

BEFORE THE NATIONAL GREEN TRIBUNAL,**PRINCIPLE BENCH, NEW DELHI****Execution Application No. 04/2023****IN****Original Application No. 147/2021****IN THE MATTER OF:****Mahesh Chandra Saxena****...APPLICANT****VERSUS****The Chief Secretary, Govt. of NCT of Delhi & Ors. ..RESPONDENTS****INDEX**

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A.K. Agrawal
03/04/2023

(A.K. Agrawal)

Member Secretary, CGWA

ए. के. अग्रवाल / A. K. Agrawal
सदस्य / Member
केन्द्रीय भूमि जल प्राधिकरण / Central Ground Water Authority
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of Water Resources, River Development & Ganga Rejuvenation
जल शक्ति मंत्रालय / Ministry of Jal Shakti
भारत सरकार / Government of India

Place: New Delhi

Dated: 03.04.2023

ACTION TAKEN REPORT ON BEHALF OF MINISTRY OF JAL SHAKTI (MOJS) IN COMPLIANCE TO HON'BLE NGT, PB, ORDER DATED 09.02.2023 IN THE MATTER OF MAHESH CHANDRA SAXENA VS. THE CHIEF SECRETARY, GOVT. OF NCT OF DELHI & ORS. (E.A. NO. 04/2023 IN O.A. NO. 147/2021)

INTRODUCTION

In Original Application No. 147/2021 in Hon'ble NGT, issue of deficiencies in rain water harvesting systems resulting in polluted water mixing with the groundwater, was raised before the Hon'ble National Green Tribunal. The matter initially pertained to 40 Societies in Dwarka Area, Delhi. The Tribunal while disposing off the matter considered the need of joint inspection of rain water harvesting systems in all areas of Delhi to ensure proper functional design, depth of borewell, use of gravel and coarse sand in filter media.

NGT ORDERS

That the Hon'ble NGT was pleased to pass an order dated 10.12.2021 in O.A. No. 147/2021, wherein the following directions were passed :-

8. In the light of experience gained in the present case, it appears that at many places where RWH systems are installed, the same are either not functional or resulting in contamination of ground water which situation needs to be remedied not only in Delhi but pan India. This may be urgently looked into by a joint Committee of CPCB, Ministry of Jal Shakti (MoJS) and Ministry of Urban Development, Government of India. MoJS will be the nodal agency for the purpose. The Secretary, MoJS may call a meeting of stakeholders for further course of action in the light of above observations, followed by issuance of appropriate directions to all the States/UTs.

Vide Order dated 09.02.2023, Hon'ble NGT further directed:-

5. We also direct the Secretary, MoJS to file action taken report in response to the direction of this Tribunal dated 10.12.2021 by email within one month, after coordinating with all State/UTs on above pattern.

ACTION TAKEN

1. Constitution of the Committee-:

In pursuance to the directives of Hon'ble NGT, a Committee under the Chairmanship of Chairman, Central Ground Water Board (CGWB) was constituted by MoJS with the following members-:

S. No.	Committee Position	Representation	Nomination
1.	Chairman	Chairman, CGWB	----
2.	Member Secretary	Member, CGWA	-----
3.	Member	Representative of Central Pollution Control Board (CPCB)	Shri J Chandra Babu, Scientist, CPCB/ Ms Alpana Narula, Sr Scientific Assistant, CPCB
4.	Member	Representative of Ministry of Housing and Urban Affairs (MoHUA)	Dr Ramakant, Dy Advisor, PHE, CPHEEO
5.	Member	Representative of State of Delhi, Rajasthan, Haryana, Karnataka, Tamil Nadu	

ToR of the Committee-:

TOR-1: Operational status including design parameters of the installed Rainwater Harvesting (RWH) systems. The Committee may identify few sites in States/ UTs for verification and preparation of reports.

TOR-2: To check the contamination status of Ground Water aquifers due to faulty design of RWH systems, if any, in the country. Committee may identify few sites for this purpose.

TOR-3: To suggest remedial measures to improve existing RWH system and also recommend preventive actions to avoid installation of faulty RWH systems in future including addressing of maintenance issues.

TOR-4: Any other activity considered appropriate by the committee.

2. Working group were also constituted in 5 states i.e Delhi, Haryana, Karnataka, Rajasthan and Tamil Nadu, drawing members from regional offices of CGWB and States government departments to support the joint committee and coordinate with them. Accordingly, teams were constituted for different States that visited the RWH Sites and made an inspection.

A copy of detailed Report incorporating observations, conclusions and suggestions of the Committee is enclosed at Annexure-I. [Pg. no. 05- 227]

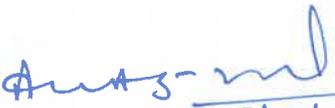
3. A Meeting was held under the chairmanship of the Secretary, DoWR, RD &GR, Ministry of Jal Shakti on 16.03.2023 on the presentation of the Report of the Joint Committee of CPCB, MoJS and MoH&UD constituted in the matter of Rainwater Harvesting Systems in India as per the directions of Hon'ble NGT. The copy of Minutes of the Meeting is enclosed as **Annexure-II**.

4. An Advisory dated 31.03.2023 has been issued by DoWR, Ministry of Jal Shakti to the Chief Secretaries/Administrators of all

the States/UTs for prevention of potential contamination from unscientific implementation of RWH systems, wherein it was requested to instruct concerned Departments/ agencies to strictly follow the guidelines including Do's & Dont's while implementing the RWH systems in their respective State. Further, it has been suggested that the concerned Department/agency in the State may approach Regional Director Offices of Central Ground Water Board (CGWB) for technical guidance/support, if any. The copy of Advisory dated 31.03.2023 issued by DoWR, MoJS is enclosed as **Annexure-III.**

5. The advisory has also been forwarded by CGWA to the concerned Additional Chief Secretary/ Principal Secretary/ Secretary/ Irrigation/ Water Resources/ Ground Water/ PHE Departments and the Regional Directors, CGWB for its compliance. The copy of the correspondences is enclosed as **Annexure-IV.**

The above is submitted for perusal of Hon'ble NGT and the present Action Taken Report may kindly be taken on record. The above is submitted for perusal of Hon'ble NGT and the present Action Taken Report may kindly be taken on record.


(A.K. Agrawal) 03/04/2023

Member Secretary, CGWA

Place: New Delhi

Dated: 03.04.2023

ए. के. अग्रवाल / A. K. Agrawal
सदस्य / Member
केन्द्रीय मृत्ति जल प्राधिकरण / Central Ground Water Authority
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भारत सरकार / Government of India

Joint Committee Report

RAIN WATER HARVESTING SYSTEMS IN INDIA

(Directions of the Hon'ble NGT in the matter of OA No. 147/2021)



March, 2023

REPORT OF THE JOINT COMMITTEE CONSTITUTED TO LOOK INTO THE MATTER OF RAIN WATER HARVESTING SYSTEMS IN INDIA IN COMPLIANCE TO THE DIRECTION OF HON'BLE NGT IN THE MATTER, OA NO. 147/2021 – MAHESH CHANDRA SAXENA VS THE CHIEF SECRETARY, GOVERNMENT OF NCT OF DELHI & ORS

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REPORT OF THE JOINT COMMITTEE CONSTITUTED TO LOOK INTO THE MATTER OF RAIN WATER HARVESTING SYSTEMS IN INDIA IN COMPLIANCE TO THE DIRECTION OF HON'BLE NGT IN THE MATTER, OA NO. 147/2021 – MAHESH CHANDRA SAXENA VS THE CHIEF SECRETARY, GOVERNMENT OF NCT OF DELHI & ORS

A. BACKGROUND/ INTRODUCTION

A-1: HON'BLE NGT DIRECTIVES

In Original Application No. 147/2021 in Hon'ble NGT, issue of deficiencies in rain water harvesting systems resulting in polluted water mixing with the groundwater, was raised before the Hon'ble National Green Tribunal. The matter initially pertained to 40 Societies in Dwarka Area, Delhi. The Tribunal while disposing off the matter considered the need of joint inspection of rain water harvesting systems in all areas of Delhi to ensure proper functional design, depth of borewell, use of gravel and coarse sand in filter media.

Hon'ble NGT, Principal Bench, New Delhi, vide Order dated 10.12.2021 **further directed** the following.

"In the light of experience gained in the present case, it appears that at many places where RWH systems are installed, the same are either not functional or resulting in contamination of ground water which situation needs to be remedied not only in Delhi but pan India. This may be urgently looked into by a joint committee of CPCB, Ministry of Jal Shakti (MoJS) and Ministry of Urban Development, Government of India. Ministry of Jal Shakti (MoJS) will be nodal agency for the purpose. The Secretary, MoJS may call a meeting of stakeholders for further course of action in the light of above observations, followed by issuance of appropriate directions to all the States/UTs".

A-2: CONSTITUTION OF COMMITTEE AND TOR

In pursuance to the directives of Hon'ble NGT, a Committee under the Chairmanship of Chairman, Central Ground Water Board (CGWB) was constituted by MoJS vide Order Dated 19.01.2022 (**Appendix: A-1**) with the following members.

S. No.	Committee Position	Representation	Nomination
1.	Chairman	Chairman, CGWB	----
2.	Member Secretary	Member, CGWA	-----
3.	Member	Representative of Central Pollution Control Board (CPCB)	Shri J Chandra Babu, Scientist, CPCB/ Ms Alpana Narula, Sr Scientific Assistant, CPCB
4.	Member	Representative of Ministry of Housing and Urban Affairs (MoHUA)	Dr Ramakant, Dy Advisor, PHE, CPHEEO
5.	Member	Representative of State of Delhi, Rajasthan, Haryana, Karnataka, Tamil Nadu	

ToR of the committee are as following.

TOR-1: Operational status including design parameters of the installed Rainwater Harvesting (RWH) systems. The Committee may identify few sites in States/ UTs for verification and preparation of reports.

TOR-2: To check the contamination status of Ground Water aquifers due to faulty design of RWH systems, if any, in the country. Committee may identify few sites for this purpose.

TOR-3: To suggest remedial measures to improve existing RWH system and also recommend preventive actions to avoid installation of faulty RWH systems in future including addressing of maintenance issues.

TOR-4: Any other activity considered appropriate by the committee.

A-2: VC MEETING OF COMMITTEE ON 03.03.2022

A meeting of committee was convened to decide course of action on 03.03.2022. Following action points emerged during the meeting held on **03.03.2022** (Minutes enclosed as **Appendix: A-2**).

1. Selected Member States, i.e Delhi, Haryana, Karnataka, Rajasthan and Tamil Nadu will share information/ data as below:
 - a. Provide list of Rain Water Harvesting structures sites to CGWA by 04.02.2020 for site visits / field inspections by the committee.
 - b. Provide Building Bye laws and rules that have been enacted by the states related to RWH system.
 - c. Provide standard design for RWH recharge structures formulated by concerned state departments.
 - d. Provide water quality impact assessment related to contamination of Ground Water, if available.
 - e. Provide existing penal provisions, if any, for groundwater contamination.
2. Constitute working group in 5 states drawing members from regional offices of CGWB and States government departments to support the joint committee and coordinate with them. Details of nominated officers are to be shared with all concerned.

Accordingly, teams were constituted for different States with representatives of states as members (**Table A-1**).

Table A-1: Teams for Visit to Different States

State	Team Members
Delhi	1. Shri Sunil Kumar, Chairman, CGWA & CGWB 2. Dr P K Naik, Scientist E, CGWA, New Delhi 3. Shri Faizal Abrar, Scientist CGWB, New Delhi 4. Ms Alpana Narula, Sr Scientific Assistant, CPCB 5. Shri Harish Chander, Addl Chief Engineer (C-8), DJB 6. Shri Vimal Belani, Executive Engineer, (RWH-I), DJB 7. Shri Rakesh Sharma, AE (RWH-I), DJB
Haryana	1. Dr Rajesh Chandra, Scientist E, CGWA, New Delhi 2. Ms Alpana Narula, Sr Scientific Assistant, CPCB 3. Shri Rakesh Kumar, Chief Hydrologist, GW Cell, Haryana 4. Shri Pankaj Mahaliya, Chief Hydrologist, GW Cell, Haryana
Karnataka	1. Shri N Jyothi Kmar, Scientist, CGWB, Bengaluru 2. Shri A K Patre, Scientist, CGWA 3. Dr Vikas Ranjan, Scientist CGWA, New Delhi 4. Shri Rahul R Shende, Scientist, CGWB, Bengaluru 5. Shri J Chandra Babu, Scientist, CPCB, New Delhi*

	6. Shri Jayanna, Dy Director, KGWA 7. Ms Ambika T. Dy Director, GWD 8. Ms Chhaya, Sr Geologist, GWD 9. Shri Lakshmi Narayana N, Superintendent, GWD 10. Dr U T Vijay, Chief Scientific Officer, KSCST, IISc Campus, Bengaluru
Rajasthan	1. Shri A K Patre, Scientist, CGWA 2. Shri Anmol Sharma, Scientist, CGWA, New Delhi 3. Shri Sujit Kumar, Scientist, CGWB, Jaipur 4. Shri J Chandra Babu, Scientist, CPCB, New Delhi* 5. Shri Anoop Thereja, Sr Hydrogeologist, GWD, Jaipur Division, Rajasthan
Tamil Nadu	1. Dr Vikas Ranjan, Scientist CGWA, New Delhi 2. Shri J Chandra Babu, Scientist, CPCB, New Delhi* 3. Shri S P Nayagam, Scientist, CGWB, Chennai 4. Er. S. Raja, Jt Chief Engineer, WRD, Tamil Nadu**

*Presently posted at CPCB, Bengaluru; **Presently retired

Working groups in the States formed to support and coordinate with central teams which were headed by respective Regional Director of CGWB and assisted by officers of CGWB Regional offices and State Government departments.

State-wise details of visited sites are given in following table (**Table A-2**) sites visited.

Table A-2: RWH Sites visited in Different States

State	Date(s) of Visit	Sites Visited
Delhi (DL)	07.03.2022	DL-1 Gold Croft CGHS Ltd., Plot No. 4, Sector-11, Dwarka, Delhi DL-2 Hind CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi DL-3 Guru Tegh Bahadur Institute of Technology, G-8 Area, Rajouri Garden, New Delhi DL-4 Siri Fort Auditorium, August Kranti Marg, New Delhi
Haryana (HR)	22.02.2022	HR-1 Maruti Suzuki India Ltd, IMT, Manesar, Haryana HR-2 Corporate Office Complex, Bestech India Pvt Ltd, Sector-44, Gurugram, Haryana
Karnataka (KA)	26.02.2022	KA-1 Sir M. Visvesaraiyaa RWH Theme Park, Bengaluru. KA-2 Falcon City Residential Complex, Bengaluru KA-3 ABB Limited, Bengaluru
Rajasthan (RJ)	19.02.2022 & 20.02.2022	RJ-1 Ankit Roofings Ltd, Vill. Dahami Khurd, Sanganer Block, Jaipur RJ-2 State GWD Campus, Sanganer Block, Jaipur RJ-3 Rajbhawan, Jhothwara Block, Jaipur
Tamil Nadu (TN)	24.02.2022 & 25.02.2022	TN-1 Rain Centre, Akash Ganga Trust Adyar, Chennai. TN-2 Tharamani Campus of WRD, Chennai TN-3 Phoenix Market City Velachery Chennai TN-4 SSM Residential Complex, Nedunkundram village, Vandalur Chengalpattu District. TN-5 Putlur Check Dam, Tiruvallur District, Tamilnadu TN-6 Asian Paints Ltd, Pondura, Sriperumbudur, Kancheepuram district

On-the-spot study of RWH Structures were carried out by different teams keeping in view the ToRs of the committee.

A-4: LAYOUT OF PRESENTATION OF OBSERVATIONS, CONCLUSIONS AND SUGGESTIONS OF COMMITTEE AS PER TOR

Section-B summarizes State-wise **Observations/ Findings** of the Committee, which include **summary** of relevant rules and findings based on the site visits. State-wise **Rules** and regulations promulgated, as well as **reports of the individual site visits** are **attached as**

Appendices. Name of the States in this report are abbreviated for convenience as following: Delhi-**DL**; Haryana-**HR**; Karnataka-**KA**; Rajasthan-**RJ**; Tamil Nadu-**TN**.

Section-C summarizes salient conclusions based on the rules / visits as per **ToR-1 & 2**, followed by **suggestions (Section-D)** as per **ToR-3 & 4**.

B. STATE-WISE OBSERVATIONS/ FINDINGS FROM THE VISIT/ STUDY OF RULES

B-1: DELHI (DL)

B-1.1: RWH Rules & Regulations, Delhi (Appendix B-1.1: DL RWH Rules)

- i. **Implementation** of RWH is governed by '**Building By-laws, 1983 (Amendment, 2001)**' of Ministry of Urban Development and its further reinforcement through provisions in '**Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 and its Amendment, 2016** of Delhi Jal Board (DJB).
- ii. Provisions in DJB's regulations make it mandatory to install RWH system depending upon Plot size (more than 100 sqm).
- iii. RWH is not mandatory in areas having depth to ground water levels less than 5m below ground.
- iv. It is also not mandatory to construct borewell for recharge. Only RWH through Roof Top is mandatory (Amendment, 2016 to Delhi Water & Sewer (Tariff & Metering Regulation). The amendment has been made to avoid misuse of borewell for groundwater extraction in the name of recharge.
- v. There is incentivization for installation of RWH system through rebate, and also penal provisions for non-installation of RWH in the form of 1.5 times tariff (water charges).
- vi. New water/ sewer connections are sanctioned by DJB, subject to installation of RWH System. To ensure installation in existing buildings Public Notices have been issued, notifying penal provisions, if the concerned fail to inform about the installation of RWH system in existing buildings.
- vii. RWH Guidelines of DJB advise that '*only non-polluted rainwater from the roof tops and other catchment areas has to be diverted to recharge structure through connection of downpipe*'. However, **there is no penal provision for contamination of groundwater due to faulty recharge.**

B-1.2: Inspection Visit, Delhi (Appendix B-1.2: DL RWH Insp)

- i. **Four sites** were visited upon.
 - DL-1** Gold Croft CGHS Ltd., Plot No. 4, Sector-11, Dwarka, Delhi
 - DL-2** Hind CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi
 - DL-3** Guru Tegh Bahadur Institute of Technology, G-8 Area, Rajouri Garden, New Delhi
 - DL-4** Siri Fort Auditorium, August Kranti Marg, New Delhi
- ii. **Gold Croft CGHS Ltd (DL-1):** Water levels of nearest Piezometer at Dwarka (less than **1 Km from DL-1**) show rise of 7m from 2019 to 2021. Water sample from this piezometer has all the basic chemical parameters within permissible limits. Heavy Metals concentrations (Cr, Mn, Fe, Ni, Cu, Zn, As, Se, Ag, Cd, Pb, U) are also within permissible limits.

