Concise

CPWD MANUAL

ON

RAIN WATER HARVESTING

RAIN WATER HARVESTING

0.0 Introduction

Rainwater harvesting is a technique recognized to conserve naturally available pure water through rainfall. In view of scarcity of potable water largely seen in most of the Metropolitan towns and also in areas not frequented by adequate rainfall, a necessity has been felt by the Govt of India to conserve natural water resource by this technique. Accordingly Central Govt has issued modifications in Unified Building Byelaws 1983 vide notification issued vide no 11001 1/9/93-DDV (Pt) DDIB dated 28.7.2001 (Annexure) making Rainwater Harvesting mandatory for buildings on plot size of 100 sqm. and above.

1.0 Definition

Rainwater harvesting is a system to

- Recharge the acquifer by rainwater through an artificial system at a rate more than that obtained under conditions of natural replenishment and/or
- Collect and store rain water.

2.0 Artificial Recharge of the Aquifer

2.1 Techniques employed are:

2.1.1 Pits

Recharge pits are constructed for recharging the shallow aquifers. These are constructed 1 to 2 m. wide and 2 to 3 m. deep which are back filled with boulders, gravels and coarse sand.

2.1.2 Trenches

These are constructed when the permeable strata is available at shallow depths. Trench may be 0.5 to1 m. wide, 1 to 1.5 m. deep and 10 to 20 m. long depending on the availability of water and the permeability of soil strata. These are back filled with filter materials.

2.1.3 Dug Wells

Existing dug wells may be utilized as recharge structure and water should pass through filter media before putting into dug well.

2.1.4 Hand Pumps

The existing hand pumps may be used for recharging the shallow/deep aquifers, if the availability of water is limited. Water should pass through filter media before diverting it into hand pumps.

2.1.5 Recharge Wells

Recharge wells of 100 to 300 mm. diameter are generally constructed for recharging the deeper aquifers and water is passed through filter media to avoid choking of recharge wells.

2.1.6 Recharge Shafts

For recharging the shallow aquifers, which are located below clayey surface, recharge shafts of 0.5 to 3 m. diameter and 10 to 15 m. deep are constructed and back filed with boulders, gravels & coarse sand.

2.1.7 Lateral Shafts With Bore Wells

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For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m. wide & 10 to 30m. long depending upon availability of water with one or two bore wells are constructed. The lateral shafts are back filled with boulders, gravels & coarse sand.

2.1.8 Spreading
When permeable strata starts from top then this technique is used. Spread the water in streams/Nalas by making check dams, nala bunds, cement plugs, gabion structures or a percolation pond may be constructed.

3.0 Collect and Store Rain Water

Underground or Surface storage tank connected to the roof top or similar water collection system with piping and storage pit through graded filter and charcoal. The under ground or surface water storage tank, to store treated rainwater, could also be connected with the water supply and distribution system as an alternative source of supply.

4.0 Criteria Necessitating Rain Water Harvesting

4.1 Artificial Recharge of the Aquifer.
Under any one or more of the following conditions, rain water harvesting by artificial recharge can be resorted to:

4.1.1 Ground water table is continuously getting lowered in identical months of the year when compared with past.

4.1.2 The source of supply is ground water drawn from tube wells or dug wells.

4.1.3 Quality of ground water is poor and it needs to be improved by artificial recharge. This is also necessary where possibility of intrusion of saline water is there, as is the case in coastal regions.

4.1.4 Permeable acquifer is available at shallow to moderate depth.

4.1.5 Depth of ground water table from the natural ground level from structural considerations is more than
a. 3 metres in case of load bearing construction,
b. 5 metres in case of framed construction with single basement
c. 8 metres in case of framed constructions with double basement

4.1.6 Sufficient depth of ground water table (more than 8 metres) for sub surface storage is available.

4.1.7 Where rate of evaporation is very high as is the case in dry and arid areas.

4.1.8 Adequate space for surface storage is not available, which is more common in urban areas.

4.2 Collect and store rain water:
Under the following circumstances, the rainwater could be collected and stored for future use.

4.2.1 Depth of ground water table is very deep.

4.2.2 Quality of ground water is very poor and unfit for human consumption. Simultaneously, it is also assessed that recharge to the ground water reservoir is not likely to improve its quality due to the nature of sub soil strata.

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4.2.3 Annual rainfall is far lower than the requirement of water for human consumption.

4.2.4 Enough roof top area or clean water collection system is available.

4.2.5 Sufficient rainwater storage capacity that could be provided either in the form of impervious surface or underground tank or ground surface storage system in the form of impervious check-dams, ponds, etc.

5.0 Data for Design of Artificial Recharge of the Aquifer

Following data is generally essentially required for design of system of artificial recharge of the aquifer.

i. Average annual rainfall
ii. Average monsoon rainfall
iii. Period of monsoon.
iv. Maximum hourly rate of rainfall
v. Bore log of sub soil with soil properties at least up to the lowest ground water table.
vi. The depth of ground water level during the leanest season.
vii. Possible recharge structure types, as stated in para 3.0 above, that could be provided.
viii. Contoured lay out plan of the area.
ix. Chemical analysis of available ground water during leanest season.

6.0 Design of Artificial Recharge of the Acquifer

The rain water harvesting system by artificial recharge of the aquifer shall be designed based on design data given in para 5.0 above and other considerations discussed herein above. The design shall be carried out considering that the system shall recharge the ground water without further contamination due to impurities and dissolved chemicals, if any, due to sources other than from rain.

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CHAPTER – 5

RE-CHARGE STRUCTURE AND ITS DESIGN

5.1 Re-charge structures :

The basic purpose of artificial recharge of Ground Water is to restore supplies from aquifers depleted due to excessive Ground Water development and usage.

Detailed knowledge of geological and hydrological features of the area is necessary for adequately selecting the site and type of recharge structures. In particular, the features parameters and data to be considered are: geological boundaries, hydrological boundaries, inflow and outflow of water, storage capacity, porosity, hydraulic conductivity, transmissivity, natural discharge of springs, water resources available for recharge, natural recharge, water balance, lithology, depth of aquifer, tectonic boundaries. The aquifer best suited for artificial recharge are those aquifers which absorb large quantity of water and do not release the same to quickly.

5.2 The various type of recharge structures are :

(i) Recharge Through Abandoned Dug Well

(ii) Recharge Through Hand Pump

(iii) Recharge pit

(iv) Recharge Through Trench

(v) Gravity Head Recharge Tube Well

(vi) Recharge Shaft

5.3 DESIGN GUIDELINES:

In general the recharge structures are designed with total volume as twice the peak discharge as detailed below:

5.3.1 ABANDONED DUG WELL (Ref Drawing No9 & 10)

(i) A dry/unused dug well can be used as a recharge structure

(ii) The recharge water is guided through a pipe to the bottom of well or below the water level to avoid scouring of bottom and entrapment of air bubbles in the aquifer.

(iii) Before using the dug well as recharge structure, its bottom should be cleaned and all the fine deposits should be removed

(iv) Recharge water should be silt free as far as possible.

(v) It should be cleaned annually preferably.

(x) Cost Rs.2500/- to Rs.5000/- as per prevailing rates in the year 2000 in Delhi.

5.3.4 RECHARGE TRENCH (Ref Drawing NO.13& 14)

(i) It is constructed when permeable strata of adequate thickness is available at shallow depth

(ii) It is a trench of shallow depth filled with pebbles and boulders

(iii) These are constructed across the land slope

(iv) The trench may be 0.5 to 1 m wide 1 to 1.5

m deep and 10 to 20 m long depending upon the availability of land and roof top area

(v) It is suitable for the buildings having the roof area of 200 to 300 Sqm

(vi) Cleaning of trench should be done periodically.

(vii) Cost Rs.5000 – 10,000/- as per prevailing rates in the year 2000 in Delhi.

5.3.5 GRAVITY HEAD RECHARGE WELL (Ref Drawing No15 TO 19)

(i) Bore wells/tube wells can be used as recharge structure

(ii) This technique is suitable where

(a) Land availability is limited

(b) When aquifer is deep and over laid by impermeable strata (clay)

(iii) The roof top Rain Water is channelised to the well and

recharges under gravity flow condition

(iv) Recharge water should be silt free as far as possible.

(v) The well can also be used for pumping

(vi) Most suitable for the areas where Ground Water levels are deep

(vii) The number of recharging structures can be determined in limited area around the buildings depending upon roof top area and aquifer characteristics.

(viii) The run off of 1st rain should not be allowed to go percolate to the rain water harvesting structure and allowed it to go to the drain by making suitable by-pass arrangement in water carrying pipe systems.

(ix) Cost Rs.50,000/- to Rs.80,000/- as per prevailing rates in the year 2000 in Delhi.

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TABLE NO. 5

Roof Area Sqm	Total Rainfall Volume for considering Delhi.	Vol. Available for recharge 80% Cum	Type of Structure recommended for recharge	
			Alluvial Area	Hard Rock Area
50	30	24	Recharge pit/hand pump	Recharge pit/hand pump
100	60	48	"	"
150	90	72	"	"
200	120	96	Trench	Trench/hand pump
300	180	144	"	"
400	240	192	Gravity head recharge well	Gravity head recharge well
500	300	240	"	"
600	360	288	"	"
800	480	384	"	"
1000	600	480	"	"
1500	900	720	"	Recharge shaft/dug well
2000	1200	960	"	"
2500	1500	1200	Recharge shaft/ dug well	"
3000	1800	1440	"	"
4000	2400	1920	"	"
5000	3000	2400	"	"

(Source : Central Ground Water Board)

(ii) With reference to the local conditions of the area, further identify the most appropriate techniques of artificial recharge suitable at various sites/ locations on the basis of total available volume of rainwater which can be harvested and the location of available aquifer. whether it is at shallow depths i.e. 6 to 8 meters from ground level or at sufficient depths i.e. more than 8 meters from ground level.

(iii) Determine the number of each type of artificial recharge structure needed to achieve the quantitative targets. The recharge structure should be designed with volume of water it may store for equivalent of 24hours rainfall and surface area of run-off for which the recharge structure has been considered, without giving any allowance for percolation during this period of 24 hours.

(iv) For individual structure at different locations ,finalise the design specifications from the details given in case studies. If required ,the necessary advice from local Geological Department or Central Ground Water Board may be obtained.

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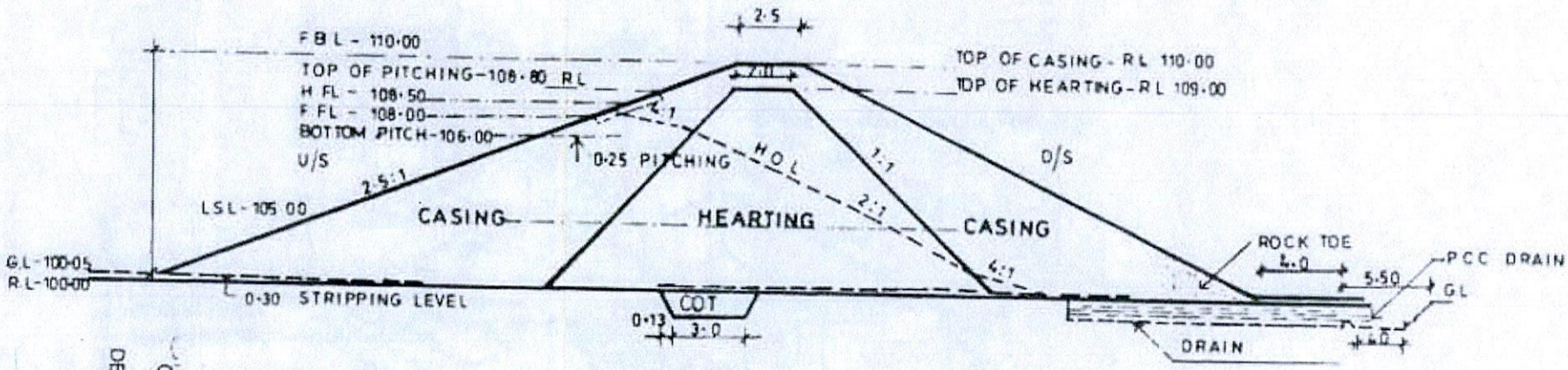
(vii) Where the evaporation rate is very high from surface water bodies.

5.6.10 The decision whether to store or recharge rain water depends on the rain fall pattern of a particular region.

(i) If the rain fall period between two spells of the rain is short i.e. two to tour months, in such situation a small domestic size water tank for. storing rain water for drinking and cooking purpose can be used.

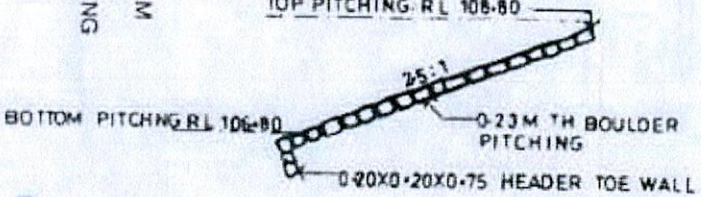
(ii) In other regions where total annual rain fall occurs only during 3 to 4 months of monsoon and the period between two such spells is very large i.e. 7 to 8 months, so it is feasible to use rain water to percolate to the ground water aquifers rather than for storage which means that huge volumes of storage container are required.

