



புதுச்சேரி மாநில அரசிதழ்

La Gazette de L'État de Poudouchéry

The Gazette of Puducherry

PART - I

சிறப்பு வெளியீடு

EXTRAORDINAIRE

EXTRAORDINARY

அதிகாரம் பெற்ற
வெளியீடு

Publiée par
Autorité

Published by
Authority

விலை : ₹ 8-00

Prix : ₹ 8-00

Price : ₹ 8-00

எண்	புதுச்சேரி	வெள்ளிக்கிழமை	2017 ௨௩	சூலை மீ 14 ௨
No. } 111	Poudouchéry	Vendredi	14	Juillet 2017 (23 Asadha 1939)
No. }	Puducherry	Friday	14th	July 2017

GOVERNMENT OF PUDUCHERRY
CHIEF SECRETARIAT (HOUSING)

(G.O. Ms. No. 12/2017-Hg., Puducherry, dated 13th July 2017)

NOTIFICATION

In exercise of the powers conferred by section 47 of the Puducherry Town and Country Planning Act, 1969 (No. 13 of 1970), the Lieutenant-Governor, Puducherry in consultation with the Town and Country Planning Department, hereby makes the following amendments to the Puducherry Building Bye-Laws and Zoning Regulations, 2012 issued in the notification *vide* G.O. Ms. No. 5/2012-Hg., dated 5th March, 2012 of the Chief Secretariat (Housing), Government of Puducherry and published in the Part-I of the Extraordinary Official Gazette No. 21, dated 8th March, 2012, namely:-

- (1) These bye-laws and regulations may be called the Puducherry Building Bye-Laws and Zoning Regulations (Amendment), 2017.
- (2) The provisions of these bye-laws and zoning regulations shall apply to the planning area declared *vide*:
 - (i) G.O. Ms. No. 79/84/F6, dated 17th August 1984, notified in the Gazette No. 35, dated 28th August 1984;
 - (ii) G.O. Ms. No. 93/85/F6, dated 8th July 1985, notified in the Gazette No. 31, dated 30th July 1985; and
 - (iii) G.O. Ms. No. 68/89/F6, dated 26th July 1989, notified in the Gazette No. 83, dated 31st July 1989 of Housing Secretariat, Puducherry and such other areas in the Union territory of Puducherry notified from time to time.
- (3) They shall come into force on and from the date of their publication in the Official Gazette.

ANNEXURE-XXI**2.0 Amendment to Part-IV Structural Safety and Services:**

In the said Building Bye-laws and Zoning Regulations, in chapter-IV for the existing regulations 68, 68.1, 68.2, the following shall be substituted; namely:

“68. Energy Conservation in building: Any building designed for energy efficiency under the budget building definition should be in accordance with the Energy Conservation Building Code 2007 notified by the Central / State Government.

- (I) Energy Conservation Building Code shall apply to all buildings having connected as specified in the Table-1 (Generation requirement);
- (II) All buildings having connected load as specified in the Table-1 shall use 20% of their power requirement from Renewable Energy sources either from their own installations or from Renewable Energy Generators.
- (III) 5% of Renewable Energy requirement shall be met from Solar Energy Sources and balance could be from Non Solar Renewable Energy sources for such buildings.

68.1 Exemptions: These directives shall not apply to:

- (a) Buildings that do not use either electricity or fossil fuel; or
- (b) Equipment and portions of building systems that use energy primarily for manufacturing processes.

68.2 Safety, Health and Environmental Codes Take Precedence: Where these directives are contrary to any of the provisions of laws relating to safety, health or environment, the provisions of safety, health or environmental laws shall apply.