- iii. **Hind CGHS Ltd (DL-2):** The **piezometer** representing DL-1 is also representing DL-2. It is also located at a distance of around **1 Km from DL-2**.
- iv. **Guru Tegh Bahadur Institute (DL-3):** RWH system comprises 5 recharge pits (without borewell) of approximate 2m depth each. Post-monsoon water levels recorded in the nearest piezometers at Tagore Garden (**≈ 2 Km** from site) and Mayapuri (**≈4 Km** from site) show decline of 5-7m in last 12 years. **Water sample from Tagore Garden Pz shows high EC and other basic chemical parameters.** However, heavy metals concentrations (Cr, Mn, Fe, Ni, Cu, Zn, As, Se, Ag, Cd, Pb, U) are within permissible limits in ground water.
- v. **Siri Fort Auditorium (DL-4):** RWH System comprises of 10 Recharge Pits (without recharge well) of 2.2m depth each. Water levels recorded in the nearest piezometer at Hauz Khas (**≈1 Km**) shows rise of 6-7m from 2006-2021 (15 years). Basic parameters and Heavy Metals concentrations in water sample taken from Hauz Khas Pz are within permissible limits except Uranium concentration (78 ppb).
- vi. **At all the four sites visited,** Rain water harvesting pits were found to be clean and working. Terrace of the building blocks were also found to be clean.
- vii. As per information provided, all structures and filter media are regularly cleaned. Inspection Team rendered advice as regard to proper maintenance of RWH system and **Geo-tagging of RWH/ Recharge structures.**

B-2: HARYANA (HR)

B-2.1: RWH Rules & Regulations, Haryana/ Gurgaon (Appendix B-2.1: HR RWH Rules)

- i. **Implementation** of RWH is governed by '**The Haryana Building Code, 2016**'. The Code also uses provisions of Water (Prevention & Control) of Pollution Act, 1974 with some amendments.
- ii. **Roof top RWH** is mandatory for roof area 100 Sqm or more **and Recharge** is mandatory for any building on plot area 500 Sqm or more, parks, vehicles' parking places, plazas, playgrounds and other common areas. Water so harvested is to be utilized for non-potable uses and recharge of aquifer.
- iii. Recognized Architect / Engineer is to certify that RWH is functional and any misrepresentation by them shall attract penal proceedings.
- iv. RWH system is to be properly designed so that **contaminated water does not enter** into RWH/ recharge system.
- v. Recharge well should be at least 10m away from any structure handling sewage/ industrial effluent (not applicable on manholes/ sewer lines although it shall be ensured that these are leak-proof).

B-2.2: Inspection Visit, Haryana/ Gurugram (Appendix B-2.2: Haryana RWH Insp)

- i. **Two sites** were visited upon.
 - HR-1** Maruti Suzuki India Ltd, IMT, Manesar, Haryana
 - HR-2** Corporate Office Complex, Bestech India Pvt Ltd, Sector-44, Gurugram, Haryana

- ii. **Maruti Suzuki India Ltd, IMT (HR-1):** At Maruti Suzuki Unit, there are 6 Lagoons having RWH cumulative capacity of 119660 CUM. At the time of visit, lagoons were completely dry and recharge wells were in running condition. Two Piezometers with DWLR are installed in the premises. There are separate and isolated pipelines for channelization of storm water to lagoons (RWH Storage). Dedicated and separate pipelines are laid for collection of Sewage and effluent to Effluent Treatment Plant (ETP Capacity: 5840 KL/Day) and Sewage Treatment Plant (STP Capacity: 1187). As per the company representative, storm water is completely insulated from sewage and effluent. To prevent contamination of run-off from paved area, trap has been provided for capturing oil/silt and transferring them to ETP. RWH system is totally insulated from sewage and wastewater from areas likely to have oil and grease, or other pollutants and that all the structures and filter media are regularly cleaned. Sample collected from TW near Gate No. 3 has all basic parameters and heavy metals analysed within permissible limits, except nitrate (65 mg/L), which is above permissible limit (45 mg/L). The inspection team rendered advice as regard to installation of **Piezometer in vicinity** of every Lagoon to keep regular checkup on water level and Quality of ground water.
- iii. **Bestech India Pvt Ltd (HR-2):** RWH system comprises of one Recharge Pit with Recharge Well. STP of 20 KLD capacity with MBBR Technology has been installed in the premises. As per representative of the firm, RWH system is totally insulated from sewage that all the structures and filter media are cleaned annually. Sample collected from RWH structure has all basic parameters and heavy metals analysed within permissible limits The team advised to clean the system 4 times a year.

B-3: KARNATAKA (KA)

B-3.1: RWH Rules & Regulations, Karnataka/ Bengaluru (Appendix B-3.1: KA RWH Rules)

- i. **Implementation** of RWH is governed by **Bangalore Water Supply and Sewerage (Amendment) Bill 2009, 2020 & 2021, BWSSB Rain Water Harvesting Act 72A Amendment 2021 and State Ground Water Act 2011**
- ii. Guidelines for RWH issued by BWSSB contains chapter on water quality and treatment to prevent contamination of recharged water. A chapter on RWH is included in the SGW Act.
- iii. RWH is mandatory in existing buildings having site dimension of 216 sqm and above and in new buildings constructed on site measuring 108 sqm and above.
- iv. Vide Amendment, 2020, capacity of Roof Top TRWH recharge structure was enhanced from 20 lt/sqm to 60 lt/sqm, whereas in respect of land based RWH, the capacity was enhanced from 10 lt /sqm to 20 lt/sqm.
- v. Dual pipe system is to be installed for RWH structure for utilization of harvested water for purposes other than drinking, cooking and bathing.
- vi. There is penal provision in case of non-compliance to RWH conditions in the form of additional charges in Monthly Water Bill till RWH is implemented. RWH system is inspected by the representative at the time of visit for water meter reading.
- vii. Regular monitoring by BWSSB of RWH schemes already implemented and organizing awareness programmes.

- viii. As per Act, Municipal Corporations, local authorities are to impose mandatory RWH conditions while according approval for construction (100 Sqm or more); permanent water and electricity connections shall be extended only after compliance of directions.
- ix. However, there are **no penal provisions for ground water contamination, neither in BWSSB guidelines, nor in the State Ground Water Act.**

B-3.2: Inspection Visit to Karnataka/ Bengaluru (Appendix B-3.2: Karnataka RWH Insp)

- i. **Three sites** were visited upon.
 - KA-1** M. Visvesaraiyaa RWH Theme Park, Bengaluru.
 - KA-2** Falcon City Residential Complex, Bengaluru
 - KA-3** M/s ABB Limited, Bengaluru
- ii. **Sir M. Visvesaraiyaa RWH Theme Park (KA-1):** The Theme Park has been set up to **demonstrate different techniques of Rain Water Harvesting** to common people through RWH storage structures with different methods of storage of rain water and recharge wells within the premises. The park is popularizing the idea of RWH to the general public, students, NGO's, architects, engineers, plumbers etc. As per BWSSB officials maintaining the park, there is no scope of contamination of ground water due to artificial recharge in the premises. However, total **coliform** was **found present** in groundwater sample from the Recharge Well in Theme Park premises. **The presence of coliform in ground water sample may be** because of extraneous reasons. *Sample from borewell within the premises analysed has **Uranium** concentration beyond the permissible limit of 30 ppb, which may be **geogenic in nature.***
- iii. In **Falcon City Residential Complex (KA-2)**, rooftop run-off is collected in Storage tanks for non-potable purposes. Chemical analyses of groundwater samples from recharge pit and nearest borewell within the premises has all basic chemical parameters within permissible limits of BIS Drinking Water Specifications (IS:10500-2012). All the recharge and storage structures are well maintained. Proper mechanism is in place to prevent sewage water from mixing into run-off/ recharged water. However, the management could not provide design of system and structures.
- iv. **ABB Ltd (KA-3)** has constructed rain water **storage-cum-recharge structures using cross wave technology** – i.e storage tanks made of Polypropylene (highly water-resistant resin) with a **high void ratio** (Claimed as almost 95%), enabling creation of larger water storage space in a smaller area compared to conventional tanks. Strength of such structure is high and therefore; space above can be utilized for parking etc. The company has installed flow-meter at storage-cum recharge structure to ascertain quantum of recharge. Trial of flow-meter has shown that initial intake capacity of structure is around 3 cum/Hr. However, the structure was yet to get its first monsoon rain, when field visit was made. There are **separate pipelines for sewage collection which are connected directly from building toilets to STP collection tank.** The firm has plan for periodic maintenance and checking to avoid any leakage in sewage pipeline. **Recharge wells were dry during inspection. Ground water quality** report of the **nearest borewell** within the premises (77m Deep) indicates that the measured values for the allbasic chemical parameters are **within BIS** Drinking Water Specifications/ **permissible limits.** The efficacy of cross-wave reservoir was also

studied later by CGWB by filling the cross-wave reservoir through tank water supply and observing the capacity of the tank. It was found that storage space of the structure is \approx 95%. It was also observed from water levels recorded during the study that recharge is taking place through recharge well.

- v. The management/ maintenance team of all the above sites have been advised to bypass first flush and to prevent entry of water from paved area having vehicular movement from entering into the RWH system.

B-4: RAJASTHAN (RJ)

B-4.1: RWH Rules & Regulations Rajasthan/ Jaipur (Appendix B-4.1: RJ RWH Rules)

- i. **Implementation of RWH is governed by Urban Area (Name of City) Building Regulation, 2020.**
- ii. There is mandatory RWH Unit/ Structure in plot areas 225 Sqm or more.
- iii. Security deposit for construction of RWH System is refunded only after submission of verification report by retired engineer.
- iv. There is **no mention of ground water quality** aspect in the regulation.

B-4.2: RWH Inspection Visit Rajasthan/ Jaipur (Appendix B-4.2: RJ RWH Insp)

- i. Three sites were visited upon.
 - RJ-1** Ankit Roofings Ltd, Vill. Dahami Khurd, Sanganer Block, Jaipur
 - RJ-2** State GWD Campus, Sanaganer Block, Jaipur
 - RJ-3** Rajbhawan, Jhothwara Block, Jaipur
- ii. **Ankit Roofings Ltd (RJ-1):** RWH System was installed in the year 2005-06, and comprises of storage tank of 25 m³ capacity and filter pit (3.6 m deep) with 60m deep injection well. Run-off from Roof Top and Paved Area is diverted to the storage tank. Water level recorded in Piezometer installed in the premises was **32.92mbgl** in **pre-monsoon 2013**. During the visit in **February, 2022**, water level in the same piezometer was recorded as **36.98 mbgl**. EC of water sample has increased marginally from 1153 mmhos/cm in 2017 to 1541 mmhos/cm in February, 2022. As per representatives of firm, roof top is cleaned twice a year and filter media is cleaned/ replaced annually.
- iii. **GWD Campus (RJ-2):** RWH System was constructed in the year 2000-01 under Central Sector Scheme. It is a Roof Top TRWH system (Run-off from paved area is not harvested) and comprises of Main Collection/ Desiltation Chamber and Recharge Trench with 40m deep Injection Well / Recharge Shaft. At the time of visit there was no debris or water in the trench, indicating that system was working fine. Rise in water level of about 10m (\approx 63mbgl to \approx 53mbgl) over last 10 years (2012-2021) has been observed in the piezometer installed in the premises. There is increase in EC value from 760 mmhos/cm (in 2001) to 1150 mmhos/cm (in 2022 – present visit) of the samples collected from TW in the premises. **Nitrate has increased significantly** from 30 mg/l (permissible limit is 45 mg/l) to 140 mg/l, **indicating mixing of polluted water**. As informed by GWD officials, roof top is cleaned 2-3 times a year. Filter media is cleaned/ desilted annually.
- iv. **Raj Bhawan (RJ-3):** RWH System was constructed in the year 2000-01 under Central Sector Scheme. It is a RTRWH system (Run-off from paved area is not harvested)

having 19m Injection Well/ Recharge Shaft for ground water recharging. **3.7m rise** in water level (26.4mbgl to 22.7mbgl) has been observed over last 10 years (2012-2021) in the piezometer installed in the premises. There is **increase in EC value** from 910 mmhos/cm (in 2014) to 1850 mmhos/cm (in 2022 – present visit) also. The ground water samples has been taken from TW located in the premises. **Nitrate has increased significantly** from 89 mg/l to 200 mg/l during this period (permissible limit of 45 mg/l). However, EC and nitrate in water sample collected in desiltation chamber have been found to be 560 mmhos/cm and 2.3 mg/l respectively. As informed by GWD officials, roof top is cleaned 2-3 times a year. Filter media is cleaned/ desilted annually.

- v. The State Government officials maintained that increase in EC and/ or nitrate is not attributable to fault in RWH system, but to extraneous factors.

B-5: TAMIL NADU (TN)

B-5.1: RWH Rules & Regulations Tamil Nadu/ Chennai (Appendix B-5.1: TN RWH Rules)

- i. Implementation of RWH is governed by **Tamil Nadu Combined Development & Building Rules, 2019** of **Municipal Administration and Water Supply Department**.
- ii. In Non-High-Rise buildings up to 12m, Roof Top water is to be collected in a sump through a filter for immediate use and surplus is to be diverted to Source Well/ Dug Well (where existing) or to a Recharge Well (where no Dug Well is existing). Run-off from paved area is to be intercepted near gate and is to be led to a Recharge Well.
- iii. In Non-High-rise such as above on plots with small area, Roof Top harvested water is to be diverted to Percolation Pits.
- iv. In Non-High Rise between 12-18.3m / industries/ institutional buildings, as well as in High Rise buildings, similar methods as (i) or (ii) or combination of two can be applied.

B-5.2: RWH Inspection Visit Tamil Nadu/ Chennai (Appendix B-5.2: TN RWH Insp)

- i. **Six sites** were visited upon by the Joint Team. Out of these, one site was a Check Dam built outside the Thiruvallur city limits and does not have much relevance in the present context. Hence, **report of 5 sites** has been attached in this report.

TN-1 Rain Centre, Akash Ganga Trust Adyar, Chennai.

TN-2 Tharamani campus of WRD, Chennai

TN-3 Phoenix Market City Velachery Chennai

TN-4 SSM Residential Complex, Nedunkundram village, Vandalur Chengalpattu district.

TN-5 Putlur Check dam, Tiruvallur district.

TN-6 Asian Paints Ltd, Pondura, Sriperumbudur, Kancheepuram district

- ii. **Akash Ganga Rain Centre (TN-1):** The run-off from paved areas is being collected through drains covered with perforated slabs and water is allowed into recharge shaft / well of 15 feet depth directly, without passage through any filter media. Founder of Rain Centre Shri. Sekar Raghavan maintains that providing filter retards recharge as the filter media gets choked quickly after one or two rains. He has been popularizing this technique among common people. There is always a possibility of aquifer material getting choked if recharge water is not passed through filter. Hence, Shri Raghvan has been advised to let the water pass through filter media before recharge. It was

observed that TDS of sump water was 120 mg/l and that of open well 1214 mg/l. Concentration of other chemical constituents were considerably high in ground water samples of open well. This may be due to mixing of water from additional natural flow into open well.

- iii. **GWD, Tharamani (TN-2):** Main structure is underground storage tank/ sump, made **largely using uPVC pipes Technique**. Top of the sump is being used as Parking Space. Water stored in the structure provides adequate amount of water for the office use for 5 to 6 months in a year. After implementation, sufficient water is available to augment water supply to the office establishment for non-potable purposes. There has been no requirement of frequent cleaning in the past five years. Water is being tested for quality periodically and found suitable for domestic purposes. The **technique used is unique and easy to construct**. But, considering the cost of imported material being used, cost of total system is on higher side by around 30% in comparison to conventional system.
- iv. **Phoenix Mall (TN-3):** RWH System comprises of recharge pits with 15m deep recharge shaft. In the event of over-flow, the surplus run-off is diverted to nearest lake (Velachery Lake), approximately 250m south of Phoenix Market City. Run-off from paved area having vehicular movement is also being diverted towards RWH system.
- v. **SSM Residential Complex (TN-4):** The RWH system comprises of Recharge Pits (3m deep) with filter and Sumps/ Storage Tanks. **The complex is divided into linear blocks with alternate bays for sewage and RWH channels**. Overflow from recharge pits is stored in Sumps/ Storage Tanks for non-potable uses. The RWH system provides adequate amount of water for gardening for this Residential Building Complex nearly for 5 to 6 months in a year. Committee observed that RWH system has been implemented within the **SSM Residential Complex though ground water level is shallow as the complex is close to coastal waters**. Only one pit was shown to the team.
- vi. **Asian Paints (TN-6):** Rooftop rainwater is collected through pipes and trenches into a large storage tank having holding capacity of 6000 kilo liters. Efficiency of structure provides adequate amount of water for the industrial use nearly for 5 to 6 months. The industry is ZLD. Hence, chances of contamination are virtually non-existent. **Industry took necessary step to close down the recharge pits after notification of CGWA guidelines**, which advise only conservation for certain category of industries. **However, State Government, does not have any such restriction on recharge**. Chemical quality results are included in the respective report of site visit.
- vii. Management and maintenance team at all the visited sites informed that all the structures and filter media are regularly cleaned/ replaced. They were advised to bypass the first flush. It was also advised to avoid water from car parking areas into the system.

C. SALIENT CONCLUSIONS BASED ON THE STUDY OF RULES AND OBSERVATIONS FROM RWH SITE VISITS (AS PER TOR-1 & 2)

ToR-1 & 2 of the Committee state the following.

ToR – 1: *Operational status including design parameters of the installed Rain Water Harvesting (RWH) systems. The Committee may identify few sites in States/ UTs for verification and preparation of reports.*

ToR – 2: *To check the contamination status of Ground Water aquifers due to faulty design of RWH systems, if any, in the country. Committee may identify few sites for this purpose.*

Accordingly, visits were undertaken to selected sites and rules pertaining to RWH were studied (**Section-B** above). A matrix summarizing the site-wise observations on some key aspects is enclosed as **Appendix-C**. Salient collective observations and conclusions are summarized here.