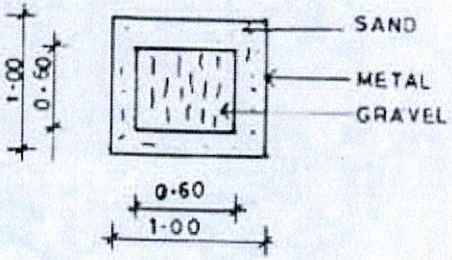


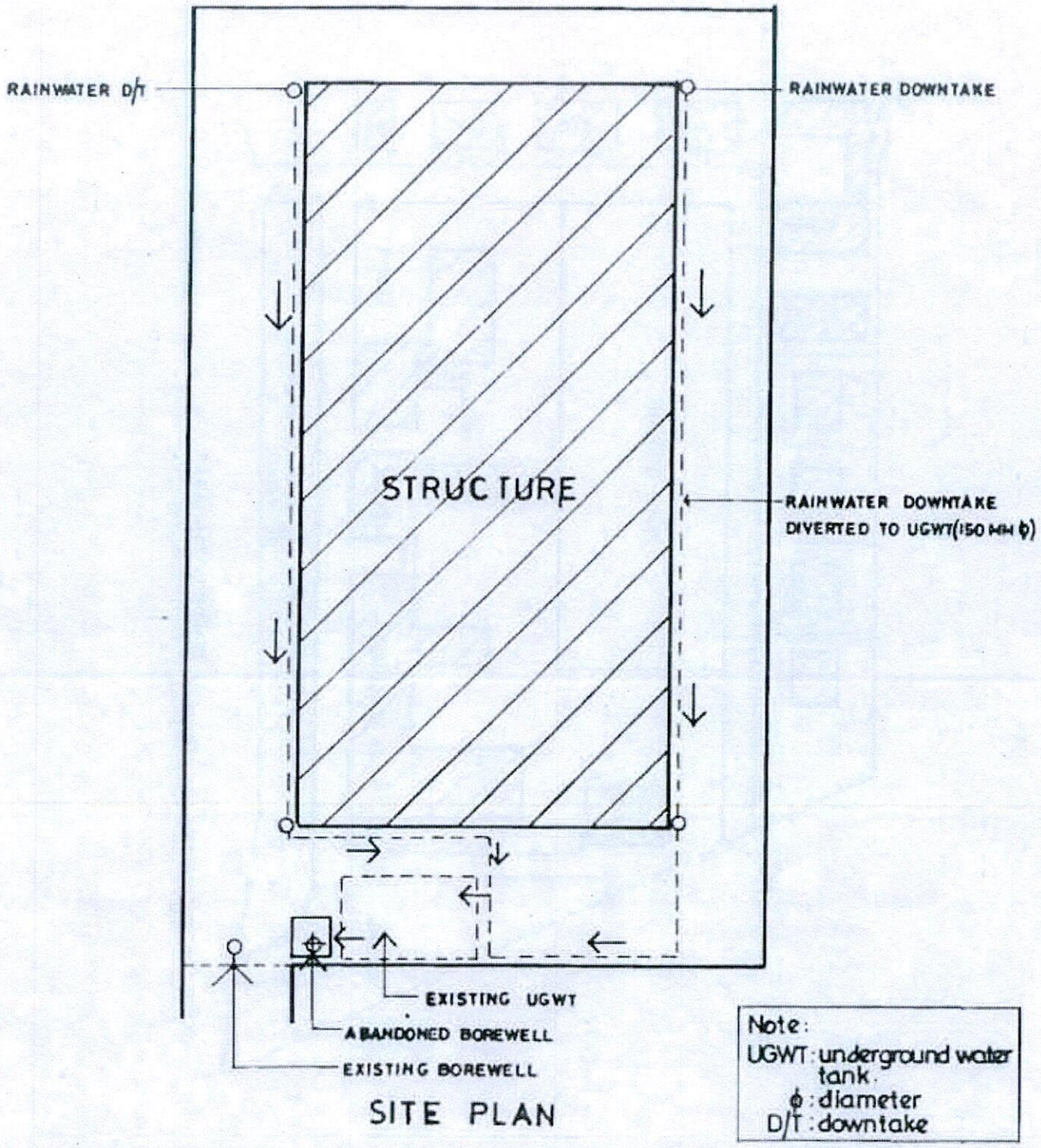
CROSS SECTION OF DAM

DETAIL OF STONE PITCHING

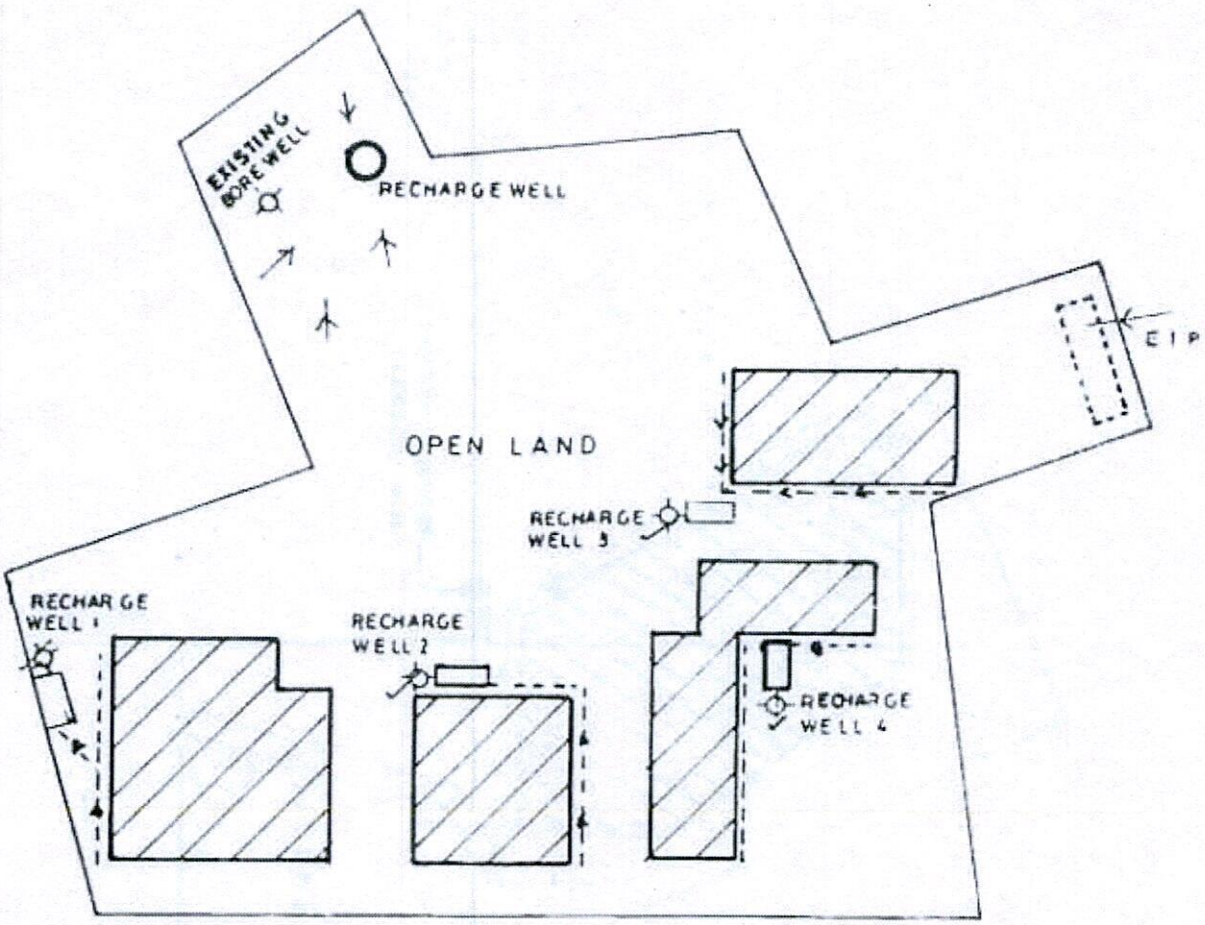
Drg-02: Percolation tank





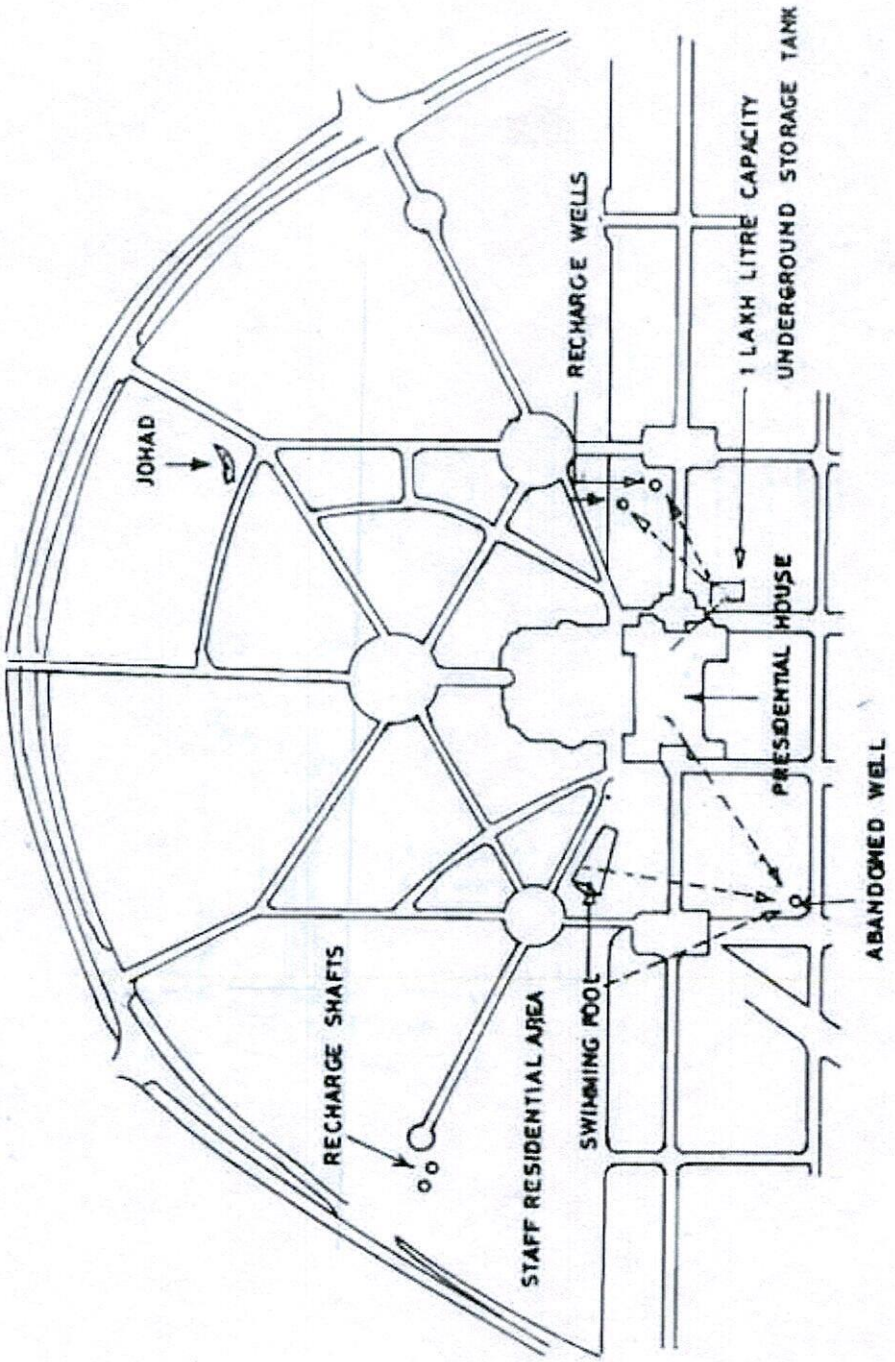


Drg-04: Scheme for water harvesting



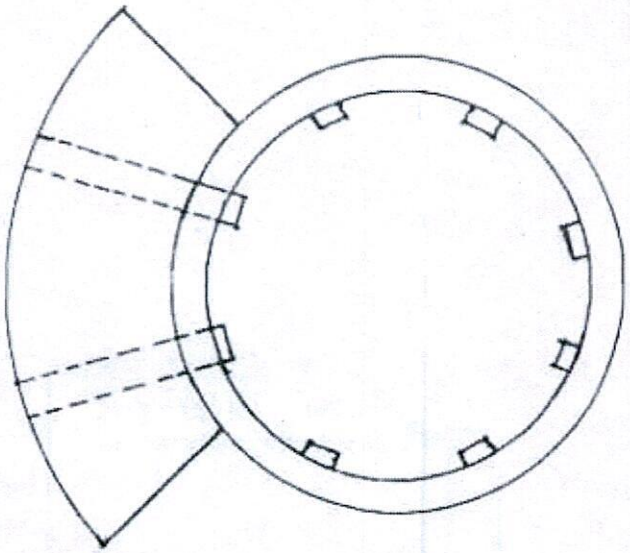
SITE PLAN

Drg-06: Scheme for water harvesting

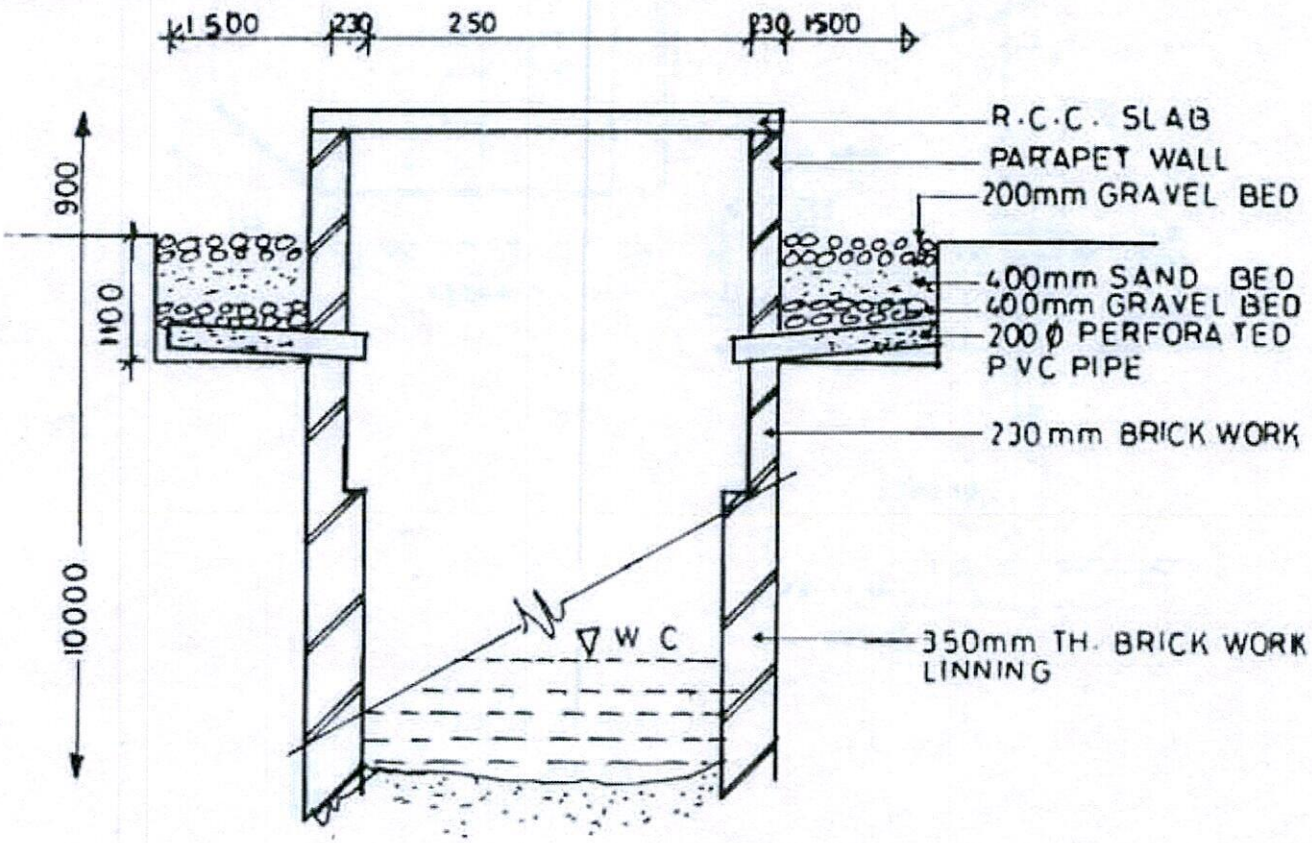


SITE PLAN

Drg-08: Scheme for water harvesting

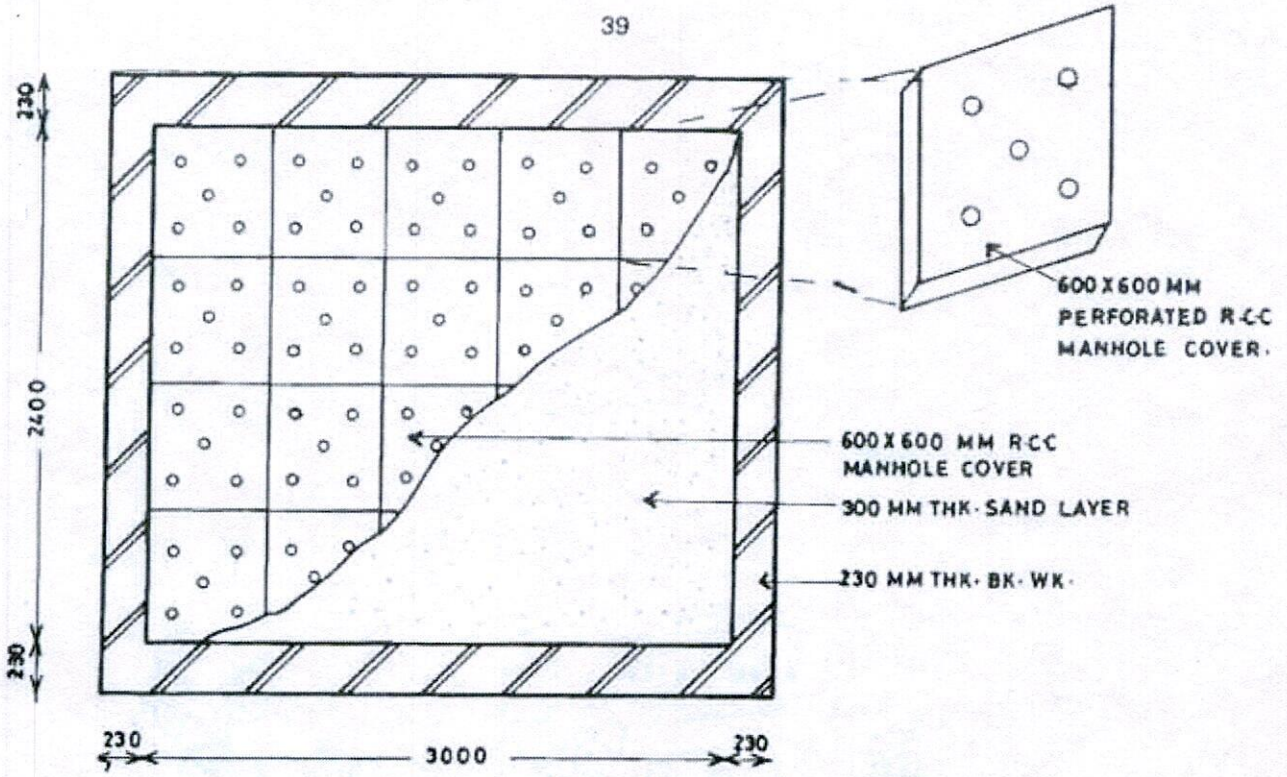


PLAN

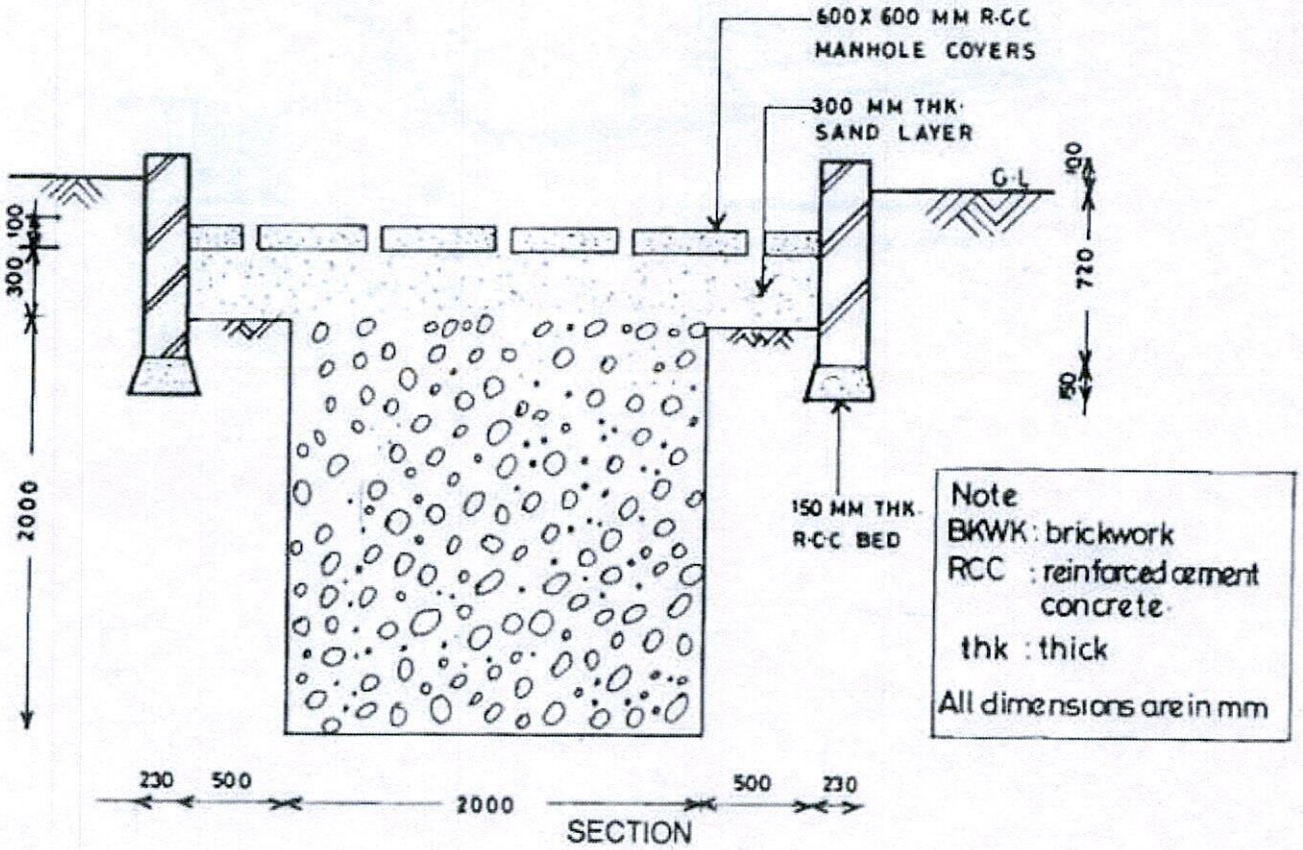


SECTION

Drg-10: Details of recharge dugwell

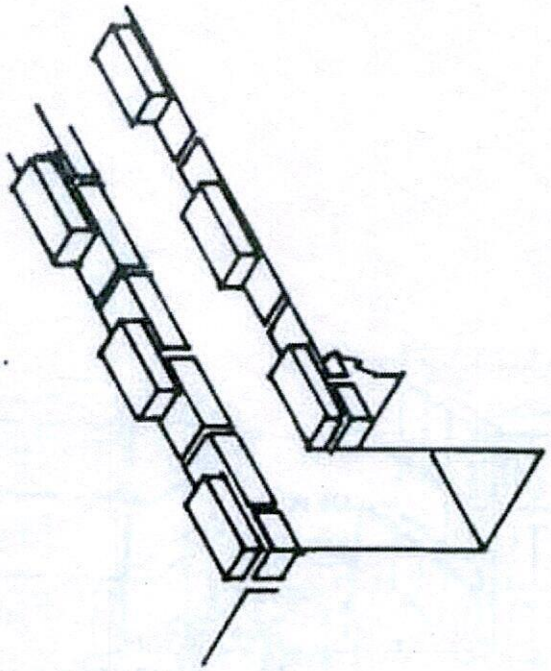


PLAN

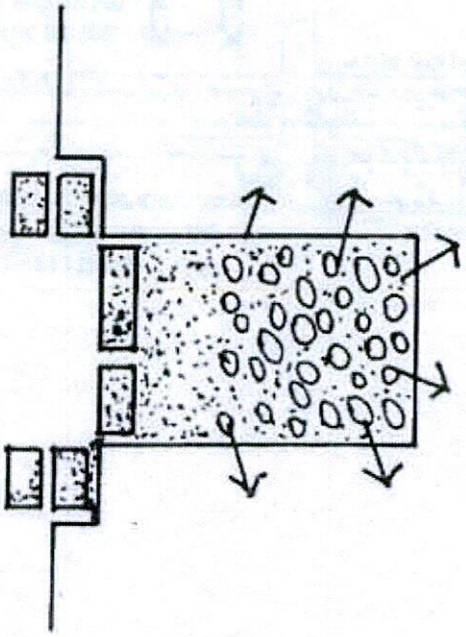


SECTION

Drg-12: Details of recharge pit

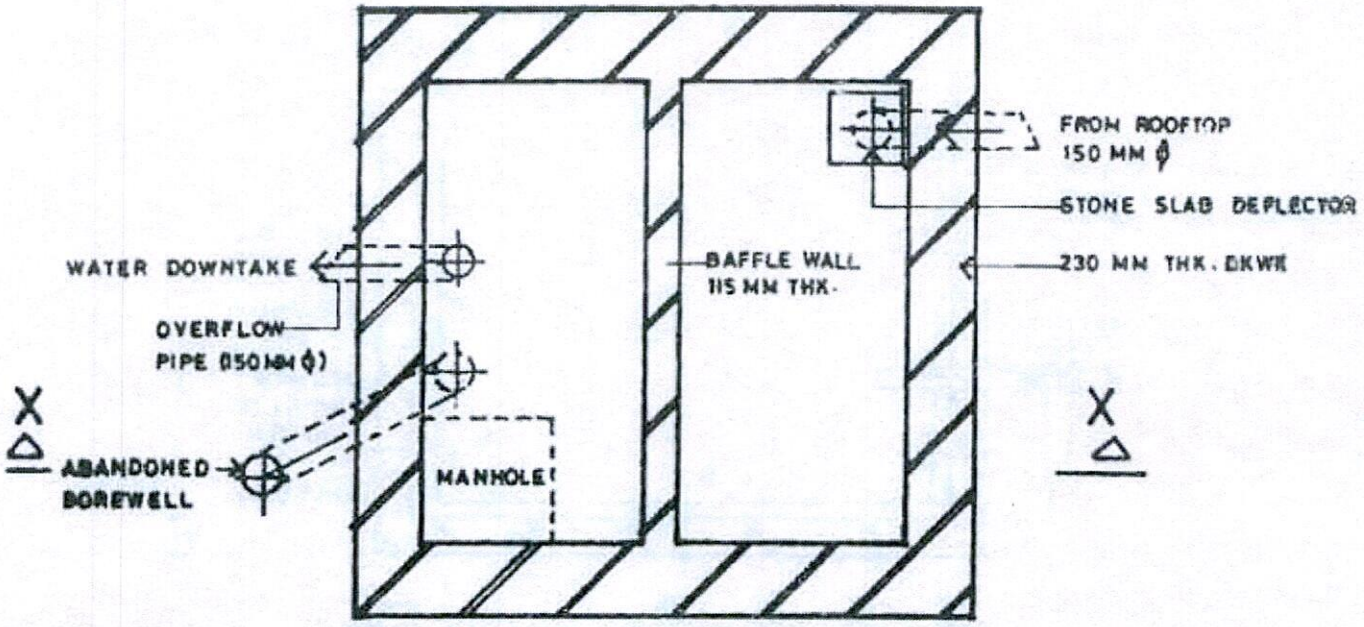


SECTIONAL VIEW



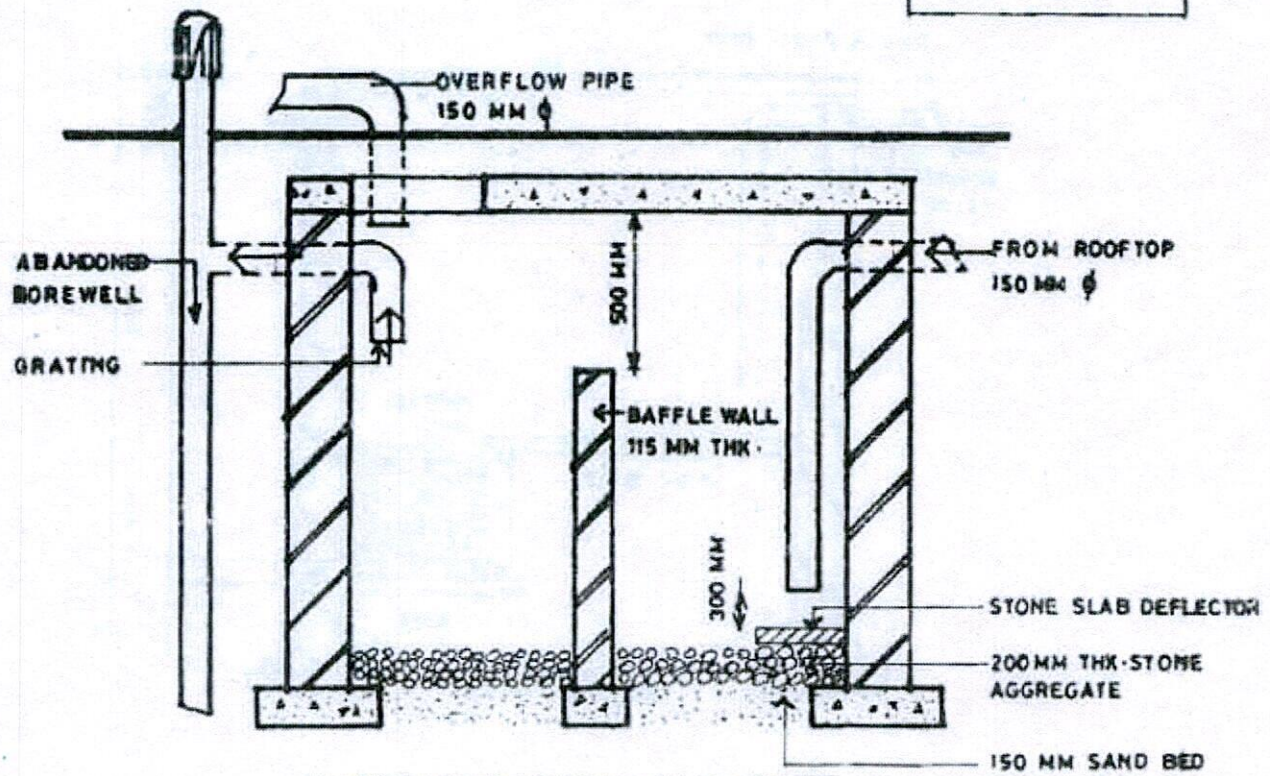
SECTION

Drg-14: Details of recharge trench



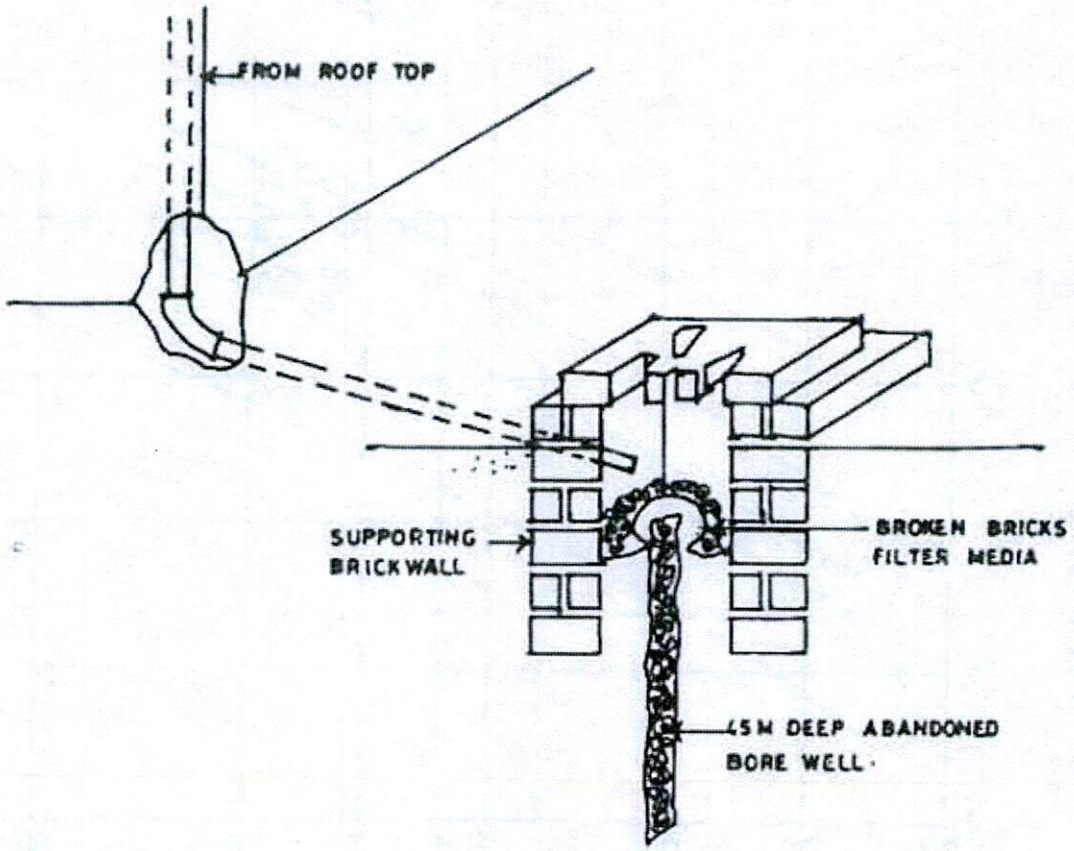
PLAN

Note:
BKWK: brickwork
ϕ : diameter
thk : thick

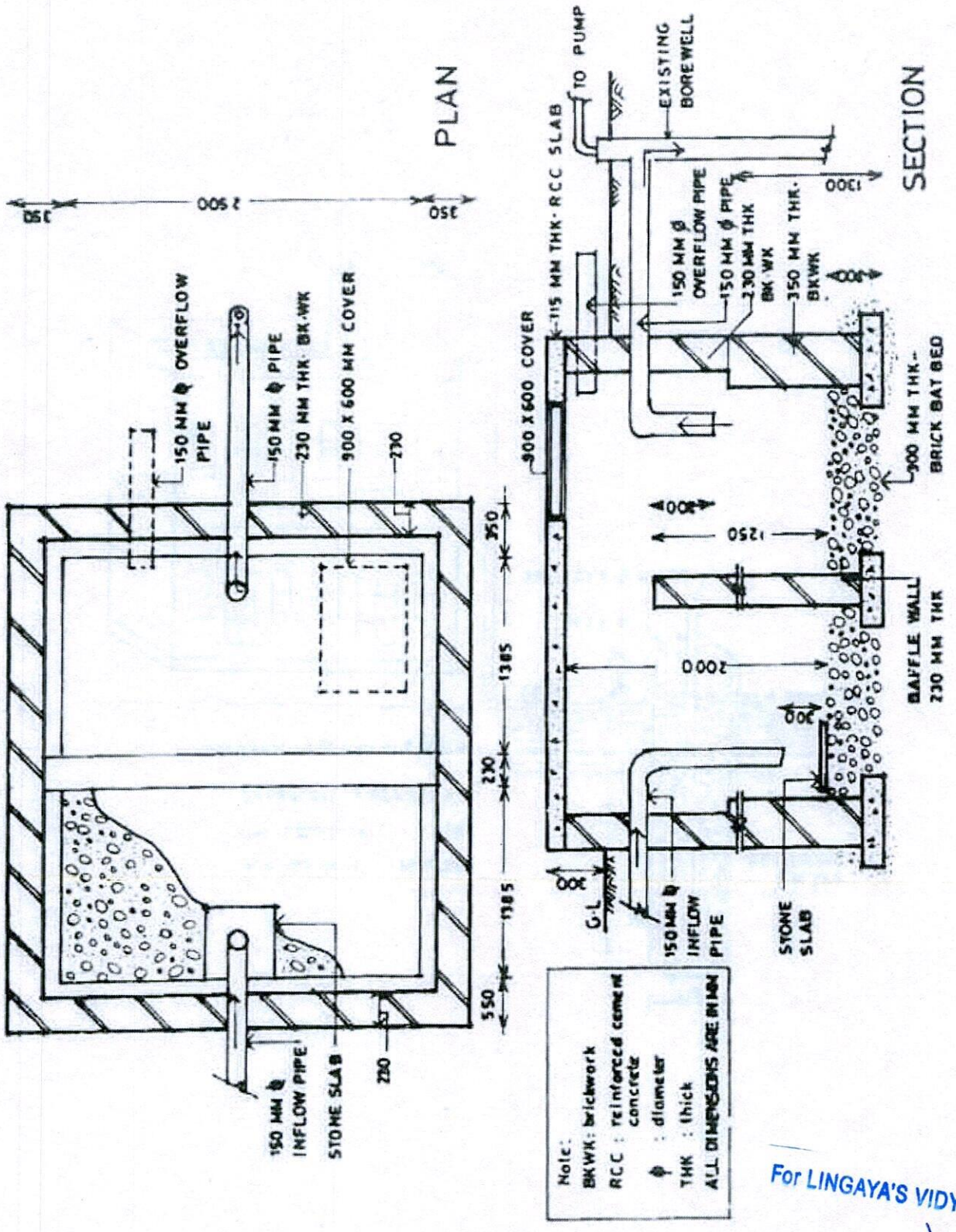


Drg-16: Details of recharge borewell and settlement tank

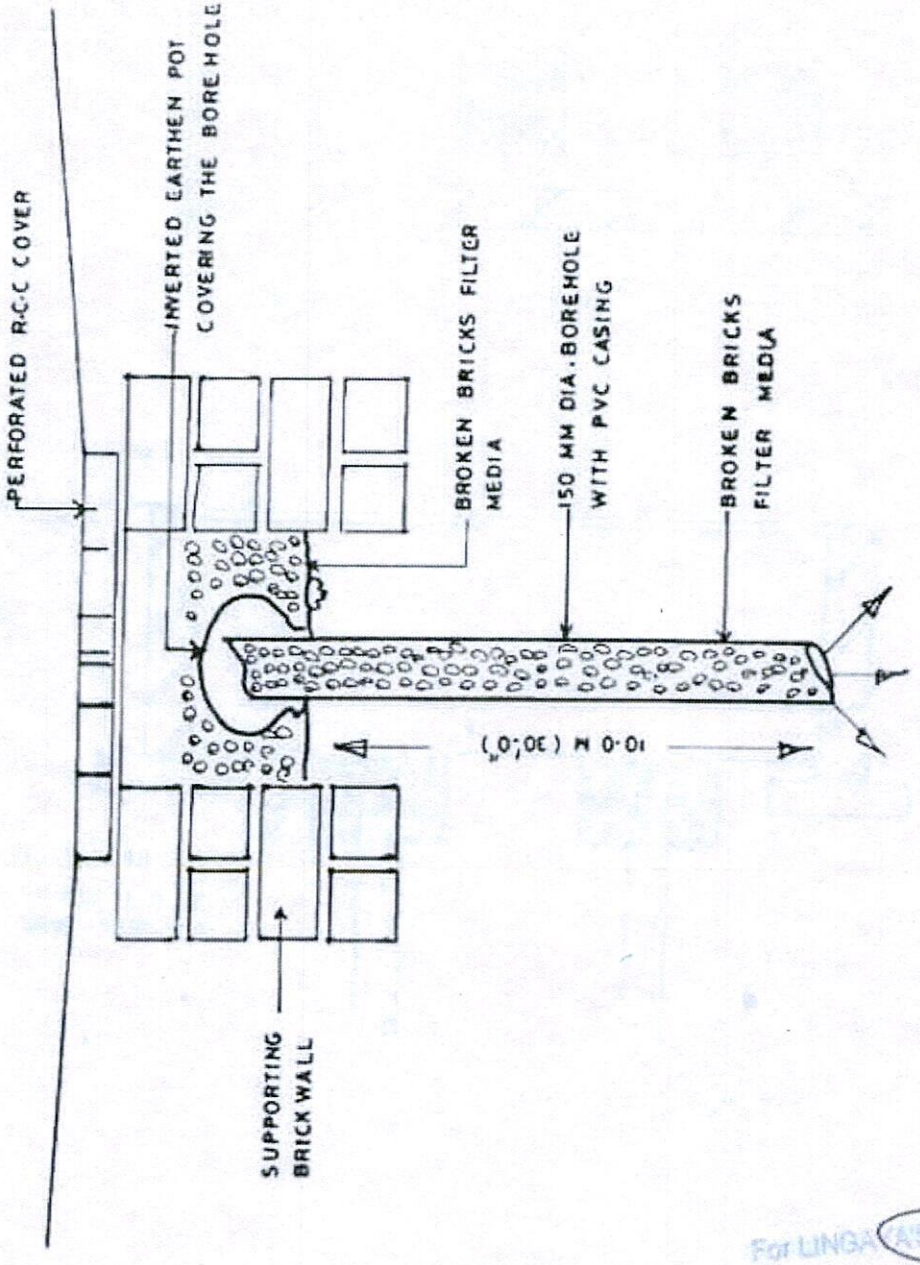
SECTION(XX)



Drg-18: Detail of abandoned boerwell recharging



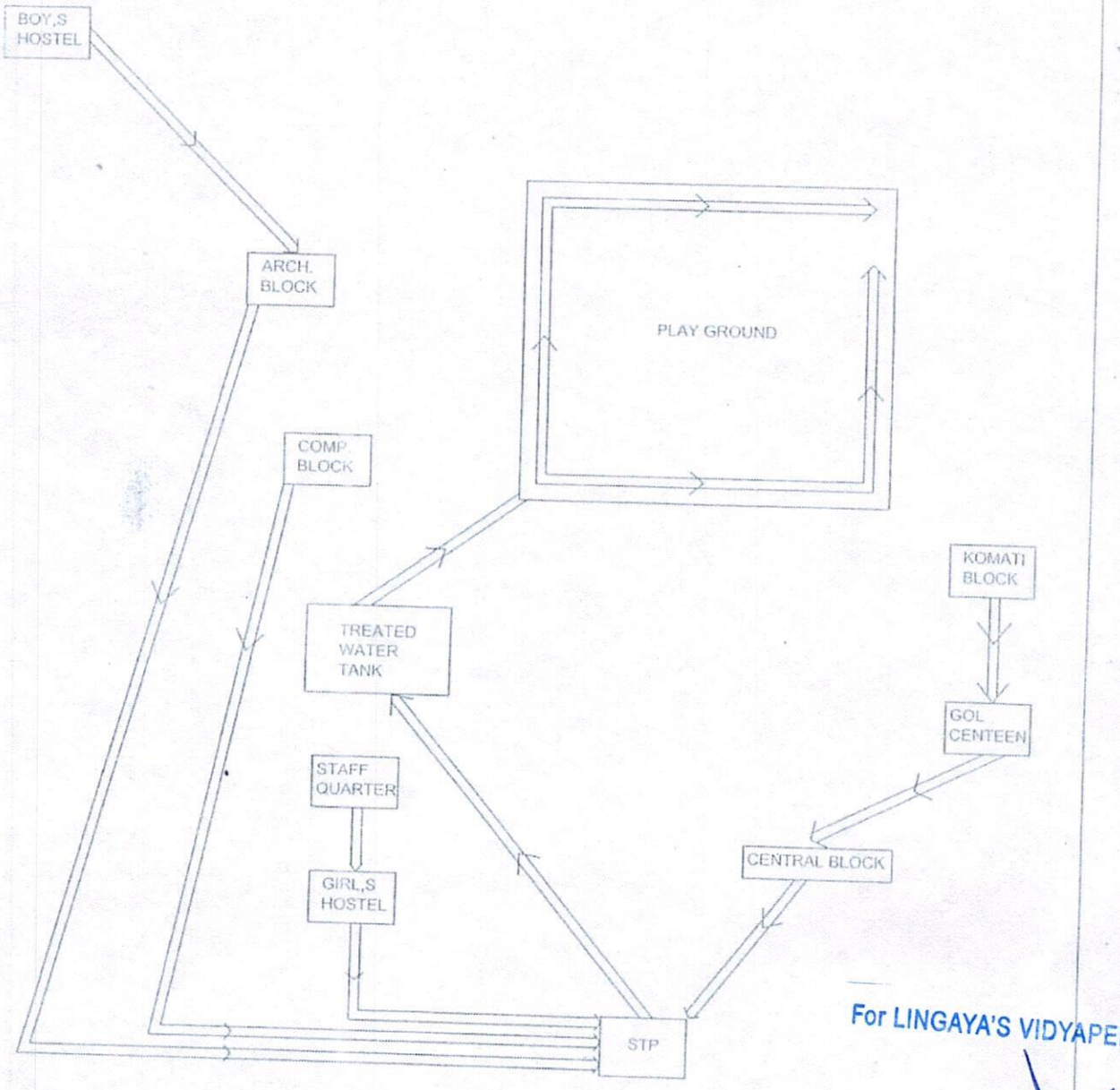
Drg-19: Details of recharge borewell & settlement tank



Drg-21: Detail of soakway

LINGAYA,S VIDYAPEETH (FARIDABAD)

RECYCLED WATER DISTRIBUTION NETWORK



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For LINGAYA'S VIDYAPEETH

For, Lingaya's Vidyapeeth, Faridabad