68.3 Roof Top Solar Energy Installations: Rooftop photovoltaic power station, or rooftop PV system, is a photovoltaic system that has its electricity-generating solar panels mounted on the rooftop of residential or commercial buildings. The various components of such a system include photovoltaic modules, mounting systems, cables, solar inverters and other electrical accessories. Rooftop PV systems are faster than other types of renewable power plants. They are clean, quiet, and visually unobtrusive. The norms for Roof Top Solar PV Installation for various categories of the buildings are given in the Table-1 below:

Table-1

S.No.	Category of buildings/area	Area standards	Generation requirement *
Residential :			
1.	Plotted Housing	For HIG Plots and above	Minimum 5% of connected load or 20W/sqft for “available roof space”**, whichever is less.
2.	Group Housing	All proposals, as per Group Housing Norms	Minimum 5% of connected load or 20W/sqft for “available roof space”, whichever is less.
All other buildings (Government or Private, defined as per clause 2(vi) (a to r) of the Part-I, Chapter-I said Building Bye-laws and Zoning Regulations (mandatory for buildings having shadow free rooftop area > 50 Sq.M)			
3.	Educational	Plot size of 500 Sq.M and above	Minimum 5% of connected load or 20W/sqft for “available roof space”, whichever is less.
4.	Institutional		
5.	Commercial		
6.	Industrial		
7.	Mercantile		
8.	Recreational		

3.0 In the said Bye-laws and Zoning Regulations, after the existing regulations 68, the following regulations 69, shall be inserted, namely: **“69. Green Buildings and Sustainability provisions:** The following Green Building Norms shall be followed while issue of Building Permit for various category of the buildings by the Planning Authority concerned in the Union territory of Puducherry:

All buildings on various plot sizes above 100 sq.m. shall comply with the green norms and conform to the requirements mandatory for sanction as mentioned below:

69.1 These provisions are not specific to any rating system and are not intended to provide a single metric indication of overall building performance. These provisions allows the practitioners to easily exercise their engineering judgment in holistically and objectively applying the underlying principles of sustainability to a development or building facility, considering its functionality and required comfort level.

69.2 Provisions and Applicability: The green building provisions on various plot sizes are indicated in the Table-2 below:

Table-2

Plot category	Applicable plot area (sq.m)	Provisions for Residential	Provisions for Non- Residential
1	2	3	4
I	Up to 100	Nil	Nil
II	100 to 500	1(a), 2(a), 2(b), 4(a)	1(a), 2(b), 4(a)
	500 to 1,000	1(a), 1(c), 2(b), 3(c), 4(a)	1(a), 1(c), 2(a), 2(b), 3(c), 4(a)
	1,000 to 3,000	1(a), 1(c), 1(d), 2(a), 2(b), 3(b), 3(c), 4(a)	1(a), 1(c), 1(d), 2(a), 2(b), 3(b), 3(c), 4(a)
III	Above 3,000	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 3(c), 4(a), 4(b)	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 3(c), 4(a), 4(b)

***Note:** provisions for sanction marked 1(a), 2(b) etc in the column (3) & (4) are as per section 69.3 below

The schemes/ projects formulated on the basis of provisions given in Master plan/ Zonal Development Plan will require approval as indicated:

EIA/ ECC (as per MoEF), NBC (latest), ECBC 2007 or latest, BEE Star rating/ LEED of IGBC/ GRIHA of TERI Certification}

EIA- Environmental Impact Assessment Study Report,

ECC- Environmental Clearance Certificate,

MoEF – Ministry of Environment and Forest,

NBC – National Building Code,

ECBC – Energy Conservation Building Code,

BEE – Bureau of Energy Efficiency,

LEED – Leadership in Energy and Environment Design,

IGBC – Indian Green Building Council,

GRIHA – Green Rating for Integrated Habitat Assessment,

TERI – The Energy and Resources Institute.

The prevailing provisions of the above shall be applicable. However if there are any modification in the same, the modified provisions shall become automatically applicable.

69.3 Provisions for Sanction (refer Table-2 at regulation 69)

69.3.1 Water Conservation and Management:

(a) Rain Water Harvesting (Norms for rain water harvesting is as per the regulations at Annexure-VII A);

(b) Low Water Consumption Plumbing Fixtures ;

(c) Waste Water Recycle and Reuse (Regulations for re-use of waste water is as per the Annexure-VII (B) of the said bye-laws and Zoning Regulations);

(d) Reduction of Hardscape.

