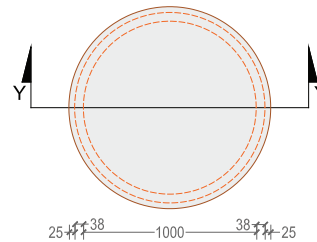
Plan



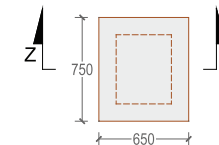
**Section: W-W
Precast post**



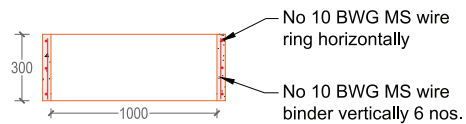
Plan of RCC ring



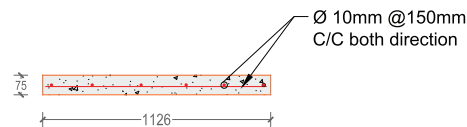
Plan of RCC ring slab



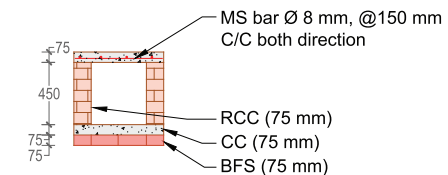
Plan of inspection pit



**Section : X-X
Ring details**



**Section : Y-Y
Ring slab details**



**Section: Z-Z
Inspection pit details**

Cost Estimate

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
1	Mobilization of all required equipment and materials to the working site for installation of a making arrangement for using the equipment, cleaning and leveling of the working site, demobilization / transportation of the equipment after completion of the work etc. all complete as per direction of the Engineer in Charge.	Item	1	1,000	1,000
2	Providing layout and carry over PWD bench-mark (BM) at site from nearby BM pillar, property lines, existing ground level (EGL), formation ground level (FGL), highest flood levels (HFL), plinth levels (PL), mean sea level (MSL), setting and marking all pillars, marker, pegs etc. showing and maintaining reduced levels (RL's) including locating, establishing, protecting all public utilities within the premise of work and finally all to be presented in black and white.	sqm	90	24	2,160
3	Earth work in excavation in all kinds of soil for foundation trenches including layout, providing center lines, local bench-mark pillars, levelling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer-in-charge, subject to submit method statement of carrying out excavation work to the Engineer-in-charge for approval. However, engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Earthwork in excavation in foundation trenches up to 1.5 m depth and maximum 10 m lead: in very stiff (hard) clayey soil/ rubbish etc.	cum	6.75	193	1,303
4	Earth filling in foundation trenches and plinth and site development in 150 mm layer with earth available within 90 m of the building site to achieve minimum dry density of 95% with optimum moisture content (Modified proctor test) including carrying watering, leveling, dressing and compacting to a specified percentage each layer up to finished level etc. all complete and accepted by Engineer-in-charge.	cum	6.75	153	1,033
5	One layer of brick flat soling in foundation or in floor with first class or picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc. complete and accepted by the Engineer-in-Charge. (This item includes materials cost, labour charge, carrying charge with VAT, Income Tax & Profit).	sqm	18.25	454	8,286
6	Supplying and laying of single layer polythene sheet weighing one kilogram per 6.5 square meter in floor or anywhere below cement concrete complete in all respect and accepted by Engineer-in-charge.	sqm	20	42	840
7	Mass concrete (1:2:4) in foundation or in floor with cement, sand (F.M. 1.2) and picked jhama brick chips including breaking of chips, screening, mixing, laying, compacting to required level and curing for at least 7 days including the supply of water, electricity, costs of tools & plants and other charges etc. all complete and accepted by Engineer-in-charge. (Cement: CEM-II/A-M)	cum	1.60	8,330	13,328
8	Brick works with first class bricks with cement sand (F.M. 1.2) mortar (1:4) in foundation and superstructure walls including filling the interstices with mortar, raking out joints, cleaning and socking the bricks at least for 24 hours before use and washing of sand, necessary scaffolding, curing at least for 7 days etc. all complete including cost of water, electricity and other charges (measurement to given as 250 mm width for one brick length and 375 mm for one brick and a half brick length) accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	cum	1.05	7,293	7,658