ToR – 1: Operational status including design parameters of the installed Rain Water Harvesting (RWH) systems

(a) In all the visited States, RWH in urban areas has been made mandatory under Building Rules or other State Acts/ Rules. **However, penal provisions for ground water contamination due to faulty RWH design** or due to lack of proper and timely maintenance are **missing**. Overall, RWH systems were found as per design and norms of Central/ State Agencies at all the visited sites.

(b) In general, the collected/ harvested water is used for non-potable and/ or recharge purposes. Out of 17 RWH systems visited, 9 systems have Recharge Pits and 6 systems have both Recharge Well and Recharge Pits. Remaining 2 sites have storage/ conservation structures only.

(c) In some **individual houses**, recharge structures have been found deviating from **scientific design**. It was observed in Chennai that **recharge structures have been made without filter media (Para B-5.2(ii))**.

(d) It was observed that Industrial units follow prevailing guidelines for RWH and AR. **(Para B-2.2(ii); (Para-B-3.2(iv)); (Para-B-5.2(vi)))**.

(e) RWH structures were found maintained at the time of inspection.

ToR – 2: To check the contamination status of Ground Water aquifers due to faulty design of RWH systems

(f) During monsoon season, recharge takes place and **if any** contamination has taken place, its spread/ signature/ indications should be present in nearby well-samples during post-monsoon period. Keeping the above in view, groundwater samples were collected from nearby wells. At some places, where water was available in structure itself, sample of the same was also collected.

(g) In general, chemical quality of water, has been found within the permissible limit. However, total **coliform** was **found** in groundwater sample from RWH well in Theme Park premises, Bengaluru **(Para B-3.2(ii))**. It is also observed that recharging water at Akash Ganga Rain Centre, Chennai may be getting mixed with water from other places. Water from other places may get diverted into open well (known as Source Well), hence, the chemical constituents have considerably higher values in comparison to sump water **(Para B-5.2(ii))**.

At all the three sites visited in Jaipur, Rajasthan (Para B-4.2(ii); B-4.2(iii) & B-4.2(iii)), it has been observed that **EC/ TDS and/ or nitrate** content in tube-wells located within the premises of RWH system have **increased** over past few years.

(h) Rain water harvesting techniques are popular, due to improper and unscientific implementation, the ground water **recharge component of RWH system is not functioning as desired**. **Presence of coliform and Nitrate in ground water (Para – g above)** indicate that the design adopted does not address the site-specific conditions. **The damage to aquifer in such cases would be permanent**. Lack of insulation of overland flow from contamination may pollute aquifer (Para – 5.2(iv)).

D. SUGGESTIONS OF THE COMMITTEE (AS PER TOR-3 & 4)

ToR-3 & ToR-4 of the Committee state the following.

ToR – 3: *To suggest remedial measures to improve existing RWH system and also recommend preventive actions to avoid installation of faulty RWH systems in future including addressing of maintenance issues.*

ToR – 4: *Any other activity considered appropriate by the committee.*

Based on the salient conclusions drawn from study of rules pertaining to RWH in the visited areas and implementation of RWH at selected sites, following suggestions can be made as per ToR of the Committee.

ToR – 3: To suggest remedial measures to improve existing RWH system

(a) Bureau of Indian Standards (BIS) has a dedicated Committee – **Ground Water and Related Investigations Sectional Committee, WRD 03**. The Committee, in consultation with experts have developed the following BIS standards.

(i) Indian Standard – Artificial Recharge to Ground Water Guideline (IS 15792: 2008)

(ii) Indian Standard – Roof Top Rainwater Harvesting – Guidelines (IS 15797: 2008)

The BIS standard **IS 15797:2008** for Roof Top Rainwater Harvesting - Guidelines (enclosed as **Appendix-D**) may be popularized among the user agencies for implementation of RTRWH system in **urban areas**. **Section 6.5 of the document** deal with general 'Management and Maintenance' of the system and **Section 7.4** specifically with 'Management of Catchment Area, Drains and Recharge Structures'. **Section 7** provides designs of AR structures suitable to different situations. The States may be mandated to adopt these standards in major cities.

(b) RWH schemes may have Artificial Recharge provisions depending upon local hydrogeological/ site-specific conditions. However, **recharge** needs to be **avoided** in areas where there is possibility of contamination of groundwater. In such cases storage of rainwater should be encouraged.

(c) Strict guidelines for protecting aquifer from contamination and damage need to be formulated. Depending upon groundwater flow direction, RWH/ AR sites need to be located as far as possible from potential contaminant source such as sewage drains/ landfill sites/ cesspool/ sewage system having hydrogeological connectivity with the aquifer.

(d) As stated in previous Section (Para C-(a)), penal provisions for ground water contamination caused due to faulty RWH/ designs or due to negligence in maintenance are

lacking or weak. Legal provisions should be introduced in State Government rules as per EPA, 1986 for contamination of groundwater owing to faulty RWH designs and/or due to poor maintenance. Penal provisions may, however, be applied as the last resort.

(e) There should be web-based, area-specific model design for guidance on the basis of hydrogeological set-up of the area.

(f) In respect of small households, cluster-based RWH system should be promoted in place of individual household scheme.

(g) Model similar to Bengaluru for ensuring compliance to mandatory RWH conditions (**Para B-3.1 (vi)**) may be adopted in other urban areas too. **However**, the monitoring mechanism has to be made more effective through involvement of officials trained to evaluate functioning of installed RWH system as per **BIS Standards**.

(h) There should be incentivization for adopting RWH, either in the form of rebate or subsidy **in water-stressed areas**. Also, penalty on non-compliance or non-adherence to the norms can be imposed, say in the form of additional water charges (**Para B-3.1 (vi)**).

(i) Large-scale RWH system, such as those in large industrial, residential and commercial complexes, should have piezometer(s) installed at appropriate site(s) for periodic monitoring of water level and water quality. These parameters are the most important and reliable indicators of functioning status and health of RWH system.

(j) The design of RWH should by-pass first flush. Mixing of drain water with rooftop run off or with runoff from paved areas, where vehicular movement takes place, should be prevented.

ToR – 4: Any other activity considered appropriate by the committee

(k) As water quality may not be strictly checked, the water stored in harvesting structures may be **used for non-potable purposes**.

(l) **Concept like RWH Theme Park, Bengaluru (Para B-3.2(ii))** run by Government Body may be promoted for proper guidance to general public/ individual households. It may be adopted in other urban areas too.

(m) Underground Storage tank/ sump, made **using cross-wave technology (Para B-3.2(iv)) or uPVC pipes (Para B-5.2(iii)) saves space, besides providing strength to the structure**. As it is **costly**, the technology may be used in large **Government Buildings**, commercial complexes and industrial premises.

(n) All RWH sites should be geo-tagged for better visibility for monitoring purpose.

(o) There should be mechanism to avoid misuse of the recharge tubewells for pumping purposes.

(p) Online filters can also be recommended to avoid minor contaminations, if any, for diverting the rooftop rainwater to the recharge tubewells.

(q) New residential complexes may be divided in a way to have alternate bays for sewerage and RWH channels.

**F.No.39/01/2021-GW Section-MoWR
Government of India
Ministry of Jal Shakti
Department of WR,RD&GR
(Ground Water Section)**

**Shram Shakti Bhawan,Rafi Marg
New Delhi, Dated:19.01.2022**

ORDER

Subject: Constitution of the Joint Committee to look into the matter of Rain Water Harvesting Systems in India as per the directions of the Hon'ble NGT in the matter of OA No. 147/2021 , Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT of Delhi & Ors.

The Hon'ble NGT in the matter of O.A. No. 147/2021, Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT of Delhi & Ors. has directed the Ministry of Jal Shakti to constitute a Joint Committee of CPCB, Ministry of Jal Shakti, Ministry of Housing & Urban Affairs, Government of India to look into the matter of rain water harvesting systems and contamination of groundwater in India.

2. In view of the above, a Committee under the Chairmanship of Chairman, Central Ground Water Board (CGWB) is hereby constituted with the following members to look into the matter and prepare a detailed report. The composition of the committee shall be as under:

1.	Chairman, CGWB	Chairman
2.	Member , CGWA	Member Secretary
3.	Representative of Central Pollution Control Board (CPCB) (not below the level of Director dealing the subject matter)	Member
4.	Representative of Ministry of Housing and Urban Affairs (not below the level of Director dealing the subject matter)	Member
5.	Representatives of State of Delhi, Rajasthan, Haryana, Karnataka, Tamil Nadu (not below the level of Director of Govt. of India dealing the subject matter)	Member

Note: The Committee may co-opt any other member if required on non-remunerative basis.

3. The Term of Reference of the Committee shall be as under:
 - i. Operational status including design parameters of the installed Rain Water Harvesting (RWH) systems. The Committee may identify few sites in States/UTs for verification and preparation of reports.
 - ii. To check the contamination status of Ground Water aquifers due to faulty design of RWH systems, if any, in the country. Committee may identify few sites for this purpose.
 - iii. To suggest remedial measures to improve existing RWH system and also recommend preventive actions to avoid installation of faulty RWH systems in future including addressing of maintenance issues.
 - iv. Any other activity considered appropriate by the committee.
4. The Committee shall meet on regular basis and submit the report in two months time.
5. Expenditure on account of TA/DA to official Members of the Committee will be met from the source from which they draw their salaries.
6. This issues with the approval of Secretary (WR, RD & GR), Ministry of Jal Shakti.

(Bisny Suresh Kumar)
Under Secretary to the Govt. of India
Ph:-11-23766907
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To

1. Secretary, Ministry of Hosing and Urban Affairs.
2. Secretary, Ministry of Environment, Forest & Climate Change
3. Chief Secretary to the States of Delhi, Rajasthan, Haryana, Karnataka,
Tamil Nadu
4. Chairman, CPCB
5. Member , CGWA
6. Chairman, CGWB

Copy to:

1. PPS to Secretary, DoWR,RD&GR

2. PPS to AS(WR, RD & GR)
3. PPS to JS(A,IC&GW), DoWR,RD&GR
4. PS to Director(GW)

DEPARTMENT OF WATER RESOURCES, RD & GR
CENTRALGROUND WATER AUTHORITY
18/11, JAMNAGAR HOUSE, MANSINGH ROAD, NEW DELHI — 110011 Ph-
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Minutes of meeting on Joint Committee to look into the matter of Rain Water Harvesting Systems in India as per the directions of the Hon'ble NGT in the matter of OA No. 147/2021 , Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT of Delhi & Ors

A Joint Committee of Central Pollution Control Board (CPCB), Ministry of Jal Shakti, Ministry of Housing & Urban Affairs, Government of India under the Chairmanship of Chairman, Central Ground Water Board (CGWB) was constituted by Ministry of Jal Shakti as directed by the Hon'ble NGT in the matter of O.A. No. 147/2021, Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT of Delhi & Ors. to look into the matter of rain water harvesting systems and contamination of groundwater in India. The first meeting of the Committee was held via video conferencing on 03.02.2022 at 03:00 p.m. where representatives 5 states i.e. Delhi, Rajasthan, Haryana, Karnataka and Tamil Nadu were participated.

The following action points are emerged during the meeting:

1. All participated states to share the preliminary information/data as given below:-
 - a. All states to identify the locations of sites where Rain Water Harvesting Structure already constructed and the list of identified sites to be provided to CGWA by 04.02.2020 for site visit/ inspection by the committee.
 - b. Building Bye laws and rules that are being opted by the state.
 - c. Standard design for recharge formulated by state departments.
 - d. Water quality impact assessment related to contamination of Ground Water, if available.
 - e. Existing penal provision being followed by the state for groundwater contamination.
2. Constituting working group in 5 states for supporting and coordination with the Joint Committee drawing members from Regional offices of CGWB and States. Details of nominated officers as to be shared.

As the time given by Hon'ble NGT for submission of report is two months, all the members as well as states were requested to take immediate action and extend their coordination to successful completion of given task.

The meeting ended with a vote of thanks to the chair.

List of Participants

1. Shri S.Raja, Joint Chief Engineer, WRD, SG&S WRDC, Tharamani, Chennai.
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8. Nawab Khan, SDO, Gurugram Water Services, sub division Gurugram.
9. Sh. Sunil Kumar, Member Secretary, CGWA, Ministry of Jal Shakti.
10. Dr. Rajesh Chandra, Scientist 'D', CGWA.
11. Shri. Ashok Patre, Scientist 'D', CGWA.
12. Smt Uma Kapoor, Consultant, CGWA.
13. Shri Anmol Sharma, Scientist 'C', CGWA
14. Shri Vikas Ranjan, Scientist 'C', CGWA.
15. Regional Directors, CGWB, Karnataka, Rajasthan, New Delhi, Haryana, Tamil Nadu.

Aso (m)
Min
Staff

Director (Revenue)

Diary No. 6728

Date 3/9/19

Total Pages 6

**OFFICE OF THE SECRETARY
DELHI JAL BOARD
VARUNALAYA PHASE-II, KAROL BAGH,
NEW DELHI - 110 005.**

No.: DJB/Secy.DJB/Meeting Asstt./2019/ 489

Dated : 2-9-19

The Delhi Jal Board vide Resolution No. 829 DJB dated- 19.08.2019 (147th meeting) duly confirmed on 27.08.2019 (148th meeting) has ratified/ apprised/ approved/ deferred/ withdrawn/ referred back/rejected / accepted information referred to C.E.O. for report, the proposal as contained in CE() / Director (Rev) letter No. DJB/ Director (Revenue)/RWH/2019/209 dated 16/7/2019 vide Item No. Admn.-339 Regarding Amendment in provision for Rain water Harvesting in Delhi Water & Sewer (Tariff & Metering) Regulation, 2012.

Resolution No. 829 /DJB dated- 19.08.2019 in original approved in the meeting of the Board/through circulation, is accordingly sent herewith for further necessary action and to intimate the action taken on the decision of Board within seven days for information and record of the Board.

Encl : As above.

[Signature]
DJB
JDR(L&A)

JDR II

[Signature]
(SANJAY GUPTA)
SECRETARY, DJB

[Signature]
Director

[Signature]
Director (Rev.)

DELHI JAL BOARD : GOVT. OF N.C.T. OF DELHI

NO.DJB/DOR/Preamble/RWH/2019/209

Item No. Admn./ 339

DATED : **16-07-2019.**

DATED: 5-8-19

1.	Name of the Subject	Amendment in Provision for Rain Water Harvesting in Delhi Water & Sewer (Tariff and Metering) Regulation, 2012.
2.	Administrative Approval/ Information	Board is the Competent Authority.
3.	Name of the Wing	Revenue Department.
4.	Brief History of the Case	<p>Ground water resources in many parts of the city are over-exploited. The extent of replenishment of ground water is much less than what the city as a whole is withdrawing due to its rapid urbanization. Availability of surface water to Delhi is limited and is dependent on river's water sharing among the riparian/basin states and interstate agreements, therefore, there is need to preserve ground water resources and to take measures for its sustainable availability.</p> <p>Rain Water Harvesting is considered as a simple, viable and eco-friendly method for conservation of water and a simple solution for ground water recharge. Use of adequately treated recycled waste water for non-potable purposes also reduces dependence on ground/surface water. Steps are being taken by Delhi Jal Board to increase the utilization of effluent from its STPs for non-potable purposes. At the same time, it is essential that all the stakeholders need to take proactive measures for conservation of water and in implementing rain water harvesting systems for sustainability of ground water resources.</p> <p>Rain Water Harvesting can be done through collection and storage of rain water that runs-off from catchment areas like roofs, pavements, roads, parks, open grounds,</p>

etc. It is essential that catchment areas shall not be contributing polluted water. The Rain water run-off can be collected and stored as surface storage in tanks or can be used for ground water recharge.

Ministry of Urban Development and Poverty Alleviation (Delhi Division), Govt. of India by its notification dated 28.07.2001 had made modification / additions in the building Bye laws of 1983, making Rain Water Harvesting mandatory in all new buildings on plots of 100 sq. meters and above (provision to be applicable as per the public notices of CGWA from time to time) and Waste Water Recycling System for horticultural purposes in buildings having a minimum discharge of 10,000 liters and above per day. (Annexure – 1).

To enhance implementation of RWH by public at large, certain provisions in DJB's Water & Sewer (Tariff and Metering) Regulation-2012 (effective from 31.08.2012) were made which are already in public domain. These are as under :

A. Under Regulation 8(d), Category 'D' for the consumers has been classified where rebate has been given in tariff for provision of either rain water harvesting or waste water recycling or both, as under:

(i) Such plot/properties which are having area of 2000 square meter or more and having installed functional rain water harvesting system or waste water recycling system, shall be granted rebate of 10% in the total bill amount and 15% if both the above systems have been set up and functional.