69.3.2 Solar Energy Utilization:

- a) Installation of Solar Photovoltaic Panels (as detailed at **Table-1** of regulations 68.3).
- b) Installation of Solar Assisted Water Heating Systems (as per the Annexure-XVIII – 7(i), (ii), (iii), (iv), (v) and (vi) of the said bye-laws and Zoning Regulations).

69.3.3 Energy Efficiency (Concept of passive solar design of buildings)

(Note: The provisions of Concept of passive solar design in building construction shall be in accordance with the provisions at 4, 4(a),(b),(c) Energy in the table 1,2 & 3 of the notification for Integration of Environmental conditions in issue of building plan approval by the Planning Authority concerned.)

- (a) Low Energy Consumption Lighting Fixtures (Electrical Appliances – BEE Star and Energy Efficient Appliances)
- (b) Energy Efficiency in Heating, ventilation and air conditioning (HVAC) systems.
- (c) Lighting of Common areas by Solar energy/ Light-Emitting Diode (LED) devices.

69.3.4 Waste Management

- (a) Segregation of Waste
- (b) Organic Waste Management

69.4 Provisions for City and Site Level greening :

In alignment with National Sustainable Habitat Mission, the Planning Authority shall encourage augmentation of green cover in the city/plot, by following “The Urban Greening Guidelines, 2014” and other provisions as given below:

- i) Provision of minimum 1 tree / every 80 Sq.M of plot area for plot sizes > 100sqmt and planted within the setback of the plot.
- ii) Compensatory Plantation for felled/transplanted trees in the ratio 1:3 within the premises under consideration.
- iii) Choice of species for plantation in site and abutting the road to be adopted as per clause 8 of the Urban Greening Guidelines, 2014.
- iv) The unpaved area shall be more than or equal to 20% of the recreational open spaces.

(Note: The provisions of City and Site Level greening shall be in accordance with the provisions at 6, 6(a), Green cover in the table 1,2 & 3 of the notification for Integration of Environmental conditions in issue of building plan approval by the Planning Authority concerned.)

4. Amendment to the Annexure- VII: In the Puducherry Byelaws and Zoning Regulations, 2012 (herein after referred to as the said Bye-laws and Regulations) for the existing Annexure-VII- A REGULATIONS FOR CONSERVATION FOR RAINWATER and in the Annexure-XVIII, the existing regulation at serial 5 shall be deleted and for the rain Water Harvesting provisions, the following shall be substituted :

4.1 Rain Water Harvesting System: The harvesting of rainwater simply involves the collection of water from surfaces on which rain falls and subsequently storing this water for use. The rainwater collected can be stored for direct use or can be recharged into the underground aquifers. In scientific terms water harvesting (broadly) refers to collection and storage of rainwater from the rooftops. This also restricts evaporation and seepage into building foundations. *All buildings having a plot size of 100 Sq.M. or more, while submitting the building plans for sanction, shall mandatorily include the complete proposal of rainwater harvesting.*

4.1.1 The rainwater harvesting system consists of:

- i. Roof catchment;
- ii. Gutters;
- iii. Down pipes;

- iv. Rain water/ Storm water drains ;
- v. Filter Chamber ;
- vi. Storage Tanks/ Pits/ Sumps ;
- vii. Ground Water recharge structures like pit, trench, tube well or combination of above structure ;

4.1.2 Rainwater Harvesting is a way to capture the rain runoff, store that water above ground or charge the underground aquifers and use it later. This happens naturally in open rural areas. But in congested, over-paved metropolitan cities, there is a need to devise methods to capture the rain water. The rainwater that is incident on the surface/ roof top is guided to borewells or pits or new/old/ abandoned wells through small diameter pipes to recharge the underground water which can be used later whenever required.

4.2. Rainwater harvesting techniques:

There are two main techniques of rain water harvestings.

- (a) Storage of rainwater on surface for future use ;
- (b) Recharge to ground water.

In order to assess and choose to adopt Rainwater harvesting, the technical aspects and various options of Rainwater harvesting are given in the **Appendix- I**.

4.3. Harvesting provisions in various Building categories:

4.3.1 All buildings in a city / Town contribute to the rainwater runoff during the monsoon and hence such runoff can be harvested for water reuse/recharge.

