ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ
Bangalore Water Supply and Sewerage Board

Rain Water Harvesting Amendments,

Regulations and Guidelines

ಇಂದಿನ ಮಳೆ ನೀರು ನಾಳಿನ ಜೀವ ಹನಿ

For more information visit :

ಸರ್.ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ ಮಳೆ ನೀರು ಸುಗ್ಗಿ ಕೇಂದ್ರ
Sir M. Visvesvaraya Rain Water Harvesting Theme Park
8th Main, 40th Cross, 5th Block, Jayanagar, Bengaluru
Ph : 080-26653666 **e-mail :** rwhthemepark@bwssb.gov.in

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ
Bangalore Water Supply and Sewerage Board

RAIN WATER HARVESTING AMENDMENTS, REGULATIONS AND GUIDELINES

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ಸಂಖ್ಯೆ: ಸಂವ್ಯಶಾಇ 6 ಶಾಸನ 2009, ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 27ನೇ ಆಗಸ್ಟ್, 2009

The Bangalore Water Supply and Sewerage (Amendment) Bill, 2009ಕ್ಕೆ, 2009ರ ಆಗಸ್ಟ್ ಮಾಹೆಯ 25ನೇ ದಿನಾಂಕದಂದು ರಾಜ್ಯಪಾಲರ ಒಪ್ಪಿಗೆ ದೊರೆತಿದ್ದು, ಸಾಮಾನ್ಯ ತಿಳುವಳಿಕೆಗಾಗಿ ಇದನ್ನು 2009ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ ಸಂಖ್ಯೆ: 19 ಎಂಬುದಾಗಿ ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪತ್ರದಲ್ಲಿ ಪ್ರಕಟಿಸಬೇಕೆಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

KARNATAKA ACT NO. 19 OF 2009

(First published in the Karnataka Gazette Extra-ordinary on the Twenty Seventh day of August, 2009)

THE BANGALORE WATER SUPPLY AND SEWERAGE (AMENDMENT) ACT, 2009

(Received the assent of the Governor on the Twenty Fifth day of August, 2009)

An Act further to amend the Bangalore Water Supply and Sewerage Act, 1964.

Whereas, it is expedient further to amend the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) for the purposes hereinafter appearing;

Be it enacted by the Karnataka State Legislature in the sixtieth year of the Republic of India as follows:-

1. Short title and commencement.- (1) This Act may be called the Bangalore Water Supply and Sewerage (Amendment) Act, 2009.

(2) It shall come into force at once.

ಪು.ತಿ.ನೋ.

2. Insertion of new section 72A.- In the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act No. 36 of 1964), after section 72, the following shall be inserted, namely:-

"72A. Obligation to provide rain water harvesting structure.- Within nine months from the date of commencement of the Bangalore Water Supply and Sewerage (Amendment) Act, 2009, every owner or occupier of a building having a sital area of 2400 square feet and above or every owner who propose to construct a building on a sital area of 1200 square feet and above, shall provide for rain water harvesting structure in such manner, with such conditions as may be provided in the regulations, failing which the Board may cause such rain water harvesting structure ahd recover the cost from the owner or occupier, as the case may be, as arrears of land revenue".

By order and in the name of the Governor of Karnataka,

G.K. BOREGOWDA
Secretary to Government
Department of Parliamentary Affairs and Legislation

KARNATAKA GAZETTE NOTIFICATION
DATED 2nd DECEMBER, 2010 (THURSDAY)

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

III FLOOR, CAUVERY BHAVAN, K.G. ROAD, BENGALURU - 560 099

NOTIFICATION

NO. BWSSB/CH/CE(QA)TAQA/2553/2010-11
DATED 28TH OCTOBER, 2010

In exercise of the powers conferred by Section 72-A and 88 of Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) and all other powers enabling it in this behalf, and with the approval of the Goverment of Karnataka accorded in Government order No.UDD 19 MNI 2010, dated 20th May, 2010, the Bangalore Water Supply and Sewerage Board hereby makes the following Regulations, the draft of the said Regulations having been published as required by sub-section (2) at Section 88 of the said Act, in Notification No.BWSSB/CH/CE(QA)/TAQA/479/2010-11 dated 31st May, 2010 duly published in part III, section 641 of the Karnataka Gazette, dated June 3rd, 2010.

REGULATIONS

1. Title and commencement :

1 These Regulations may be called the Bangalore Water Supply and Sewerage (Rain Water Harvesting) Regulations, 2010

2 They shall come in to force from the date of their publication in the official Gazette.

2. Definitions:

In these Regulations, unless the context otherwise requires :-

a) "Act" means the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964)

b) “Bore Well” means Well drilled in the hard rock formation for extraction of ground water.

c) “Disinfection” means removing the bacteriological contamination.

d) “Expert” means specialist in subject matter of rain water harvesting

e) “Filter” means line or graded material used for filtering the unwanted.

f) "Ground Water" means The Water available below the ground in the zone of saturation.

g) "Ground Water recharge" means The Water put below the ground to charge ground Water body by artificial structure or pit.

h) "Non Potable Water" means The Water used Tor garden, washing, Flushing or any other secondary purposes.

i) "Open well" means well constructed for extraction of ground Water. "Rail Water Harvesting" means the technique of collection and storage of rain Water for future use or for recharge of ground Water

k) "Regulations" means Regulations made by The Board.

3. Implementation of Rain Water Harvesting Scheme :

The manner OT providing rain Water harvesting structure as required under section 72A of the Act, shall be distinct Tor roof based rain Water harvesting as specified in regulation 4 and 5 respectively and guidelines issued there under.

4. Roof based Rain Water Harvesting :

1. Roof based rainwater shall be harvested for use through a filter into a storage tank or for recharge of an open well. In case of a bore well in the building through artificial recharge structure or pits, irrespective the nature of sub-soil conditions.

2. Rain Water from The roof of the buildings such as tiled/slope roof and flat/RCC roof may be collected using appropriate size of gutters or pipe lines respectively and stored either in a collection tank or storage structure of appropriate size placed over the ground or underground after proper filter and disifection. Appropriate filter shall be used for filtering rain Water. The Water shall be used for non portable purpose. The water to be used for portable purpose by owner/occupier shall be treated to IS 10500 standards before using. The surplus water available after filling the storage tank/sump may be diverted to the open well or bore well through recharge structure or pits.

5. Land based Rain Water Harvesting :

Land based rain Water harvesting, shall be done by using appropriate ground water recharge structures or pits depending on the nature of the sub-soil coditions.

6. Capacity designing of rain water storage structure :

1. While designing the roof based rain water harvesting the capacity of a storage structure or for for artificial recharge structures to ground water, a provision at the rate of 20 ltrs or more capacity per Sq. mtr. of the roof area shall be adopted.
2. While designing The Land based rain water harvesting the capacity of a storage structure or for artificial recharge structure to ground water a provision at The rate of 10 ltrs or more capacity per sq.mtrs. of the land.

7. Recharging of ground water through open well or Bore Well :

1. Through open well : The rain water collected from The roof of tiled or sloped roof and flat or RCC roofs using gutters or pipe lines rain water harvested shall be diverted to the open well through a filter before recharging into a open well. Appropriate disinfection methods shall be practiced before using Tor artificial recharge to ground water. Contaminated water should not be used as source of water for recharging The open well.
2. Through Bore Well : The rain water collected from the roof of tiled or sloped roof and flat or RCC roofs using gutters or pipe lines or Land based rain water harvested shall be filtered through proper filter, stored and stabilized in a sedimentation Tank before recharging into bore well. Expert advice may be obtained before recharging the bore well. Adequate bypoass or safety arrangements shall be provided in the system.

Sd/-

Chairman

Bangalore Water Supply and Sewerage Board

KA/BC-CPO/2515/WPP-47/2009-2011

ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರ

ಅಧಿಕೃತವಾಗಿ ಪ್ರಕಟಿಸಲಾದುದು

ವಿಶೇಷ ಪತ್ರಿಕೆ

ಭಾಗ–IV-A	ಬೆಂಗಳೂರು, ಶನಿವಾರ, ಫೆಬ್ರವರಿ ೫, ೨೦೧೧ (ಮಾಘ ೧೬ ಶಕ ವರ್ಷ ೧೯೩೨)	ಸಂಖ್ಯೆ ೮

ಸಂಸದೀಯ ವ್ಯವಹಾರಗಳು ಮತ್ತು ಶಾಸನ ರಚನೆ ಸಚಿವಾಲಯ

ಅಧಿಸೂಚನೆ

ಸಂಖ್ಯೆ:ಸಂವ್ಯಶಾಇ 34 ಶಾಸನ 2010, ಬೆಂಗಳೂರು, ದಿನಾಂಕ:05.02.2011

The Bangalore _Water Supply and Sewerage (Amendment) Bill, 2011ಇದಕ್ಕೆ, 2011ರ ಫೆಬ್ರವರಿ ಮಾಹೆಯ 02ನೇ ದಿನಾಂಕದಂದು ರಾಜ್ಯಪಾಲರ ಒಪ್ಪಿಗೆ ದೊರೆತಿದ್ದು, ಸಾಮಾನ್ಯ ತಿಳುವಳಿಕೆಗಾಗಿ ಇದನ್ನು 2011ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ ಸಂಖ್ಯೆ:05 ಎಂಬುದಾಗಿ ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪತ್ರದಲ್ಲಿ ಪ್ರಕಟಿಸಬೇಕೆಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

KARNATAKA ACT N0. O5 OF 2011

(First published in the Karnataka Gazette Extraordinary on the fifth day of February,2011)

THE BANGALORE WATER SUPPLY AND SEWERAGE (AMENDMENT) ACT, 2011

{Received the assent of the Governor on the Second day of February. 2011}

An Act further to amend the Bangalore Water Supply and Sewerage Act 1964.

Whereas, it is expedient further to amend the Bangalore Water Supply and Sewerage ACT, 1964 {Karnataka Act 36 of 1964} for the purposes hereinafter appearing:

Be it enacted by the Karnataka State Legislature in the sixty first year of the Republic of India as follows:-

1. Short title and commencement:- (1) This Act may be called the Bangalore Water Supply and Sewerage (Amendment) Act, 2011.

(2) It shall come into force at once.

2, Substitution of section 72A:- In the Bangalore Water Supply and Sewerage ACT 1964 (Karnataka Act 36 of 1964) for section 72A, the following shall be substituted, namely:-

72A. Obligation to provide for rain water harvesting structure.- Every owner or occupier of a building having sital area of not less than 2400 square feet or every owner who propose.-velo construct a building on a sital area of not less than 1200 square feet shall provide. rain water 11a.rves,,ting, structure for storage for use or for ground water recharge within such date as may be notified by the State Government in such manner and subject to such conditions as may be provided in the regulations and guidelines issued by the Board.

Explanation:- For the purpose of this section

(a)"rain water harvesting" means collection and storage of rain water from roof top of a building or from a vacant land for use or for ground water recharge; and

(b) "ground water recharge" means recharging of open well or the underground water as the case may be, by use of harvested rain Water."

By Order and in the name of the Governor of Karnataka
G.K. BOREGOWDA
Secretary to Government.
Department of Parliamentary Affairs and Legislation

KARNATAKA GAZETTE NOTIFICATION DATED 19TH MAY, 2011 (THURSDAY)

URBAN DEVELOPMENT SECRETARIAT
NOTIFICATION

NO. UDD 125 MNI 2011, BANGALORE, DATED 03-05-2011

In exercise of powers conferred by Section 72A of the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964), the Government of Karnataka, hereby notifies that the 31st December 2011 shall be the date within which rain water harvesting structure for storage use or ground water recharge shall be provided as per regulations and guideliness issued by the Board

By Order and in the name of the Governor of Karnataka

S. RENUKARADYA
Under Secretary to Government
Urban Development Department

KARNATAKA GAZETTE NOTIFICATION

Dt. 7th July 2011 (Thursday)

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

3rd Floor, Cauvery Bhavan, K.G. Road, Bengaluru - 560 009

NOTIFICATION

No. BWSSB/CH/CE(QA)/TAQA/1099/10-'1'1, Dated : 20.06.2011

In exercise of the powers conferred by Section 72-A and 88 of Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) and all other powers enabling it in this behalf, and with the approval of the Government of Karnataka accorded in Government Order No.UDD 306 MNI 2020, Dated : 21st April, 2011, the Bangalore Water Supply and Sewerage Board hereby makes the following Regulations, the draft of the said Regulations having been published as required by sub-section (2) of Section 88 of the said Act, in Notification No. BWSSB/CH/CE/(QA)/TAQA/242/2011-12 Dated : 26th April, 2011 duly published in part-III, Page 1421 of the Karnataka Gazette, Dated May 5th, 2011

REGUGULATIONS

1. Title and Commencement

1) The Regulations may be called the Bangalore Water Supply and Sewerage (Rain Water Harvesting) (Amendment) Regulations, 2011.