Authorized Signatory

Mr. Sandeep Kaul

Waste water collection tanks (concrete structure)

1	Boy's Hostel	Length=10ft. , Width=10ft. , Depth=20ft.	No.	1
2		Length=15ft. , Width=15ft. , Depth=4ft.	No.	1
3	Gol Canteen	Length=5ft. , Width=6ft. , Depth=10ft.	No.	1
4	Central Block-quard	Length=6ft. , Width=6ft. , Depth=10ft.	No.	1
5		Length=8ft. , Width=8ft. , Depth=4ft.	No.	1
6	Arch. Block- quard	Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
7	Comp. Block- quard	Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
8		Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
9	Girl's Hostel	Length=10ft. , Width=7ft. , Depth=5ft.	No.	1
10	Near bus parking	Length=16ft. , Width=10ft. , Depth=8ft.	No.	1
	S.T.P			
1	Collection tank at plant	Length=23ft. , Width=17ft. , Depth=25ft.	No.	1
2	Erection tank at plant	Length=13ft. , Width=8ft. , Depth=10ft.	No.	1
3	Buffer tank at plant	Length=7ft. , Width=5ft. , Depth=8ft.	No.	1
4	Holding tank at plant	Length=9ft. , Width=8.5ft. , Depth=5ft.	No.	1
5			No.	1
6	Treated tank near staff quarter	Length=17ft. , Width=17ft. , Depth=11ft.	No.	1
7	Treated tank near central block	Length=20ft. , Width=15ft. , Depth=4ft.	No.	1

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Details of water tanks

S.No.	Location	Item Name	Unit	Quantity
1	Central Block- Roof	Washroom water tank 2000 ltr.	Nos.	2
2		Washroom water tank 1000 ltr.	Nos.	3
3		R.O raw water tank 2000 ltr.	No.	1
4		R.O pure water tank 1000 ltr.	No.	1