The indicative provisions of rainwater harvesting in various buildings types are given in the Table-3 as follows:

Table-3			
Category / use	Area of Plot (Sq.M)	Provision to be made	Other conditions
Residential Plotted Houses:			
New Proposals	100 and above	Construction of Rain Water Harvesting Structure.	Shall have emphasis on both storage and reuse.
Group Housing:			
New Proposals	All plot sizes	(i) Construction of Rain Water Harvesting Structure. (ii) Concrete paving to be avoided and permeable materials are to be used for all open parking spaces.	Should indicate the system of Storm Water Drainage, Rain Water Harvesting Structure and Recharging Well
Public and semi public buildings:			
All Proposals All plot sizes	All Proposals All plot sizes	(i) Shall have Rain Water Harvesting Structure and storage (ii) Shall have Recharge pits.	Shall have emphasis on both storage and reuse.
Commercial / Mixed use :			
All Proposals	All plot sizes	(i) Construction of Rain Water Harvesting Structure. (ii) Soft landscape provisions and open spaces with Percolation pits. (iii) Common treatment plant to be made part of the integrated development, funded by sale of commercial space.	Should indicate the system of Storm Water Drainage, Rain Water Harvesting Structure and Recharging Well. Shall have emphasis on both storage and reuse.
Industrial :			
All proposals	All plot sizes	(i) Construction of Rain Water Harvesting Structure. (ii) Soft landscape provisions and open spaces with Percolation pits. (iii) Use of abandoned bore wells for recharging of ground water. (iv) Common treatment plant to be made part of the integrated development funded by sale of commercial space.	Should indicate the system of Storm Water Drainage, Rain Water Harvesting Structure and Recharging Well. Provision should be made not to inject contaminated water into recharge structures in industrial areas and care is to be taken to keep such structures away from sewer lines, septic tanks, soak pits, landfill and other sources of contamination.
Other proposals	All plot sizes	Similar as above	Similar as above

Note: *The number of recharge bores to be provided in Buildings and constructions having built-up area between 5000 Sq.M to 1,50,000 Sq.m shall be in accordance with the provisions at S.No. 2 of the Table 1 – Table 3 in the notification for Integration of Environmental conditions in issue of Building Plan approval.*

4.4. Rain Water Harvesting Provisions for Open spaces in urban areas :

The open spaces/recreational land use generally constitute regional parks, district parks, play ground and stadium, sports complex, monument zones, public parking, Plaza and other public open space. All such public open spaces *above the size of 500 Sq.m.* shall have arrangements for complete utilization and capture of storm water with scientific rain water harvesting arrangements. Following are the some of the ideas / arrangements to harvest rain water in public open spaces:

- (i) Well cum Channel cum Percolation pits.
- (ii) Use of abandoned bore wells for recharging of ground water
- (iii) Artificial or natural Storage of storm water runoff from larger sites.

4.5. Enforcement and Monitoring :

4.5.1 The Planning Authority shall constitute a Rainwater Harvesting Cell which will be responsible for enforcement and monitoring of the provisions of Rainwater Harvesting. The cell shall employ qualified persons who are well versed with the interpretation of Building Bye Laws and responsible for enforcement as well as monitoring the functioning of the Rainwater Harvesting System.

4.5.2. The details of the Rain Water Harvesting (R.W.H.) System shall be as shown in the site plan enclosed along with the application in Form I A seeking approval for construction and permission to execute the work. Building permission by the Planning Authorities shall not be issued unless adequate R.W.H. systems are provided in the building plan submitted.

4.5.3. The Planning Authority shall include *inspection of Rainwater Harvesting Structures* before **issuing** Completion Certificates / occupancy certificate or NOCs for service connections to the property.

4.5.4. Set an example in the city / town by ensuring that Rainwater is harvested in the properties /assets owned by them including public buildings, markets, community centres, parking spaces, roads and parks etc.

4.5.5. The Authority shall also establish a mechanism to monitor 100% of RWH provisions in all the buildings above 1000 Sq.M. with annual physical verification, while buildings less than 1000 Sq.M. can be monitored on the basis of 10% random survey by competent authority.