(ii) If the Rain Water Harvesting System is adopted by a society then the individual member of that

		<p>society will be entitled to above mentioned rebate in water bill.</p> <p>B. Penal Provisions in Regulation 50 have also been made for non-implementing rain water harvesting systems, which are as under:</p> <p>(i) The consumer of the Board having a plot/property of size 500 sq. metres or more shall make provision for rain water harvesting covering the entire plot area, within one year, in case of commercial/industrial property and within three years for residential property from the date of coming into force of these regulations under intimation to the area ZRO.</p> <p>(ii) In case, the consumer fails to comply with the above provisions within the time limit the tariff as applicable for the consumer respective category will be increased by 1.5 times, till the provision is installed.</p> <p>Public Notices in the press were also issued by the office of DOR about the above provisions and requesting the public to implement Rain Water Harvesting. Press clippings are enclosed as Annexure-2 & 3.</p>
5.	Present Status/ Issues	<p>In March, 2016 Board vide Resolution No.276 dated 01-03-2016 approved following amendments in Delhi Water & Sewer (Tariff and Metering) Regulation 2012. (Annexure-4). Implementation of Rain Water Harvesting System was simplified vide aforesaid Resolution by providing that for provision of Rain Water Harvesting, rain water run-off generated from roof top of the building premises shall only be considered for the purpose of provision of Rain Water Harvesting System, instead of installation of recharge bores for the purpose. It further provided as</p>

below :

- (I) Rebate in total bill amount on account of having functional Rain Water Harvesting System shall be extended to plot/properties having area of 500 sqm or more. Accordingly, the existing Section 8 (d)(i) was substituted as under :
- Sub-Section 8 (d) (i)**
- “Such plots/properties which are having area of 500 Sqm. or more having installed functional Rain Water Harvesting System or Waste Water Recycling System shall be granted rebate of 10% in the total bill amount for having functional Rain Water Harvesting System and 15% if both the above systems have been set up and are functional.”
- (II) Mandatory provision for Rain Water Harvesting and consequent Penal Provision was deferred upto 30th July 2017. Further, for provision of RWH, rain water runoff generated from rooftop of the building premises shall only be considered for the purpose of provisions on RWH contained in the Tariff Regulations.
- (III) For provision of RWH Systems in the building premises, rain water runoff generated from rooftop areas shall only be considered for the purpose of applicability of penal and rebate provisions contained in the Tariff Regulations, 2012.
- (IV) RWH through artificial ground water recharge structures is not recommended where post monsoon ground water levels are shallower than 5m. Penalties as per the Delhi Water & Sewer (Tariff and Metering) Regulations, 2012 will not be levied on DJB consumers for non-provision of RWH System in such areas. However, in such areas rain water storage for its use in non-potable purposes

		<p>after required treatment may be carried out as a voluntary option.</p> <p>(V) Further, as an additional step for replenishment of ground water and with a view to enhance implementation of Rain Water Harvesting by public at large Board had also decided that :</p> <p>“(a) Such plots/properties which are having area of 100 Sq. Mtrs. or more having installed functional Rain Water Harvesting System shall be granted rebate of 10% in the total bill amount for having functional Rain Water Harvesting System.</p> <p>(b) Such plots/properties which are having area of 500 Sq. Mtrs. or more having installed functional Rain Water Harvesting System or Waste Water Recycling System shall be granted rebate of 10% in the total bill amount for having functional Rain Water Harvesting System and 15% if both the above system have been set up and are functional”.</p> <p>No penalty would be imposed on plots/properties which have area of 100 Sq. Mtrs. or more but less than 500 Sq. Mtrs. if no Rain Water Harvesting System is provided.</p> <p>Presently, there is no provision for requirement of functional Rain Water Harvesting System or Waste Water Recycling System at the time of sanction of a new water/sewer connection and therefore, a decision is required in this regard to make a beginning.</p>
6.	Detailed Proposal of the subject	As provided in MHUA notification dated 28-07-2001 referred above, though Rain Water Harvesting is mandatory in all new buildings on plot of 100 Sq. Mtrs. and above, it would be applicable only for properties constructed after 2001. Therefore, a large number of properties constructed prior to 2001 would be left out and

		<p>therefore, would not be able to contribute in improving ground water table, which is fast depleting in NCT of Delhi.</p> <p>It is felt that some strong decisions also needs to be taken with respect to sanction of new water/sewer connections, so that consumers are required to install functional Rain Water Harvesting System, which would help in improving ground water recharge.</p> <p>To ensure proper implementation of Rain Water Harvesting norms following amendments in Delhi Water and Sewer (Tariff & Metering) Regulations 2012 are proposed for consideration and approval of the Board (Regulation 50):-</p> <p>(i) It will be mandatory for plots/properties which are having area of 100 Sq. Mtrs. or more to have functional Rain Water Harvesting System, even if the property is constructed prior to 28-07-2001. Such plot/property owning consumers would be required to install functional Rain Water Harvesting System within 1 years from the date of Public Notice issued in this regard or from date to be decided by CEO, DJB, who may consider further extension of the date, if required. In case consumers whose construction was before 28-07-2001 fails to comply with the aforesaid mandatory provision within the time limit prescribed, the tariff as applicable for the respective consumer category will be increased by 1.5 times, till the system is installed and intimated to the respective Zonal Revenue Officer.</p>
		<p>(ii) Further, in case of properties having area of 100 sq.m. or more, constructed after 28-07-2001 who have not intimated about the Rain Water Harvesting provision made to the respective area ZRO, may also</p>

		<p>inform the area ZRO within 6 months from the issue of Public Notice in this regard, failing which, tariff as applicable for the respective consumer category will be increased by 1.5 times, till the system is installed and intimated to the respective Zonal Revenue Officer.</p> <p>(iii) Besides (i) & (ii) above, it is also proposed to disconnect water connection of all consumers who fail to install functional Rain Water Harvesting System or intimate area ZRO within prescribed time limit. This provision will, however, be applicable in case of all properties having area of 100 Sq. Mtr. and above but after timelines provided in both the aforesaid cases is over.</p> <p>(iv) To begin with new water/sewer connection to the existing and newly constructed properties having plot area of 500 Sq. Mtrs. and above will be sanctioned only after confirmation of installation of functional Rain Water Harvesting System. Necessary functionality certificate in this regard would be given by the respective Maintenance Division as per Instructional Orders issued by the Rain Water Harvesting Cell, in this regard.</p> <p>(v) New water/sewer connection to newly constructed properties/buildings having a minimum discharge of 10000 Ltrs. and above per day will be sanctioned only after confirmation of installation of functional Waste Water Recycling System, as per norms. Necessary functionality certificate in this regard too would be given by the respective Maintenance Division.</p>
		<p>(vi) Implementation of (iv) above for plots/properties having area of 100 Sqm and above but below 500</p>

		<p>Sqm. would be applicable after timelines provided in (i) and (ii) above are over.</p> <p>(vii) In cases where installation of Rain Water Harvesting System is not technically feasible, for any reason, CEO, DJB may take appropriate decision in respective case, on merits.</p>
7.	Implementation Schedule with Timelines for each stage including internal processing.	Will be implemented on approval of the proposal in consultation with the System integrator for RMS 2.0.
8.	Financial Implication of the Proposed Subject.	The overall revenue collection may increase.
9.	Comments of the Finance.	N.A.
10.	Comments of the Wing on the comments of Finance Department.	N.A.
11.	Details of previous Board Resolution, Existing Provision of Water Board Act / Regulations thereof.	N.A.
12.	Legal Implication of the Subject & Comments of Law Department.	N.A.
13.	Comments of Department on the comments of Law Department.	N.A.
14.	Whether C.V.C. guidelines followed or not.	N.A.

15.	Recommendations	The proposals as contained in para 6 above are accordingly submitted for consideration and approval of the Board. Department may be allowed to take further action in anticipation of the confirmation of the minutes.
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(R.S. GODBOLEY)
DIRECTOR (REVENUE)

SECRETARY, D.J.B.

A-45

A-21

Annexure-VI

The Copy of the Gazette Notification issued by Ministry of Urban Development and Poverty Alleviation vide No. N-11011/9/98-DDVI (Pt.)/DDIB dt. 28th July, 2001 regarding modifications / additions to the building bye laws 1983 is as under:-

NOTIFICATION

S.O.--Whereas the issue of making suitable provision in the Building Bye laws 1983 to ensure that the building that are erected in Delhi provide for the water harvesting through storing of rain water runoff to recharge underground aquifers has been under the consideration of the Government.

Whereas the following modifications/additions which the Central Government proposed to make in the Building Bye-laws, 1983 in this regard were published for public information vide Public Notice dated 20th June, 2001 and were advertised in the leading newspapers on 30.6.2001. In all five objections/suggestions were received and they were examined by a Committee under the convenorship of Chief Planner of town and Country Planning Organization.

Whereas after through consideration of the report Central Government has decided to make the following Modifications/additions in the Building Bye-laws, 1983.

Now, therefore, in exercise of the powers conferred by sub-section (2) of Section 11 A of Delhi Development Act, 1957, the Central Government hereby makes the following modifications/additions to the Building Bye-laws, 1983 with effect from the date of publication of this notification in the Gazette of India.

MODIFICATIONS

1. Clause 22.4 Part -III (Structural Safety and Services) of the Building Bye-laws, 1983.
2. 22.4.1 Water harvesting through storing of water runoff including rain water in all new building on plots of 100 sq. mtrs and above will be mandatory. The plans submitted to the local bodies shall indicate the system of storm water drainage along with points of collection of rain water in surface reservoirs or in recharge wells. These provisions will be applicable as per the public Notice (s) of Central Ground Water Authority issued from time to time.

3. 22.4.2 All building having a minimum discharge of 10.000 litres and above per day shall incorporate waste water recycling system. The recycled water should be used for horticultural purposes.

Note: - These modifications/amendments will be applicable from the date of Notification.

(No.N-11011/9/98-DDVI (Pt.) DDIB)

-sd-

(Devendra Kumar Goel)

Under Secretary to the Govt. of India

101 24/5/15

DELHI JAL BOARD
OFFICE OF DIRECTOR (REVENUE)
VARUNALAYA PHASE-II, KAROL BAGH, NEW DELHI-110005

Annexure-2

PUBLIC NOTICE

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation 2012 were notified on 31-08-2012. Regulation 50(a) of these Regulations makes it mandatory for the consumer of the Board having a plot/property of 500 Sq. m. or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation, further provides that the aforesaid Rain Water Harvesting shall be provided within one year, in case of commercial/Industrial property and within three years, in case of domestic consumers, from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.).

2. Whereas, Regulation 50(b) provides that the consumer who fails to comply with the above provisions within the provided time limit, the tariff as applicable for the consumer of respective category will be increased by 1.5 times till the provision is installed.

3. Therefore, all consumers of the Board having commercial/Industrial connection (which includes Institutes, Hospitals, Schools, Offices, Office Complexes, Railway Stations/Yards, Police Stations, Airports, Bus-Stand, Petrol Pumps, Hotels, Guest Houses, Restaurants, Clubs, Marriage Halls, Industry, Cooling Plants, Factories, Ice Cream Factory, Amusement Parks, Dhobi Ghat etc.) with plot/property having size of 500 Sq. m. and above are required to intimate to the Zonal Revenue Officer of the area about installation of Rain Water Harvesting within 15 days from the issue of this notice, failing which their tariff will be increased by 1.5 times of the provision is installed, and its intimation given to the Z.R.O. Further, as far as domestic consumers having plot/property area of 500 Sq. m. and above are concerned, they are required to make provision for Rain Water Harvesting by 31-08-2015.

ISSUED BY P.R.O. (WATER)
 Advt. No. J.S.V. 2015-16/53

Sd/-
 Director (Revenue)

THE HINDUSTAN TIMES

OFFICE OF JT. DIRECTOR REVENUE (HQ)
DELHI JAL BOARD: GOVT. OF NCT OF DELHI
VARUNALAYA PHASE-II, KAROL BAGH, NEW DELHI-110005
PUBLIC NOTICE

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 were notified on 31.08.2012. Regulation 50(a) of these Regulations makes it mandatory for the domestic consumer of the Board having a plot/property of 500 Sq.m or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation further provides that the aforesaid Rain Water Harvesting shall be provided within three years from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.). The last date for making such provision of Rain Water Harvesting is 31.08.2015.

2. Whereas, Regulation 50(b) provides that the consumer who fails to comply with the above provisions within the provided time limit, the tariff as applicable for the consumer of respective category will be increased by 1.5 times till the provision is installed.

3. Therefore, all domestic consumers of the Board including Group Housing Societies having plot/property size of 500 Sq.m and above are required to make provision for Rain Water Harvesting by 31.08.2015 positively, failing which their tariff will be increased by 1.5 times till the provision is installed. Further, such domestic consumers are required to intimate to the Zonal Revenue Officer of the area about installation of Rain Water Harvesting on or before 31.08.2015.

ISSUED BY P.R.O. (WATER)
 Advt. No. J.S.V. 2015-16/195 Director (Revenue)

TIMES OF INDIA

OFFICE OF JT. DIRECTOR (REVENUE) HQ
DELHI JAL BOARD GOVT. OF NCT OF DELHI
VARUNALAYA PHASE-II, KAROL BAGH
NEW DELHI-110005
PUBLIC NOTICE

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation 2012 were notified on 31-08-2012. Regulation 50(a) of these Regulations makes it mandatory for the domestic consumer of the Board having a plot/property of 500 Sq. m. or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation, further provides that the aforesaid Rain Water Harvesting shall be provided within three years, from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.). The last date for making such provision of Rain Water Harvesting is 31.8.2015.

2. Whereas, Regulation 50(b) provides that the consumer who fails to comply with the above provisions within the provided time limit, the tariff as applicable for the consumer of respective category will be increased by 1.5 times till the provision is installed.

3. Therefore, all domestic consumers of the Board including Group Housing Societies having plot / property size of 500 Sq.m. and above are required to make provision for Rain Water Harvesting by 31.8.2015 positively, failing which their tariff will be increased by 1.5 times till the provision is installed. Further, such domestic consumers are required to intimate to the Zonal Revenue Officer of the area about installation of Rain Water Harvesting on or before 31-08-2015.

ISSUED BY P.R.O. (WATER)
 Advt. No. J.S.V. 2015-16/195 Director (Revenue)

INDIAN EXPRESS

OFFICE OF JT. DIRECTOR REVENUE (HQ)
DELHI JAL BOARD: GOVT. OF NCT OF DELHI
VARUNALAYA PHASE-II, KAROL BAGH
NEW DELHI-110005
PUBLIC NOTICE

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 were notified on 31.08.2012. Regulation 50(a) of these Regulations makes it mandatory for the domestic consumer of the Board having a plot/property of 500 Sq.m. or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation further provides that the aforesaid Rain Water Harvesting shall be provided within three years from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.). The last date for making such provision of Rain Water Harvesting is 31.08.2015.

2. Whereas, Regulation 50(b) provides that the consumer who fails to comply with the above provisions within the provided time limit, the tariff as applicable for the consumer of respective category will be increased by 1.5 times till the provision is installed.

3. Therefore, all domestic consumers of the Board including Group Housing Societies having plot/property size of 500 Sq.m and above are required to make provision for Rain Water Harvesting by 31.08.2015 positively, failing which their tariff will be increased by 1.5 times till the provision is installed. Further, such domestic consumers are required to intimate to the Zonal Revenue Officer of the area about installation of Rain Water Harvesting on or before 31.08.2015.

ISSUED BY P.R.O. (WATER)
 Advt. No. J.S.V. 2015-16/195 Director (Revenue)

हिन्दुस्तान

कार्यालय संयुक्त निदेशक राजस्व (मुख्यालय)
 दिल्ली जल बोर्ड: रा.रा.क्ष. दिल्ली सरकार
 वरुणालय फेज-II, करोल बाग, नई दिल्ली-110005

सार्वजनिक सूचना

जहाँकि दिल्ली जल एवं सीवर (शुल्क एवं मीटरिंग) विनियमन 2012, 31.08.2012 को अधिसूचित किया गया था। इन विनियमनों का विनियमन 50(अ), 500 वर्ग मीटर या ज्यादा के प्लॉट/सम्पत्ति वाले गृहों के अंतर्गत उपभोक्ताओं से पानी संग्रहीत करने का अनिवार्य प्रस्ताव है कि पूरा 31.08.2015 को पूर्ण किया जाए। इसके अभाव में उपभोक्ताओं को 31.08.2015 के बाद पानी संग्रहीत करने के अर्थ में इन विनियमनों के लागू होने को धिरे से तीन वर्षों के भीतर उपभोक्ताओं को जल संग्रहीत करने के लिए प्रस्तावित किया जाएगा। वर्षा जल संग्रहीत करने के लिए उपभोक्ताओं को 31.08.2015 तक 1.5 गुना बढ़ जाएगा।

2. जहाँकि विनियमन 50(ब) का प्रावधान है कि जो उपभोक्ता प्रदान की गयी समय सीमा के भीतर उपभोक्ता-प्रदाताओं को पालन करने में विफल होता है, निर्धारित दरों के उपभोक्ताओं के लिए पानी संग्रहीत करने के लिए प्रस्तावित होने तक 1.5 गुना बढ़ जाएगा।

3. इसलिए, 500 वर्ग मी. एवं ऊपर के क्षेत्रों के प्लॉट/सम्पत्ति वाली ग्रुप हाउसिंग सोसाइटीज सहित बोर्ड के सभी घरेलू उपभोक्ताओं को निर्दिष्ट रूप से 31.08.2015 तक वर्षा जल संग्रहीत करने का अनिवार्य प्रस्ताव है अतः उपभोक्ताओं को जल संग्रहीत करने तक 1.5 गुना बढ़ जाएगा। इसके अभाव में उपभोक्ताओं को 31.08.2015 को या उसके पहले वर्षा जल संग्रहीत करने के लिए प्रस्तावित करने के लिए प्रस्तावित किया जाएगा।

ज.स. अधि (जल) द्वारा जारी
 दिना. सं. ज.स.वि. 2015-16/195 Director (Revenue)

No.: CE (Pig) water.....01.....

Item No. Est. 93

Dated...10.02.2016.....

Dated...10/2/16.....