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
9	125 mm brick works with first class bricks with cement sand (F.M. 1:2) mortar (1:4) and making bond with connected walls including necessary scaffolding, raking out joints, cleaning and soaking the bricks for at least 24 hours before use and washing of sand, curing at least for 7 days in all floors including cost of water, electricity and other charges etc. all complete and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) In ground floor	sqm	14.50	1,023	14,834
10	Supply and installation as per drawing and design of R.C.C (1:2:4) Precast pillars of section 125 mm x 125 mm at top 300 mm square spread footings (pillars reinforced with 4 Nos. 08 mm dia main rod and 6 mm dia stirrups @ 150 mm c/c, footing reinforced with 4 Nos. 08 mm dia rod both ways) including 12 mm thick (1:4) cement plaster to the top portion of the pillars etc. complete and accepted by the Engineer-in-charge.	each	16	1,900	30,400
11	Minimum 12 mm thick cement sand (F.M. 1.2) plaster with neat cement finishing to outside wall, plinth, floor of toilet etc. with cement (1:4) up to 150 mm below ground level including washing of sand, finishing the edges and corners and curing at least for 7 days, cost of water, electricity, scaffolding and other charges etc. all complete in all respect as per drawing and accepted by the Engineer-in-charge. (Cement: CEM-II/A-M) ground floor.	sqm	33	311	10,263
12	Supplying and making Door frames, Chowkat, Rafter, Purlin, Fencing walls etc. with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-in-charge. All sizes of wood are finished, using Mehgoni wood.	cum	0.65	125,177	81,365
13	0.27 mm thick galvanized iron plain sheet ridging with 300 mm lap on either side fitted and fixed with galvanized bolts and nuts etc. all complete and accepted by the Engineer-in-charge.	meter	7.10	490	3,479
14	Supply and installation of 0.457 mm thick corrugated galvanized iron colour sheet (Bangladesh made) having min weight 63-65 kg per bundle (2'-6" width, 70 – 72 rft long) fitted and fixed on M.S. sections with 'J' hook or wooden purlin with screws, limpet washers and putty etc. all complete and accepted by the Engineer-in-charge.	sqm	64.75	566	36,649
15	Supply and installation of 2.0 mm thick fiber glass sheet (transparent sheet) for roof, wall etc. on M.S. purlin, angle etc. with 'J' hook or screws with washer and putty, all complete as per drawing, specification and direction of Engineer-in-charge.	sqm	16.50	1,414	23,331
16	Supplying inside dia best Quality u PVC B-grade soil 100 mm inner dia, wall thickness 3.40 mm rain water down pipe ,waste pipe , having specific gravity 1.33-1.45, ,and other physical, chemical, thermal, fire resistivity properties etc., as per BSTI approved manufacturer standards or ASTM,BS / ISO / IS standards fitted and foxed in position with sockets, bends, end cap for pipe fitted in soak pit with all accessories such as Round grating / domed roof grating bands, sockets etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge.	meter	18	450	8,100
17	Supplying, fitting and fixing of 125 mm dia stainless steel floor grating in traps or in drains including making holes in walls/floors and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	4	257	1,028
18	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	4	627	2,508

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
19	Supplying, fitting and fixing of 450 mm x 350 mm size and 5 mm thick unframed super quality mirror with hard boards at the back with all necessary fitting including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer-in-charge (Made in Japan or equivalent).	each	4	675	2,700
20	Supplying, fitting and fixing of standard size CP soap tray including making holes in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge.	each	4	460	1,840
21	Supplying of best quality plastic bucket of 15-liter capacity with lid and handle of standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	4	350	1,400
22	Supplying of best quality plastic mug of 1.5-liter capacity, standard size etc. all complete approved and accepted by the Engineer- in- charge.	each	4	80	320
23	Supplying of best quality 10-liter capacity plastic pedal waste box with inbuilt lid and bucket inside for disposing of wastes made of RFL or equivalent etc. all complete approved and accepted by the Engineer- in- charge.	each	1	500	500
24	Manufacturing and supplying 1:2:4 proportion RCC ring of well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Ring size will be of 38 mm wall thickness, 1000 mm inner & 1076 mm outer diameter, 300 mm height as per drawing. Rings and slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneurs (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per design, marking the Project name with production centre name and ring serial number on the body of ring, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement 03 nos No. 10 BWG GI / MS wire ring for placing horizontally and 06 no's vertically and its fabrication and shuttering with approved quality plain sheet and other fixtures are being used to manufacture rings locally)	each	10	800	8,000
25	Manufacturing and supplying 1:2:4 proportion RCC precast slab over well with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 1126 mm outer diameter. Precast Slab of well to be produce in some of production centre selected by the authority involving Local Small Entrepreneurs (LSE) in the local suitable area, where quality of the product materials will be supervised and monitored during process, production and supply it to the site for installation by the Authority/ Engineers authorized representatives / Engaged agency authorized personnel for supervision of the works. Placing of reinforcing materials in position, casting as per drawing and design, marking the Project name with production centre name and serial number on the body of Slab, curing for requisite period, carrying in site, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufacture rings locally)	each	2	1,750	3,500