4.5.6. With regard to open public spaces viz., Parks, playgrounds etc. the implementation of provision rainwater harvesting may be done with the help of Residents Welfare Associations, Community Building Organization and Non- Governmental Organizations.

4.5.7. The Planning Authority shall ensure earmarking budgetary provision for the creation and maintenance of rainwater harvesting structures in public spaces owned and maintained by them, like parking spaces, parks, plazas etc.

4.5.8. The practice of incentives and penalties to promote rain water harvesting shall be formulated by the local authority based on best practices. Authority shall design its own incentive and penalty systems, considering the water level and scarcity.

4.5.9 Exemption in respect of implementing the Rain Water Harvesting system may be granted in respect of cases where water logging is common or in areas with impermeable sub-soil conditions to considerable depth. The assessment of the conditions of the sub-soil may be made by the Planning Authority in consultation with the State Ground Water unit of the Agriculture Department, Puducherry.

4.6. The other components on how the rain water is to be utilized, that is, for ground water recharging or for direct use, shall be as follows:

(A) For storing and reuse of the rainwater: A storage tank that has provision for drawing water and for spillover of excess water is to be provided; and

For charging the ground water aquifers, the water from the filter unit shall be diverted to suitable structures like dug wells, bore wells, recharge trenches or recharge pits for charging the groundwater aquifers.

(B) For ground water recharging: Through direct channelling of surface water to abandoned wells or hand-pumps, recharge pits or recharge trenches, or to through recharge shafts.

Directing of harvested rain water to pumping wells.

Note: Additional arrangements for carrying the spillover water from storage tank to recharge well or percolation pit shall be provided.

(i) The owner(s) / occupier (s) shall maintain the rooftop rainwater harvesting arrangements and artificial ground water recharge arrangements in good working conditions.

(ii) The Planning Authorities of the Union territory of Puducherry shall enforce workable artificial ground water recharging arrangements as an integral part of all new building constructions through collection of roof top rainwater.

5.0 Amendment to the Annexure- VII : In the said Bye-Laws and Zoning Regulations, in Annexure-VII, after existing "B. REGULATIONS FOR RE-USE OF WASTE WATER", the following shall be inserted, namely :-

(C) Sustainable Waste Management:

Zero Waste is a concept of waste management and planning approaches that emphasize waste prevention as opposed to end waste management. This means restructuring production and distribution systems, designing and managing products and processes to systematically follow the 3R rule of Reduce, Re-use and Re-cycle the volume of waste, to conserve and recover all used resources, and therefore eliminating all discharges to landfills and prevent air, water and land pollution.

Zero Waste/ land-fill can be achieved by adopting systematic approach of segregation at source by planning, by collection facilitation and most importantly by creating public awareness.

The green waste can be converted into fuel cakes, kitchen waste into manure, construction & demolition waste into bricks, plastic waste into oil, paper, glass and steel back into the same and all residual inert materials can also be converted into bricks. Achieving zero land-fill is more conveniently possible, if

(a) the collection is made from house to house and some segregation is done at household level ;

(b) separate wet and dry bins must be provided at the ground level and

(c) the recycling is done at decentralized, say, ward or even lower levels.

(Note: The provision "Waste Management" are as per the integration of set of environmental conditions while issue of Building Permit by the Planning Authority which will be notified separately for which the Ministry of Environment, Forest and Climate Change, Government of India accorded concurrence).

(D) Sustainability of Building Materials:

Sustainability of natural resources for building materials shall be ensured through conservation of available natural resources and use of supplementary materials such as industrial/agricultural by-products, renewable resources, factory made building components and recycled construction and demolition waste.

Supplementary building materials (derived or processed waste) shall be suitably used in combination with conventional resources offers dual advantages in purview of health and environmental benefits.

(i) Use of Factory made pre-fab/pre-cast and recycled components with *Green benefits*:

(a) Panels, hollow slabs, hollow blocks—etc. – conservation of materials, less water requirement.

(b) Fly Ash bricks, Portland Pozzolana cement, Fly ash concrete, phosphogypsum based walling and roofing panels, particle wood – recycled use of industrial/ agricultural by-products.