5	Arch. Building- Roof	Washroom water tank 2000 ltr.	Nos.	3
6		Market water tank 1000 ltr.	No.	1
7		R.O raw water tank 2000 ltr.	No.	1
8		R.O pure water tank 1000 ltr.	No.	1
9	Komati Building- Roof	Washroom water tank 2000 ltr.	Nos.	2
10		R.O raw water tank 2000 ltr.	No.	1
11		R.O pure water tank 500 ltr.	No.	1
12	Comp. Building- Roof	Washroom water tank 2000 ltr.	Nos.	4
13		R.O raw water tank 2000 ltr.	No.	1
14		R.O pure water tank 1000 ltr.	No.	1
15		R.O pure water tank 2000 ltr.	No.	1
16	Staff Quarter- Roof	Washroom water tank 2000 ltr.	Nos.	2
17	Boy's Hostel- Roof	Washroom water tank 5000 ltr.	Nos.	2
18		Washroom water tank 2000 ltr.	No.	1
19		R.O raw water tank 2000 ltr.	No.	1
20		R.O raw water tank 1000 ltr.	No.	1
21		R.O pure water tank 500 ltr.	No.	1
22	Girls's Hostel- Roof	Washroom water tank 5000 ltr.	Nos.	4
23		Washroom water tank 2000 ltr.	No.	1
24		R.O raw water tank 2000 ltr.	No.	1
25		R.O pure water tank 1000 ltr.	No.	1
26	Bus Parking	Water tank 1000 ltr.	No.	1

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c. 8 metres in case of framed constructions with double basement

4.1.6 Sufficient depth of ground water table (more than 8 metres) for sub surface storage is available.

4.1.7 Where rate of evaporation is very high as is the case in dry and arid areas.

4.1.8 Adequate space for surface storage is not available, which is more common in urban areas.

4.2 Collect and store rain water:

Under the following circumstances, the rainwater could be collected and stored for future use.