1.	Name of Subject	Amendment in Provisions for Rain Water Harvesting in Delhi Water & Sewer (Tariff & Metering) Regulations, 2012
2.	Name of the Division	EE (RWH/GWC)
3.	Background	<p>Ground water resources in many parts of the city are over-exploited. The extent of replenishment of ground water is much less than what the city as a whole is withdrawing due to its rapid urbanization. Availability of surface water to Delhi is limited and is dependent on river's water sharing among the riparian/basin states and interstate agreements, therefore, there is need to preserve ground water resources and to take measures for its sustainable availability.</p> <p>Rain water harvesting is considered as a simple, viable and eco-friendly method for conservation of water and a simple solution for ground water recharge. Use of adequately treated recycled waste water for non-potable purposes also reduces dependence on ground/surface water. Steps are being taken by Delhi Jal Board to increase the utilization of effluent from its STPs for non-potable purposes. At the same time, it is essential that all the stakeholders need to take proactive measures for conservation of water and in implementing rain water harvesting systems for sustainability of ground water resources.</p> <p>Rain water harvesting can be done through collection and storage of rain water that runs-off from catchment areas like roofs, pavements, roads, parks, open grounds, etc. It is essential that catchment areas shall not be contributing polluted water. The rain water run-off can be collected and stored as surface storage in tanks or can be used for ground water recharge.</p> <p>Ministry of Urban Development and Poverty Alleviation (Delhi Division), Govt. of India by its notification dated 28.07.2001 had made modification / additions in the building Bye laws of 1983, making Rain Water Harvesting mandatory in all new buildings on plots of 100 sq. meters and above (provision to be applicable as per the public notices of CGWA from time to time) and waste water re-cycling system for horticultural purposes in buildings having a minimum discharge of 10,000 liters and above per day.</p> <p>To enhance implementation of RWH by public at large, certain provisions in DJB's Water & Sewer (Tariff & Metering) Regulations-2012 (effective from 31.08.2012) were made which are already in public domain. These are as under:</p> <p>A Under Regulation 8(d), Category 'D' for the consumers has been classified where rebate has been given in tariff for provision of either rain water harvesting or waste water recycling or both, as under;</p>

3		<p>(i) Such plot/properties which are having area of 2000 square meter or more and having installed functional rain water harvesting system or waste water recycling system, shall be granted rebate of 10% in the total bill amount and 15% if both the above systems have been set up and functional.</p> <p>(ii) If the Rain Water Harvesting system is adopted by a society then the individual member of that society will be entitled to above mentioned rebate in water bill.</p> <p>B Penal Provisions in Regulation 50 have also been made for non-implementing rain water harvesting systems, which are as under:</p> <p>(i) The consumer of the Board having a plot/property of size 500 sq. metres or more shall make provision for rain water harvesting covering the entire plot area, within one year, in case of commercial/industrial property and within three years for residential property from the date of coming into force of these regulations under intimation to the area ZRO.</p> <p>(ii) In case, the consumer fails to comply the above provisions within the time limit the tariff as applicable for the consumer respective category will be increased by 1.5 times till the provision is installed.</p> <p>Public Notices in the press were also issued by the office of DOR about the above provisions and requesting the public to implement RWH. Press clippings are enclosed as Annexure-1 & 2.</p> <p>A full day consultation workshop with participations from various stakeholders was held on 08.10.2015 in Delhi wherein Mr. Sekar Raghavan from Chennai, the founder of NGO Akash Ganga presented the successes of RWH in the city of Chennai. One of the recommendations in the outcome of the deliberations held in the workshop was to frame a new specific RWH regulations/rules under the aegis of the UD Department, GNCTD having following key principals:</p> <ol style="list-style-type: none"> i. The law will be all pervasive: It will apply to all civic bodies (MCD, PWD, CPWD, DIB, etc), all building types (Govt. pvt, residential, etc.) and both new & old buildings ii. Clearly define a deadline for conformance and penalties of non-conformance – build at owners cost, disconnect, penalty. iii. UD will be the nodal department to navigate the legislation iv. The legislation framework of Chennai will be used as reference point v. The legislation will be supported by specific rules to avoid ambiguity in implementation. Rules will spell out specific requirements by types of buildings, local soil conditions, type of RWH structure etc. <p>Member (WS) has already requested the Principal Secretary, UD Department, GNCTD for the above. Copy of the letter dated 21.12.2015 is enclosed as Annexure-3.</p>
4.	Present Status/Issues	General Standard Designs for roof-top RWH for the purpose of ground water recharge provided by Central Ground Water Board (Delhi State Unit office)

recommends that recharge bores are required to be provided in the areas where post monsoon ground water levels are deeper than 15m, while RWH for artificial recharge to ground water is not recommended when the post monsoon ground water levels are shallower than 5m. When the post monsoon ground water levels are between 5m and 15m below then only recharge chambers/trenches (without recharge bores) are required to be provided for the purpose of RWH. The General Standard Designs given by CGWB also provides provisions for filter media in the recharge trenches/chambers. The same were available on DJB website for public facilitation.

It is observed that applicants seeking permissions for installation of recharge bores for the purpose of Rain Water Harvesting are not getting permissions from the District Advisory Committees, while at the same time penalties as per the provisions in Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 are being imposed on the DJB consumers for non-provision of RWH systems in their premises. It was reported that District Advisory Committees are not giving permissions for recharge bores for the purpose of Rain Water Harvesting to avoid misuse of the permissions for the purpose of extraction of ground water.

It is also observed that recently there have been instances of increase in ground water levels in certain areas like Siddartha Enclave Extn., Okhla Industrial Area, Friends Colony, etc., and there is a need to map the areas in consultation with the CGWB where RWH is not required for the purpose of ground water recharge.

Also, though there may be area specific technical requirements for the recharge bores and filter media in the recharge chambers for their full efficacy, there is need to have simple designs for RWH structures for the purpose of ground water recharge which are easy and economical to implement by the public at large for their wider implementation.

Therefore, it has been considered that RWH structures for the purpose of ground water recharge may be without recharge bores and filter media comprising of stone/pea gravels etc. Further, simple modular designs and drawings of recharge chambers are to provide capacities and suggestive sizes of the recharge chambers required depending on the runoff generated from roof top area only. To prevent clogging of natural soil strata, a suggesting filter media may be given which will be necessary only for seeking rebate in total bill amount as per provisions in Tariff Regulations, 2012 for having functional RWH system. Standard operating procedures for maintenance, their periodicity is also to be given. The same are to be made available on DJB website for public facilitation. Simple modular designs & drawings on recharge chambers may also be distributed along with the water bills.

It has also been considered that a proposal for consideration of the "Board" to defer imposition of penalties on the consumers as per the Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 for not having provisions for

○		RWH in their premises is to be put up and time period of up to June 2016 may be given to ensure implementation as per the modular simpler standard designs. This period may further be extended, if considered necessary.
5.	Detailed Proposal on the subject	<p>Following is proposed:</p> <p>A. Amendments in Delhi Water & Sewer (Tariff & Metering) Regulation, 2012.</p> <p>(I) Rebate in total bill amount on account of having functional RWH system shall be extended to plot/properties having area of 500sqm or more. Accordingly, the existing Section 8 (d) (i) may be substituted as under:</p> <p>Sub-Section 8 (d) (i) "Such plots/properties which are having area of 500sqm or more having installed functional RWH system or waste water recycling system shall be granted rebate of 10% in the total bill amount for having functional RWH system and 15% if both the above systems have been set up and are functional."</p> <p>(II) Mandatory provision for RWH and consequent Penal Provision has been deferred upto 30th June 2016 which may be further extended with the approval of CEO, if required. Further, for provision of RWH, rain water runoff generated from rooftop of the building premises shall only be considered for the purpose of provisions on RWH contained in the Tariff Regulations. Following insertions as Section 50 (a) may be made in Chapter-V of the existing Regulations-2012:</p> <p>Section 50 (a):</p> <p>(i) "Mandatory provision for RWH and consequent penal provisions under Section 50 will be applicable from 01.07.2016. CEO is further delegated the power to defer the same and make it applicable from a subsequent date, if required."</p> <p>(ii) "For provision of RWH systems in the building premises, rain water runoff generated from rooftop areas shall only be considered for the purpose of applicability of penal and rebate provisions contained in the Tariff Regulations, 2012."</p> <p>(iii) RWH through artificial ground water recharge structures is not recommended where post monsoon ground water levels are shallower than 5m. Penalties as per the Delhi Water & Sewer (Tariff & Metering) Regulations, 2012 will not be levied on DJB consumers for non-provision of RWH system in such areas. However, in such areas rain water storage for its use in non-potable purposes after required treatment may be carried out as a voluntary option.</p> <p>(B) Guidelines on implementing simple modular Rain Water Harvesting</p>

9.	Budget Provision	structures have been approved and are enclosed as Annexure-4. Not applicable
7.	Comments on the observations from the Finance Department	Finance Department has seen the proposal.
8.	Details of the existing provision of Water Board Acts/Regulation thereof.	As mentioned in the background.
9.	Whether CVC guidelines followed or not.	Not applicable.
10.	Whether the case has been cleared by the sub technical committee	Not applicable.
11.	Proposal before Delhi Jal Board	<p>The case is placed before the Board to approve the followings:</p> <p>A. Amendments in Delhi Water & Sewer (Tariff & Metering) Regulation, 2012.</p> <p>(i) Rebate in total bill amount on account of having functional RWH system shall be extended to plot/properties having area of 500sqm or more. Accordingly, the existing Section 8 (d) (i) may be substituted as under:</p> <p>Sub-Section 8 (d) (i) "Such plots/properties which are having area of 500sqm or more having installed functional RWH system or waste water recycling system shall be granted rebate of 10% in the total bill amount for having functional RWH system and 15% if both the above systems have been set up and are functional."</p> <p>(ii) Mandatory provision for RWH and consequent Penal Provision has been deferred upto 30th June 2016 which may be further extended with the approval of CEO, if required. Further, for provision of RWH, rain water runoff generated from rooftop of the building premises shall only be considered for the purpose of provisions on RWH contained in the Tariff Regulations. Following insertions as Section 50 (a) may be made in Chapter-V of the existing Regulations-2012:</p> <p>Section 50 (a):</p>

		<p>(i) "Mandatory provision for RWH and consequent penal provisions under Section 50 will be applicable from 01.07.2016. CEO is further delegated the power to defer the same and make it applicable from a subsequent date, if required."</p> <p>(ii) "For provision of RWH systems in the building premises, rain water runoff generated from rooftop areas shall only be considered for the purpose of applicability of penal and rebate provisions contained in the Tariff Regulations, 2012.</p> <p>(iii) RWH through artificial ground water recharge structures is not recommended where post monsoon ground water levels are shallower than 5m. Penalties as per the Delhi Water & Sewer (Tariff & Metering) Regulations, 2012 will not be levied on DJB consumers for non-provision of RWH system in such areas. However, in such areas rain water storage for its use in non-potable purposes after required treatment may be carried out as a voluntary option.</p> <p>B. Guidelines on implementing simple modular Rain Water Harvesting structures have been approved and are enclosed as Annexure-4.</p>
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PBlayans
(Praveen Bhargava)
CE (Planning) Water

Secretary (DJB)

N 13T 27/5/15

दिल्ली जल बोर्ड
कार्यालय, निदेशक (राजस्व)
वरुणालय फेज-II, करोल बाग, नई दिल्ली-110005
सार्वजनिक सूचना

जैसा कि, दिल्ली शानी एवं शीकर (टैरिफ एवं प्रमादश) विनियम, 2012 को 31.08.2012 को अधिसूचित किया गया, इन विनियमों का विनियम 50 (ए), बोर्ड के उपभोक्ता जिसके पास 500 वर्ग मीटर या अधिक का प्लॉट/सम्पत्ति है, को सम्पूर्ण प्लॉट क्षेत्रफल को शामिल करते हुए वर्षा जल संचयन के लिए व्यवस्था करना अनिवार्य बना दिया है। यह विनियम अभी यह प्रावधान करता है कि इन विनियमों के लागू होने की तिथि से व्यावसायिक/औद्योगिक/सम्पत्ति की स्थिति में एक वर्ष के अंदर तथा घरेलू उपभोक्ताओं की स्थिति में तीन वर्षों के अंदर उपरोक्त वर्षा जल संचयन उपलब्ध कराना होगा जिसकी पर्यवेक्षण जेड आर ओ जेड ऑफिसर (जेड आर ओ) को दी जाएगी।

2. जैसा कि विनियम 50 (बी) प्रावधान करता है कि वह उपभोक्ता जो उपलब्ध कराई गई समय सीमा के अंदर उपरोक्त प्रावधानों के अनुपालन में असफल रहता है, संबंधित सर्वोच्च उपभोक्ता के लिए लागू अनुसार शुल्क दर, उपरोक्त व्यवस्था प्रतिष्ठापित किए जाने तक 1.5 गुना बढ़ा दी जाएगी।

3. इसलिए, बोर्ड के सभी उपभोक्ता, जिनके पास साइज 500 वर्ग मी. तथा अधिक के प्लॉट/सम्पत्ति पर व्यावसायिक/औद्योगिक/कमरेशन (जिसमें सस्थान, अस्पताल, विद्यालय, कार्यालय, कार्यालय, मरिस, क्लब, रेस्टोरेंट/थिएटर, पुलिस स्टेशन, गैर-पार्टमेंट, बस-स्टॉप, मंदिर, मस्जिद, स्कूल, आतिथेय गृह, रेस्तरां, क्लब, मैजिस्ट्राल, उद्योग, कालम, स्टाटस, कारखाने, आइसक्रीम फैक्टरी, एम्प्लॉयमेंट एकेडमी, याद आदि शामिल है) को इस नोटिस के निपटारे से 15 दिनों के अंदर वर्षा जल संचयन के प्रतिष्ठापन के बारे में पर्यवेक्षण जेड आर ओ जेड ऑफिसर को सूचित करना होगा, जिसमें असफल रहने पर शुल्क दर, व्यवस्था के प्रतिष्ठापित होने तथा इसकी मानकरी जेड आर ओ को दिए जाने तक 1.5 गुना बढ़ा दी जाएगी। इसके अतिरिक्त पराल उपभोक्ता, जिनके पास 500 वर्ग मी. तथा अधिक का प्लॉट/सम्पत्ति है, को 31.08.2015 तक वर्षा जल संचयन व्यवस्था करना होगा।

जे.एस.आ. (जल) द्वारा जारी
 विज्ञापन, जे.एस.बी. 2015-16/53-
 निदेशक (राजस्व)

Times of India
 27/5/15

8 AUG 2015

THE HINDUSTAN TIMES

OFFICE OF JT. DIRECTOR REVENUE(HQ)
DELHI JAL BOARD GOVT. OF NCT OF DELHI
VARUNALAYA PHASE-II, KAROL BAGH, NEW DELHI-110005

PUBLIC NOTICE

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 notified on 31.08.2012, Regulation 50(a) of these Regulations makes it mandatory for the domestic consumer of the Board having a plot/property of 500 Sq.m. or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation further provides that the aforesaid Rain Water Harvesting shall be provided within three years from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.). The last date for making such provision of Rain Water Harvesting is 31.08.2015.

Whereas Regulation 50(b) provides that the consumer who fails to comply with the above provisions within the provided time limit, the tariff applicable for the consumer of respective category will be increased 1.5 times till the provision is installed.

Therefore, all domestic consumers of the Board including Group Housing Societies having plot/property size of 500 Sq.m. and above are required to make provision for Rain Water Harvesting by 31.08.2015 positively failing which their tariff will be increased by 1.5 times till the provision is installed. All such domestic consumers are required to intimate to the Zonal Revenue Officer of the area about installation of Rain Water Harvesting prior to 31.08.2015.

ISSUED BY P.R.O. (WATER)
Adv. No. J.S.V. 2015-16/195 Director (Revenue)

TIMES OF INDIA

OFFICE OF JT. DIRECTOR (REVENUE) HQ
DELHI JAL BOARD GOVT. OF NCT OF DELHI
VARUNALAYA PHASE-II, KAROL BAGH
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ISSUED BY P.R.O. (WATER)
Adv. No. J.S.V. 2015-16/195 Director (Revenue)

INDIAN EXPRESS

OFFICE OF JT. DIRECTOR REVENUE (HQ)
DELHI JAL BOARD GOVT. OF NCT OF DELHI
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ISSUED BY P.R.O. (WATER)
Adv. No. J.S.V. 2015-16/195 Director (Revenue)

हिन्दुस्तान

नया बंद मुद्रित नदियक मजसब (मज्यालय)
दिल्ली जल बोर्ड, वरुनाली, दिल्ली सरकार
वरुनालाय फेज-II, कारोल बाग, नया दिल्ली-110005

पब्लिक नोटिस

Whereas Delhi Water & Sewer (Tariff & Metering) Regulation, 2012 notified on 31.08.2012, Regulation 50(a) of these Regulations makes it mandatory for the domestic consumer of the Board having a plot/property of 500 Sq.m. or more to provide for Rain Water Harvesting covering the entire plot area. The Regulation further provides that the aforesaid Rain Water Harvesting shall be provided within three years from the date of coming into force of these Regulations, under intimation to the area Zonal Revenue Officer (Z.R.O.). The last date for making such provision of Rain Water Harvesting is 31.08.2015.

OFFICE OF THE MEMBER (WATER SUPPLY)
 DELHI JAL BOARD: GOVT OF NCT OF DELHI
 VARUNALAYA PH-II, KAROL BAGH
 NEW DELHI-110005

No. DJB/MEM (WS)/2015/ 1935^{to} 1939

Dated: 21/11/15

To,

The Principle Secretary,
 Urban Development Department,
 Govt. of NCT of Delhi,
 Delhi Secretariat, I.P. Estate,
 New-Delhi-110002

Sub: New Regulations /Rules on implementation of Rain Water Harvesting (RWH) in NCT of Delhi.

There is a need to enhance implementation of Rain Water Harvesting in NCT of Delhi. The Vice Chairman and Member Secretary, Delhi Dialogue Commission visited Chennai to study the success story of RWH. A full day consultation workshop with participations from various stakeholders was held on 08.10.2015 in Delhi wherein Mr. Shekhar Raghvan from Chennai, the founder of NGO Akash Ganga presented the successes of RWH in the city of Chennai. One of the recommendations in the outcome of the deliberations held in the workshop was to frame a new specific RWH regulations/rules under the aegis of the UD Ministry having following key principals:

- i. The law will be all pervasive: It will apply to all civic bodies (MCD, PWD, CPWD, DIB, etc), all building types (Govt. pvt. residential, etc.) and both new & old buildings
- ii. Clearly define a deadline for conformance and penalties of non-conformance – build at owners cost, disconnect penalty
- iii. UD will be the nodal department to navigate the legislation
- iv. The legislation framework of Chennai will be used as reference point
- v. The legislation will be supported by specific rules to avoid ambiguity in implementation. Rules will spell out specific requirements by types of buildings, local soil conditions, type of RWH structure etc.

The above proposal has been approved by the Hon'ble CM of Delhi. It is therefore, requested to frame new regulations/rules on RWH to speed up implementation of RWH in NCT of Delhi.

A brief compilation on existing Regulations on Ground Water Development and Rain Water Harvesting in NCT of Delhi is enclosed as Annexure-A. New regulations/rules may include the followings:

- a) Artificial recharge structures for rain water harvesting for the purpose of ground water recharge shall not be implemented in the areas where post monsoon ground water levels are shallower than 5 mtr below ground levels.