(c) Fly ash / AAC (Autoclaved aerated light weight concrete) panels / CLC (Cellular light weight concrete) panels- ensures thermal comfort (significant reduction in air conditioning requirement);

(Note: The provisions of use of materials in building construction shall be in accordance with the provisions at 4 (c) Energy in the table 2 and 3 of the notification for Integration of Environmental conditions in issue of building plan approval by the Planning Authority concerned.)

(d) Use of bamboo, Casuarinas trees and rapidly growing plantation timbers- environmental benefits.

Local materials are generally suitable for prevailing geo-climatic conditions & have advantage of low transportation cost & time. Sustainable use of building materials shall be encouraged which may combine certain mandatory provisions and incentives.

(E) Various Guidelines for Green Rating systems:

A green building rating system is a tool that evaluates the performance of a building and its impact on the environment. It comprises a predefined set of criteria relating to the design, efficient use of natural resources like building materials, water, energy and other resources with minimal generation of non-degradable waste during construction and operations of green buildings.

The Union territory of Puducherry prepares their separate Green Rating systems for buildings by selectively combining / adopting / amending the provisions between the following guidelines:

(1) IGBC guidelines by the Confederation of Indian Industries.

(2) GRIHA guidelines by the Ministry of New and Renewable Energy. Government of India.

Green rating shall be done by assessing on implementation of the following in the new building / construction :

- Rainwater harvesting and recharge mandatory for every construction;
- Renewable energy systems ;
- Waste and water management ;
- encourage use of solar energy in buildings;
- Comprehensive practices by the professionals on energy efficiency in all buildings
- Building materials;
- Greater use of energy saving insulation, more efficient heating boilers and consider using low or zero carbon systems such a solar panels and geothermal technology to demonstrate compliance.

In pursuance of the National Sustainable Habitat Mission on *Energy Efficiency* in Buildings, the Planning Authority shall encourage the provisions of the following Energy efficiency guidelines by certain mandatory provisions and incentives-

(3) ECBC guidelines prepared by Bureau of Energy Efficiency, Ministry of Power. GoI

(4) Model Energy Efficiency guidelines. (NSMH Sub report by Bureau of Energy Efficiency)

6.0 Amendment to the Annexure- XV : In the said Bye-Laws and Zoning Regulations, in Annexure-XV after the existing provisions at serial No. 22(a) and (b), the following shall be inserted, namely :-

(23) Glass Façade/ Service Ducts/Shafts/ Refuge Area/ Vents :

- (a) An Opening to the glass façade of min. width 1.5 m and height 1.5m shall be provided at every floor at a level of 1.2 m from the flooring facing compulsory open space as well as on road side. Construction that complies with the fire rating of the horizontal segregation and has any gap packed with a non-combustible material to withstand thermal expansion and structural movement of the walling without the loss of seal against fire and smoke.
- (b) Mechanism of Opening: The openable glass panel shall be either left or right shall have manual opening mechanism from inside as well as outside. Such openable panels shall be marked conspicuously so as to easily identify the openable panel from outside.
- (c) Fire seal to be provided at every floor level between the external glazing and building structure.
- (d) The glazing used for the façade shall be of toughened (tempered) safety glass as per I.S.2553.
- (e) To avoid fire propagation vertically from one floor to another floor, a continuous glass l must be separated internally by a smoke/ fire seal which is of non-combustible material having a fire resistance rating of not less than 2 hours.
- (f) Service ducts and shafts shall be enclosed by walls and doors with fire resistance rating. All such ducts/shafts shall be properly sealed and stopped fire ingress at all floor levels.
- (g) A vent opening at the top of the service shaft shall be provided having an area between one- fourth and one-half of the area of the shaft.
- (h) The openable vent of minimum 2.5% of the floor area shall be provided. The openable vent can be pop out type or bottom hinged provided with fusible link opening mechanism and shall also be integrated with automatic Smoke Detection System.

(or)

(i) Alternate vertical glass panels of the façade shall be openable type with the mechanism mentioned above in order to ventilate the smoke.

(ii) Refuge areas covered with the glass façade shall have all the panels fully openable (either left or right hinged) both from inside as well as outside.