Sl. No	Item of Work	Unit	Quantity	Rate (BDT)	Amount (BDT)
26	Construction of Tubewell Platform: Construction of C.C (1:2:4) platform size: 2050mm x 1750 mm x 75 mm with 900 mm long drain over 150 mm thick sand cushioning, brick flat soling and laying polythene under cement concrete before casting 75mm thick concrete as per drawing including well block by making 200mm x 200 mm x 300mm block as per drawing and 12 mm thick plaster (1:4) with neat cement finishing of the concrete surface etc. all complete as per specification, drawing and direction of the Engineer in Charge.	each	2	8,500	17,000
27	Manufacturing and supplying 1:2:4 proportion RCC precast slab over IP with fresh Portland cement (Cement: CEM-II/A-M), sand FM 1.2 & 15 mm down well graded 1st class or picked jhama brick chips conforming ASTM C-33 including breaking chips, screening to remove surki and small particles. Slab size will be of 75 mm thick, 0.700 mm x 0.800 mm as per drawing. Placing of reinforcing materials in position, casting as per drawing and design, curing for requisite period, fixing in position etc. including carrying materials in site etc. all complete as per satisfaction and acceptance of the Engineer in Charge. (The cost is inclusive of reinforcement of 08mm dia. MS rod @ 150mm center to center in both ways and its fabrication and shuttering with approved quality plain sheet, forms and other fixtures are being used to manufactures locally)	each	2	900	1,800
28	Other supplies & accessories fittings supplying & fixing				
a)	Stud nail (62.50mm)	kg	4	125	500
b)	MS clamp size 450mm x 62.5mm x 03mm thickness	Nos	16	125	2,000
c)	Nail of different size	kg	6	125	750
d)	Hinges	Nos	12	50	600
e)	Screw for hinges	dozen	8	100	800
f)	Lock chain for door lock inside and outside	Nos	8	40	320
				Total	289,593

Note: > Appropriate technology for extraction of water for using the bathing unit to be selected and accordingly to be added the amount for two no's water option as mentioned below, if the suitable aquifer is found to be deeper, the additional expenditure should also be applicable.

Option- 1: > Shallow tubewell with no - 06 handpump, av. depth considered - 61.00meter, approximate cost involves in normal areas for an amount of BDT 32,000.00 (Thirty-two thousand) only other than difficult areas of Bangladesh (list of difficult areas of Bangladesh shown in Annex -I)

Option- 2: > Deep-set handpump tubewell with no - 06 handpump, av. depth considered - 67.00meter, approximate cost involves in normal areas for an amount of BDT 75,000.00 (Seventy-five thousand) only, (For low water table area).

Option- 3: > Extractable tara tubewell with modified no - 06 handpump, av. depth considered - 100.00meter, approximate cost involves in normal areas for an amount of BDT 82,000.00 (Eighty-two thousand) only (For low water table area).

> The BOQ has been prepared based on the design drawings presented above. Depending on the site conditions, the quantities of certain items could vary. The quoted rates have been taken primarily from PWD (2018), DPHE Schedule of rates (2019) and other sources.

ANNEXES

Annex-I:

List of Difficult Areas of Bangladesh for installation of Tubewell

Sl.No	District Name	Upazila Name	Physiographic Condition
1	Bagherhat	Mongla	Coast, Offshore Island and Saline
2	Barguna	Patharghata	Coast, Saline
3		Taltoli	Coast, Saline
4	Barisal	Agailjhara	Boring Difficult Zone
5	Bhola	Burhanuddin	Coast, Offshore Island and Saline
6		Tazumuddin	Coast, Offshore Island and Saline
7		Monpura	Coast, Offshore Island and Saline
8		Daulatkhan	Coast, Offshore Island and Saline
9	Bogra	Sariakandi	Char
10	Brahmanbaria	Bancharampur	Boring Difficult Zone
11	Chittagong	Sandwip	Coast, Offshore Island and Saline
12	Cox's Bazar	Chakaria	Hilly
13		Moheskhalia	Island
14		Kutubdia	Hilly
15		Teknaf	Hilly
16		Ukhia	Hilly
17	Gaibandha	Fulchhari	Char
18	Habiganj	Ajmirganj	Hoar/ Wetland
19		Baniarchang	Hoar/ Wetland
20		Chunarughat	Hilly
21		Lakhai	Hoar/ Wetland