2) They shall come into force from the date of their publication in the Official Gazette.

2. Inseration of new reguation 8 : In the Bangalore Water Supply and Sewerage (Rain Water Harvesting) Regulations, 2010, after regulation 7, the following shall be inserted, namely :

8 Disconnection of Water supply : Where the owner or occupier of the building fails to provide rain water Harvesting structure in the building within such date as modified under section 72A of the Act, water supply connection provided to such building may be disconnected.

Provided that, "no disconnection shall be made as above unless an opportunity of being heared is given to the affected persons"

Sd/-
Chairman
Bangalore Water Supply and Sewerage Board
Bangalore

BANGALORE WATER SUPPLY AND SEWERAGE BOARD, BANGALORE

NOTIFICATION

No. BWSSB/C/CAO-S/4136/2015-16, Bangalore Dated : 25.02.2016

THE BANGALORE WATER SUPPLY AND SEWERAGE (RAIN WATER HARVESTING) (AMENDMENT) REGULATIONS, 2015

In exercise of the powers conferred by Section 72-A and 88 of Bangalore Water Suppluy and Sewerage Act, 1964 (Karnataka Act 36 of 1964) and other power enabling it in this belhaf, and with the approval of the Government of Karnataka accorded in Government Order No. UDD 191 MNI 2015, dated 07.01.2016, the Bangalore Water Supply and Sewerage Board hereby makes the following Regulations, the draft of the said Regulations having been published as required by sub-section (2) of Section 88 of the said Act, in Notification No. BWSSB/CH/CAO-S/3525/2015-16 dated 13.01.2016 duly published in Part-IV A, pages 56 of the Karnataka Gazette, dated 13.01.2016 namely,-

1. **Title and Commencement :-** (1) These regulations may be called the Bangalore Water Supply and Sewerage (Rain Water Harvesting) (Amendment) Regulations, 2015.

   (2) They shall come into force from the date of their final publication in the Official Gazette.

2. **Substitution of regulation 8.-** For regulation 8 of the Bangalore Water Supply and Sewerage (Rain Water harvesting) Regulations, 2010, the following shall be substituted, namely:-

   "8. Levy of Additional Water and Sanitary Charges.- (1) Where the Owner or occupier of a residential building fails to provide rain water harvesting structure in the building within such date as notified under section 72A of the Act, there shall be levied and additional charges of twenty-five percent of the total water and sanitary charges for the first three months and thereafter an additional charges of fifty percent of the total water and sanitary charges till the rain water harvesting structure is provided to the building.

(2) Where the Owner or Occupier of a non-residential building fails to provide rain water harvesting structure in the building within such date as notified under section 72A of the Act, there shall be levied an additional charges of fifty percent of the total water and sanitary charges for the first three months and thereafter an addtional charges of hundred percent of the total water and sanitary charges till the rain water harvesting structure is provided to the building;

Provided that no Additional Water and Sanitary charges shall be levied as above unless an opportunity of being heard is given to the affected persons"

By order,

Chief Administrative Officer cum Secretary,
Bangalore Water Supply and Sewerage Board

Bangalore Water Supply and Sewerage Board

NOTIFICATION

No. BWSSB/C/CAO-S/5199/2019-20, Bangalore, dated 06.03.2020

Bangalore Water Supply and Sewerage (Rain Water Harvesting) (Amendment) Regulations, 2019

In exercise of the powers conferred by section 72A and 88 of the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) with previous approval of the State Government vide Order No. UDD 10 MNI 2019 dated: 27.12.2019 the Bangalore Water Supply and Sewerage board hereby makes the following regulations further to amend the Bangalore Water Supply and Sewerage (Rain Water Harvesting) Regulations, 2010, the draft of the said Regulations is previously published as required by sub-section (2) of Section 88 of Bangalore Water Supply and Sewerage Act, 1964 vde notification No. BWSSB/C/CAO-C/4058/2019-20, Bangaloredated : 18.01.2020 in Part III of Karnataka Gazette dated: 30.01.2020 namely:-

Title and Commencement : (1) These regulations may be called the Bangalore Water Supply and Sewerage (Rain Water Harvesting) (Amendment) Regulations, 2019

(2) They shall come into force from the date of their final publication in the Official Gazette.

1. **Amendment of regulation 8 : -** Inregulation 8 of the Bangalore Water Sewerage (Rain Water Harvesting) Regulations, 2010

(i) in sub - regulation (1)

(a) for the words "twenty five percent" shall be substituted : and

(b) for the words "fifty percent", the words "hundred percent" shall be substituted.

(ii) in sub-regulation (2)

(a) for the words "fifty percent" the words "hundred percent" shall be substituted; and

(b) for the words "fifty percent", the words "hundred percent", the words "two hundred percent" shall be substituted.

By order,

Chief Administrative Officer cum Secretary,
Bangalore Water Supply and Sewerage Board

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

Cauvery Bhavan, K.G. Road, Bangalore

NOTIFICATION

No. BWSSB/C/CAO-S/294/2020-21 dt : 6.5.2020

In exercise of the powers conferred by section 16. 72-A and 88 of the Bangalore Water Supply and Sewerage Act 1964 (Karnataka Act 36. of 1965) with previous approval of the State Government is hereby published as required by the sub section (2) of Section 88 of Bangalore Water Supply and Sewage Act. 1964 vide Notification No. BWSSB/C/CAO-C/5224/2019-20 Dtd: 23.3.2020 in Part-III of Karnataka Gazette dated : 26.03.2020

1. **Title and Commencement : - (1)** These regulations may be called the Bangalore Water Supply and Sewerage (Rain Water Harvesting) (Amendment) Regulations 2020.

2. **Substitute of regulation 6:-** In the Bangalore water Supply and Sewerage (Rain Water Harvesting) Regulations. 2010 (herein after referred as the said regulations) for regulation 6 the following shall be substituted, namely:-

   "6. Capacity designing of rain water storage structure : (1) In respect of roof top rain water harvesting the capacity of storage structure or for artificial recharge strctures to ground water a provision at the rate of not less than 60 litres per square meter shall be adopted.

   (2) In respect of land based rain water harvesting the capacity of storage structure or aftificial recharge structure to ground water a provision at the rate of not less than 30 litres per square meter of land surface shall be adopted."

3. Insertion of new regulation 9:- After regulation 8 of the total regulations, the following shall be inserted namely :-

   "9. Certification of implementation of rain water harvsting unit:- The implementation of rain water harvesting shall be certified by the Board Engineers or by the third party agencies accredited or empanlled by the Board

By order,

Chief Administrative Officer cum Secretary,
Bangalore Water Supply and Sewerage Board

ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರ

ಅಧಿಕೃತವಾಗಿ ಪ್ರಕಟಿಸಲಾದುದು

ವಿಶೇಷ ರಾಜ್ಯ ಪತ್ರಿಕೆ

ಭಾಗ – IV A Part – IV A	ಬೆಂಗಳೂರು, ಗುರುವಾರ, ೦೭, ಅಕ್ಟೋಬರ್, ೨೦೨೧(ಆಶ್ವಯುಜ, ೧೫, ಶಕವರ್ಷ, ೧೯೪೩) BENGALURU, THURSDAY, 07, OCTOBER, 2021(ASHWAYUJA, 15, SHAKAVARSHA, 1943)	ನಂ. ೮೨೦ No. 820

DEPARTMENT OF PARLIAMENTARY AFFAIRS AND LEGISLATION SECRETARIAT

NOTIFICATION

NO: DPAL 25 SHASANA 2021, BENGALURU, DATED:07.10.2021

The Bangalore Water Supply and Sewerage (Amendment) Bill, 2021 ಇದಕ್ಕೆ 2021ರ ಅಕ್ಟೋಬರ್ ತಿಂಗಳ 5ನೇ ದಿನಾಂಕದಂದು ರಾಜ್ಯಪಾಲರ ಒಪ್ಪಿಗೆ ದೊರೆತಿದ್ದು, ಸಾಮಾನ್ಯ ತಿಳುವಳಿಕೆಗಾಗಿ ಇದನ್ನು 2021ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ ಸಂಖ್ಯೆ: 29 ಎಂಬುದಾಗಿ ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರದಲ್ಲಿ (ಭಾಗ IV-A) ಪ್ರಕಟಿಸಬೇಕೆಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

KARNATAKA ACT NO. 29 OF 2021

(First published in the Karnataka Gazette Extra-ordinary on the 7th day of October, 2021)

THE BANGALORE WATER SUPPLY AND SEWERAGE (AMENDMENT) ACT, 2021

(Received the assent of the Governor on the 5th day of October, 2021)

An Act to further amend the Bangalore Water Supply and Sewerage Act, 1964.

Whereas, it is expedient further to amend the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) for the purposes hereinafter appearing:

Be it enacted by the Karnataka State Legislature in the seventy second year of the Republic of India as follows:

1. Short title and commencement.- (1) This Act may be called the Bangalore Water Supply and Sewerage (Amendment) Act, 2021.

(2) It shall come into force at once.

2. Substitution of section 72A.- In the Bangalore Water Supply and Sewerage Act, 1964 (Karnataka Act 36 of 1964) for section 72A, the following shall be substituted, namely:-

"**72A. Obligation to provide rain water harvesting structure.**- (1) Every owner who proposes to construct a building on a sital area of not less than 108 square meter shall provide rain water harvesting structure for storage, for use or for ground water recharge in such manner and subject to such conditions as may be provided in the regulations and guidelines issued by the Board.

(2) Every owner or occupier of a building having sital area of not less than 216 square meter and not more than 1000 square meter, who has not provided rain water harvesting structure before the commencement of the Bangalore Water Supply and Sewerage (Amendment) Act, 2021, shall provide rainwater harvesting structure for storage, for use and for ground water recharge subject to such conditions as may be specified in the regulations.

(3) Every owner who proposes to construct a building on sital area of not less than 1000 square meter or a owner or occupier of a building having sital area of not less than 1000 square meter who has not provided rain water harvesting structure before the commencement of the Bangalore Water Supply and Sewerage (Amendment) Act, 2021 shall provide dual piping system and rain water harvesting structure for storage and for use, other than drinking, cooking and bathing purpose, based on roof area and ground water recharge based on paved and unpaved areas in such manner and subject to such conditions as may be provided in the regulations and guidelines issued by the Board.

Explanation.- For the purpose of this section,-

(a) "rain water harvesting" means collection and storage of rain water from roof top of a building or from a vacant land for use or for ground water recharge; and

(b) "ground water recharge" means recharging of open well or the bore well or the underground water as the case may be, by use of harvested rain water."