4.2.1 Depth of ground water table is very deep.

4.2.2 Quality of ground water is very poor and unfit for human consumption. Simultaneously, it is also assessed that recharge to the ground water reservoir is not likely to improve its quality due to the nature of sub soil strata.

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18 APR 2024

4.2.3 Annual rainfall is far lower than the requirement of water for human consumption.

4.2.4 Enough roof top area or clean water collection system is available.

4.2.5 Sufficient rainwater storage capacity that could be provided either in the form of impervious surface or underground tank or ground surface storage system in the form of impervious check-dams, ponds, etc

5.0 Data for Design of Artificial Recharge of the Aquifer

Following data is generally essentially required for design of system of artificial recharge of the aquifer.

i. Average annual rainfall
ii. Average monsoon rainfall.
iii. Period of monsoon.
iv. Maximum hourly rate of rainfall
v. Bore log of sub soil with soil properties at least up to the lowest ground water table.
vi. The depth of ground water level during the leanest season.
vii. Possible recharge structure types, as stated in para 3.0 above, that could be provided.
viii. Contoured lay out plan of the area.
ix. Chemical analysis of available ground water during leanest season.

6.0 Design of Artificial Recharge of the Acquifer

The rain water harvesting system by artificial recharge of the aquifer shall be designed based on design data given in para 5.0 above and other considerations discussed herein above. The design shall be carried out considering that the system shall recharge the ground water without further contamination due to impurities and dissolved chemicals, if any, due to sources other than from rain.

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18 APR 2024

CHAPTER – 5

RE-CHARGE STRUCTURE AND ITS DESIGN

5.1 Re-charge structures :

The basic purpose of artificial recharge of Ground Water is to restore supplies from aquifers depleted due to excessive Ground Water development and usage.

Detailed knowledge of geological and hydrological features of the area is necessary for adequately selecting the site and type of recharge structures. In particular, the features parameters and data to be considered are: geological boundaries, hydrological boundaries, inflow and outflow of water, storage capacity, porosity, hydraulic conductivity, transmissivity, natural discharge of springs, water resources available for recharge, natural recharge, water balance, lithology, depth of aquifer, tectonic boundaries. The aquifer best suited for artificial recharge are those aquifers which absorb large quantity of water and do not release the same to quickly.

5.2 The various type of recharge structures are :

(i) Recharge Through Abandoned Dug Well

(ii) Recharge Through Hand Pump

(iii) Recharge pit

(iv) Recharge Through Trench

(v) Gravity Head Recharge Tube Well

(vi) Recharge Shaft

5.3 DESIGN GUIDELINES:

In general the recharge structures are designed with total volume as twice the peak discharge as detailed below:

5.3.1 ABANDONED DUG WELL (Ref Drawing No9 & 10)

(i) A dry/unused dug well can be used as a recharge structure

(ii) The recharge water is guided through a pipe to the bottom of well or below the water level to avoid scouring of bottom and entrapment of air bubbles in the aquifer.

(iii) Before using the dug well as recharge structure, its bottom should be cleaned and all the fine deposits should be removed

(iv) Recharge water should be silt free as far as possible.

(v) It should be cleaned annually preferably.

(x) Cost Rs.2500/- to Rs.5000/- as per prevailing rates in the year 2000 in Delhi.

5.3.4 RECHARGE TRENCH (Ref Drawing NO.13& 14)

(i) It is constructed when permeable strata of adequate thickness is available at shallow depth

(ii) It is a trench of shallow depth filled with pebbles and boulders

(iii) These are constructed across the land slope

(iv) The trench may be 0.5 to 1 m wide 1 to 1.5

m deep and 10 to 20 m long depending upon the availability of land and roof top area

(v) It is suitable for the buildings having the roof area of 200 to 300 Sqm

(vi) Cleaning of trench should be done periodically.

(vii) Cost Rs.5000 – 10,000/- as per prevailing rates in the year 2000 in Delhi.

5.3.5 GRAVITY HEAD RECHARGE WELL (Ref Drawing No15 TO 19)

(i) Bore wells/tube wells can be used as recharge structure

(ii) This technique is suitable where

(a) Land availability is limited

(b) When aquifer is deep and over laid by impermeable strata (clay)

(iii) The roof top Rain Water is channelised to the well and

recharges under gravity flow condition

(iv) Recharge water should be silt free as far as possible.

(v) The well can also be used for pumping

(vi) Most suitable for the areas where Ground Water levels are deep

(vii) The number of recharging structures can be determined in limited area around the buildings depending upon roof top area and aquifer characteristics.

(viii) The run off of 1st rain should not be allowed to go percolate to the rain water harvesting structure and allowed it to go to the drain by making suitable by-pass arrangement in water carrying pipe systems.

(ix) Cost Rs.50,000/- to Rs.80,000/- as per prevailing rates in the year 2000 in Delhi.

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18 APR 2024

TABLE NO. 5

Roof Area Sqm	Total Rainfall Volume for considering Delhi.	Vol. Available for recharge 80% Cum	Type of Structure recommended for recharge	
			Alluvial Area	Hard Rock Area
50	30	24	Recharge pit/hand pump	Recharge pit/hand pump
100	60	48	"	"
150	90	72	"	"
200	120	96	Trench	Trench/hand pump
300	180	144	"	"
400	240	192	Gravity head recharge well	Gravity head recharge well
500	300	240	"	"
600	360	288	"	"
800	480	384	"	"
1000	600	480	"	"
1500	900	720	"	Recharge shaft/dug well
2000	1200	960	"	"
2500	1500	1200	Recharge shaft/ dug well	"
3000	1800	1440	"	"
4000	2400	1920	"	"
5000	3000	2400	"	"

(Source : Central Ground Water Board)

(ii) With reference to the local conditions of the area, further identify the most appropriate techniques of artificial recharge suitable at various sites/ locations on the basis of total available volume of rainwater which can be harvested and the location of available aquifer. whether it is at shallow depths i.e. 6 to 8 meters from ground level or at sufficient depths i.e. more than 8 meters from ground level.

(iii) Determine the number of each type of artificial recharge structure needed to achieve the quantitative targets. The recharge structure should be designed with volume of water it may store for equivalent of 24hours rainfall and surface area of run-off for which the recharge structure has been considered, without giving any allowance for percolation during this period of 24 hours.

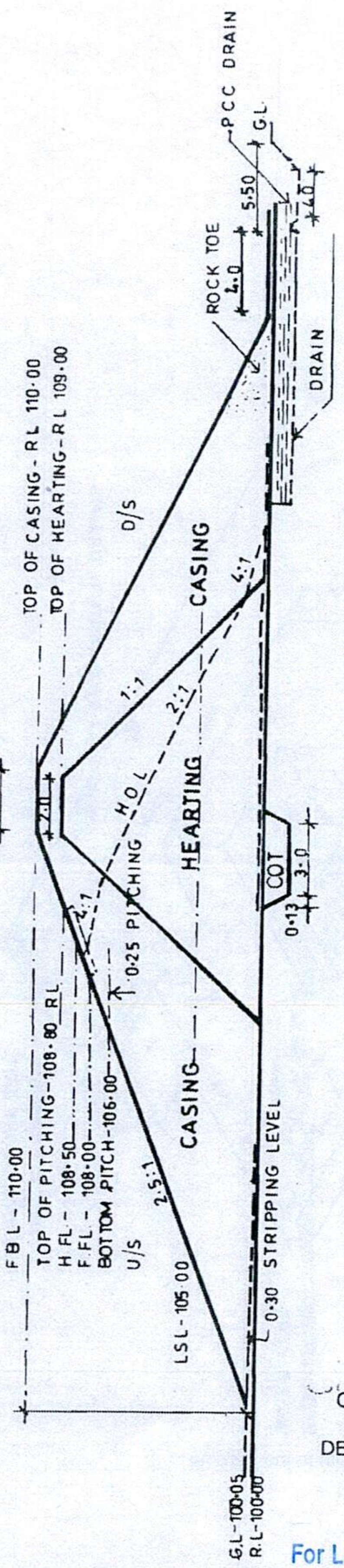
(iv) For individual structure at different locations ,finalise the design specifications from the details given in case studies. If required ,the necessary advice from local Geological Department or Central Ground Water Board may be obtained.

(vii) Where the evaporation rate is very high from surface water bodies.

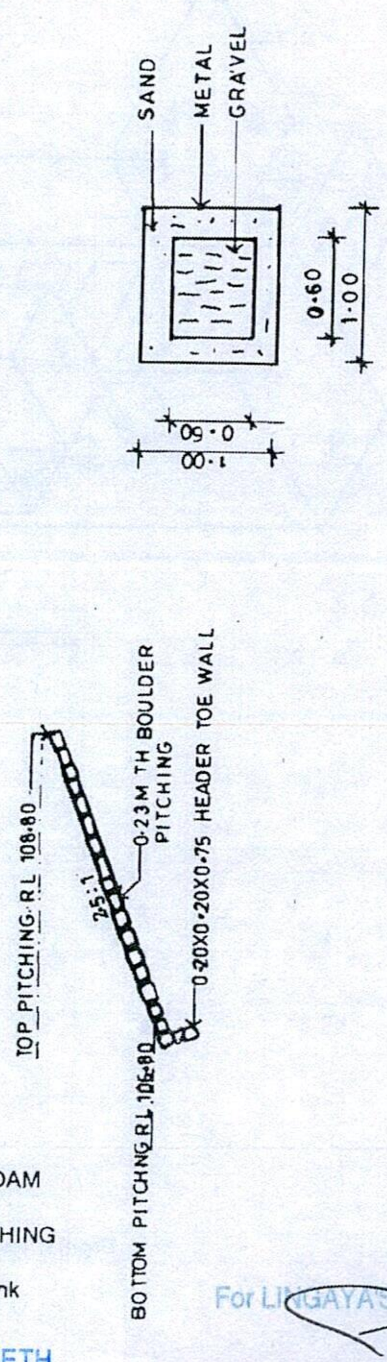
5.6.10 The decision whether to store or recharge rain water depends on the rain fall pattern of a particular region.

(i) If the rain fall period between two spells of the rain is short i.e. two to tour months, in such situation a small domestic size water tank for. storing rain water for drinking and cooking purpose can be used.

(ii) In other regions where total annual rain fall occurs only during 3 to 4 months of monsoon and the period between two such spells is very large i.e. 7 to 8 months, so it is feasible to use rain water to percolate to the ground water aquifers rather than for storage which means that huge volumes of storage container are required.