- b) In the areas where post monsoon ground water levels are shallower than 5 mtrs below ground levels, provisions for RWH systems are required to be made by storing rain water run-off in storage tanks for its re-use in non-drinking purposes like horticulture, gardening, flushing, storages in fire tanks, cooling plants and industrial purposes, etc. after appropriate treatment. This will be applicable for all properties/premises having area of 2000 sqm or more.
- c) Provision for RWH systems will not be mandatory for properties/premises having area of less than 2000 sqm, where post monsoon ground water levels are shallower than 5 mtrs below ground levels. Certificate of post monsoon ground water levels shallower than 5 mtrs below ground levels is to be given by Delhi unit of Central Ground Water Board.
- d) Artificial recharge structures for ground water recharge in respect of individual residential premises and farm houses shall be without recharge bores as per the general standard designs specified by the Urban Development Department of GNCTD.
- e) Artificial recharge structures for RWH in Cooperative Group Housing Societies, Institutional Buildings, Hospitals, Hotels, Malls, Government Buildings, etc. for the purpose of ground water recharge shall be with or without recharge bores as specified by CGWB from area to area basis in Delhi. Capacities of recharge chambers and provisions for recharge bores for artificial recharge structures in such categories shall be got approved from Delhi Jal Board.
- f) All building premises having provisions for functional rain water harvesting systems for the purpose of ground water recharge shall be given a rebate of 15 % in water bills and will be applicable to all the registered consumers of DJB.
- g) All building premises having provision for functional RWH systems for the purpose of collection and storage of rain water runoff in underground/surface storage tanks and its use in flushing and other non-potable purposes shall be given a rebate of 20% in water bills and will be applicable to all the registered consumers of DJB.
- h) Existing penal provisions in Water and Sewer (Tariff and Metering) Regulation, 2012 for non-provision of RWH in plot/property of size 500 sqm or more will continue to be applicable except for the aforesaid exceptions in Para 'c' above.

Encl: As Above


R. S. Tyagi
Member (WS)

Copy to:

1. Vice-Chairman, DDC
2. CEO, DJB
3. Member Secretary, DDC/Additional Secretary to CM

ou


Member (Water Supply)

RAIN WATER HARVESTING GUIDELINES**ANNEXURE 4****GUIDELINES FOR CALCULATING THE CAPACITY OF THE RAIN WATER HARVESTING ARTIFICIAL RECHARGE STRUCTURES FOR GROUND WATER RECHARGE:**

1. For the purpose of compliance with Delhi Water & Sewer (Tariff & Metering) Regulations, 2012 recharge structures need to be made only for the Rain Water runoff that comes from the rooftops. The following formulae may be used by citizens to calculate the capacity of the Recharge pits that will need to be made for their establishments:

Roof top area (in sqm) X 0.8 (runoff coefficient for roof top/concrete area) X 0.025 (average maximum rain fall intensity in meters per day)

Example:

For a plot area of 500sqm maximum ground coverage is 75% (DDA Master Plan for Delhi-2021), i.e. maximum roof-top area would be 375sqm. Thus, the required total storage capacity (ies) of the recharge structure(s) (can be one or more) would be $375 \times 0.8 \times 0.025 = 7.5$ cu.m.

Hence, a recharge chamber with a length & breadth of 1.8m and depth of 2.3m will be sufficient.

Required Capacities of Rectangular and Circular Recharge Chambers for Roof-Top Rain Water Harvesting for Artificial Recharge to Ground Water and their schematic diagrams are given in Fig.1 & Fig. 2 respectively.

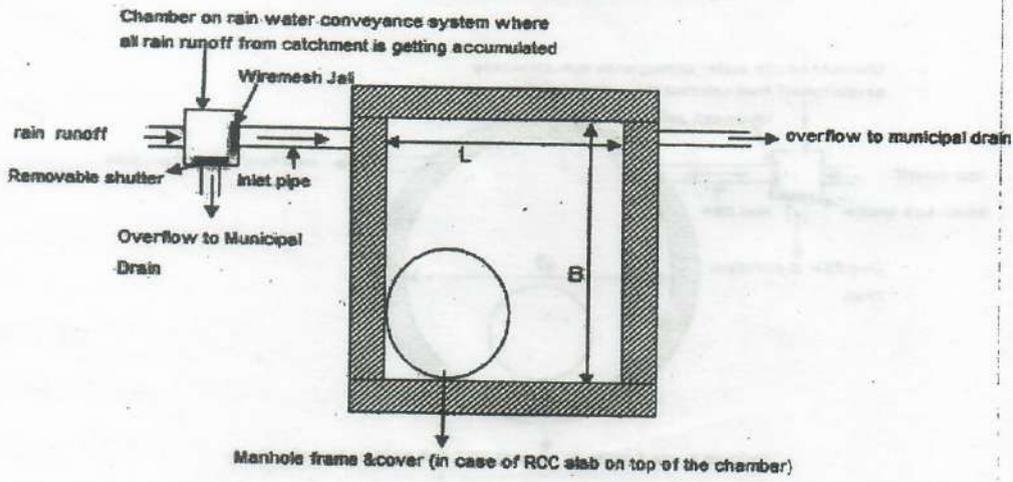
Salient Points on Implementation, Operation and Maintenance of Artificial Recharge Structures for RWH

- i. Capacities for recharge structures are based on rain water runoff from roof areas. However citizens are encouraged to make recharge structures of additional capacities that take runoff from other non polluting catchments.
- ii. All the dimensions indicated in the above sizes are the inner dimensions and below the inlet pipes. This is to ensure that the full system capacity is utilized for groundwater recharge.
- iii. Minimum and maximum depths of recharge structures may not be less than 1.0m and may not be more than 4.0m respectively.
- iv. Recharge structures are to be located at a safe distance away from the buildings/foundations. A minimum distance of 1.5m (or 5m for buildings having single basements) or as recommended by the architect/structural engineer depending on the type of buildings, whichever is more may be considered.
- v. Sizes of the recharge structures given above are suggestive only and may vary according to site conditions. They may be changed to suit the available space and one or more recharge structures may be provided subject to the condition that the cumulative capacities are not less than the required capacities. It is to be ensured that recharge structures should become integral part of the rain water conveyance system of the premises.
- vi. Recharge bores are not proposed in the RWH structures suggested by Delhi Jal Board and are applicable for building premises without basements. However, for building premises with basements and for the purpose of increasing efficiency of recharge to ground water interested citizens and institutions may separately approach Central Ground Water Board for design and drawings of artificial recharge structures having provisions for Recharge wells.
- vii. Run-off coefficient for roof top/concrete area is considered as 0.8. Equivalent catchment areas for bituminous roads/paved areas and open/green areas without steep slopes can be worked out by considering their run-off coefficients as 0.6 and 0.1 respectively.
- viii. Only non-polluted rain water from the roof tops and other catchment areas has to be diverted to recharge structure through connection of down pipe.
- ix. Before the onset of the monsoon all the catchment areas considered for recharge are to be cleaned. The

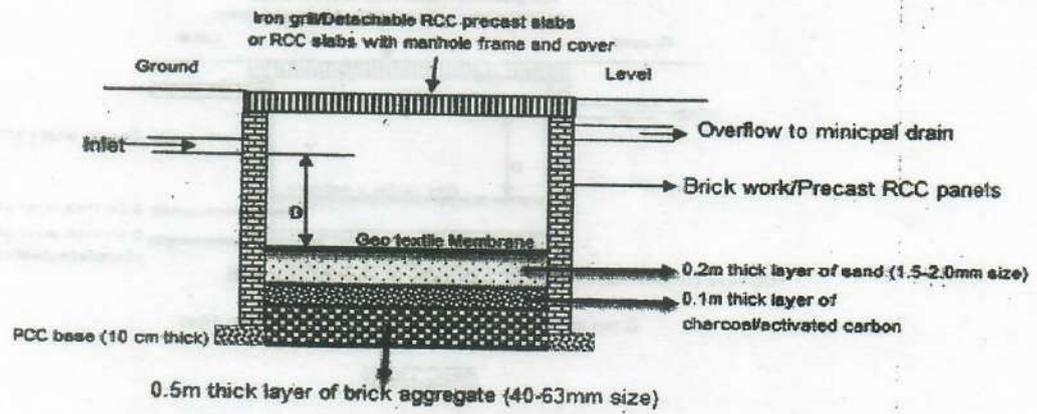
recharge structures are to be in operation during the monsoon season only so as to avoid any contamination.

- x. A mesh/Jali should be provided at the mouth of roof rain water pipes and inlets to the recharge structures so that leaves or any other solid waste/debris is prevented from entering the pit. By-pass arrangements may be provided before the recharge chamber to divert the first rain runoff directly into the municipal drains.
- xi. An overflow pipe is to be provided in recharge structures, leading/out falling into municipal storm water drains.
- xii. Necessary flow checks may be provided within the internal storm water drains (rain water conveyance system) for settling the silt, if felt necessary.
- xiii. Recharge structures should be implemented with requisite structural soundness and adhere to all relevant construction and structural norms. The structure should not pose any danger to people and building. The design should be based on the soil type and land use. Thickness of RCC cover slabs and reinforcement shall be dependent on structural loads. Access manhole frame and covers to be provided. Thickness of recharge chamber walls/Circular RCC rings shall be dependent on its depth and structural loads.
- xiv. It is recommended to provide filter media consisting of brick aggregates (40/50/63 mm size)/charcoal and activated carbon/coarse sand (1.5-2.0mm) /geo textile membrane. Alternative to suggested filter media may be multiple layers of jute mats in recharge chambers / modular RWH filters in rain water pipes from rooftops with the objective to arrest the silt in the rain runoff generated from the catchments before its percolation into the natural soil strata and thereby minimizing its clogging. However, simple RWH structures without filter media and recharge bores having adequate capacity depending on the rain water runoff from roof top areas will be considered for exemption from levy of penalties as per the Delhi Water & Sewer (Tariff & Metering) Regulations, 2012 on the consumers of Delhi Jal Board.
- xv. RWH through artificial ground water recharge structures is not recommended where post monsoon ground water levels are shallower than 5m. In such areas rain water storage for its use in non-potable purposes after required treatment may be carried out.
- xvi. DJB consumers are allowed a rebate of 10% in total bill amount as per Delhi Water & Sewer (Tariff & Metering) Regulations, 2012 in the Plot / Properties of 2000sqm and above, having installed functional RWH System. Provision of filter media as indicated in Simple Modular Designs of RWH structures or suitable alternatives to minimize silt in the runoff will be necessary for seeking rebate.
- xvii. Recharge structures shall be cleaned before onset of monsoon season every year including removal, washing and relaying with topping of filter media layers, if provided.
- xviii. It is advisable to clean the recharge structures after every 2 rainfalls during the rainy season or more frequently. Recharge structures shall be checked and cleaned at least 7 days interval or more frequently during rainy season.
- xix. Post monsoon cleaning and maintenance of recharge chambers shall be carried out. It is again to emphasize that proper & timely maintenance is the key factor for the success of Artificial Recharge structures. Citizens are required not just to make the RWH structures but also to maintain them such that they are efficiently able to function during the monsoons. Following annual maintenance activities shall also need to be done in this regard:
 - a) De-silting i.e removal of all accumulated debris and silt in the recharge structures and rain water conveyance system.
 - b) Cleaning of filter media by thoroughly washing it with water/topping/replacement of filter media.
 - c) Repair for structural damages & system efficiency.
 - d) Repair / design modifications / diversions to ensure that no contaminated water enters the structures and not to allow any changes in catchment that may prevent Rain Water runoff from reaching the recharge chambers.

Fig. 1 : Rectangular Recharge Chambers for RWH



PLAN

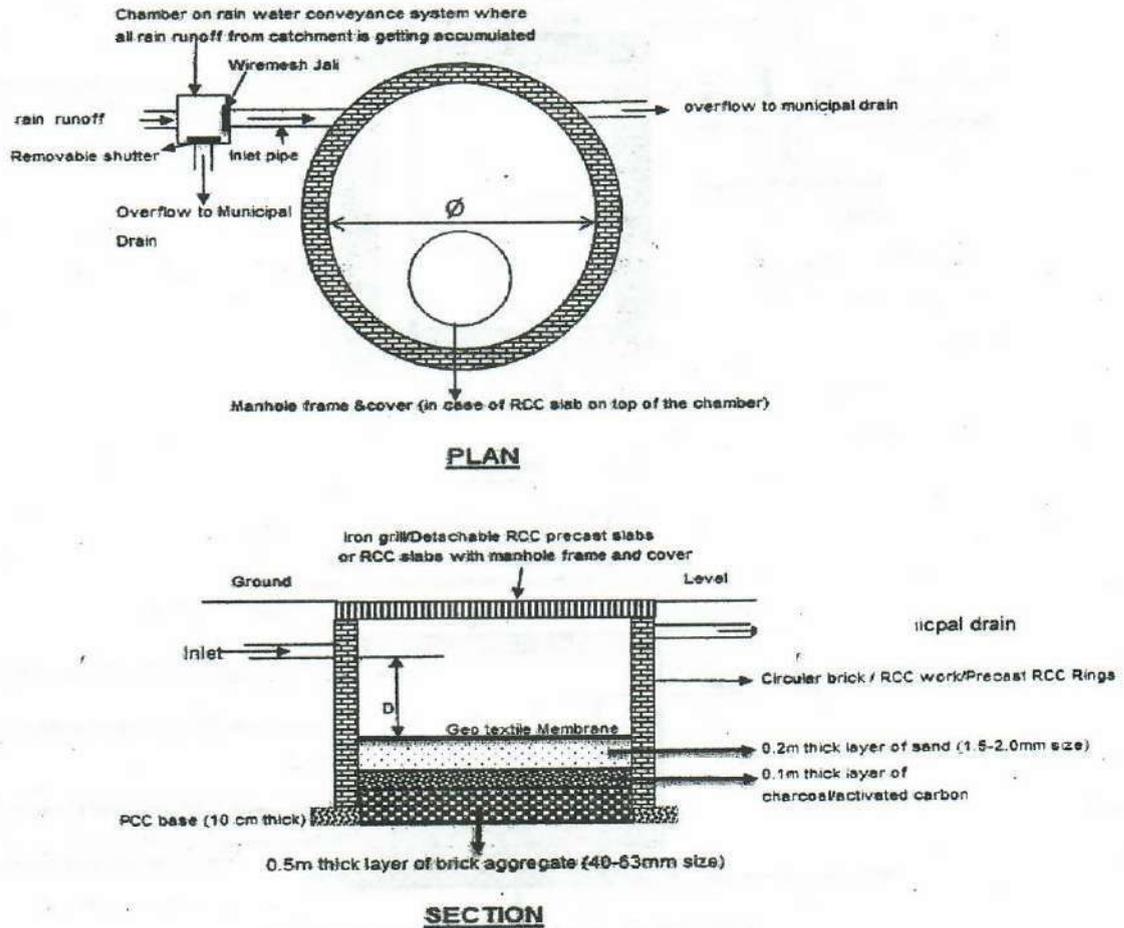


SECTION

S No	Plot Area (sq.m)	Maximum Roof-top area as per DDA MPD-2021 (%)	Roof-Top Area (sqm)	Required Capacity (cum)	Suggestive dimensions of Recharge Chambers/Trenches {length (L) X breadth (B) X depth (D) in meters}
1	100	90	90	1.8	1.2 X 1.2 X 1.25
2	200	75	150	3	1.2 X 1.2 X 2.1
3	300	75	225	4.5	1.5 X 1.5 X 2.0
4	400	75	300	6	1.8 X 1.8 X 1.85
5	500	75	375	7.5	1.8 X 1.8 X 2.30

Note: For working out the storage/retention capacities, depths are to be considered below the invert level of the lowest inlets to the recharge chambers/trenches. Alternative to suggested filter media may be multiple layers of jute mats in recharge chambers / modular filters in rain water pipes from rooftops with the objective to arrest the silt in the rain runoff generated from the catchments before its percolation into the natural soil strata. No waste water is allowed to be entered into Recharge Structures. For more details, please contact to the office of EE (RWH/GWC), Delhi Jal Board, Room No. 11, Varunalaya Phase-I, Karol Bagh, New Delhi-110005, Tel No. 011-23558264.

Fig. 2 : Circular Recharge Chambers for RWH

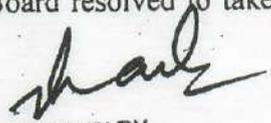


S No	Plot Area (sq.m)	Maximum Roof-top area as per DDA MPD-2021 (%)	Roof-Top Area (sqm)	Required Capacity (cum)	Suggestive Diameter (\emptyset) (internal) of Circular Chambers (mtrs)	Depth (D) of Circular Chambers (mtrs)
1	100	90	90	1.8	1.2m (4 ft)	1.6
2	200	75	150	3	1.5m (5 ft)	1.7
3	300	75	225	4.5	1.5m (5 ft)	2.5
4	400	75	300	6	2 structures of size mentioned in Sl. No. 2	
5	500	75	375	7.5	1 structure of size mentioned in Sl. No. 2 & 1 structure of size mentioned in Sl. No. 3 (i.e. total 2 structures)	

Note: For working out the storage/retention capacities, depths are to be considered below the invert level of the lowest inlets to the recharge chambers/trenches. Alternative to suggested filter media may be multiple layers of jute mats in recharge chambers / modular filters in rain water pipes from rooftops with the objective to arrest the silt in the rain runoff generated from the catchments before its percolation into the natural soil strata. No waste water is allowed to be entered into Recharge Structures. For more details, please contact to the office of EE (RWH/GWC), Delhi Jal Board, Room No. 11, Varunalaya Phase-I, Karol Bagh, New Delhi-110005, Tel No. 011-23558264.

RESOLUTION NO. 276**ITEM NO. Est.- 93 Amendment in Provisions for Rain Water Harvesting in Delhi Water & Sewer (Tariff & Metering) Regulations, 2012.**

The Board considered the proposal contained in C.E.(Plg.)Water's letter No. DJB/CE(Plg.)W/Preamble/2016/01 dated 10.02.2016 and resolved to approve the same. The Board further directed to examine the possibilities for giving more benefits to the consumers' so that they may themselves come forward for making operational rain water harvesting system in their premises promptly and also to attract large number of people under the scheme. The Board further suggested that the general public should be encouraged to adopt Rain Water harvesting. Adequate publicity should also be given to ensure that government agencies make making arrangements to harvest rain water within their premises. The Board resolved to take further action in anticipation of confirmation of the minutes.