By Order and in the name of

the Governor of Karnataka,

G. SRIDHAR
Secretary to Government
Department of Parliamentary Affairs
and Legislation

ಸಂಸದೀಯ ವ್ಯವಹಾರಗಳು ಮತ್ತು ಶಾಸನ ರಚನೆ ಸಚಿವಾಲಯ

ಅಧಿಸೂಚನೆ

ಸಂಖ್ಯೆ: ಸಂವ್ಯಶಾಇ 25 ಶಾಸನ 2021, ಬೆಂಗಳೂರು, ದಿನಾಂಕ:07.10.2021

The Karnataka Official Language Act, 1963 (Karnataka Act 26 of 1963) ರ ಪ್ರಕರಣ 5-ಎ ರಡಿಯಲ್ಲಿ ರಾಜ್ಯಪಾಲರಿಂದ ಅಧಿಕೃತಗೊಳಿಸಿದ The Bangalore Water Supply and Sewerage (Amendment) Act, 2021 (Karnataka Act 29 of 2021) ನ ಭಾಷಾಂತರವನ್ನು ಅಧಿಕೃತ ಕನ್ನಡ ಪಠ್ಯವೆಂದು ಕರ್ನಾಟಕ ರಾಜ್ಯಪತ್ರದಲ್ಲಿ (ಭಾಗ IV-A) ಪ್ರಕಟಿಸಬೇಕೆಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

2021 ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ ಸಂಖ್ಯೆ: 29

(2021 ರ ಅಕ್ಟೋಬರ್ ತಿಂಗಳ 7ನೇ ದಿನಾಂಕದಂದು ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪತ್ರದ ವಿಶೇಷ ಸಂಚಿಕೆಯಲ್ಲಿ ಮೊದಲು ಪ್ರಕಟವಾಗಿದೆ)

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ (ತಿದ್ದುಪಡಿ) ಅಧಿನಿಯಮ, 2021

(2021 ರ ಅಕ್ಟೋಬರ್ ತಿಂಗಳ 5ನೇ ದಿನಾಂಕದಂದು ರಾಜ್ಯಪಾಲರಿಂದ ಅನುಮತಿಯನ್ನು ಪಡೆಯಲಾಗಿದೆ)

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ ಅಧಿನಿಯಮ, 1964ಕ್ಕೆ ಮತ್ತಷ್ಟು ತಿದ್ದುಪಡಿ ಮಾಡಲು ಒಂದು ಅಧಿನಿಯಮ.

ಇಲ್ಲಿ ಇನ್ನು ಮುಂದೆ ಕಂಡು ಬರುವ ಉದ್ದೇಶಗಳಿಗಾಗಿ ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ ಅಧಿನಿಯಮ, 1964ನ್ನು (1964ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ 36) ಮತ್ತಷ್ಟು ತಿದ್ದುಪಡಿ ಮಾಡುವುದು ಯುಕ್ತವಾಗಿರುವುದರಿಂದ;

ಇದು, ಭಾರತಗಣರಾಜ್ಯದ ಎಪ್ಪತ್ತೆರಡನೇ ವರ್ಷದಲ್ಲಿ ಕರ್ನಾಟಕ ರಾಜ್ಯ ವಿಧಾನಮಂಡಲದ ಮೂಲಕ ಈ ಮುಂದಿನಂತೆ ಅಧಿನಿಯಮಿತವಾಗಲಿ,

1. ಸಂಕ್ಷಿಪ್ತ ಹೆಸರು ಮತ್ತು ಪ್ರಾರಂಭ.- (1) ಈ ಅಧಿನಿಯಮವನ್ನು ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ (ತಿದ್ದುಪಡಿ) ಅಧಿನಿಯಮ, 2021 ಎಂದು ಕರೆಯತಕ್ಕದ್ದು.

(2) ಇದು, ಈ ಕೂಡಲೇ ಜಾರಿಗೆ ಬರತಕ್ಕದ್ದು.

2. 72ಎ ಪ್ರಕರಣದ ಪ್ರತಿಯೋಜನೆ.- ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ ಅಧಿನಿಯಮ, 1964ರ (1964ರ ಕರ್ನಾಟಕ ಅಧಿನಿಯಮ 36) 72ಎ ಪ್ರಕರಣದ ಬದಲಾಗಿ ಈ ಮುಂದಿನದನ್ನು ಪ್ರತಿಯೋಜಿಸತಕ್ಕದ್ದು, ಎಂದರೆ:-

"**72ಎ. ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಒದಗಿಸುವ ಹೊಣೆಗಾರಿಕೆ.**- (1) 108 ಚದರ ಮೀಟರಿಗಿಂತ ಕಡಿಮೆಯಲ್ಲದ ನಿವೇಶನದಲ್ಲಿ ಕಟ್ಟಡವನ್ನು ನಿರ್ಮಿಸುವ ಉದ್ದೇಶವನ್ನು ಹೊಂದಿರುವ ಪ್ರತಿಯೊಬ್ಬ ಮಾಲೀಕನು, ಮಂಡಳಿಯು ಹೊರಡಿಸಿದ ವಿನಿಯಮಗಳು ಮತ್ತು ಮಾರ್ಗಸೂಚಿಗಳಲ್ಲಿ ಉಪಬಂಧಿಸಬಹುದಾದ ಅಂಥ ರೀತಿಯಲ್ಲಿ ಮತ್ತು ಅಂಥ ಷರತ್ತುಗಳಿಗೆ ಒಳಪಟ್ಟು ಮಳೆನೀರು ಶೇಖರಣೆಗಾಗಿ, ಬಳಕೆಗಾಗಿ ಅಥವಾ ಅಂತರ್ಜಲ ಪುನರ್ಭರ್ತಿಗಾಗಿ ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಒದಗಿಸತಕ್ಕದ್ದು.

(2) 216 ಚದರ ಮೀಟರುಗಳಿಗಿಂತ ಕಡಿಮೆಯಿರದ ಮತ್ತು 1000 ಚದರ ಮೀಟರುಗಳಿಗಿಂತ ಹೆಚ್ಚಲ್ಲದ ನಿವೇಶನ ಪ್ರದೇಶದಲ್ಲಿ ಕಟ್ಟಡವನ್ನು ಹೊಂದಿರುವ ಪ್ರತಿಯೊಬ್ಬ ಮಾಲೀಕ ಅಥವಾ

ಅಧಿಭೋಗದಾರನು ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ (ತಿದ್ದುಪಡಿ) ಅಧಿನಿಯಮ, 2021ರ ಪ್ರಾರಂಭಕ್ಕೆ ಮೊದಲು ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಕಲ್ಪಿಸದಿದ್ದರೆ, ವಿನಿಯಮಗಳಲ್ಲಿ ನಿರ್ದಿಷ್ಟಪಡಿಸಬಹುದಾದ ಅಂಥ ಷರತ್ತುಗಳಿಗೆ ಒಳಪಟ್ಟು ಮಳೆನೀರು ಶೇಖರಣೆಗಾಗಿ, ಬಳಕೆಗಾಗಿ ಅಥವಾ ಅಂತರ್ಜಲ ಪುನರ್ಭರ್ತಿಗಾಗಿ ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಒದಗಿಸತಕ್ಕದ್ದು.

(3) ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಗ್ರಾಮಸಾರ ಚರಂಡಿ ವ್ಯವಸ್ಥೆ (ತಿದ್ದುಪಡಿ) ಅಧಿನಿಯಮ, 2021ರ ಪ್ರಾರಂಭಕ್ಕೆ ಮುಂಚೆ ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಕಲ್ಪಿಸದಿರುವ 1000 ಚದರ ಮೀಟರುಗಳಿಗಿಂತ ಕಡಿಮೆಯಿರದ ವಿಸ್ತೀರ್ಣದಲ್ಲಿ ಕಟ್ಟಡವನ್ನು ನಿರ್ಮಿಸಲು ಉದ್ದೇಶಿಸಿರುವ ಪ್ರತಿಯೊಬ್ಬ ಮಾಲೀಕನು ಅಥವಾ 1000 ಚದರ ಮೀಟರುಗಳಿಗಿಂತ ಕಡಿಮೆಯಿರದ ನಿವೇಶನ ಪ್ರದೇಶದಲ್ಲಿ ಕಟ್ಟಡವನ್ನು ಹೊಂದಿರುವ ಮಾಲೀಕನು ಅಥವಾ ಅಧಿಭೋಗದಾರನು ಛಾವಣಿಯಿಂದ ಬೀಳುವ ಮಳೆ ನೀರು ಸಂಗ್ರಹಣೆಗಾಗಿ ಮತ್ತು ಕುಡಿಯುವುದಕ್ಕೆ, ಅಡಿಗೆಗೆ ಹಾಗೂ ಸ್ನಾನದ ಉದ್ದೇಶಕ್ಕೆ ಹೊರತಾದ ಬಳಕೆಗಾಗಿ ಹಾಗೂ ಕಲ್ಲು ಹಾಸು ಮತ್ತು ಕಲ್ಲು ಹಾಸು ಇಲ್ಲದ ಜಾಗದಿಂದ ಬರುವ ಮಳೆ ನೀರನ್ನು ಅಂತರ್ ಜಲ ಪುನರ್ಭರ್ತಿಗಾಗಿ ಮಂಡಳಿಯು ಹೊರಡಿಸಿದ ವಿನಿಯಮಗಳು ಹಾಗೂ ಮಾರ್ಗಸೂಚಿಗಳಲ್ಲಿ ಉಪಬಂಧಿಸಬಹುದಾದಂಥ ರೀತಿಯಲ್ಲಿ ಹಾಗೂ ಅಂಥ ಷರತ್ತುಗಳಿಗೊಳಪಟ್ಟು ದ್ವಿಕೊಳವೆ ವ್ಯವಸ್ಥೆಯನ್ನು ಹಾಗೂ ಮಳೆ ನೀರು ಕೊಯ್ಲು ರಚನೆಯನ್ನು ಕಲ್ಪಿಸತಕ್ಕದ್ದು.

ವಿವರಣೆ: ಈ ಪ್ರಕರಣದ ಉದ್ದೇಶಕ್ಕಾಗಿ,-

(ಎ) "ಮಳೆ ನೀರು ಕೊಯ್ಲು" ಎಂದರೆ, ಬಳಕೆಗಾಗಿ ಅಥವಾ ಅಂತರ್ಜಲ ಪುನರ್ಭರ್ತಿಗಾಗಿ, ಕಟ್ಟಡದ ಮೇಲ್ಛಾವಣಿಯಿಂದ ಬೀಳುವ ಅಥವಾ ಖಾಲಿ ಭೂಮಿಯಿಂದ ಬರುವ ಮಳೆ ನೀರಿನ ಶೇಖರಣೆ ಮತ್ತು ಸಂಗ್ರಹಣೆ; ಮತ್ತು

(ಬಿ) "ಅಂತರ್ಜಲ ಪುನರ್ಭರ್ತಿ" ಎಂದರೆ, ಕೊಯ್ಲು ಮಾಡಿದ ಮಳೆ ನೀರಿನ ಬಳಕೆಯಿಂದ ತೆರೆದ ಬಾವಿ ಅಥವಾ ಕೊಳವೆಬಾವಿ ಅಥವಾ ಸಂದರ್ಭಾನುಸಾರ, ಅಂತರ್ಜಲ ನೀರಿನ ಮಟ್ಟವನ್ನು ಹೆಚ್ಚಿಸಲು ಪುನರ್ಭರ್ತಿ ಮಾಡುವುದು."

The above translation of the Bangalore Water Supply and Sewerage (Amendment) Act, 2021 (Karnataka Act 29 of 2021) shall be authoritative text in Kannada language under section 5-A of the Karnataka Official Language Act, 1963 (Karnataka Act 26 of 1963).

ಥಾವರ್‌ಚಂದ್ ಗೆಹ್ಲೋಟ್
ಕರ್ನಾಟಕದ ರಾಜ್ಯಪಾಲರು

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆಜ್ಞಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

ಜಿ. ಶ್ರೀಧರ್
ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿ
ಸಂಸದೀಯ ವ್ಯವಹಾರಗಳು ಮತ್ತು
ಶಾಸನ ರಚನೆ ಇಲಾಖೆ.

Guidelines on Rain Water Harvesting

Rainwater harvesting is an age old practice becoming popular due to the realization of the potential of the rain water and due to the increased demand for fresh water.

Rainwater is pure and soft. It has a nearly neutral pH and is free from disinfection, by-products, salts, minerals, and other natural and man-made contaminants.

Though, the practice of Rooftop water harvesting is an age-old one, systematic collection and storage of water to meet the domestic water needs of the family is thought of recently. The cheaper and cost effective rain water harvesting components, readily available know-how on systematic and economic methods of construction will encourage the user to adopt this practice. There is also a need for creation of awareness and development of simple techniques to popularise roof water harvesting as a potential alternative source of fresh water.