CROSS SECTION OF DAM



DETAIL OF STONE PITCHING

Drg-02: Percolation tank

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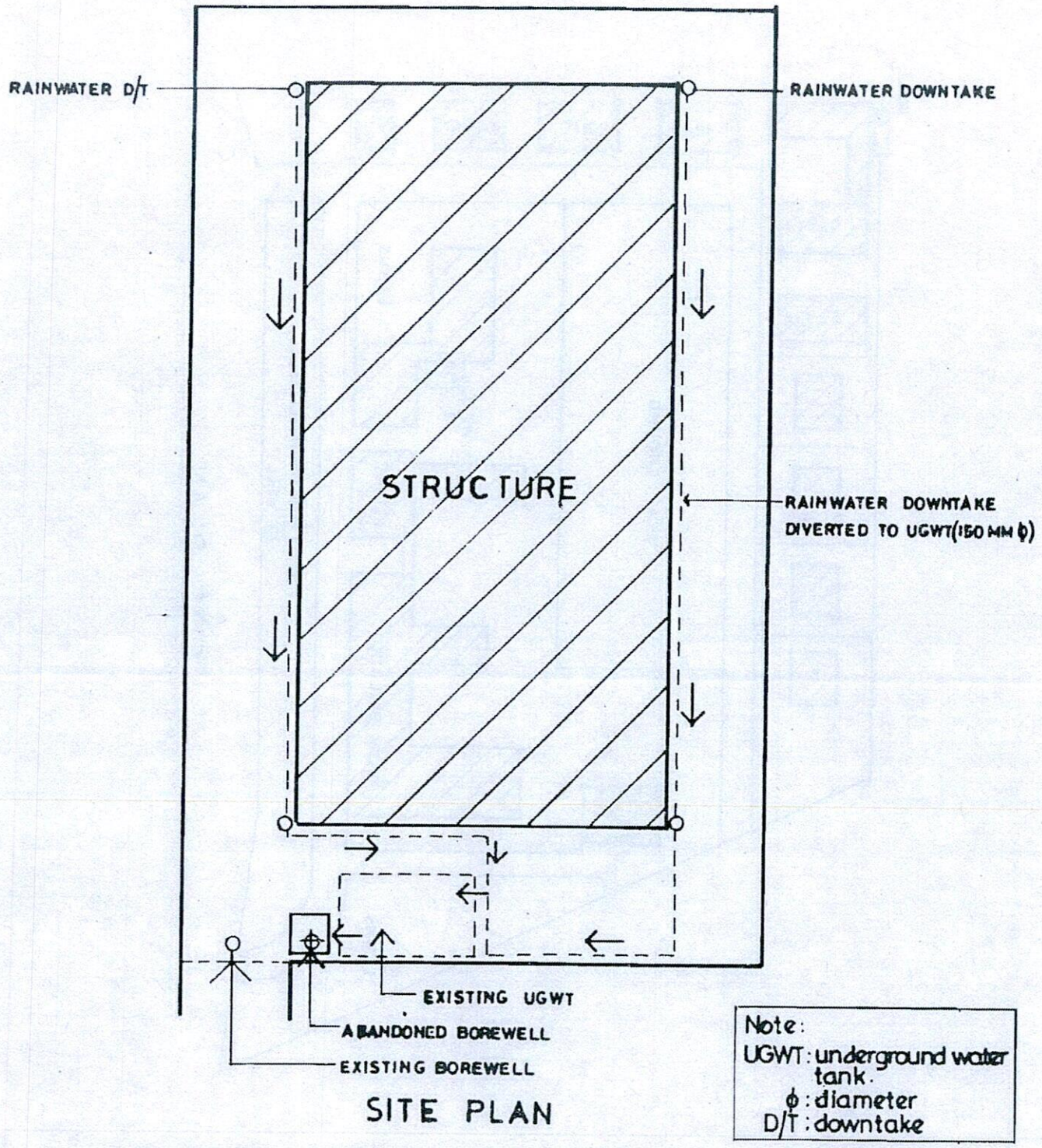
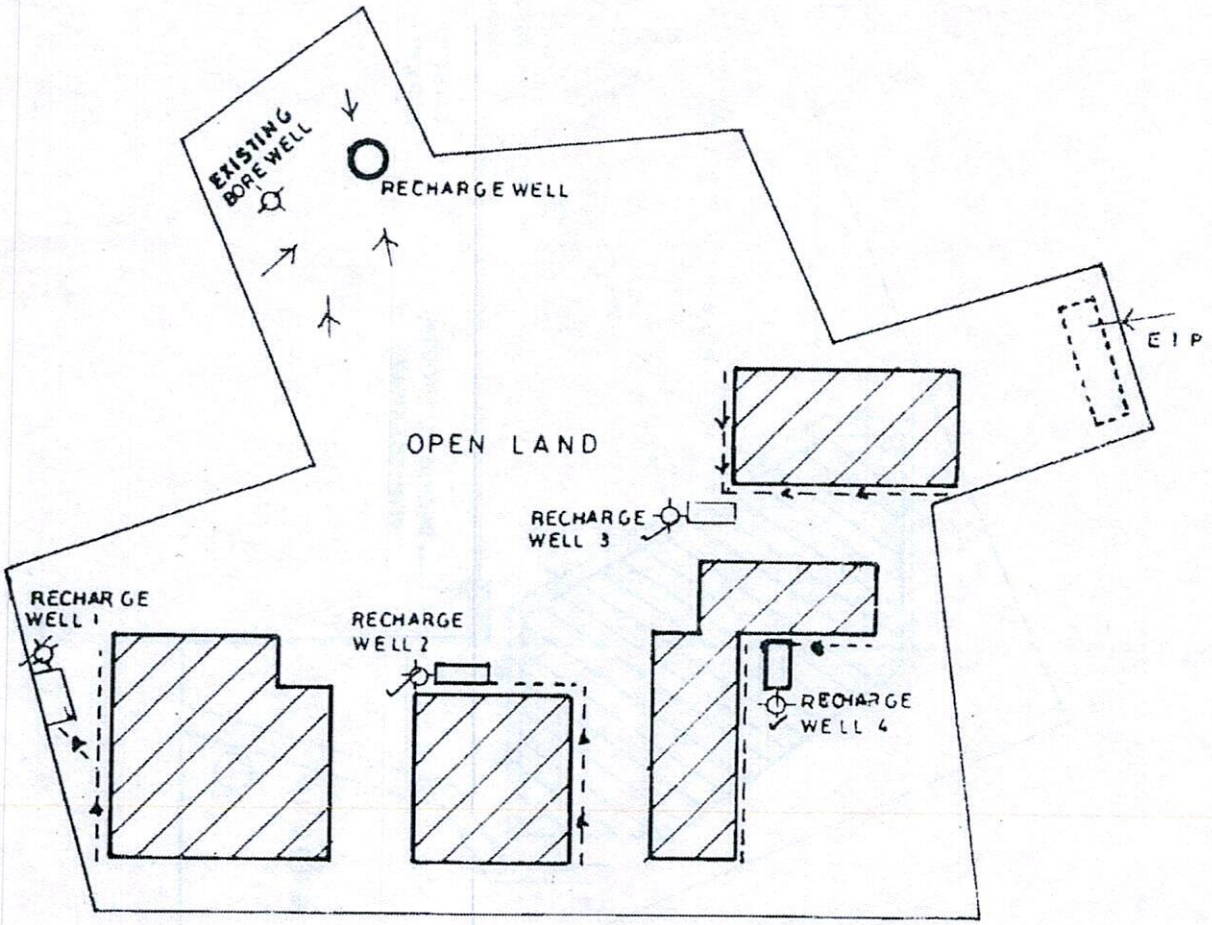
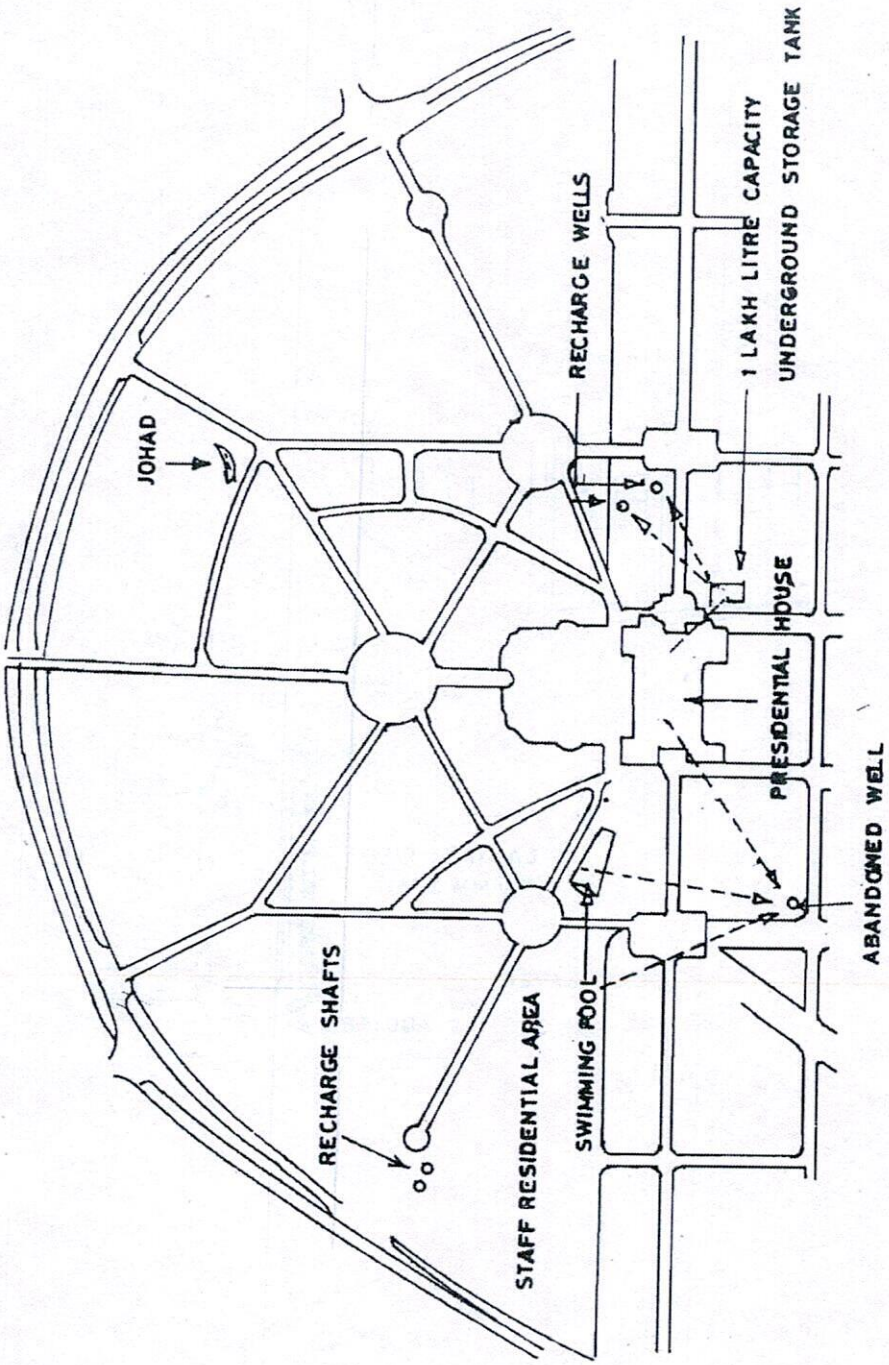