SECRETARY
DELHI JAL BOARD
Office of N.C.T. of Delhi
Varokya Phase-II, Kirti Bhawan
New Delhi-110005

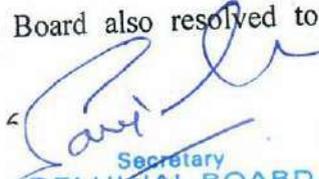
A-56

RESOLUTION NO. 829**ITEM NO. Admn. - 339****Amendment in provision for Rain Water Harvesting in Delhi Water & Sewer (Tariff & Metering) Regulation, 2012**

The Board considered the proposal contained in letter No. DJB/ Director (Revenue)/ Preamble/RWH/2019/209 dated 16.07.2019 of Director (Revenue) and resolved as under:-

- i) It will be mandatory for plots/properties having area of 100 Sq. Mtrs or more and constructed prior to 28.07.2001, to install functional RWH System within 01 year from the date of issue of Public Notice in this regard and inform the area ZRO. As per the policy those consumers who install functional RWH System will be eligible for 10% rebate in water bill and defaulters will have to pay 1.5 times the bill till the system is installed.
- ii) Consumers of the properties having area of 100 Sq.Mtr. or more who have done construction after 28.07.2001, but have not installed functional RWH System will install the same by 31st March, 2020. Those consumers who already have RWH System or those consumers who would make provision of RWH System by 31st March, 2020 will inform their Area ZRO in this regard. Those Consumers who do not install the RWH System or inform their Area ZRO by this period will have to pay 1.5 times the bill amount till the system is installed.
- iii) In case of non-compliance of (i) & (ii) above within the stipulated time lines, the water connection to the property or part thereof shall also be disconnected.
- iv) New water/sewer connection to plots having area of 500 Sq.Mtrs and above will be sanctioned only after installation of functional RWH system.
- v) New water/sewer connection, to newly constructed properties/buildings having minimum discharge of 10000 Ltrs. and above per day, will be sanctioned only after installation of a functional Waste Water Recycling System.
- vi) Implementation of (iv) above for plots/ properties having area of 100 Sqm. and above but below 500 Sqm., would be applicable after timelines provided in (i) and (ii) above are over.
- vii) In cases, where installation of RWH system is not technically feasible, for any reason, CEO, DJB is authorised to take appropriate decision in respective cases, on merits.

The Board further directed to ensure that required procedures/ systems including requirement of manpower are in place so that there are no problems for consumers and ensures smooth implementation of the scheme. The Board also resolved to take further action in anticipation of confirmation of the minutes.


Secretary
DELHI JAL BOARD
Govt. of N.C.T. of Delhi
Varunalaya, Phase-II, Karol Bagh
New Delhi-110005

Appendix B-1.2: Delhi RWH Inspection

DL-1

**JOINT INSPECTION OF RAIN WATER HARVESTING SYSTEMS IN NCT DELHI
AS PER THE DIRECTIONS OF THE HON'BLE NGT IN THE MATTER OF O A NO.
147/2021 Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT Delhi &
Ors. Carried out on 7th March, 2022**

Inspection Team Members

Central Ground Water Authority

Dr. P.K. Naik, Scientist 'E'

Central Ground Water Board, State Unit Office-Delhi

Faisal Abrar, AHG

Central Pollution Control Board

Ms. Alpana Narula, SSA

Delhi Jal Board

Harish Chander, Addl Chief Engineer (C-8)

Vimal Belani, Executive Engineer (RWH-I)

Rakesh Sharma, AE (RWH-I)

1. Format of the Site Visit Report for Inspection of RWH Structures

(To be prepared Site-wise)

Introduction:

Site Name: Gold Croft CGHS Ltd., Plot No. 4, Sector-11, Dwarka, Delhi

Coordinates: 28°35'40" N; 77°02'56" E

Tehsil: Dwarka

District: South West

Ownership and Maintenance Responsibility of the Recharge Structure:

Management Committee, Gold Croft CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi

Objective and purpose of RWH Scheme under Reference:

Rain Water Harvesting is the technique of collection and storage of rain water at surface or in subsurface aquifer, before it is lost as surface runoff. In urban areas rain water available from roof tops of buildings goes waste. This water can be recharged to aquifer and can be utilized gainfully at the time of need. The rain water harvesting system needs to be designed in a way that it does not occupy large space for collection and recharge system.

The Management Committee of Gold Croft CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi has installed rain water harvesting system in their premises under the guidance received from the office of Executive Engineer, (RWH/GW), Jhandewalan, Delhi Jal Board.

General Geology and Hydrogeology:

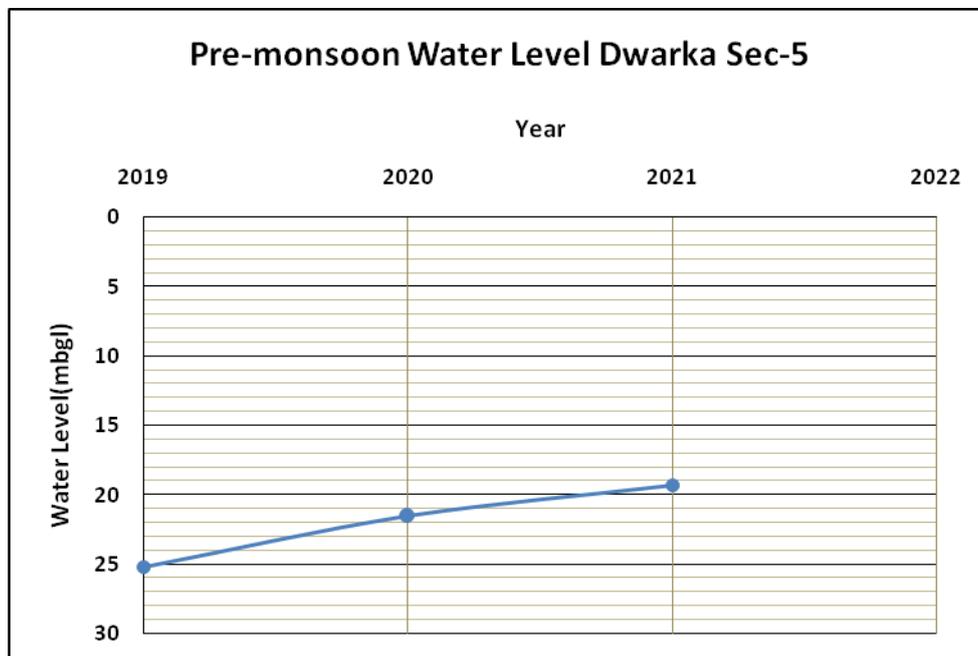
The South-West district of NCT Delhi covers 420 sq. km. area and is characterized by unconsolidated Quaternary alluvium deposits. Only, 18 sq km area is covered by denudational hills especially in the eastern part of the district. Ground water exploration has been carried down to 325 m depth. The bed rock has been encountered at many places i.e. in Dhansa (297m), Pindwalakala (300m), Toghan pur(298m) and Jhuljhuli(251m). Thick pile of alluvium overlies the basement rock and consists of alternate layers of silt with kankar, clay and sand. Nearly fine to medium sand and silt grade sediments occur frequently up to the depth of 50 m along with buff coloured clay admixed with coarse kankars. On the other hand, after the depth of 50 m, silty –clay and clay (Light yellow) beds with kankars predominate. The granular zone at deeper depth is not as frequent as in the shallower depth.

The depth of fresh-saline water interface varies greatly in entire area ranging from 35 m at Shikarpur to 150 m at Rajokri. All along the Najafgarh drain and two

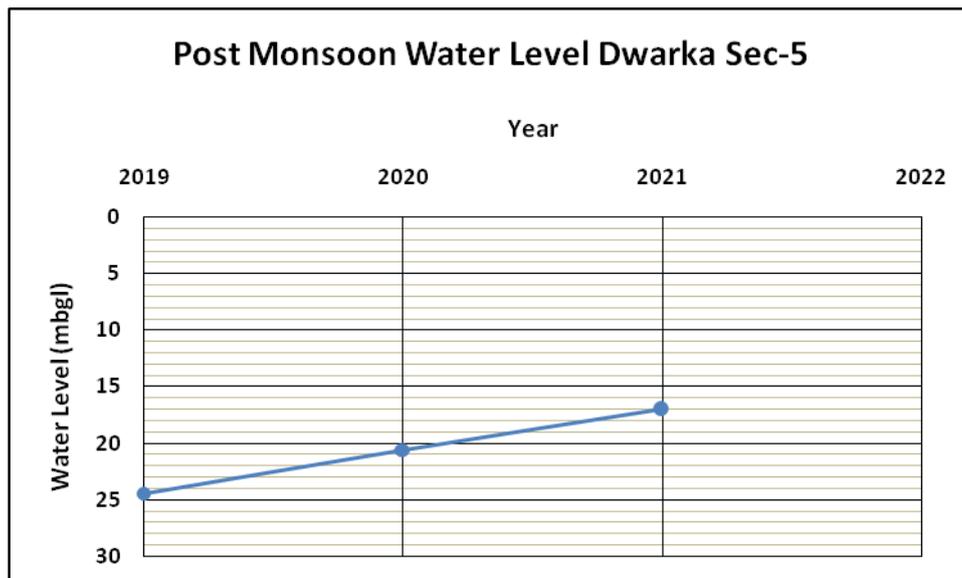
topographic depressions (Gummanhera Vill. & Pindwalan Kalan) somewhat deep fresh water layer i.e. up to 35m bgl exists but rest of the area is having thin layer of fresh water i.e. up to the depth of 25/28 m bgl only. In the eastern part characterized by hard rock, the fresh–saline water interface rests at deeper depth i.e. around 80 to 90 m bgl.

Water Level: The nearest piezometer of CGWB is located at a distance of less than one (1) km at DDA Park, Sector-5, Dwarka. The details of the pre-monsoon & post monsoon water level for the last three years is given below:

Pre-monsoon Water Level		
Site Name	WL(mbgl)	Year
Dwarka,Sec-5,DDA Park	25.19	2019
Dwarka Sec-5 DDA Park	21.54	2020
Dwarka Sec-5 DDA Park	19.26	2021



Post-monsoon Water Level		
Site Name	WL (mbgl)	Year
Dwarka Sect-5 DDA Park	24.44	2019
Dwarka Sec-5 DDA Park	20.61	2020
Dwarka Sec-5 DDA Park	17.03	2021



Type of Recharge Structure:

In the premises 3 Nos. recharge pits without recharge bore well and 1 recharge pit with recharge bore well is present.

Details of Structures:

Total area of Flat: 19771sqm

Total Roof Top Area considered for RTRWH Systems: 4157sqm

Avg. yearly Rain Water Run-off available for recharge: 650mm

Dimensions:

- 1) 5.0m×3.0m×1.80m
- 2) 5.0m×3.0m×1.80m
- 3) 5.0m×3.0m×1.80m
- 4) 3.4m×1.3m×2.0m with 6" dia bore well

Design of Structure: 3 Nos. recharge pits without borewell and 1 Recharge pit with bore well Designs are attached as Annexures.

Cost of Structure: 1.Construction Cost: 20.60 Lakhs

2. Maintenance Cost: Rs. 20,000/-(approx.)

Recharge: Annual quantum of Recharge: **2719 Cum**

Water Quality Analysis Report of Piezometer located at Sector-5, Dwarka

Basic Chemical analysis,2021																
Location	Source	pH	EC in µS/cm at 25° C	CO ₃	HCO ₃	Cl	SO ₄	NO ₃	F	PO ₄	Ca	Mg	Na	K	SiO ₂	TH as CaCO ₃
				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Dwarka Sec 5 DDA Park	TW	8.28	253	0	113	14	27	4	0.85	<0.01	28	17	3.5	1.3	14	140

Heavy metal Analysis 2021													
Location	Source	Cr	Mn	Fe	Ni	Cu	Zn	As	Se	Ag	Cd	Pb	U
		(ppm)						(ppb)					
Dwarka Sec 5 DDA Park	TW	BDL	0.003	0.006	BDL	BDL	0.047	1.251	0.048	BDL	0.155	BDL	2.517

Any other relevant Information considered to be incorporated

- On the roof top (terrace) mesh should be fixed at the opening of drain pipes so as to stop dust and other particles going into the filter media.
- Display boards giving details of the each rain water harvestings pits should be put up.
- On the entrance of the society gate sign board displaying "Rain water harvested society/campus" may be put up.

Observations/ Conclusion:

- Rain water harvesting pits were found to be clean and working.
- Terrace of the buildings blocks were also found to be clean.
- Following is recommended by the inspection committee:-
 - Filter media should be changed every year after proper cleaning of the recharge pits.
 - Steel mesh should be fitted in the roof intake pipe for filtration of rain water.
 - All rain water harvesting pits should be properly numbered & geo-tagged.
 - Display boards giving details of Rain water harvesting pits should be placed.
 - Parking of vehicles at recharge pits to be prohibited at all times for physical verification & maintenance.

Annexure:-

- Questionnaire as provided by the Inspection Team (See next page)**
- Documents required:**
 - Building Bylaws mandating RTRWH.-Yes, Annexure
 - Penal Provision if any for not complying with Building By-laws –Yes, Annexure.
 - Water Quality impact assessment related to contamination of Ground water.

d) Does state has any provision/ Guidelines to prevent contamination from recharged water- Yes.

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

Not applicable

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

Not applicable

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

Not applicable

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Twice in a month

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Not applicable

6. **Frequency of cleaning/ replacement of filter Media.**

Once in a year

Different components of RWH structures in Gold Croft CGHS Ltd.



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Appendix B-1.2: Delhi RWH Inspection

DL-2

JOINT INSPECTION OF RAIN WATER HARVESTING SYSTEMS IN NCT DELHI
AS PER THE DIRECTIONS OF THE HON'BLE NGT IN THE MATTER OF O A NO.
147/2021 Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT Delhi &
Ors. Carried out on 7th March, 2022

Inspection Team Members

Central Ground Water Authority

Dr. P.K. Naik, Scientist 'E'

Central Ground Water Board, State Unit Office-Delhi

Faisal Abrar, AHG

Central Pollution Control Board

Ms. Alpana Narula,

Delhi Jal Board

Harish Chander, Addl Chief Engineer (C-8)

Vimal Belani, Executive Engineer (RWH-I)

Rakesh Sharma, AE (RWH-I)

Format of the Site Visit Report for Inspection of RWH Structures
(To be prepared Site-wise)

Introduction:

Site Name: Hind CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi

Coordinates: 28°36'03" N; 77°03'29" E

Tehsil: Dwarka

District: South West Delhi

Ownership and Maintenance Responsibility of the Recharge Structure:

Management Committee, Hind CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi.

Objective and purpose of RWH Scheme under Reference:

Rain Water Harvesting is the technique of collection and storage of rain water at surface or in subsurface aquifer, before it is lost as surface runoff. In urban areas rain water available from roof tops of buildings goes waste. This water can be recharged to aquifer and can be utilized gainfully at the time of need. The rain water harvesting system needs to be designed in a way that it does not occupy large space for collection and recharge system.

The Management Committee of Hind CGHS Ltd., Plot No. 12, Sector-5, Dwarka, Delhi has installed rain water harvesting system in their premises under the guidance received from the office of Executive Engineer, (RWH/GW), Jhandewalan, Delhi Jal Board.

General Geology and Hydrogeology:

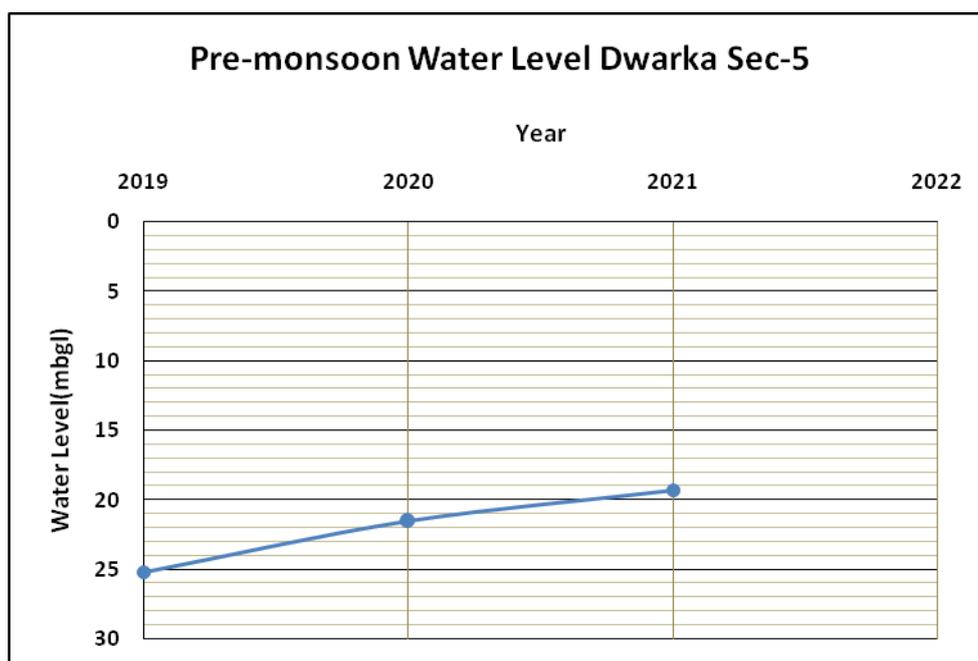
The South-West district of NCT Delhi covers 420 sq. km. area and is characterized by unconsolidated Quaternary alluvium deposits. Only, 18 sq km area is covered by denudational hills especially in the eastern part of the district. Ground water exploration has been carried down to 325 m depth. The bed rock has been encountered at many places i.e. in Dhansa (297m), Pindwalakala (300m), Toghhan pur(298m) and Jhuljhuli(251m). Thick pile of alluvium overlies the basement rock and consists of alternate layers of silt with kankar, clay and sand. Nearly fine to medium sand and silt grade sediments occur frequently up to the depth of 50 m along with buff coloured clay admixed with coarse kankars. On the other hand, after the depth of 50 m, silty –clay and clay (Light yellow) beds with kankars predominate. The granular zone at deeper depth is not as frequent as in the shallower depth.