The guideline is intended to serve as a tool for planning of residential and other rain water harvesting systems and also to encourage use of easily available precious fresh water through simple techniques.

Some of the benefits of rainwater harvesting are as shown below

- The water is free except for the expenses for collection.
- The harvested water is available where it is required as such there is no distribution cost.
- Rainwater provides a fresh water source where groundwater quality is poor and can be used for recharging the aquifer.
- The zero hardness of rainwater helps prevent scale on appliances, extending their use. Rainwater eliminates the need for a water softener.
- Rainwater is sodium-free and good for persons on low-sodium diets.
- Rainwater harvesting reduces flow to storm water drains, mitigates Urban flooding and also reduces non- point source pollution of surface and ground water.

- Rainwater harvesting helps to manage the summer demand peak Through ground water banking.
- Rainwater harvesting reduces water bill.

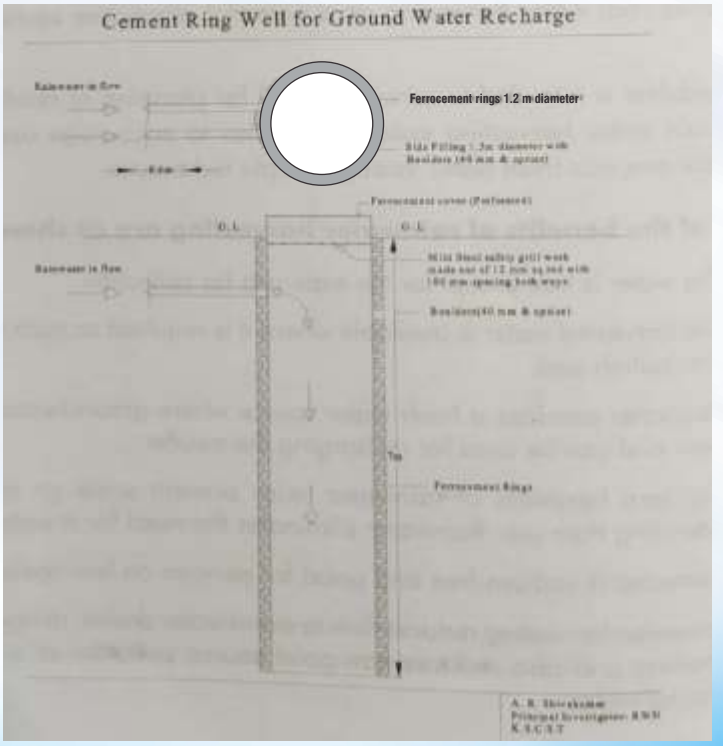
Minimum requirement:

Rain water storage (surface tank or under ground sump) & ground recharge (RCC precast ringwell) of minimum 60 ltrs. Per Sq. Mtr of roof area and a minimum of 30 ltrs. Per Sq. mtr. Paved open space. Provision shall be made. The open well/recharge well of depth of 3 mtrs(minimum) & diameter of .9 mtr.(minimum) without filling in the well (like aggregates jelly, sand etc.,) provision shall be made.

The outer periphery of RCC rings shall be covered with 40 mm and up six jelly to a width of 0.15 mtr from bottom of well upto the gorund level. This will ensure proper seating of RCC rings and easy for infiltration of rain water.

For safety purpose, 1 no of MS grill made of 12 mm sq rod with 100 mm spacing both ways shall be provided below the first RCC ring from ground level. The ring well should be properly covered.

Cement Ring well for Ground Water Recharge



Components of Rain Water Harvesting

Rainwater harvesting is to capture, convey, and store the rainwater. It is useful for watering plants, domestic use, flushing toilet, car washing, ground water recharge, and reduces flooding of storm water drains.

Basic Components

The rainwater harvesting system comprises of following components:

- Catchment surface: the collection surface from which rainfall runs off
- Gutters and down pipes channel water from the roof to the tank
- Screens, first-flush system and filter components which remove debris and dust from the captured rainwater before it goes to the tank
- Storage tanks
- Delivery system: gravity-fed or pumped to the end use
- Treatment/purification: filters and other methods

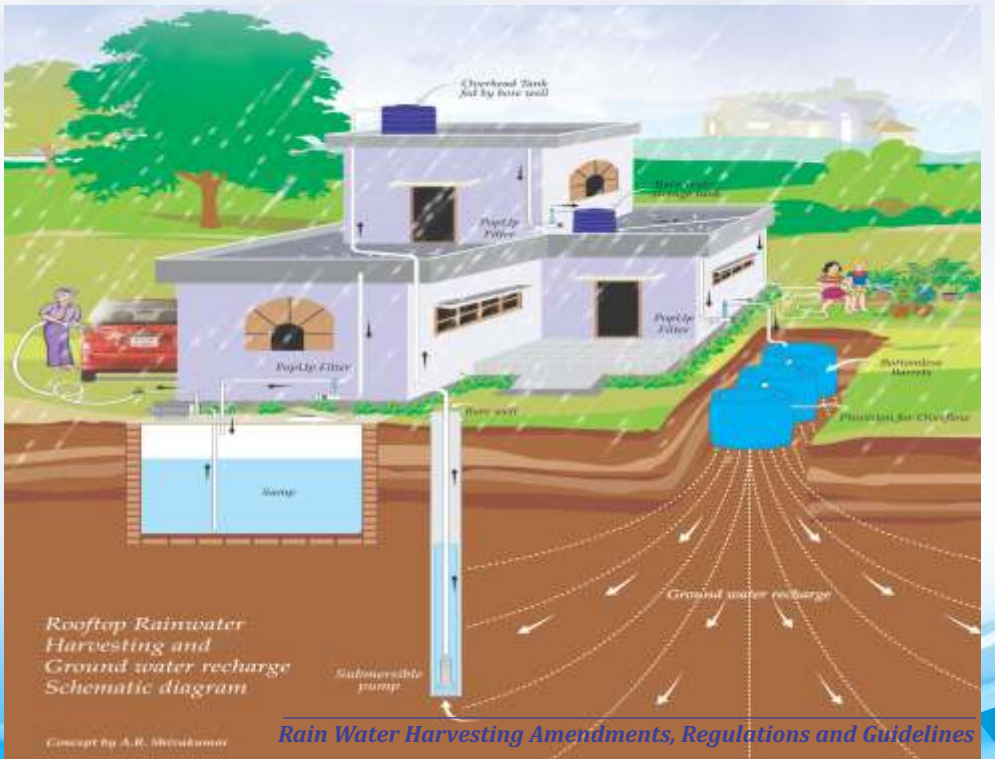


Figure 2-1
Typical rainwater harvesting installation

The Catchment Surface

The catchment surface includes roof of the building and the open area surrounding the building from where the rain water is harvested. Various types of materials are used for constructing the roof. Water quality from different roof catchments is a function of the type of roof material, climatic conditions, and the surrounding environment.

Sloping roofs

Roofs made of corrugated metal sheets or tiles can be utilised for harvesting the rainwater. Gutters and channels can be fixed on the edges of roof all around to collect and transport the rain water from the roof to the storage tank. Gutters can be prepared in semi-circular and rectangular shapes. Locally available material such as plain Galvanized Iron sheets can be easily folded to required shapes to prepare semi-circular and rectangular gutters. Semi-circular gutters of PVC material can be readily prepared by cutting the PVC pipes into two equal semi-circular channels.

Flat or Concrete Roof

This is common type roof surface encountered in the urban areas. In the case of flat roof, the pipes are fixed on the wall around the building to drain out the rain water collected on the roof tops. These pipes are connected through PVC pipes to convey water from roof to the storage tank.

Fig 2-2
Flat RCC Roof

Gutters and Down Pipes

Gutters are channels fixed to the lower edges of roof to collect and convey the rainwater from the roof to the storage tank. The most common materials for gutters and down pipes are half-round PVC, vinyl, pipe, seamless aluminum and galvanized steel. Gutters can be prepared in semi-circular and rectangular shapes.

Locally available material such as plain galvanized iron sheet can be easily folded to required shapes to prepare semi-circular and rectangular gutters. Semi-circular gutters of PVC material can be readily prepared by cutting the PVC pipes into two equal semi-circular channels. These channels are fixed to the roof ends to divert the rainwater into the storage tank. These channels are fixed to the roof by using suitable supports.

Gutter

Gutters should be installed with slope towards the down pipe; also the outside face of the gutter should be lower than the inside face to encourage drainage away from the building wall.

Down Pipe

Down pipe is the pipe which carries the rainwater from the gutters to the storage tank. Down pipe is joined with the gutters at one end, and the other end is connected to the filter unit of the storage tank. PVC pipes of diameter 75 mm to 110 mm (3 inch to 4 inch) are commonly used for down-pipe. In the case of RCC building, drain pipes themselves serve as down pipes. They have to be inter-connected to carry water to the storage tank.

The orientation and arrangement of the down pipe depends on relative locations of tank and roof. The shape of the roof and type of the roof also determine the arrangement of down pipes. The most common types of down pipe arrangement is shown in Fig. 2-3.

2-3
Gutter and Down Pipe

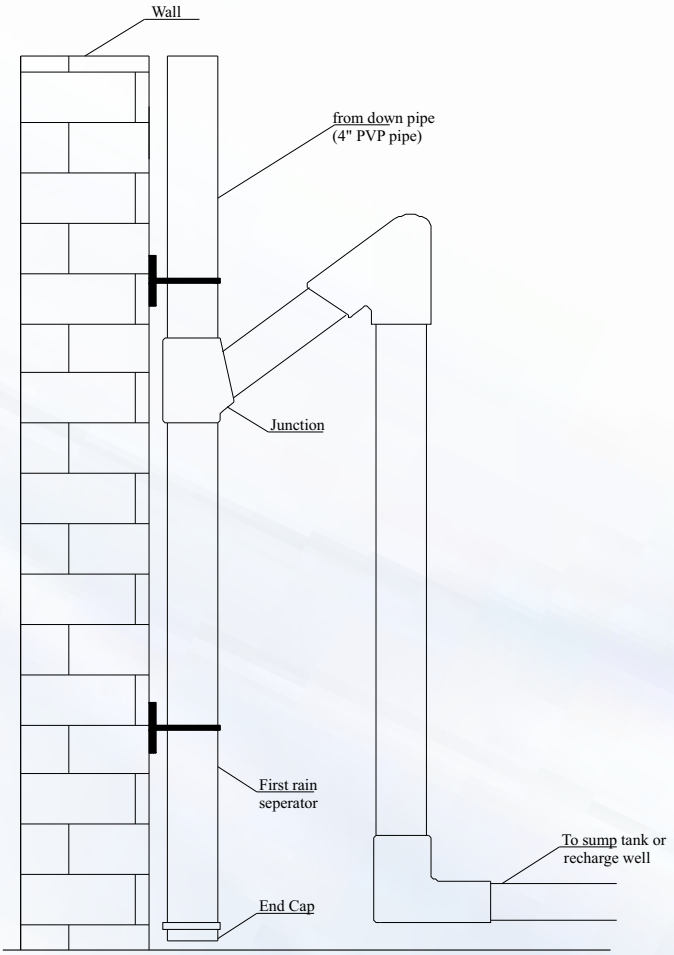


Fig. 2.4 First Flush System

Debris, dirt and dust collect on the roofs during non-rainy periods:

When the first rains arrive, this unwanted material will be washed into the storage tank. This causes contamination of water collected in the storage tank thereby rendering it unfit for domestic use. Therefore, a first flush system is to be incorporated in the Rooftop Rainwater Harvesting Systems to dispose off the 'first flush' water so that is does not enter the tank.

A simple system with a separate vertical pipe is fixed to the down pipe and a valve provided below the 'T' junction as shown in figure 2-4

After the first rain is washed out through first flush pipe, the value is closed to allow the water to enter the down pipe and reach the storage tank.

Filter Unit

1. Sand bed filter :

The process of filtration forms the most important stage in the purification of water. If usually consists in allowing water to pass through a thick layer of sand. During the process of filtration, the suspended and colloidal impurities which are present in water in a finely divided state are removed to a great extent.