Drg-04: Scheme for water harvesting



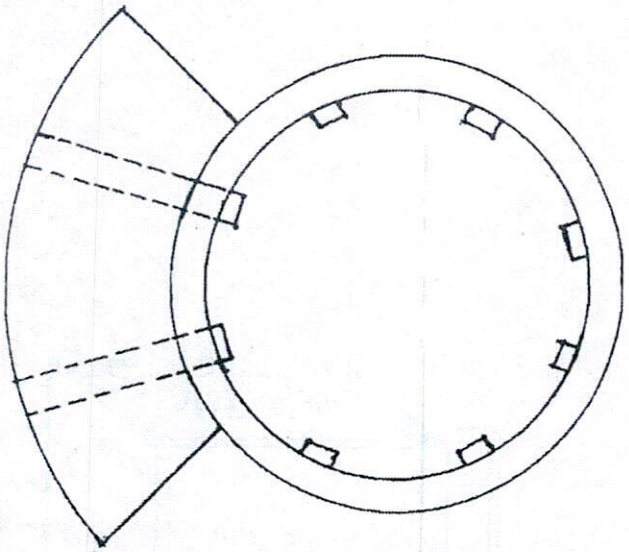
SITE PLAN

Drg-06: Scheme for water harvesting

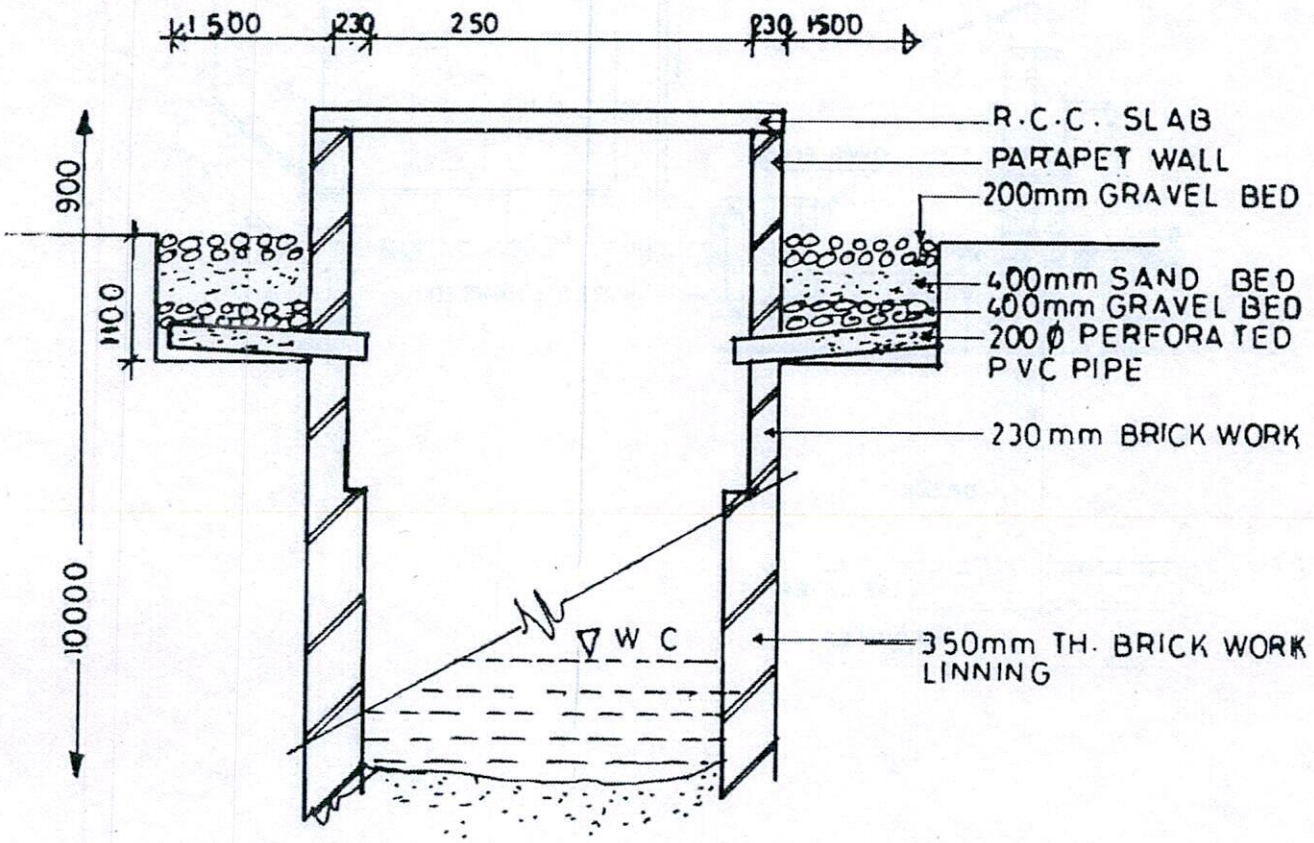


SITE PLAN

Drg-08: Scheme for water harvesting

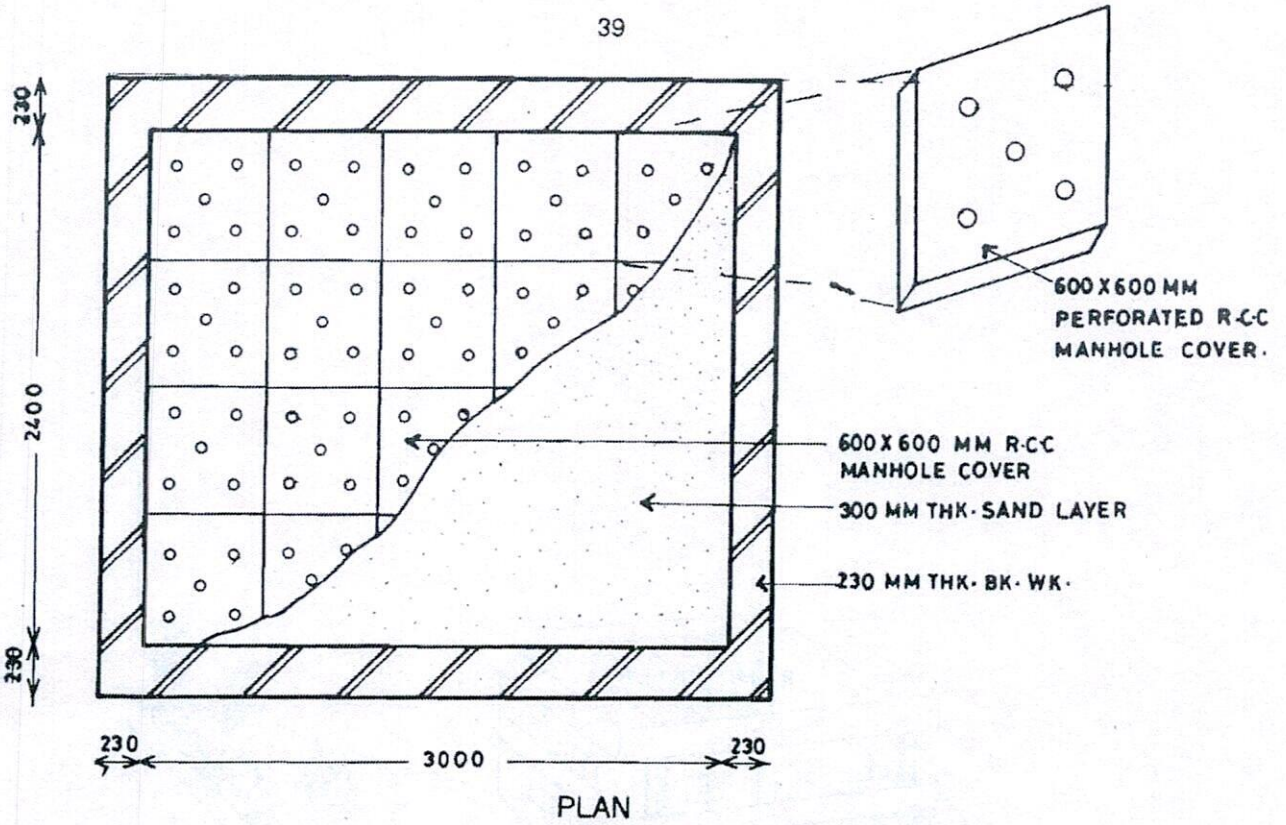


PLAN

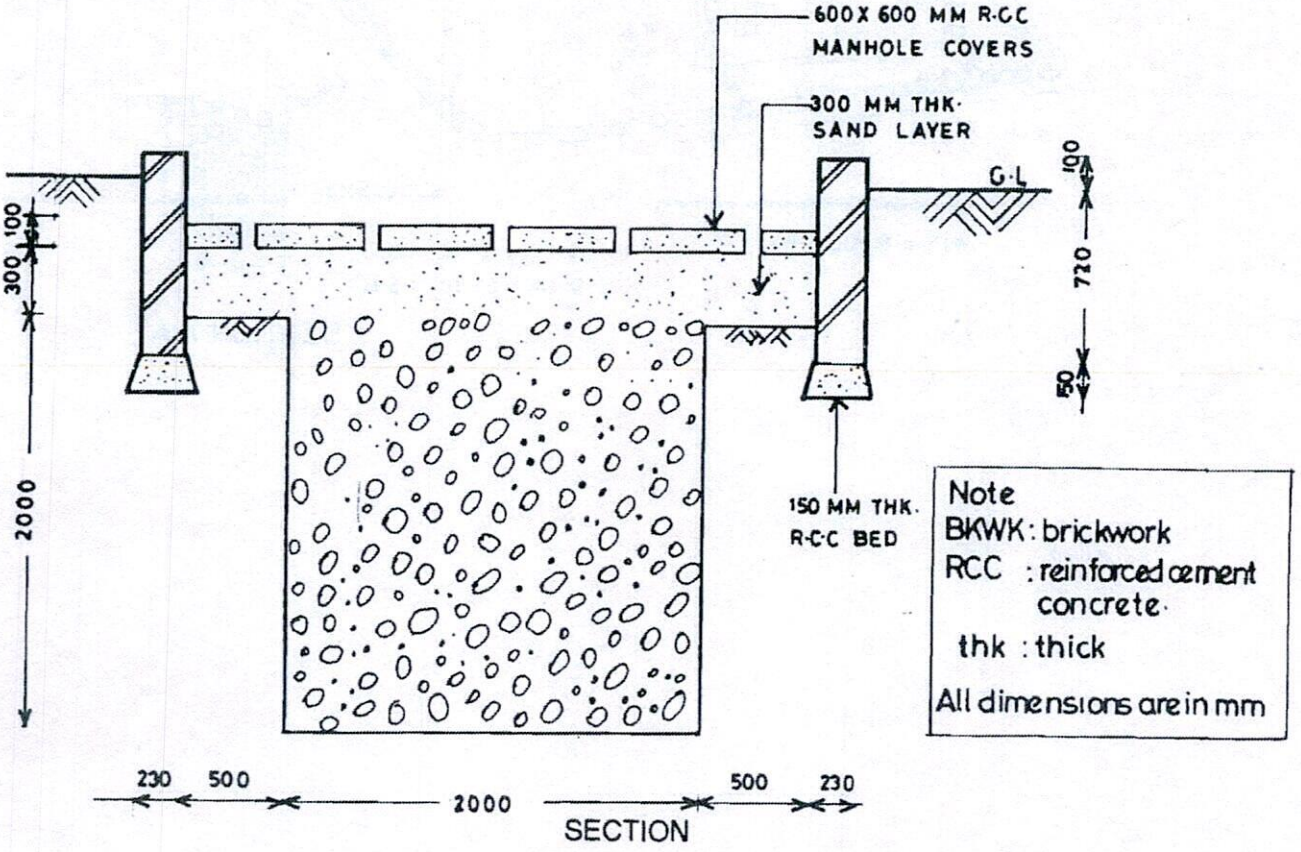


SECTION

Drg-10: Details of recharge dugwell

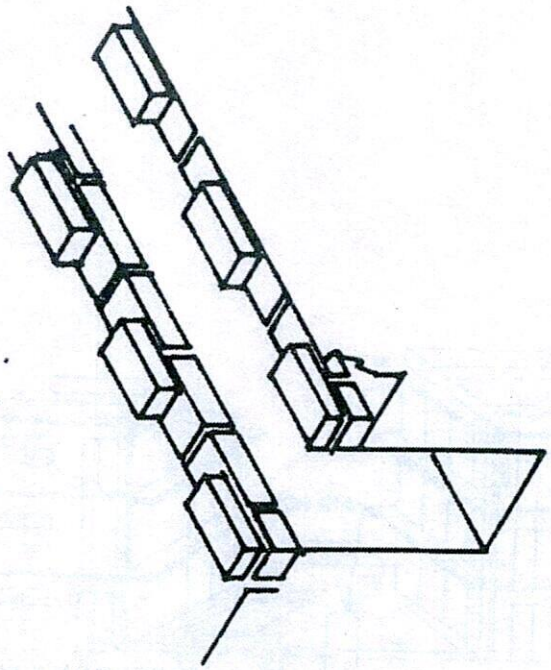


PLAN

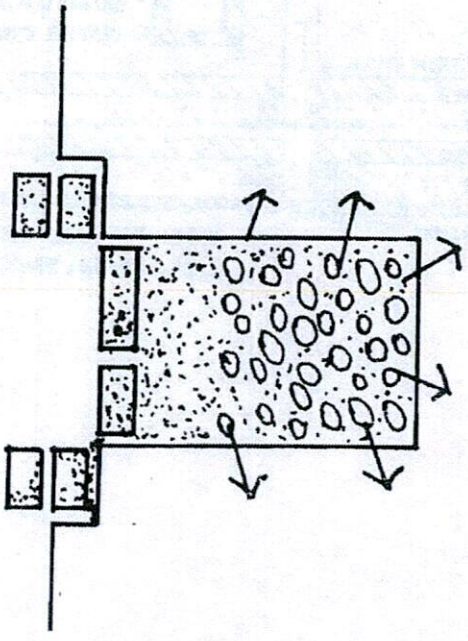


SECTION

Drg-12: Details of recharge pit

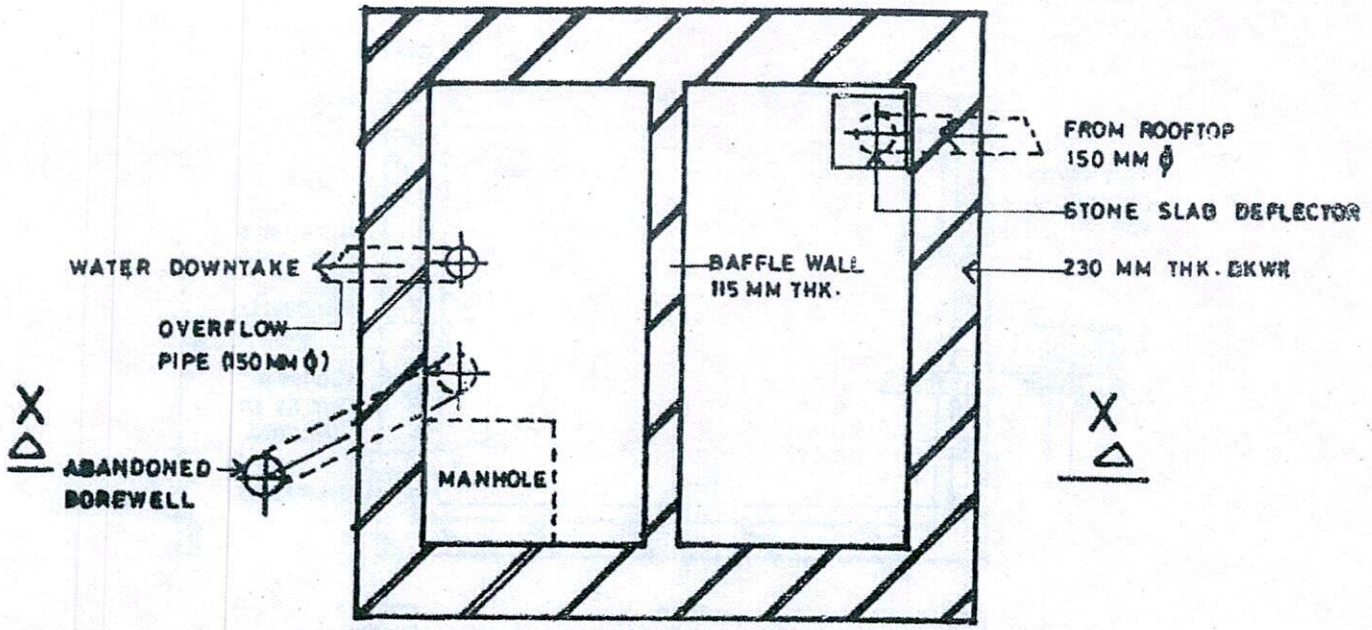


SECTIONAL VIEW



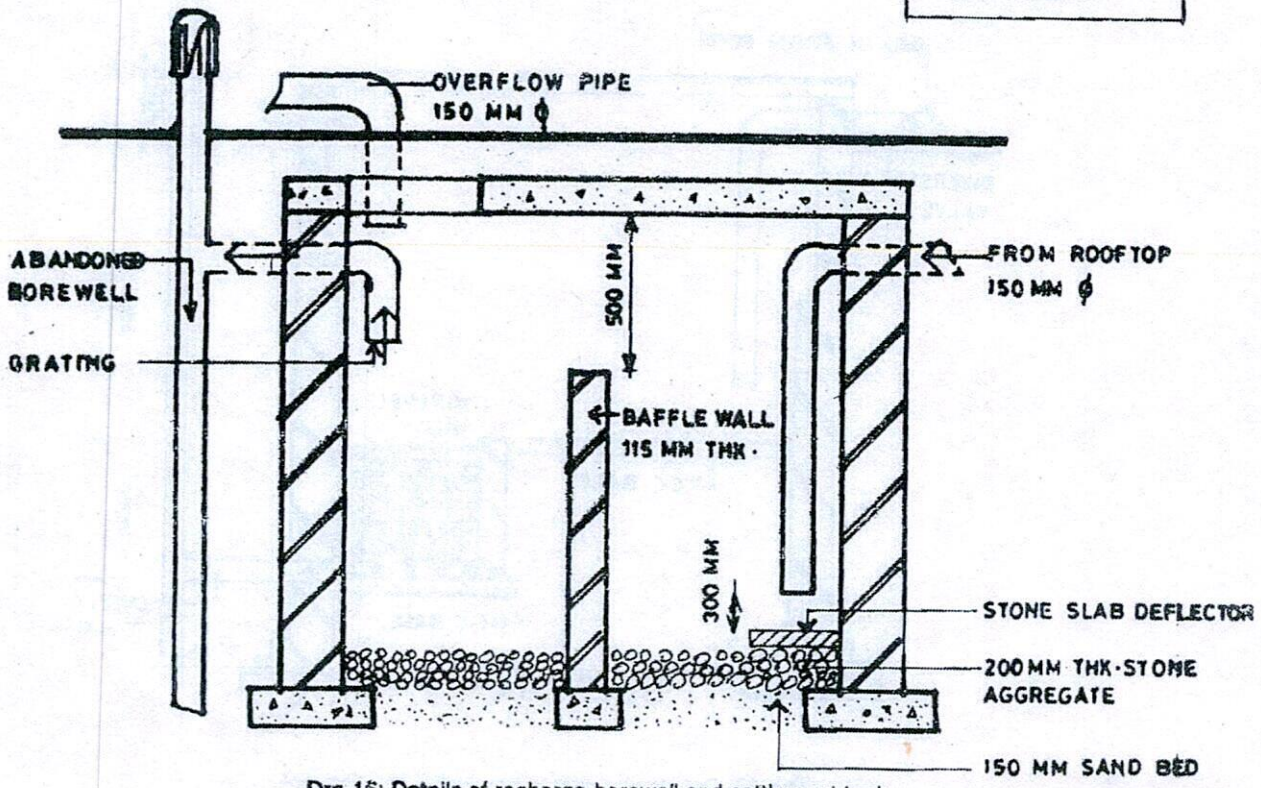
SECTION

Drg-14: Details of recharge trench



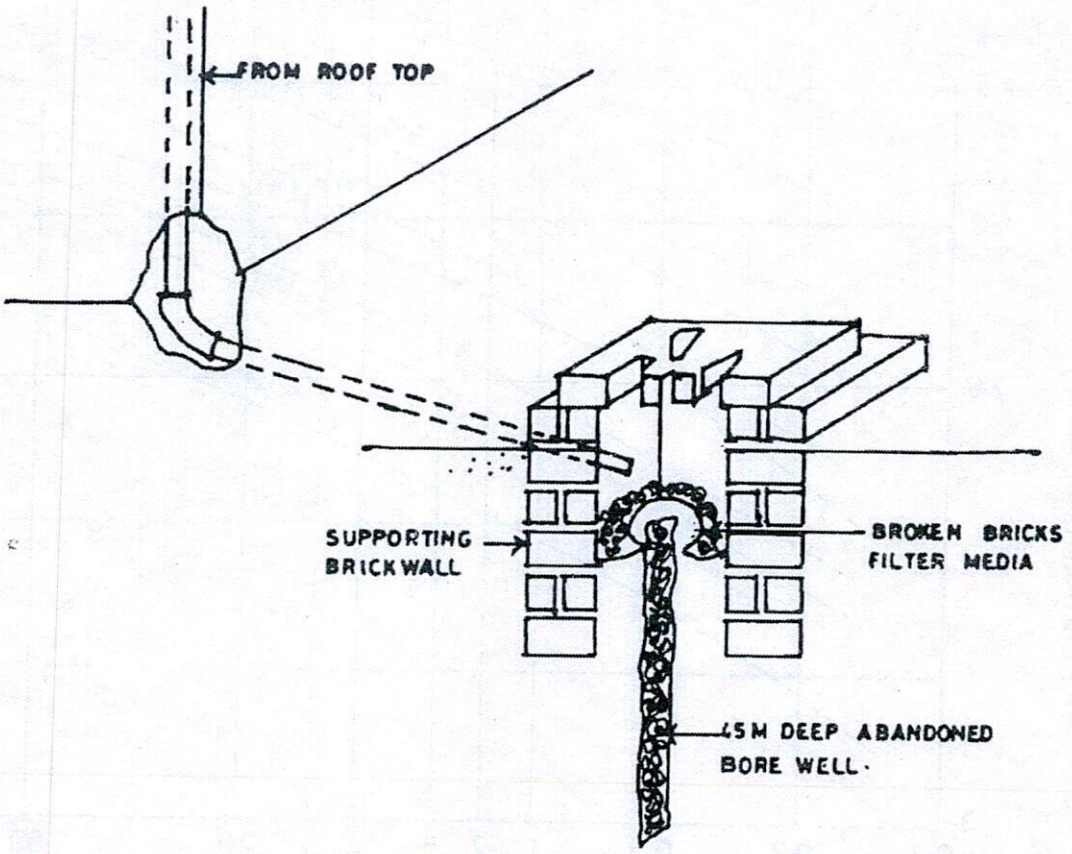
PLAN

Note:
BKWK: brickwork
ϕ : diameter
thk : thick

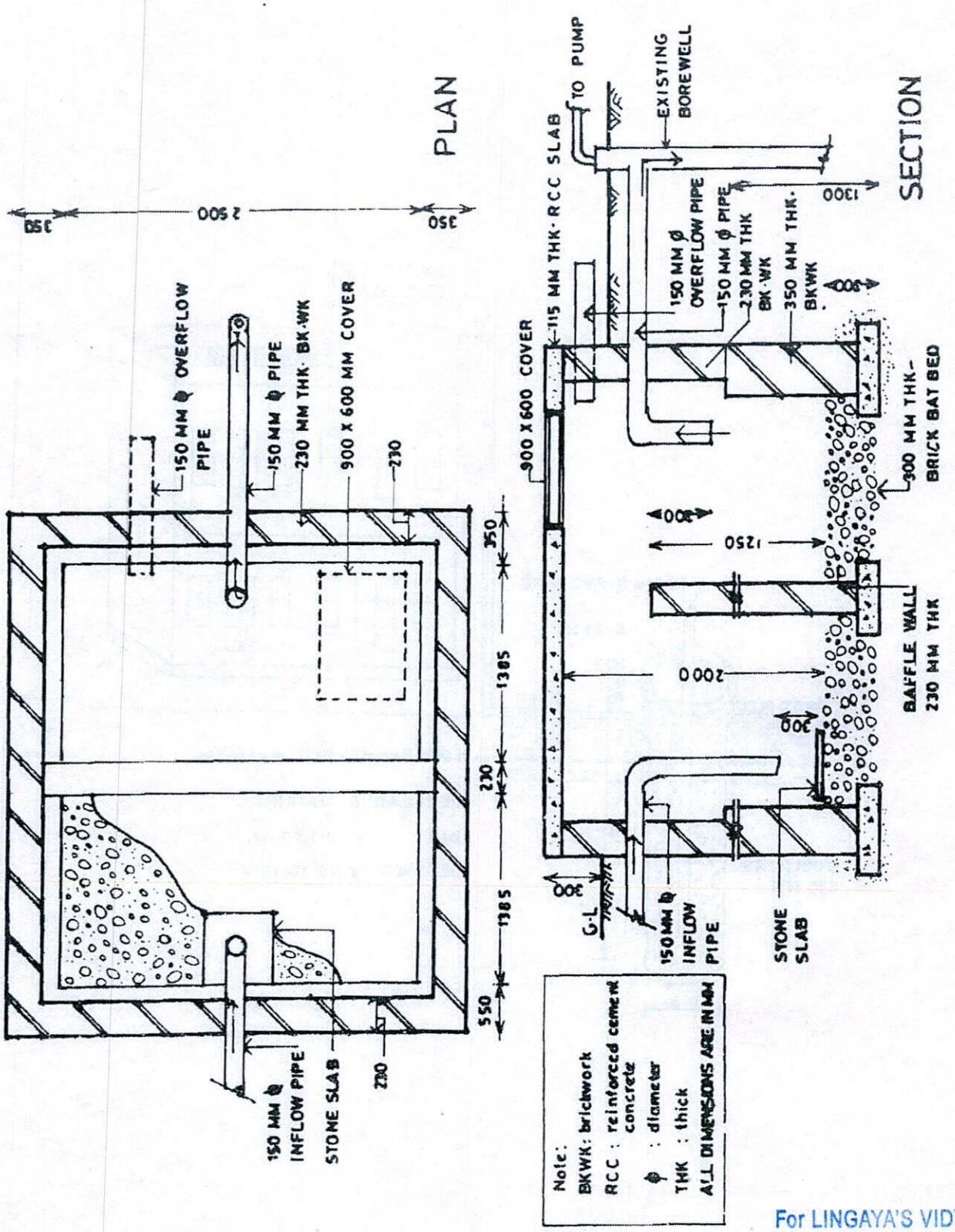


Drg-16: Details of recharge borewell and settlement tank

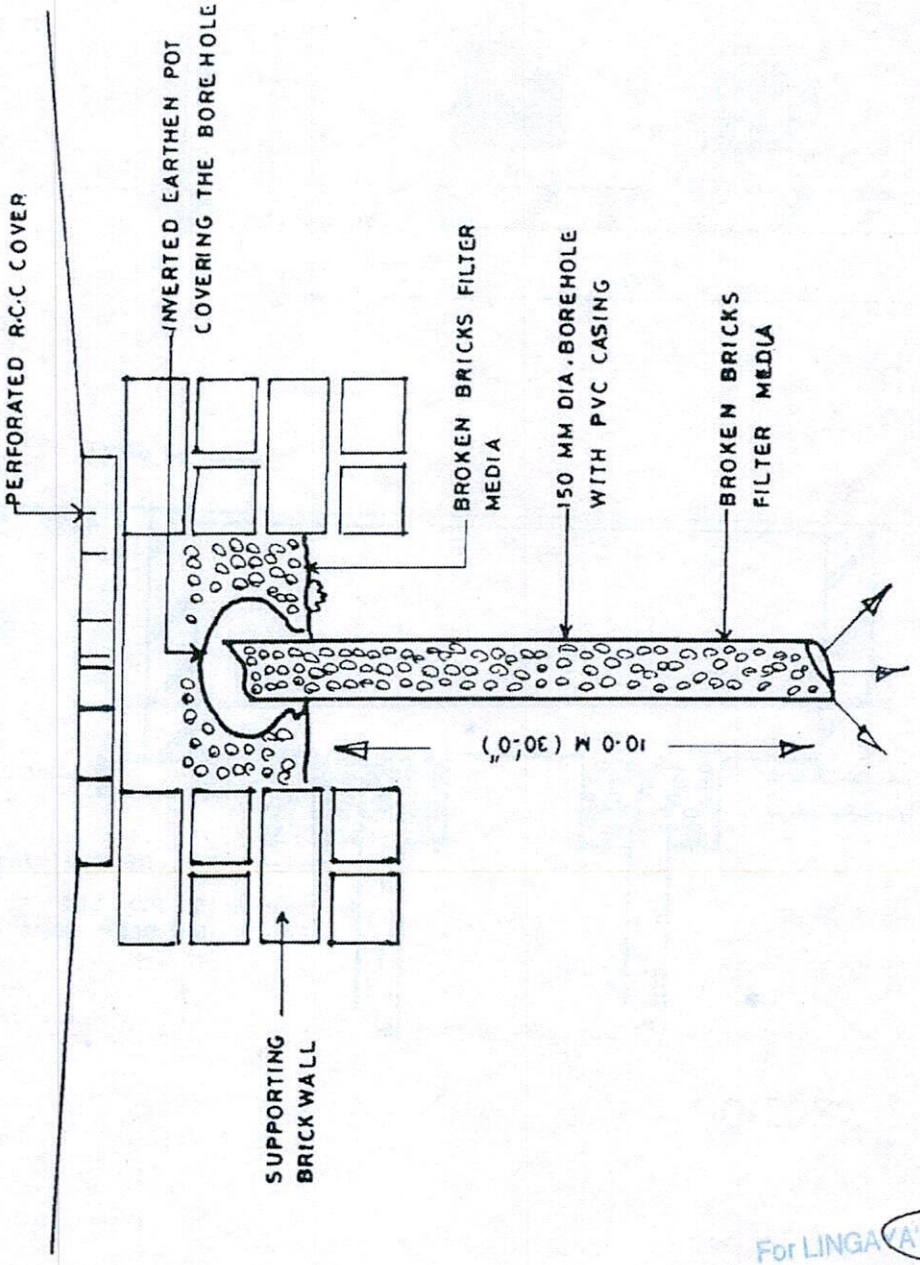
SECTION (X X)



Drg-18: Detail of abandoned boerwell recharging



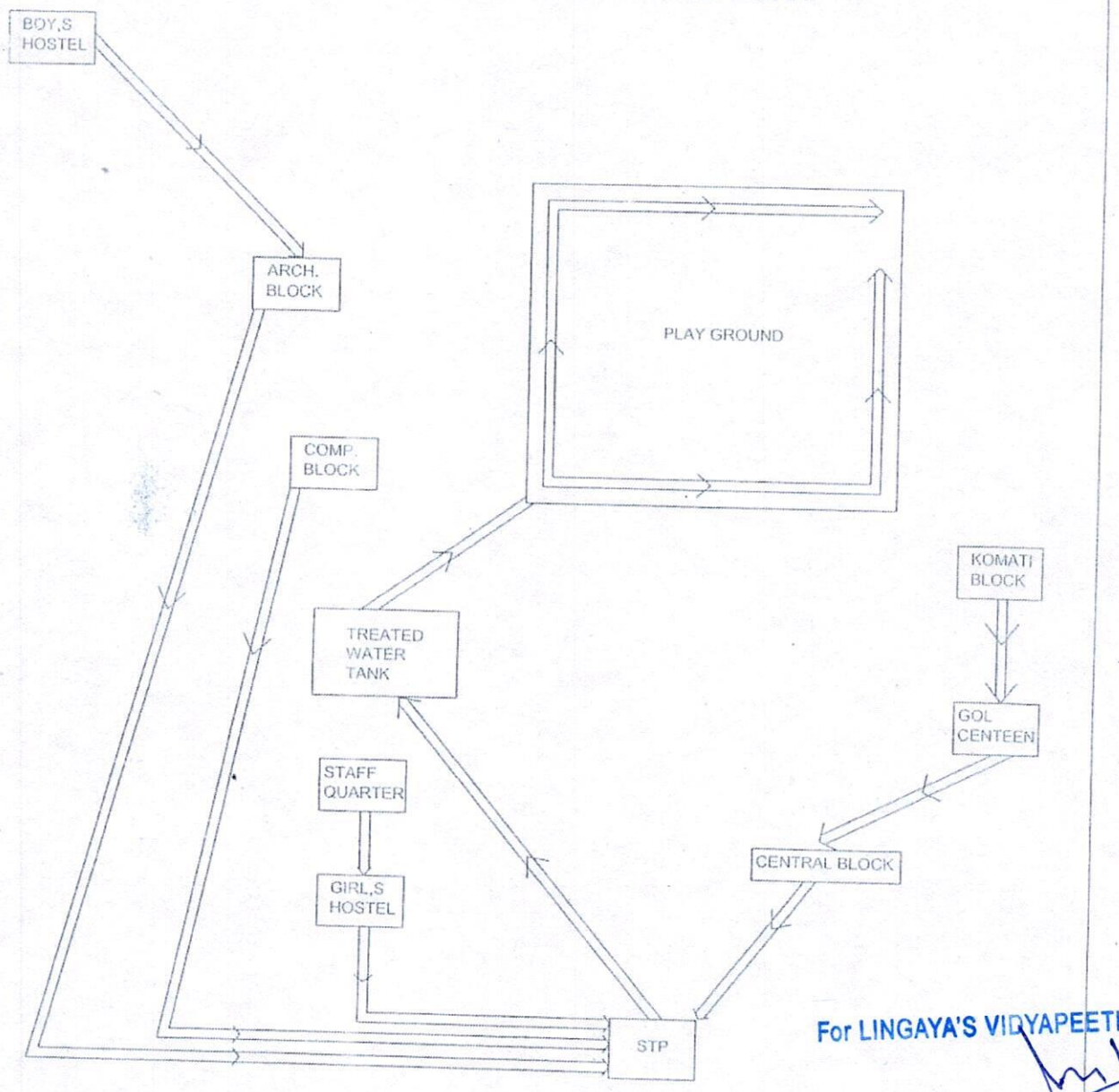
Drg-19: Details of recharge borewell & settlement tank



Drg-21: Detail of soakway

LINGAYA,S VIDYAPEETH (FARIDABAD)

RECYCLED WATER DISTRIBUTION NETWORK



For LINGAYA'S VIDYAPEETH

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For LINGAYA'S VIDYAPEETH

Registrar

LINGAYA'S VIDYAPEETH Under Section-3 of UGC Act, 1956 Neharpar, Faridabad-121002, Haryana

For, Lingaya's Vidyapeeth, Faridabad

Authorized Signatory

Mr. Sandeep Kaul

Waste water collection tanks (concrete structure)

1	Boy's Hostel	Length=10ft. , Width=10ft. , Depth=20ft.	No.	1
2		Length=15ft. , Width=15ft. , Depth=4ft.	No.	1
3	Gol Canteen	Length=5ft. , Width=6ft. , Depth=10ft.	No.	1
4	Central Block-quard	Length=6ft. , Width=6ft. , Depth=10ft.	No.	1
5		Length=8ft. , Width=8ft. , Depth=4ft.	No.	1
6	Arch. Block- quard	Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
7	Comp. Block- quard	Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
8		Length=12ft. , Width=10ft. , Depth=15ft.	No.	1