Sl.No	District Name	Upazila Name	Physiographic Condition
22	Khulna	Batiaghata	Coast, Offshore Island and Saline
23		Dacope	Coast, Offshore Island and Saline
24		Digholia	Coast, Offshore Island and Saline
25		Koyra	Coast, Offshore Island and Saline
26	Kishoreganj	Itna	Hoar/ Wetland
27		Mithamain	Hoar/ Wetland
28		Tarail	Hoar/ Wetland
29	Kurigram	Char Rajibpur	Char
30		Raumari	Char
31	Lalmonirhat	Patgram	Boring Difficult Zone
32	Madaripur	Shib Char	Char
33	Mymensingh	Haluaghat	Barind
34		Dhobaura	Barind
35	Noagaon	Porsha	Gravel Area
36		Shapahar	Gravel Area
37	Narail	Kalia	Beel/Wetland
38	Pabna	Bera	Char
39		Chatmohor	Char

Sl.No	District Name	Upazila Name	Physiographic Condition
40	Satkhira	Shyamnagar	Coast, Offshore Island and Saline
41		Debhata	Coast, Offshore Island and Saline
42		Asasuni	Coast, Offshore Island and Saline
43	Saritpur	Jajira	Boring Difficult Zone
44		Gosairhat	Boring Difficult Zone
45	Sylhet	Companiganj	Beel/Wetland
46		Gosairhat	Beel/Wetland
47		Jaintapur	Beel/Wetland
48		Kanaighat	Hilly
49	Bandarban	Bandarban sadar	Hilly
50		Alikadam	Hilly
51		Lama	Hilly
52		Naikhongchori	Hilly
53		Rowangchori	Hilly
54		Ruma	Hilly
55		Thanchi	Hilly
56	Rangamati	Rangamati Sadar	Hilly
57		Baghaichari	Hilly
58		Barkal	Hilly
59		Kaukhali	Hilly
60		Belaichari	Hilly
61		Kaptai	Hilly

Sl.No	District Name	Upazila Name	Physiographic Condition
62		Juraichari	Hilly
63		Langudu	Hilly
64		Naniarchar	Hilly
65		Rajsthal	Hilly
66	Khagrachari	Khagrachori Sadar	Hilly
67		Dighinala	Hilly
68		Laxmichari	Hilly
69		Mahalchari	Hilly
70		Manikchari	Hilly
71		Matiranga	Hilly
72		Panchari	Hilly
73		Ramgarh	Hilly
74		Guimara	Hilly
Total		25	74

Note: These Upazilas (74 nos) will be considered as "Difficult Areas of Bangladesh" and additional 5% rate would be added in the schedule of rate while preparing the estimate. The areas where accessibility and drilling were found difficult have been considered under this 'Difficult Areas of Bangladesh' table.

Annex-II:

Table for measuring beaching power for shock chlorination against depth of tubewells¹

Depth of Tube well and Amount of water		Amount of Chlorine (gm)	Amount of Bleaching Powder (gm)														
Depth (ft)	Volume of water (Litre)		Percentage of Chlorine in Bleaching Powder														
			20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%
100	30	6	30	24	20	17	15	13	12	11	10	9	9	8	8	7	7
120	40	8	40	32	27	23		18	16	15	13	12	11	11	10	9	9
140	40	8	40	32	27	23	20	18	16	15	13	12	11	11	10	9	9
160	50	10	50	40	33	29	25	22	20	18	17	15	14	13	13	12	11
180	60	12	60	48	40	34	30	27	24	22	20	18	17	16	15	14	13
200	60	12	60	48	40	34	30	27	24	22	20	18	17	16	15	14	13
220	70	14	70	56	47	40	35	31	28	25	23	22	20	19	18	16	16
240	80	16	80	64	53	46	40	36	32	29	27	25	23	21	20	19	18
260	80	16	80	64	53	46	40	36	32	29	27	25	23	21	20	19	18
280	90	18	90	72	60	51	45	40	36	33	30	28	26	24	23	21	20
300	100	20	100	80	67	57	50	44	40	36	33	31	29	27	25	24	22
320	100	20	100	80	67	57	50	44	40	36	33	31	29	27	25	24	22
340	110	22	110	88	73	63	55	49	44	40	37	34	31	29	28	26	24
360	120	24	120	96	80	69	60	53	48	44	40	37	34	32	30	28	27
380	120	24	120	96	80	69	60	53	48	44	40	37	34	32	30	28	27
400	130	26	130	104	87	74	65	58	52	47	43	40	37	35	33	31	29
420	140	28	140	112	93	80	70	62	56	51	47	43	40	37	35	33	31
440	140	28	140	112	93	80	70	62	56	51	47	43	40	37	35	33	31
460	150	30	150	120	100	86	75	67	60	55	50	46	43	40	38	35	33
480	160	32	160	128	107	91	80	71	64	58	53	49	46	43	40	38	36
500	160	32	160	128	107	91	80	71	64	58	53	49	46	43	40	38	36

¹ "Guidelines for operationalization and its safe use of water source at community level for preventing Covid-19". DPHE, Unicef and WASH Cluster. April 2020.



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