The filter unit is a container or chamber filled with filter media such as coarse sand, charcoal, pebbles and gravels to remove the debris and dirt from water that enters the tank.

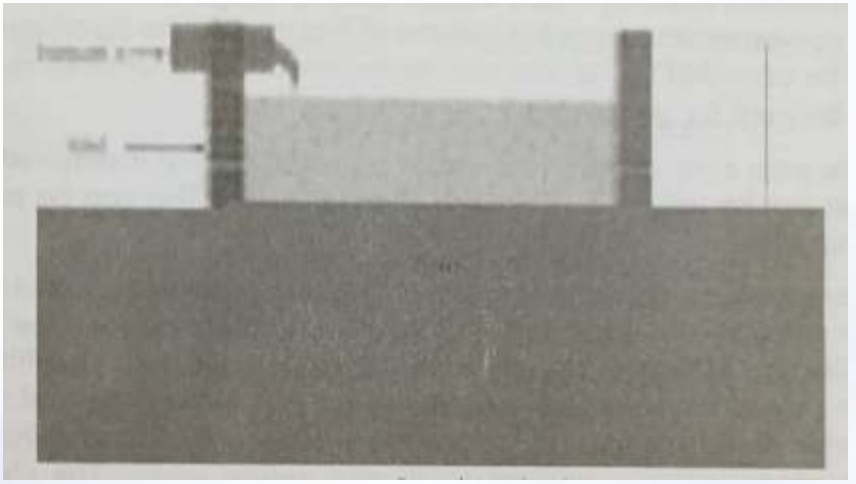


Fig. 2.5 Sand bed filter

2 Wall Mounted Filters :

There is a filter developed by KSCST and also several filters are readily availble in the market promoted by different agencies. These filters are wall mounted, to be aligned in between the pipes coming from the roof top and pipes moving towards the storage tank Normally these filters are capable of filtering the rain water coming from the roof area of 100 to 250 sq.mt. Hence, these filters can be used for the buildings having roof surface of 100 to 250 sq.mt. and for the roof area of more than 250 sq.mt. multiple number of filter may be used.

3. First Flush valve or First Rain Separator :

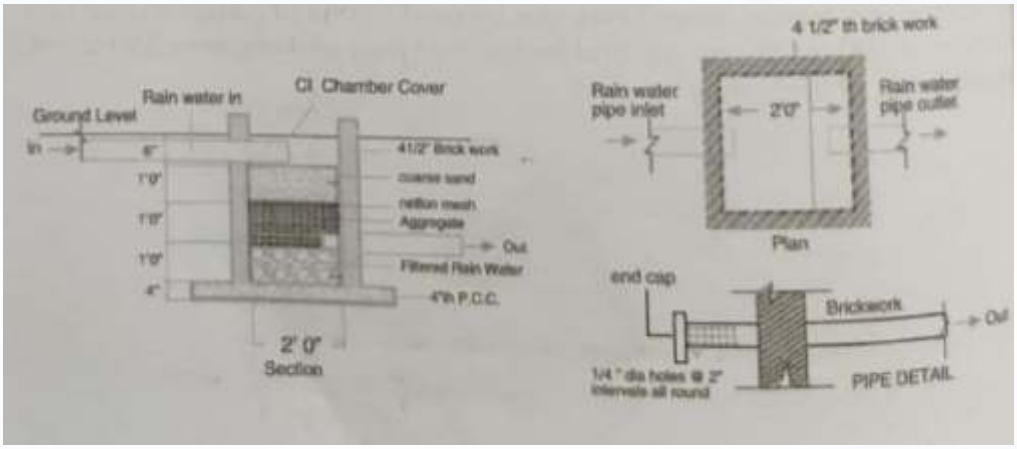
For the roof areas larger than 500 sq.mt. or more the method of First flush valve or first rain separator combined with sand bed filter for the filtration of rain water has to be adopted. There are units developed by KSCST and also units available in market promoted by different agencies.

a. The First rain separator should be designed to separate out the rainfall from the first 1 mm of rain fall. Hence if the rooftop is 500 sq.mt. 500 litres should be separated out. This water will not be filtered or used for any domestic purposes. The first rain separator can be a drum/storage of equivalent capacity. There should be an arrangement to drain out the first rain separator. Since the volume of first rain will be significant, a tap can be provided to the first rain separator and this drained out water can be used for gardening.

b. A bye-pass arrangement should be provided so that if required all the water can be let out and none of it is harvested. This can be provided along with the first rain separator.

c. In Bangalore, given that the maximum intensity of rainfall is about 60 mm/hour, the filter should be sized for 1 mm of rainfall. Hence if the rooftop is 500 sq. mt. 500 litres should be the effective capacity of the filter. This filter should be filled with aggregate for not more than half its total volume. Recommended aggregates are 12 mm jelly, 20 mm jelly, 40 mm jelly, coarse sand, wood charcoal and netlon mesh. The choice of aggregates will depend on the expected quality of the output water. An overflow pipe should be provided in the filter to handle rainfall that is of greater intensity than 60 mm per hour.

SAND BED FILTER FOR FILTERNING RAIN WATER



Storage Tanks

The Storage tank is used to store the water that is collected from the Rooftops and it is the most expensive component of the rainwater harvesting system.

For storing larger quantities of water, the system will usually require a bigger tank with sufficient strength and durability. Different types of storage tanks feasible for storing rooftop rainwater are given below.

Storage tanks

- **RCC**
- **Masonry**
- **Ferro Cement**
- **PVC etc**

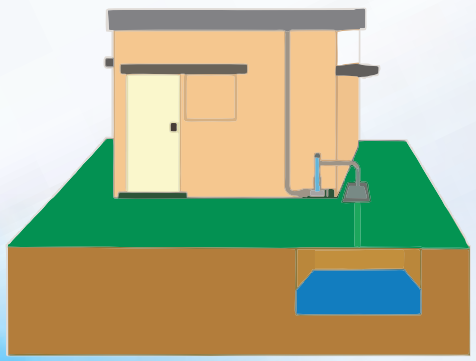


Fig.2-6.b. Storage of Rain Water in a Underground Sump

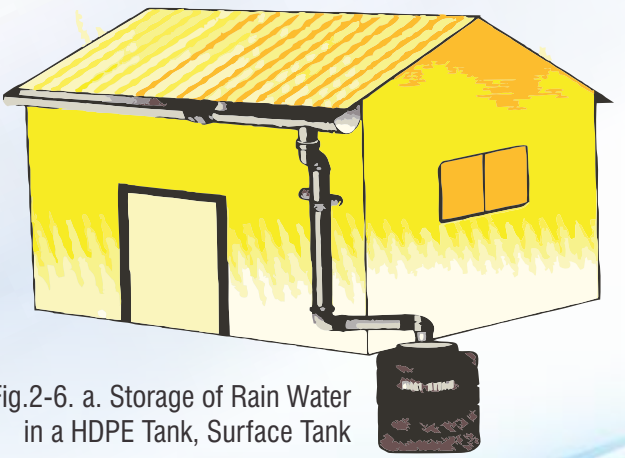


Fig.2-6. a. Storage of Rain Water in a HDPE Tank, Surface Tank

Harvestable rain water and tank capacity

Factors affecting the system design

There are many factors that determine the total quantity of rain water that can be harvested in a particular area and the system that would be appropriate for efficiently harvesting this quantity. Some of these are given below;

Rainfall quantity:

The total volume of rain water available from any roof top surface is a product of total rainfall and the surface area of collection. A runoff coefficient is usually applied to account for infiltration, evaporation and other losses and it varies from 0.8 to 0.95. In order to estimate the average annual/monsoon runoff from rooftop area in any location, the average annual/monsoon rainfall data for the location need to be used.

Rainfall pattern:

Rainfall pattern as well as the total rainfall will often determine the feasibility of a rain water harvesting system. In areas where rainfall occurs regularly in most parts through out the year, will mean that the storage requirement is low and hence the system cost will be correspondingly low and vice versa. On the other hand, areas where total rainfall occurs during 1-2 months, the water collected during the monsoon has to be stored for use in remaining months throughout the year which requires large storage structures as well as arrangement for some treatment.

Intensity of rainfall:

The maximum intensity of rainfall will decide the peak flow, which is to be harvested and depending upon the peak flow the gutter size for sloping roof and diameter of drainage pipe has to be calculated. In Bangalore the maximum intensity of rainfall has been observed to be 90 mm/hour.

Collection Surface Area:

For roof top rain water harvesting, the collection area is restricted by the size of the roof of the dwelling. Sometimes other surfaces such as terrace, balconies and other projections are used to supplement the roof top collection area.

Storage Capacity:

The storage tank is usually the most expensive component of rain water harvesting system hence a careful analysis is required for design of storage tank capacity.

How much water can be harvested

The total amount of water that is received in the form of rainfall over an area is called the total rain water quantity available. Out of this, the amount that can be effectively harvested is called the water harvesting potential. The collection efficiency accounts for the fact that all the rain water falling over an area cannot be effectively harvested.

Roof Based Runoff

Rain water Harvesting Potential(Q)
= Roof Area(A) x Runoff Coefficient(K) x Annual Rain Fall(R)

Consider a building with a flat terrace area of 100 m^2 The average annual rainfall in Bangalore is approximately 970mm. Assuming a runoff coefficient 0f 0.8 then in one year we will capture 77600 litres of water from rain fall

$$Q = 100 \ X \ 0.970 \ X 0.8 = 77,600 \text{ Litres}$$

Land Based Runoff

Consider a site with an area of 240 m^2 and a building with a flat terrace area of 100 m^2. The average annual rainfalls in Bangalore is approximately 970 mm. Assuming a runoff coefficient of 0.5 for the open area then in one year we will capture 67900 litres of water from rain fall.

$$Q = 140 \ X \ 0.970 \ X 0.5 = 67,900 \text{ Litres}$$

MONTHLY RAIN FALL BANGALORE (1951 to 1980)

Month	Mean Temperature ^{o}C		Mean Total Rainfall (mm)	Mean Number of Rainy Days
	Daily Minimum	Daily Maximum		
January	*15.1*	*27.0*	*2.7*	*0.2*
February	*16.6*	*29.6*	*7.2*	*0.5*
March	*19.2*	*32.4*	*4.4*	*0.4*
April	*21.5*	*33.6*	*46.3*	*3.0*
May	*21.2*	*32.7*	*119.6*	*7.0*
June	*19.9*	*29.2*	*80.6*	*6.4*
Jully	*19.5*	*27.5*	*110.2*	*8.3*
August	*19.4*	*27.4*	*137.0*	*10.0*
September	*19.3*	*28.0*	*194.8*	*9.3*
October	*19.1*	*27.7*	*180.4*	*9.0*
Novemober	*17.2*	*26.6*	*64.5*	*4.0*
December	*15.6*	*25.9*	*22.1*	*1.7*
		Total	**969.8**	**59.8**

Table 1: Water availability for a given Roof top Area and Rainfall (for flat roofs)

Roof top area (Sq.m)	Rainfall (mm)												
	100	200	300	400	500	600	800	1000	1200	1400	1600	1800	2000
	Water availability in cum (1 cum = 1000 liters)												
20	1.6	3.2	4.8	6.4	8	9.6	12.8	16	19.2	22.4	25.6	28.8	32
30	2.4	4.8	7.2	9.6	12	14.4	19.2	24	28.8	33.6	38.4	43.2	48
40	3.2	6.4	9.6	12.8	16	19.2	25.6	32	38.4	44.8	51.2	57.6	64
50	4	8	12	16	20	24	32	40	48	56	64	72	80
60	4.8	9.6	14.4	19.2	24	28.8	38.4	48	57.6	67.2	76.8	86.4	96
70	5.6	11.2	16.8	22.4	28	33.6	44.8	56	67.2	78.4	89.6	100.8	112
80	6.4	12.8	19.2	25.6	32	38.4	51.2	64	76.8	89.6	102.4	115.2	128
90	7.2	14.4	21.6	28.8	36	43.2	57.6	72	86.4	100.8	115.2	129.6	144
100	8	16	24	32	40	48	64	80	96	112	128	144	160
150	12	24	36	48	60	72	96	120	144	168	192	216	240
200	16	32	48	64	80	96	128	160	192	224	256	288	320
250	20	40	60	80	100	120	160	200	240	280	320	360	400
300	24	48	72	96	120	144	192	240	288	336	384	432	480
400	32	64	96	128	160	192	256	320	384	448	512	576	640
500	40	80	120	160	200	240	320	400	480	560	640	720	800
1000	80	160	240	320	400	480	640	800	960	1120	1280	1440	1600
2000	160	320	480	640	800	960	1280	1600	1920	2240	2560	2880	3200
3000	240	480	720	960	1200	1440	1920	2400	2880	3360	3840	4320	4800