Glass quality and Practice of use of Glass in buildings shall have to be in conformity with the BIS codes as given in Table-4 below:

Table-4

I.S. Code	Specification
2553 (Part 1):1990	Specification for safety glass: Part 1 General purpose (<i>third revision</i>)
2835:1987	Specification for flat transparent sheet glass (<i>third revision</i>)
438:1994	Specification for silvered glass mirrors for general purposes (<i>second revision</i>)
5437:1994	Specification for figured rolled and wired glass (<i>first revision</i>).
14900:2000	Specification for transparent float glass.

// By order of the Lieutenant Governor //

(B. ZAREENA BEGAM)
DEPUTY SECRETARY TO GOVT. (HOUSING)

APPENDIX-I

Technical aspects and various options of Rainwater harvesting:

The storage of rain water on surface is a traditional technique and the structures used were underground tanks, ponds, check dams, weirs etc. Recharge to ground water is a new concept of rain water harvesting and the structures generally used are :

- (a) **Pits:** Recharge pits are constructed for recharging the shallow aquifer. These are constructed 1 to 2m, wide and to 3m. deep which are back filled with boulders, gravels, coarse sand.
- (b) **Trenches:** These are constructed when the permeable stream is available at shallow depth. Trench may be 0.5 to 1m. wide, 1 to 1.5m deep and 10 to 20m long depending up availability of water. These are back filled with filler materials.
- (c) **Dug wells:** Existing dug wells may be utilized as recharge structure and water should pass through filter media before putting into dug well.
- (d) **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.
- (e) **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.
- (f) **Recharge Shafts:** For recharging the shallow aquifer 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 filled with boulders, gravels and coarse sand.
- (g) **Lateral shafts with bore wells:** For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m. wide and 10 to 30 m. long depending upon availability of water with one or two bore wells are constructed. The lateral shafts are back filled with boulders, gravels and coarse sand.
- (h) **Spreading techniques:** When permeable strata start 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.

ILLUSTRATIONS OF COMMON HARVESTING TECHNIQUES

Figure.1: Rainwater harvesting and groundwater recharge for individual plotted house (by percolation pits and well-cum-channel)

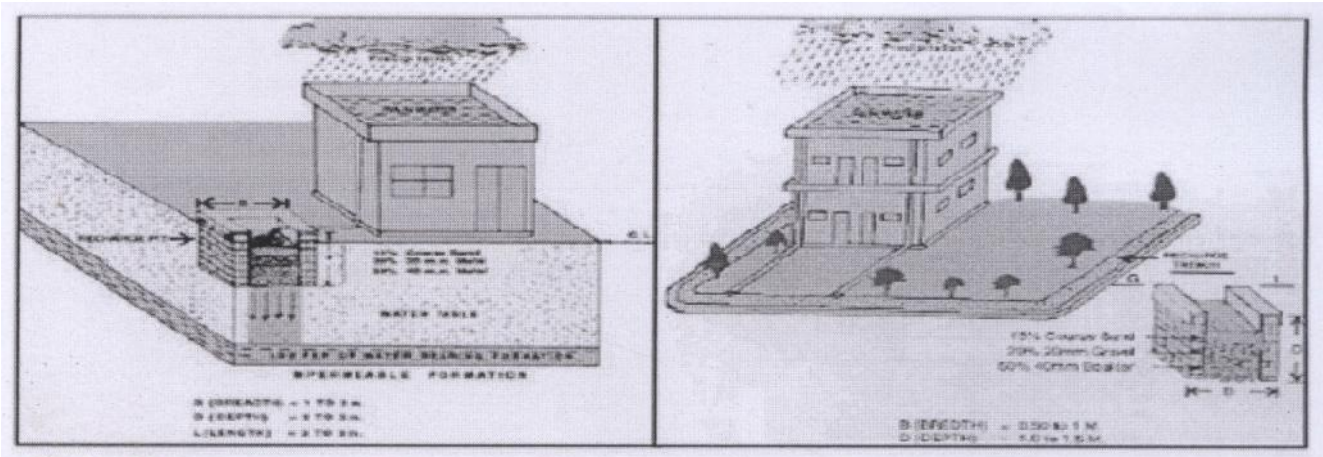


Figure.2: Rainwater harvesting and groundwater recharge for individual plotted house and Multi-storied residential building (by storage sump and percolation pits)