9	Girl's Hostel	Length=10ft. , Width=7ft. , Depth=5ft.	No.	1
10	Near bus parking	Length=16ft. , Width=10ft. , Depth=8ft.	No.	1
	S.T.P			
1	Collection tank at plant	Length=23ft. , Width=17ft. , Depth=25ft.	No.	1
2	Erection tank at plant	Length=13ft. , Width=8ft. , Depth=10ft.	No.	1
3	Buffer tank at plant	Length=7ft. , Width=5ft. , Depth=8ft.	No.	1
4	Holding tank at plant	Length=9ft. , Width=8.5ft. , Depth=5ft.	No.	1
5			No.	1
6	Treated tank near staff quarter	Length=17ft. , Width=17ft. , Depth=11ft.	No.	1
7	Treated tank near central block	Length=20ft. , Width=15ft. , Depth=4ft.	No.	1

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18 APR 2024

Details of water tanks

S.No.	Location	Item Name	Unit	Quantity
1	Central Block- Roof	Washroom water tank 2000 ltr.	Nos.	2
2		Washroom water tank 1000 ltr.	Nos.	3
3		R.O raw water tank 2000 ltr.	No.	1
4		R.O pure water tank 1000 ltr.	No.	1
5	Arch. Building- Roof	Washroom water tank 2000 ltr.	Nos.	3
6		Market water tank 1000 ltr.	No.	1
7		R.O raw water tank 2000 ltr.	No.	1
8		R.O pure water tank 1000 ltr.	No.	1
9	Komati Building- Roof	Washroom water tank 2000 ltr.	Nos.	2
10		R.O raw water tank 2000 ltr.	No.	1
11		R.O pure water tank 500 ltr.	No.	1
12	Comp. Building- Roof	Washroom water tank 2000 ltr.	Nos.	4
13		R.O raw water tank 2000 ltr.	No.	1
14		R.O pure water tank 1000 ltr.	No.	1
15		R.O pure water tank 2000 ltr.	No.	1
16	Staff Quarter- Roof	Washroom water tank 2000 ltr.	Nos.	2
17	Boy's Hostel- Roof	Washroom water tank 5000 ltr.	Nos.	2
18		Washroom water tank 2000 ltr.	No.	1
19		R.O raw water tank 2000 ltr.	No.	1
20		R.O raw water tank 1000 ltr.	No.	1
21		R.O pure water tank 500 ltr.	No.	1
22	Girls's Hostel- Roof	Washroom water tank 5000 ltr.	Nos.	4
23		Washroom water tank 2000 ltr.	No.	1
24		R.O raw water tank 2000 ltr.	No.	1
25		R.O pure water tank 1000 ltr.	No.	1
26	Bus Parking	Water tank 1000 ltr.	No.	1

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