Table2: Water availability for a given Roof top Area and Rainfall (for sloping roofs)

Roof top area (Sq.m)	Rainfall (mm)												
	100	200	300	400	500	600	800	1000	1200	1400	1600	1800	2000
	Water availability in cum (1 cum = 1000 liters)												
20	1.9	3.8	5.7	7.6	9.5	11.4	15.2	19	22.8	26.6	30.4	34.2	38
30	2.9	5.7	8.6	11.4	14.3	17.1	22.8	28.5	34.2	39.9	45.6	51.3	57
40	3.8	7.6	11.4	15.2	19	22.8	30.4	38	45.6	53.2	60.8	68.4	76
50	4.8	9.5	14.3	19	23.8	28.5	38	47.5	57	66.5	76	85.5	95
60	5.7	11.4	17.1	22.8	28.5	34.2	45.6	57	68.4	79.8	91.2	102.6	114
70	6.7	13.3	20.0	26.6	33.3	39.9	53.2	66.5	79.8	93.1	106.4	119.7	133
80	7.6	15.2	22.8	30.4	38	45.6	60.8	76	91.2	106.4	121.6	136.8	152
90	8.6	17.1	25.7	34.2	42.8	51.3	68.4	85.5	102.6	119.7	136.8	153.9	171
100	9.5	19	28.5	38	47.5	57	76	95	114	133	152	171	190
150	14.3	28.5	42.8	57	71.3	85.5	114	142.5	171	199.5	228	256.5	285
200	19	38	57	76	95	114	152	190	228	266	304	342	380
250	23.8	47.5	71.3	95	118.8	142.5	190	237.5	285	332.5	380	427.5	475
300	28.5	57	85.5	114	142.5	171	228	285	342	399	456	513	570
400	38	76	114	152	190	228	304	380	456	532	608	684	760
500	47.5	95	143	190	237.5	285	380	475	570	665	760	855	950
1000	95	190	285	380	475	570	760	950	1140	1330	1520	1710	1900
2000	190	380	570	760	950	1140	1520	1900	2280	2660	3040	3420	3800
3000	285	570	855	1140	1425	1710	2280	2850	3420	3990	4560	5130	5700

Roof Based Rain Water Harvesting

The Storage Capacity of Tank

The size of storage tank is dictated by several variables: the rainwater supply (local precipitation), the demand, the projected length of dry spells without rain, the catchments surface area, aesthetics, personal preference, and budget.

Storage tank can be constructed underground or above ground. The underground tank may be of masonry or R.C.C. structure suitably lined with water proofing materials placed at elevation on a raised platform. Choice of the tank depends on locally available materials and space available.

Regulations specify a minimum capacity of 20 litres per sq. m. of roof area i.e. 2000 litres for 100 sq. m. of roof area

However, the size of the tank can be optimized based on the calculation methods described below

- Daily Maximum Rainfall.
- Based on the water demand for two days.
- Based on number of rainy days in an year.

Method- I - Daily Maximum Rainfall

In another simple method, the size of the tank is calculated by dividing the total harvestable rain water by number of rainy days in a year. Volume of the tank can be calculated by the following formula:

$$V = A \times K \times R$$

V= Volume of tank in litres

A= Area of the roof

R=Daily Maximum Rainfall

For example

Area of the roof (A) is 100 m^2
Daily Maximum Rainfall(R) is 40mm
Coefficient (K) 0.8

$$V = 100 \times 40/1000 \times 0.8 = 3200 \text{ litres.}$$

Method-II - Based on the water demand for two days

In another simple method, the size of the tank should be enough to supply sufficient water for the users during the dry period i.e. during the gap period between the rains. the volume of the tank can be calculated by the following formula:

$$V = t \times n \times q$$

V= Volume of tank in litres

t=Length of the dry season (days)

n=Number of people using the tank

q=Consumption in litres per capita per day

If, for example, 135 lpd (q) is agreed upon and a dry period of 2 days (t) is normally not exceeded, for a family of 5 members (n), a storage volume of 2025 litres would be required

$$V = 2\ (t) \times 5\ (n) \times 135\ (q) = 1350 \text{ litres or } 1.35\ m^3$$

Method - III - Based on number of rainy days in a year

In another simple method, the size of the tank is calculated by dividing the total harvestable rain water by number of rainy days in a year. Volume of the tank can be calculated by the following formula:

$V = Q/N$

$V =$ Volume of tank in litres

$Q =$ Harvestable rain water per year in Litres

$N =$ Number of rainy days per year

If, for example, 77600 litres per year (Q) and Number of rainy days per year is 60(N) a storage volume of 1280 litres would be required

$V = 77600/60 = 1280$ 0r $1.280\ m^3$

Land Based Rain Water Harvesting

The Design of Recharge Structure

Regulations specify a minimum capacity of 10 litres per sq. m. of open space area i.e. 1000 litres for 100 sq. m. of open space area

However, the size of the recharge structure can be optimized based on the calculation methods described below

The capacity of the recharge structure is dictated by several variables: the rainwater supply (local precipitation), soil type, permeability, depth to ground water etc.

The Capacity of the recharge structure is calculated by the following methods

- Daily Maximum Rainfall
- Based on number of rainy days in an year

Method-I- Daily Maximum Rainfall

In this method, the capacity of the recharge structure is calculated by dividing the total harvestable rain water by number of rainy days in an year.

$V = A \times K \times R$

V= Volume of tank in litres

A= Open Area

R=Daily Maximum Rainfall

For example, Open Area (A) is 140 m^2, and Daily Maximum Rainfall® is 20 mm, and Coefficient (K) 0.5

$V = 140 \times 20/1000 \times 0.5 = 1400$ litres OR 1.4 m^3

Method-II- Based on number of rainy days in an year

In another simple method, the capacity of the recharge structure is calculated by dividing the total harvestable rain water by number of rainy days in an year.

$V = Q/N$

V= Volume of the recharge structure

Q= Harvestable rain water per year in Litres

N=Number of Rainy Days per year

For example, Runoff from the open area is 67900 litres per year (Q) and Number of rainy days per year is 60(N) a storage volume of 1280 litres would be required

$V = 67900/60 = 1132$ 0r 1.132 m^3

Water Quality and Treatment

The raindrop as it falls from the cloud is soft and is among the cleanest of water sources.

The condition of environment, the catchment surface and the storage tanks affect the quality of harvested rainwater. With minimal treatment and adequate care of the system, rainfall can be used for domestic and non domestic purposes.

The catchment area may have dust, dirt, fecal matter from birds and small animals, and plant debris such as leaves and twigs. Rainwater intended for domestic potable use must be treated using appropriate filtration and disinfection equipment.

Total dissolved solids (TDS) in rainwater originating from particulate matter suspended in the atmosphere range from 2 milligrams per liter (mg/l or ppm) to 20 mg/l. Compared with bore well water whose TDS can range from 100 ppm to more than 2000 ppm.

Factors Affecting Water Quality

pH (acidity/alkalinity)

As a raindrop falls and comes in contact with the atmosphere, it dissolves naturally occurring carbon dioxide to form a weak acid. The resultant pH is about 5.7, whereas a pH of 7.0 is neutral. (A slight buffering using 1 tablespoon of baking soda to 100 gallons of water in the tank will neutralize the acid, if desired. Also, a concrete storage tank will impart a slight alkalinity to the water)

BIS 10500-1991 specifies a ph range of 6.5 to 8.5 for potable purpose.

Particulate matter

Particulate matter refers to smoke, dust, and soot suspended in the air. Fine particulates can be emitted by industrial and residential combustion, vehicle exhaust, agricultural controlled burns, and sandstorms. As rainwater falls through the atmosphere, it can incorporate these contaminants.

Particulate matter is generally not a concern for rainwater harvesting.

Chemical compounds

In agricultural areas, rainwater could have a higher concentration of nitrates due to fertilizer residue in the atmosphere. Pesticide residues from crop dusting in agricultural areas may also be present.

Also, dust derived from calcium-rich soils can add 1 mg/l to 2 mg/l of hardness to the water. Hard water has a high mineral content, usually consisting of calcium and magnesium in the form of carbonates.

In industrial areas, rainwater samples can have slightly higher values of suspended solids concentration and turbidity due to the greater amount of particulate matter in the air.

Catchment surface

When rainwater comes in contact with a catchment surface, it can wash bacteria, molds, algae, fecal matter, other organic matter, and/or dust into storage tanks. The longer the span of continuous number of dry days (days without rainfall), the more catchment debris is washed off the roof by a rainfall event

Tanks

The more filtering of rainwater prior to the storage tanks, the less sedimentation and introduction of organic matter will occur within the tanks. Sedimentation reduces the capacity of tanks, and the breakdown of plant and animal matter may affect the color and taste of water, in addition to providing nutrients for microorganisms.

Water Treatment

The cleanliness of the roof in a rainwater harvesting system directly affects the quality of the captured water. The cleaner the roof, the less strain is placed on the treatment equipment. It is advisable that overhanging branches be cut away both to avoid tree litter and to deny access to the roof by rodents and lizards.

To improve water quality, several treatment methods are discussed. It is the responsibility of the individual installer or house owner to weigh the advantages and disadvantages of each method for appropriateness for the individual situation.

Disinfecting Water

Disinfecting is the process of killing the disease causing micro-organism present in the water. This can be done either by boiling the water in a vessel before consuming or by dissolving bleaching powder in required quantity to the water stored in the tank.

For disinfecting using bleaching powder, the general dosage recommended is 10 milligrams of bleaching powder containing 25% of free chlorine per litre of water. this meets the required standard of 2.5 milligrams of chlorine per litre of water.

After adding the bleaching powder, the water shall be stirred thoroughly for even distribution of the disinfectant agent. The water should be kept without use for about 30 minutes after adding bleaching powder. Following table can be referred for arriving at the quantity of bleaching powder to be added for different water depths in the storage tank.

Recommended dosage of bleaching powder for Disinfecting water Storage Dosage of bleaching powder (in grams)

Capacity of tank (litre)	Full tank	Tank three fourth (3/4) full	Tank half (1/2) full	Tank one fourth (1/4) full
5,000	50	37.5	25	12.5
6,000	60	45	30	15
7,000	70	52.5	35	17.5
8,000	80	60	40	20
9,000	90	67.5	45	22.5
10,000	100	75	50	25

Water Quality Monitoring

Water stored from the house roof top is presumed to be pure and potable as it will not flow on the ground and come into contact with any liquid or solid materials which can alter its quality. But, the rainwater falls on the roof, passes through the gutters and finally reaches the storage tank. In this process, water comes into contact with the dust, debris and leaf litter collected on the roof and the gutters. The water collected in the tank is stored for a period of 3 to 6 months before use. During this period, water will be in contact with tank walls and pipe fittings in the storage tank. If the stored water is exposed to outer environment it allows growth of algae and breeding of mosquitoes in the tank.