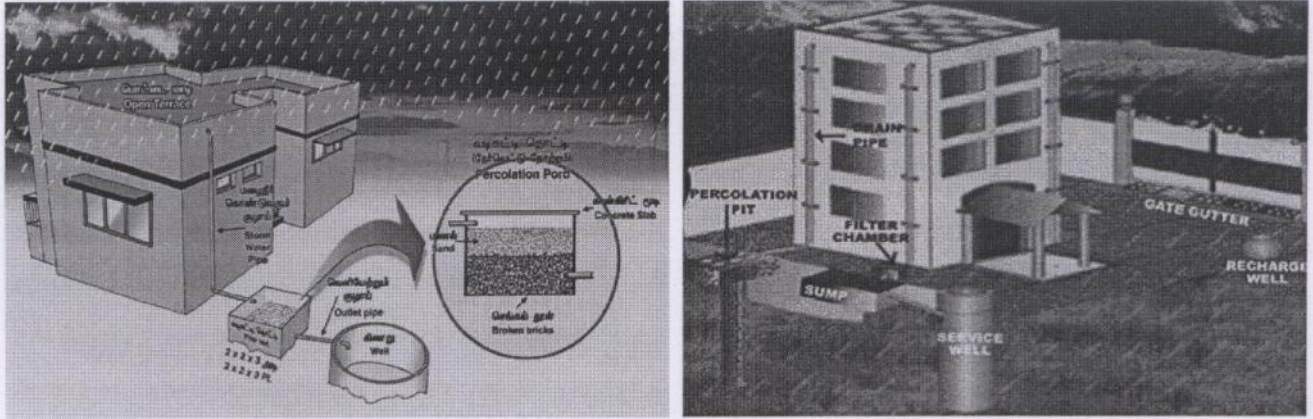


Figure.3: Rainwater harvesting for parks/open spaces :

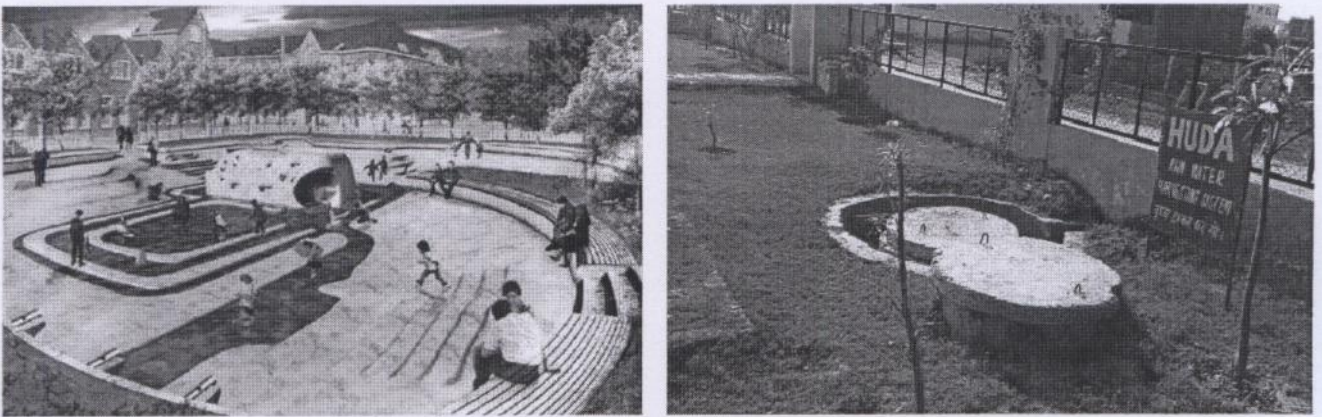


Figure. 4 : Rainwater collection (through downpipes and sieves)



Figure. 5: Rainwater collection and Groundwater recharge (through abandoned wells and Hand pumps)