The reasons for variations in chemical constituents and bacteriological properties of water from Rooftop Rainwater Harvesting system (RRHS) could be many but the most important ones are listed below:

- Even though the water flows over the house roof for a short distance, it may dissolve some chemicals deposited on the roof from the atmosphere or the residue of chemical reaction between the atmospheric gases and the roof material.
- In general rainwater is pure and free from contamination. However, the air pollution from factories, industries, mining etc. does influence the chemical quality of water vapour in the atmosphere. When this water vapour condenses and comes in contact with the roof material, may react and leave residue on the roof. this phenomenon usually occurs over areas surrounding industries. The impact of this pollution on this rain water quality is not alarming, but needs attention.
- The rainwater while passing on the roof may carry the dust and debris resulting in change in the quality of water.
- The organic matter from the bird drops, rotten tree leaves, seeds and algae formation will be dissolved and carried by the rain water while flowing on the roof top. This may also cause quality changes of water stored in the tank.
- Breeding of mosquitoes or entry of insects through the opening of the tank such as over flow pipe may affect the quality of water.

The chemical and bacteriological contamination of roof water during the collection and storage processes can be prevented effectively by proper and regular maintenance of the system.

Analysis of Water samples

As the bacteriological contamination cannot be detected by the naked eye, it is necessary to analyse the quality of water in laboratories by collecting few water samples from storage tank. These tests help in verifying the presence of pathogenic bacteria. Following is the procedure for sample collection:

- Take three clean and dry sterilized glass or plastic bottles of 100 ml. size
- Rinse the bottles in the tank water from which samples have to be collected
- Fill the bottles with the tank water through the tap
- Take the water samples for testing to the nearest laboratory within 48 hours of collection of samples.

- Observe the test reports for the presence of E-coli bacteria in the water samples is an indication of water contamination by pathogen bacteria, which tends to multiply. Therefore, treatment of water becomes necessary even if less number of E-coli is noticed.

UV Light

UV light has been used in Europe for disinfection of water since the early 1900s, and its use has now become common. Bacteria, virus, and cysts are killed by exposure to UV light. The water must go through sediment filtration before the ultraviolet light treatment because pathogens can be shadowed from the UV light by suspended particles in the water. In water with very high bacterial counts, some bacteria will be shielded by the bodies of other bacteria cells.

UV lights are benign: they disinfect without leaving behind any disinfection by-products. They use minimal power for operation. One should follow manufacturer's recommendations for replacement of bulbs.

Before water is used for potable purpose, it should be ensured that it meets BIS 10500 Standards.

Recharge Wells

In areas where the aquifers are overlain by a considerable thickness of impervious formation, a new recharge bore well can be constructed for recharging the harvested rain water.

Chapter 5 Recharge of Harvested Rain Water

The runoff water collected from roof tops can artificially recharged to augment the depleting ground water resources especially in the urban areas, where the natural recharge has diminished considerably. The areas having depth to water table > 8 m. below ground level and underlain by permeable strata are suitable for artificial recharge.

Fig. 5-1
Recharge through abandoned Bore well

Fig. 5-2
Artificial Recharge through Open well

Design of efficient artificial recharge structures

The design involves consideration of data on hydrological and hydro geological aspects and hydro meteorological parameters. The background information which needs to be collected is:

- Layout plan of the area
- Demarcation of the roof, paved and open areas
- Delineation of storm water drains and flow of storm water
- Details of the existing ground water abstraction structures in and around the vicinity of the project site.
- Computation of the runoff for recharge.

Apart from the above mentioned parameters, selection of appropriate recharge structure depends on the availability of space for construction of recharge structures and invert levels of storm water drains at inlets to recharge structures. While preparing the recharge scheme, depth and shape of the storage facility in recharge structure depends on the availability of runoff, depth of storm water drainage and space availability in an area

Recharge structures

The most suitable recharge structures for roof top rain water harvesting are:

- Recharge pits
- Recharge trenches
- Recharge through dry or operational dug wells.
- Recharge through abandoned/existing tube wells
- Recharge wells etc.

Recharge pits

- The technique is suitable for small buildings having a roof area of about 100 sq. m. The recharge pits are constructed for recharging the shallow aquifers.
- Recharge Pits may be of any shape and size and are generally constructed 1 to 2 m. wide and 2 to 3 m. deep which are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1.5-2 mm) in graded form – Boulders at the bottom, gravels in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the coarse

sand layer and can easily be removed. For smaller roof area, pit may be filled with broken bricks/cobbles.

- A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the pit and a desilting/collection chamber may also be provided at the ground to arrest the flow of finer particles to the recharge pit.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.

Recharge trenches

- Recharge trenches are suitable for buildings having roof area of 200-300 sq. m. and where permeable strata are available at shallow depths.
- Trench may be 0.5 to 1 m. wide, 1 to 1.5 m. deep and 10 to 20 m. long depending upon availability of water to be recharged.
- These are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1.5-2 mm) in graded form – boulders at the bottom, gravel in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the sand layer and can easily be removed.
- A mesh should be provided at roof so that leaves or any other solid waste/debris is prevented from entering the trench and a desilting/collection chamber may also be provided on ground to arrest the flow of finer particles to the trench.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.

Recharge through dry or operational dug wells.

- Dry/operational dug wells if exist in the campus/nearby may be utilized as recharge structures after cleaning and de-silting the same.
- Recharge water is guided through a pipe from desilting chamber to the bottom of the well or below the water level to avoid scouring of bottom and entrapment of air bubbles in the aquifer.
- Recharge water should be silt free and for removing the silt contents, the runoff water should pass either through a de-silting chamber or filter chamber.
- Periodic chlorination should be done for controlling the bacteriological contamination in operational dug well.
- Provide wire mesh filter just before the inlet to avoid entry of any foreign material, tree leaves etc. in to the dug well.

Recharge through abandoned/existing tube wells

- Abandoned/existing tube wells may be used as recharge structures (fig. 5-1).
- The abandoned tube well should be properly developed before use as recharge structure.
- PVC pipes of 10 cm dia are connected to roof drains to collect rain water.

The first roof runoff is let off through the bottom of drain pipe if existing tube well is used as recharge structure. After closing the bottom pipe, the rain water of subsequent rain showers is taken through a T to an online PVC filter in case of small roofs. If the roof area is more, a filter pit may be provided. Rain water from roofs is taken to collection/desilting chambers located on ground. These collection chambers are interconnected as well as connected to the filter pit through pipes.

- A connecting pipe with recharge well is provided at the bottom of the pit for recharging of filtered water through well.
- Provide wire mesh filter just before the inlet to avoid entry of any foreign material, tree leaves etc. in to the system.
- Is used for recharging single/multiple aquifers.
- A settlement cum storage tank is constructed near the tube well for settlement of silt particles and storage of excess water.
- Roof top water is diverted to the settlement tank through pipes.
- Clear water of storage tank is diverted to the recharge tube well for recharge.
- It is suitable for recharging roof top rain water of big buildings/blocks.
- If runoff availability is less then on line filter may be used in the pipe line connecting roof water with recharge well.

Maintenance of Catchment Area, Water Drains and Recharge Structures.

- Maintain the catchments neat and clean, do not use roof top/terrace of the building and open spaces around the buildings for dumping of unwanted items and scrap material.
- Do not let the washing machine water which is having heavy dose of detergents shall not be allowed to enter into the water drains which are connected with recharge structures.
- Open water drains covered with perforated detachable RCC slabs are best as the maintenance of these drains is easy and pollution especially bacteriological pollution can be avoided. If the storm

water drainage is through pipe system, provide manholes and chambers at regular intervals and also near the suspected silt and waste accumulation places with in the channel.

- Protect the drainage system from tree leaves, polythene bags, plastic bottles and pouches of eatables which often seen dumped in storm water drains.
- Put up the sign boards mentioning that the campus of building is equipped with rain water harvesting system which is being recharged to the ground water system. Mention the ill effects and health impacts if the storm water drains are not properly maintained. Educate the staffs who are maintaining the storm water drains to keep the drains neat and clean.
- Provide wire mesh filter just before the inlet. Provide silt check wall within the drain bed at a convenient place, to clean. If more silt is expected provide check wall at regular interval in the storm water drains.
- The periodic removal of the material deposited on the surface by scraping the silt accumulated on top of the filter bed regularly.
- Precaution should be taken to avoid domestic waste water entering into the recharge structures.
- Recharge tube wells shall be developed periodically by hand bailers to avoid clogging of the slots.
- Before the arrival of monsoon, the rooftop as well as drains has to be properly cleaned.
- Length and placement of the slotted pipe shall be finalized after drilling of pilot hole for tube well.
- Recharge water should be introduced into the structure at its lowest point to prevent erosion and disturbance of filter material.
- A wire mesh shall be placed at the entrance of recharge structures.
- Periodic cleaning of collection chambers shall be carried out to remove the plastic bags, leaves etc. which chokes the entry of water recharge structures.

PRECAUTION:

Groundwater recharge has to be undertaken with care to avoid contamination of aquifer. Adequate care should be taken to ensure that no contaminated water or sewage enters the groundwater recharge structure.

Approved by committee.

1	Kemparamaiah, CE(QA)	> Chairman of the Committee
2	A.R. Shivakumar Executive Secretary	> RWH Expert, KSCST
3	C.S. Ramashesha Rt. Commissioner	> RWH expert. Ministry of water Resources, Central Ground Water Board.
4	S. Vishwanath Secretary General	> RWH expert International Catchment System Association
5	S.R. Roop Kumar ACE(K2)	> Member of the Committee
6	Narayana ACE(K2)	> Member of the Committee
7	Jayaram R. Hegde Law Officer	> Member of the Committee
8	A.N. Prahalada Rao, PRO	> Member of the Committee
9	H.N. Nagendra EE(WAC)	> Member of the Committee
10	Goutham Kumar EE(QA)	> Convener of the Committee
11	N. Sathish AEE (C2)	> Member of the Committee

ANNEXURE

1. Minimum requirement :

Rain water storage (surface tank or under ground sump) & ground recharge (RCC precast ring well) of minimum 60 ltrs. per sq. Mtr of roof area and a minimum of 30 ltrs. per sq. mtr. paved open space. Provision shall be made. The open well/recharge well of depth of 3 mtrs (minimum) & diameter of 0.9 mtr. (minimum) without filling in the well (like aggregates jelly, sand etc.,) provision shall be made.

The outer periphery of RCC rings shall be covered with 40 mm and up six jelly to a width of 0.15 mtr from bottom of well upto the ground level. This will ensure proper seating of RCC rings and easy for infiltration of rain water.

For safety purpose, 1 nos of MS grill made of 12 mm sq rod with 100 mm spacing both ways shall be provided below the first RCC ring from ground level. The ring well should be properly covered.

2. Filter Unit

i. **Sand bed filter :** The process of filteration forms the most important stage in the purification of water. It usually consists in allowing water to pass through a thick layer of sand. During the process of filtration, the suspended and colloidal impurities which are present in water in a finely divided state are removed to a great extent.

The filter unit is a container or chamber filled with filter media such as coarse sand, charcoal, pebbles and gravels to remove the debris and dirt from water that enters the tank.

ii. **Wall Mounted Filters :** There are several filters are readily available in the market promoted by different agencies. These filters are wall mounted, to be aligned in between the pipes coming from the roof top and pipes moving towards the storage tank. Normally these filters are capable of filtering the rain water coming from the roof area of 100 to 250 sq.mt. Hence, these filters can be used for the buildings having roof surface of 100 to 250 sq.mt. and for the the roof area of more than 250 sq.mt. multiple no. of filters may be used.

iii. **First Rain Separator :** For the roof areas larger than 500 sq.mt. the metof first rain separator combined with sand bed filter for the filtration of rain water has to be adopted. There are various designs available in market promoted by different agencies.

a. The First rain separator should be designed to separate out the rainfall from the first 1 mm of rain fall. Hence if the rooftop is 500 sqm, 500 litres should be separated out. This water will not be filtered or used for any domestic purposes. This first rain separator can be a drum/storage of equivalent capacity. There should be an arrangement to drain out the first rain separator. Since the volume of first rain will be significant, a tap can be provided to the first rain separator and this drained out water can be used for grardening.

b. A bye-pass arrangement should be provided so that if required all the water can be let out and none of it is harvested. This can be provided along with the first rain separatr.

c. In Bangalore, given that the maximum intensity of rainfall is about 60 mm/hour, the filter should be sized for 1 mm of rainfall. Hence if the rooftop is 500 sqm, 500 litres should be the effective capacity of the filter. This filter should be filled with aggregate for not more than half its total voume. Recommended aggregates are 12 mm jelly, 20 mm jelly, 40 mm jelly, coarse sand, wood charcoal and netlon mesh. The choice of aggregates will depend on the expected quality of the output water. An overflow pipe should be provided in the filter to handle rainfall that is of greater intensity than 60 mm per hour.

Sir M.Visvesvaraya Rain Water Harvesting Theme Park

8th Main, 40th Cross, 5th Block Jayanagar, Bangalore

- A RWH Theme Park by name Sir M Visvesvaraya Rain Water Harvesting Theme Park has been established at 8th Main, 40th Cross, 5th Block, Jayanagar, Bangalore,, A First of its kind in the Country.
- All information on implementation of RWH is provided to public free of cost under one roof.
- A Help Desk with a team of Engineers has been set up to provide technical knowledge & clarification about the RWH to the general public.
- All the RWH methods using different types of filters in the buildings for the collection & re-use of rain water are demonstrated in the Theme Park.
- Recharge wells, Percolation pits in the drains & different types of bunds are also constructed to demonstrate infiltration methods to recharge ground water.
- Interactive Models have been installed to demonstrate the economic use of water.
- Backlit information Kisosks are setup to provide integrated information about Bangalore Water Supply, Lake system & all relevant information about saving precious water.
- Open Air Theatre is established to spread the message of water saving and prudent use of water through cultural events.
- A modern Auditorium equipped with Multimedia has been built for communicating the message of water conservation & to hold seminar & workshops.
- The Theme Park functions everyday from 10.30 am to 5.30 pm excluding Sundays & general holidays.

ಮಳೆ ನೀರು ಕೊಯ್ಲು ಪದ್ಧತಿಯ ವಿವಿಧ ಅಳವಡಿಕೆಗಳು

ಮಳೆ ನೀರು ಕೊಯ್ಲು - Rain Water Harvesting

ಮಳೆ ನೀರು ಕೊಯ್ಲು ಎಂದರೆ ಮಳೆ ನೀರು ಹರಿದು ಹೋಗಿ ಪೋಲಾಗದಂತೆ ಮುಂದಾಲೋಚನೆಯಿಂದ ವೈಜ್ಞಾನಿಕ ರೀತಿಯಲ್ಲಿ ಸಂಗ್ರಹಿಸಿ ಶೇಖರಿಸಿಡುವ ವಿಧಾನ ಮತ್ತು ಅಂತರ್ಜಲ ಮಟ್ಟವನ್ನು ಪುನಶ್ಚೇತನಗೊಳಿಸಲು ಭೂಮಿಯಲ್ಲಿ ಇಂಗುವಂತೆ ಮಾಡುವುದು.

Rain Water Harvesting is the process of collecting and using the rainwater in a scientific and controlled manner for future use and for ground water recharge.

ಕಾವೇರಿ ಭವನ - Cauvery Bhavan

Technical Assistance: Karnataka State Council for Science and Technology Indian Institute of Science, Bangalore - 560 012
Tel: 080 - 2334 1652 / 2334 8848

ಸ್ಥಳದ ಒಟ್ಟು ವಿಸ್ತೀರ್ಣ/Total Plot Area	2,282 ಚದರ ಮೀಟರ್/sq.m
ಮಳೆನೀರಿನ ಸಾಮರ್ಥ್ಯ/Rainwater Potential	2.7 ಮಿಲಿಯನ್ ಲೀಟರ್‌ಗಳು/m.ltr.
ವಾರ್ಷಿಕ ಮಳೆ/Annual Rainwater	1,060 ಮಿಲಿ ಮೀಟರ್/m.m
ಮೇಲ್ಛಾವಣಿ ಪ್ರದೇಶ/Roof Area	836 ಚದರ ಮೀಟರ್/sq.m.
ಮೇಲ್ಛಾವಣಿ ಪ್ರದೇಶ ವಾರ್ಷಿಕ ಮಳೆನೀರಿನ ಸಾಮರ್ಥ್ಯ Roof top annual rainwater potential	8.44 ಲಕ್ಷ ಲೀಟರ್‌ಗಳು/lakh ltr.
ಫಸ್ಟ್ ಫ್ಲಕ್ ಫ್ಲೋಟ್ ಲಾಕ್/First flush float lock	1 ಸಂಖ್ಯೆ/No.
ಮರಳು ಶೋಧಕ ಹಾಸಿಗೆ/Sand bed filter	1 ಸಂಖ್ಯೆ/No.
ಒಟ್ಟು ಯೋಜನೆಯ ಮೊತ್ತ/Total cost of the project	ರೂ./Rs. 5,32,583/-
ಅನುಷ್ಠಾನಗೊಂಡ ದಿನಾಂಕ/Date of Commissioning	ಜೂನ್/June 2009

Executive Engineer (Quality Assurance) Division
Contractor : Dhruva Associates

ಸನ್ಮಾನ್ಯ ಮುಖ್ಯಮಂತ್ರಿಗಳ ಗೃಹ ಕಚೇರಿ - ಕೃಷ್ಣ
Home Office of Hon'able Chief Miniser - Krishan

ಅನುಷ್ಠಾನ/Implementation
ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಲಿ
Bangalore Water Supply and Sewerage Board

ಮಾರ್ಗದರ್ಶನ/Guidance
ಕರ್ನಾಟಕ ರಾಜ್ಯ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಮಂಡಳಿ
Karnataka Stae Council for Science and Technology

ತೋಟಗಾರಿಕೆ ಸ್ವಚ್ಛತಾ ಕಾರ್ಯ ಇತ್ಯಾದಿಗಳಿಗೆ ಬಳಸಲು, ಮೇಲ್ಛಾವಣಿಯ ಮೇಲೆ ಬೀಳುವ ಮಳೆ ನೀರನ್ನು ಪಾಪ್-ಆಪ್ ಶೋಧಕಗಳ ಮೂಲಕ ಹಾಯಿಸಿ 2000 ಲೀಟರ್ ಸಾಮರ್ಥ್ಯವುಳ್ಳ ಎರಡು ಹೆಚ್‌ಡಿಪಿಇ ಸಂಗ್ರಹ ತೊಟ್ಟಿಗಳಲ್ಲಿ ಶೇಖರಿಸಿಡಲಾಗುತ್ತದೆ.

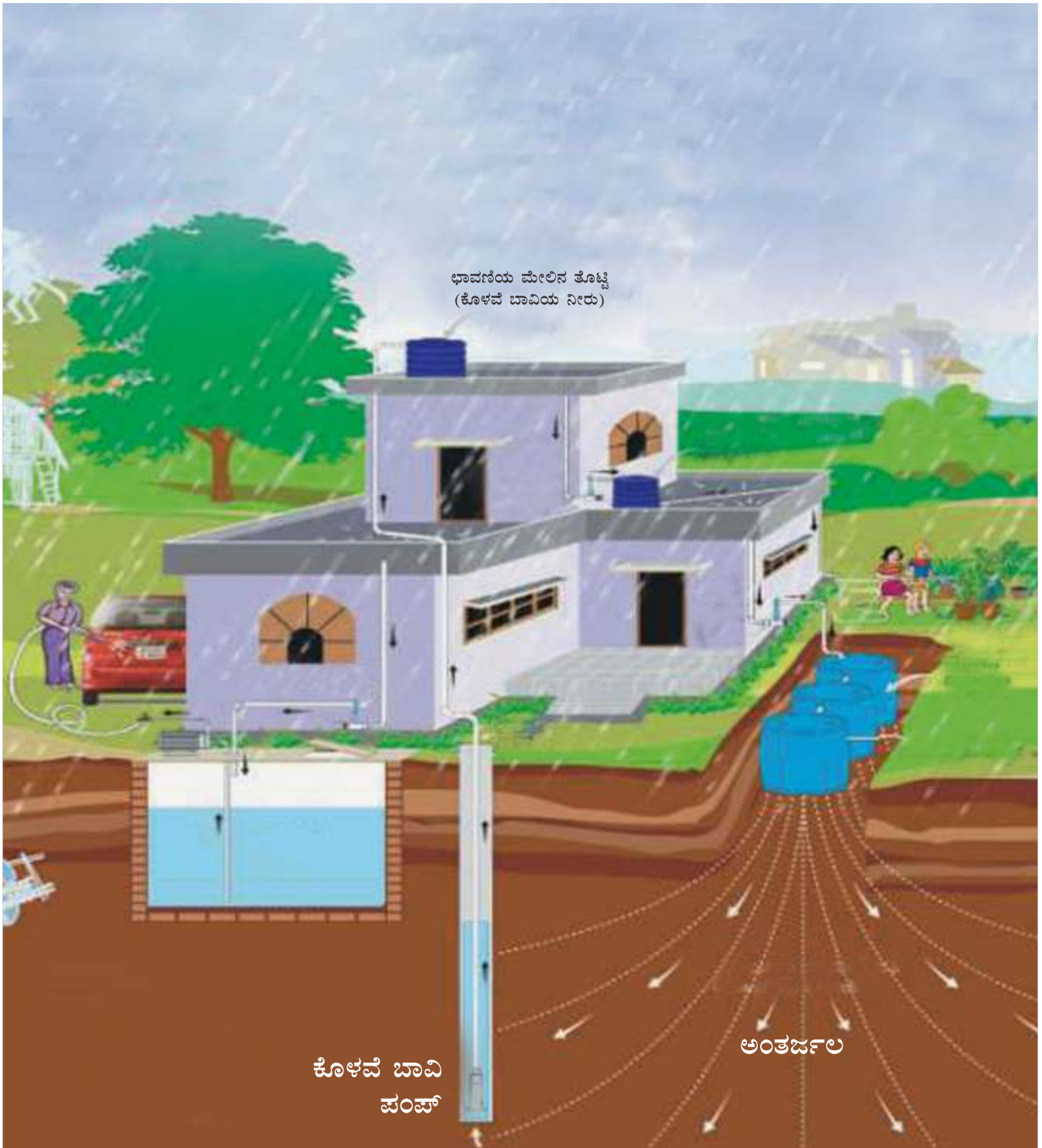
The Rain Water from the roof top of the building is made to pass through the Pop-Up filter and collected in 2000 ltr. Capacity (2 Nos.) HDPE tank and may be used for gardening cleaning and other non-potable purposes

ಮೇಲ್ಛಾವಣಿ ವಿಸ್ತೀರ್ಣ /Roof Area	279 ಚದರ ಮೀಟರ್/sq.m.
ಮೇಲ್ಛಾವಣಿ ಪ್ರದೇಶ ವಾರ್ಷಿಕ ಮಳೆನೀರಿನ ಸಾಮರ್ಥ್ಯ Roof top annual rainwater potential	2,83,279 ಲೀಟರ್‌ಗಳು/ltrs.

ಭೂಮಿ. ಅಂತರ್ಜಲ ಮಟ್ಟವನ್ನು ಪುನಶ್ಚೇತನಗೊಳಿಸಲು 25 ಅಡಿ ಆಳದ 5 ಅಡಿ 6 ಇಂಚು ವ್ಯಾಸದ ಇಂಗುಗುಂಡಿ ನಿರ್ಮಿಸಲಾಗಿದೆ.

Recharge well of size 25 deep and 5½ dia is constructed to recharge the ground water table by infiltration

ತೆರೆದ ಪ್ರದೇಶ ವಿಸ್ತೀರ್ಣ /Open Space Area	1171 ಚದರ ಮೀಟರ್/sq.m.
ಮಳೆನೀರಿನ ಸಾಮರ್ಥ್ಯ /annual rainwater potential	9,30,000 ಲೀಟರ್‌ಗಳು/ltrs.
ಬಾವಿಯ ಸಾಮರ್ಥ್ಯ /Well Capacity	17,000 ಲೀಟರ್‌ಗಳು/ltrs.



ಮೇಲ್ಛಾವಣಿ ಮಳೆ ನೀರಿನ
ಸಂಗ್ರಹಣೆ ಹಾಗೂ ಅಂತರ್ಜಲ
ಮರುಪಾವತಿಯ ಚಿತ್ರ