The depth of fresh-saline water interface varies greatly in entire area ranging from 35 m at Shikarpur to 150 m at Rajokri. All along the Najafgarh drain and two topographic depressions (Gummanhera Vill. & Pindwalan Kalan) somewhat deep fresh water layer i.e. up to 35m bgl exists but rest of the area is having thin layer of

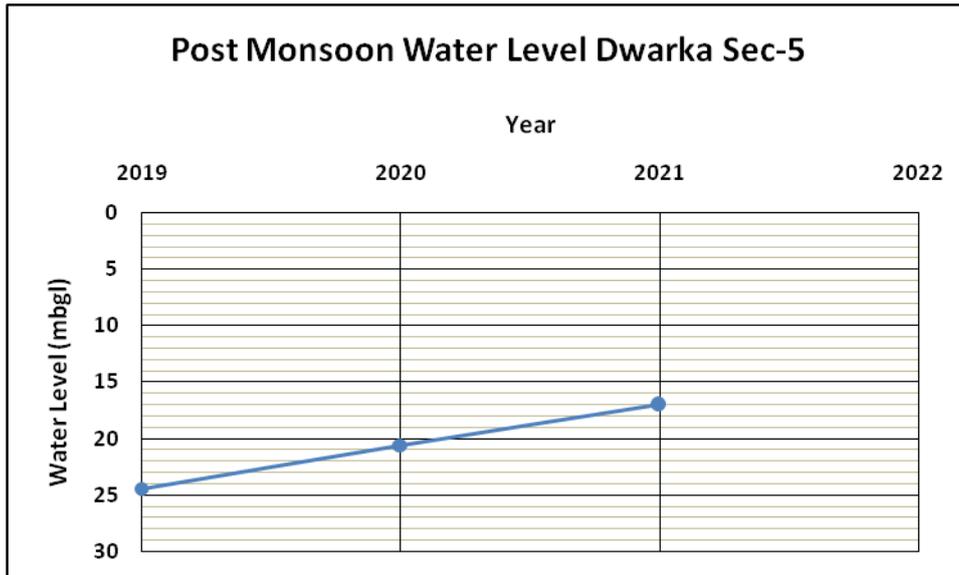
fresh water i.e. up to the depth of 25/28 m bgl only. In the eastern part characterized by hard rock, the fresh–saline water interface rests at deeper depth i.e. around 80 to 90 m bgl.

Water Level: The nearest piezometer of CGWB is located at DDA Park, Sector-5, Dwarka. The details of the pre-monsoon & post monsoon water level for the last three years is given below:

Pre-monsoon Water Level		
Site Name	WL(mbgl)	Year
Dwarka,Sec-5,DDA Park	25.19	2019
Dwarka Sec-5 DDA Park	21.54	2020
Dwarka Sec-5 DDA Park	19.26	2021



Post-monsoon Water Level		
Site Name	WL (mbgl)	Year
Dwarka Sect-5 DDA Park	24.44	2019
Dwarka Sec-5 DDA Park	20.61	2020
Dwarka Sec-5 DDA Park	17.03	2021



Type of Recharge Structure:

In the premise two Nos. recharge pits are present without recharge bore well.

Details of Structures:

Total area of Flat: 7500 sqm
Total Roof Top Area considered for RTRWH Systems: 2500 sqm
Avg. yearly Rain Water Run-off available for recharge: 650 mm

Dimensions: 1) 4.0m x 2.0m x 2.20m

2) 4.0m x 2.0m x 2.20m

Design of Structure: Two Nos. recharge pits without borewell with dimensions

- 1) 4.0m x 2.0m x 2.20m (2) 4.0m x 2.0m x 2.20m

Designs are attached as Annexures.

Cost of Structure: 1. Construction Cost: Rs. 6,00,000/- (approx.)

2. Maintenance Cost: Rs. 18000/- (approx.)

Recharge: Annual quantum of Recharge: **1056 Cum**

Water Quality Analysis Report of Piezometer located at Sector-5, Dwarka:

Basic Chemical analysis,2021																
Location	Source	pH	EC in µS/cm at 25 ^o C	CO ₃	HCO ₃	Cl	SO ₄	NO ₃	F	PO ₄	Ca	Mg	Na	K	SiO ₂	TH as CaCO ₃
				mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Dwarka Sec 5 DDA Park	TW	8.28	253	0	113	14	27	4	0.85	<0.01	28	17	3.5	1.3	14	140

Heavy metal Analysis 2021														
Location	Source	Cr	Mn	Fe	Ni	Cu	Zn	As	Se	Ag	Cd	Pb	U	
		(ppm)							(ppb)					
Dwarka Sec 5 DDA Park	TW	BDL	0.003	0.006	BDL	BDL	0.047	1.251	0.048	BDL	0.155	BDL	2.517	

Any other relevant Information considered to be incorporated

- On the roof top (terrace) mesh should be fixed at the opening of drain pipes so as to stop dust and other particles going into the filter media.
- Display boards giving details of the each rain water harvestings pits should be put up.
- On the entrance of the society gate sign board displaying "Rain water harvested society/campus" may be put up.

Observations/ Conclusion:

- Rain water harvesting pits were found to be clean and working.
- Terrace of the buildings blocks were also found to be clean.
- Following is recommended by the inspection committee:-
 - Filter media should be changed every year after proper cleaning of the recharge pits.
 - Steel mesh should be fitted in the roof intake pipe for filtration of rain water.
 - All rain water harvesting pits should be properly numbered & geo-tagged.
 - Display boards giving details of Rain water harvesting pits should be placed.
 - Parking of vehicles at recharge pits to be prohibited at all times for physical verification & maintenance.

Annexure:-

- Questionnaire as provided by the Inspection Team (See next page)**
- Documents required:**
 - Building Bylaws mandating RTRWH. – Annexure 1
 - Penal Provision if any for not complying with Building By-laws- Annexure 1
 - Water Quality impact assessment related to contamination of Ground water - Not Applicable

d) Does state has any provision/ Guidelines to prevent contamination from recharged water. Yes, Annexure

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

Not Applicable

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

Not Applicable

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

Not Applicable

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Twice in a month

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

NA

6. **Frequency of cleaning/ replacement of filter Media.**

Once in a Year

Different components of RWH structures in Hind CGHS Ltd Apartment.



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Appendix B-1.2: Delhi RWH Inspection

DL-3

**JOINT INSPECTION OF RAIN WATER HARVESTING SYSTEMS IN NCT DELHI
AS PER THE DIRECTIONS OF THE HON'BLE NGT IN THE MATTER OF O A NO.
147/2021 Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT Delhi &
Ors. Carried out on 7th March, 2022**

Inspection Team Members

Central Ground Water Authority

Dr. P.K. Naik, Scientist 'E'

Central Ground Water Board, State Unit Office-Delhi

Faisal Abrar, AHG

Central Pollution Control Board

Ms. Alpana Narula, SSA

Delhi Jal Board

Harish Chander, Addl Chief Engineer (C-8)

Vimal Belani, Executive Engineer (RWH-I)

Rakesh Sharma, AE (RWH-I)

Format of the Site Visit Report for Inspection of RWH Structures
(To be prepared Site-wise)

Introduction:

Site Name:

Guru Tegh Bahadur Institute of Technology, G-8 Area, Rajouri Garden, New Delhi

Coordinates: 28°37'52" N; 77°07'00" E

Tehsil: Rajouri Garden

District: West Delhi District

Ownership and Maintenance Responsibility of the Recharge Structure:

Management Committee, Guru Tegh Bahadur Institute of Technology G-8 Area, Rajouri Garden, New Delhi.

Objective and purpose of RWH Scheme under Reference:

Rain Water Harvesting is the technique of collection and storage of rain water at surface or in subsurface aquifer, before it is lost as surface runoff. In urban areas rain water available from roof tops of buildings goes waste. This water can be recharged to aquifer and can be utilized gainfully at the time of need. The rain water harvesting system needs to be designed in a way that it does not occupy large space for collection and recharge system.

The Management Committee of Guru Tegh Bahadur Institute of Technology, G-8 Area, Rajouri Garden, New Delhi has installed rain water harvesting system in their premises under the guidance received from the office of Executive Engineer, (RWH/GW), Jhandewalan, Delhi Jal Board.

General Geology and Hydrogeology:

West Delhi district is occupied by unconsolidated Quaternary alluvium underlain by Precambrian meta-sediments of Delhi System. Quaternary alluvium comprises of sand, clay, silt, gravels/pebbles and kankars. The aquifer system includes fine to coarse grained sand admixed with kankars with clay and silt. Clay is dominant lithology along with discontinuous silt with kankar layer. Clay is sticky and plastic in nature, light greyish in colour, admixed with a little sand and kankars, fine to medium grained. The depth of fresh saline interface varies from 35 m bgl at Peera Garhi Chowk and Tagore Garden to 60 m bgl at Mayapuri. Bedrock has not been encountered till the drilled depth except at Baljeet Nagar, where a well drilled down to 107 m has indicated presence of weathered quartzite zone in the depth range of

28 m to 107 m gl. At Moti Nagar, no bedrock has been encountered till the drilled depth of 230 m.

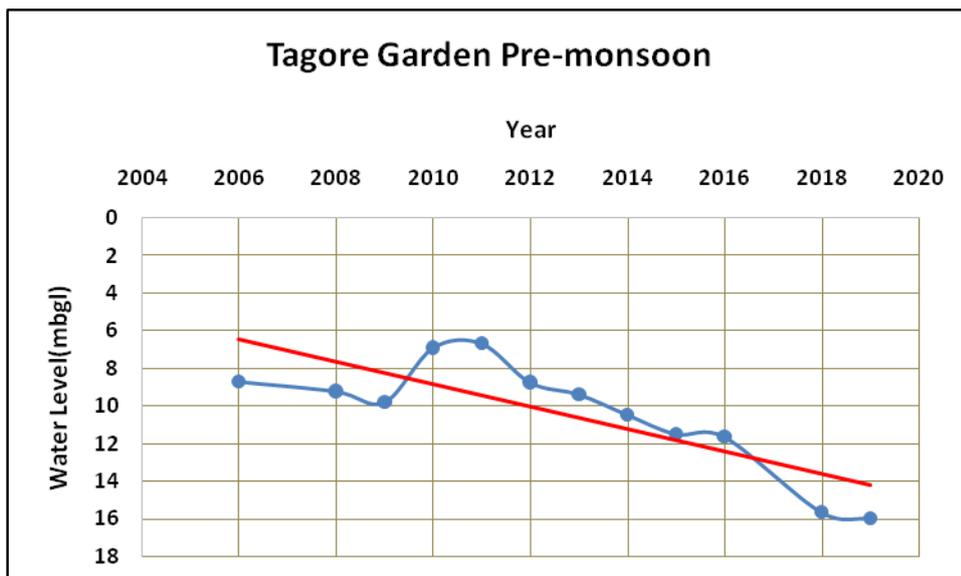
The site falls in the Rajouri Garden Tehsil of West Delhi District of NCT Delhi. The assessment unit has been categorized as over-exploited as per GWRE, 2020 and stage of development is 127.19%.

Water Level: The nearest piezometer of CGWB is located at DDA Workshop, Mayapuri, Delhi and inside DDA park, Tagore Garden, New Delhi. The details of the pre-monsoon & post monsoon water level for the last fifteen (15) years is given below:

Pre-monsoon Data

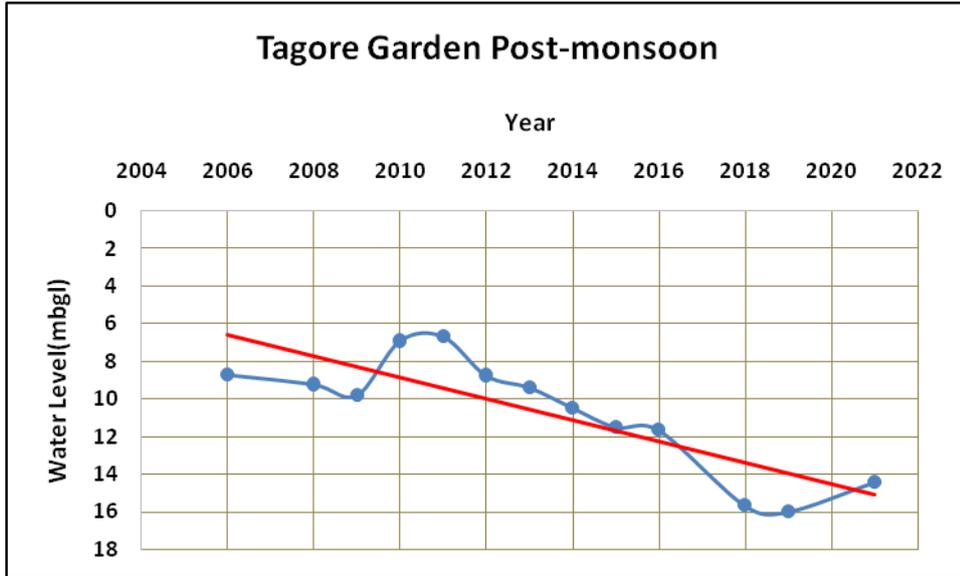
MayapuriPz	31.06	2007
MayapuriPz	32.13	2008
MayapuriPz	32.1	2009
MayapuriPz	33.2	2010
MayapuriPz	33.5	2011
MayapuriPz	34.6	2012
MayapuriPz	35.54	2013
MayapuriPz	35.68	2014
MayapuriPz	36.91	2015
MayapuriPz	36.76	2016
MayapuriPz	37.36	2017
MayapuriPz	39.38	2018
MayapuriPz	38.7	2019
MayapuriPz	37.43	2020
MayapuriPz	38.26	2021

Tagore Garden Pz	8.3	2006
Tagore Garden Pz	9.17	2007
Tagore Garden Pz	9.68	2008
Tagore Garden Pz	10.25	2009
Tagore Garden Pz	9.85	2010
Tagore Garden Pz	7.69	2011
Tagore Garden Pz	7.48	2012
Tagore Garden Pz	9.82	2013
Tagore Garden Pz	9.93	2014
Tagore Garden Pz	11.12	2015
Tagore Garden Pz	12.53	2016
Tagore Garden Pz	13.45	2017
Tagore Garden Pz	15.72	2018
Tagore Garden Pz	15.21	2019
Tagore Garden Pz	16.2	2020



Post Monsoon

Tagore Garden Pz	8.7	2006
Tagore Garden Pz	9.22	2008
Tagore Garden Pz	9.8	2009
Tagore Garden Pz	6.9	2010
Tagore Garden Pz	6.67	2011
Tagore Garden Pz	8.75	2012
Tagore Garden Pz	9.38	2013
Tagore Garden Pz	10.47	2014
Tagore Garden Pz	11.5	2015
Tagore Garden Pz	11.65	2016
Tagore Garden Pz	15.68	2018
Tagore Garden Pz	16	2019



MayapuriPz	32.48	2009
MayapuriPz	33.7	2010
MayapuriPz	34	2011
MayapuriPz	34.86	2012
MayapuriPz	35.51	2013
MayapuriPz	36.63	2014
MayapuriPz	36.9	2015
MayapuriPz	36.74	2016
MayapuriPz	37.76	2017
MayapuriPz	38.85	2018
MayapuriPz	38.7	2019
MayapuriPz	37.27	2020
MayapuriPz	36.66	2021

Type of Recharge Structure: 05 Nos. recharge pits without recharge bore well is present in the premises.

Details of Structures:

Total Roof Top area: 3883.158 sqm

Total Catchment Area considered for RTRWH Systems: 3883.158 sqm

Avg. yearly Rain Water Run-off available for recharge: 650mm

Dimensions: 05 Recharge pits having following dimensions

- (i) Recharge Pit No. 1: 3.55m x 2.23.m x 2.22 m
- (ii) Recharge Pit No. 2: 4.21m x 2.41.m x 1.85 m
- (iii) Recharge Pit No. 3: 3.83m x 2.59.m x 1.96 m
- (iv) Recharge Pit No. 4: 3.91m x 2.74.m x 2.00 m
- (v) Recharge Pit No. 5: 4.26m x 3.55.m x 2.97 m

Design of Structure: Enclosed

Cost of Structure: 1. Construction Cost: 11 Lakhs (Approx.)

2. Maintenance Cost: Rs. 25,000/-(approx.)

Recharge: Annual quantum of Recharge: **3663.30 Cu.m**

Location	pH*	EC* in $\mu\text{S/cm}$ at 25 ⁰ C	CO ₃	HCO ₃	Cl*	SO ₄	NO ₃ *	F*	PO ₄	Ca*	Mg*	Na*	K*	SiO ₂	TH*as CaCO ₃
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Tagore Garden Pz	7.95	11440	0	183	1850	4323	44	0.54	<0.10	489	355	2105	50	27	2682

Location	52Cr (KED)	55Mn (KED)	57Fe (KED)	60Ni (KED)	65Cu (KED)	67Zn (KED)	75As (KED)	77Se (KED)	107Ag (KED)	111Cd (KED)	206Pb (KED)	238U (KED)
	Concentration in PPM						Concentration in PPB					
Tagore Garden Pz	<0.005	<.030	0.182	<0.002	<0.150	0.214	<1.000	<1.000	<1.000	<1.000	<1.000	14.287

Any other relevant Information considered to be incorporated

- (a) On the roof top (terrace) mesh should be fixed at the opening of drain pipes so as to stop dust and other particles going into the filter media.
- (b) Display boards giving details of the each rain water harvestings pits should be put up.
- (c) On the entrance of the society gate sign board displaying “Rain water harvested society/campus” may be put up.

Observations/ Conclusion:

1. Rain water harvesting pits were found to be clean and working.
2. Terrace of the buildings blocks were also found to be clean.
3. Following is recommended by the inspection committee:-
 - (i) Filter media should be changed every year after proper cleaning of the recharge pits.
 - (ii) Steel mesh should be fitted in the roof intake pipe for filtration of rain water.
 - (iii) All rain water harvesting pits should be properly numbered & geo-tagged.
 - (iv) Display boards giving details of Rain water harvesting pits should be placed.
 - (v) Parking of vehicles at recharge pits to be prohibited at all times for physical verification & maintenance.

Annexure:-

1. **Questionnaire as provided by the Inspection Team (See next page)**
2. **Documents required:**
 - a) Building Bylaws mandating RTRWH: Annexure 1
 - b) Penal Provision if any for not complying with Building By-laws: Annexure 1
 - c) Water Quality impact assessment related to contamination of Ground water.
– Not Applicable
 - d) Does state has any provision/ Guidelines to prevent contamination from recharged water - Yes

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

Not applicable

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

Not applicable

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

Not applicable

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Twice in a month

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Not applicable

6. **Frequency of cleaning/ replacement of filter Media.**

Once in a year

Different components of RWH structures in Guru Tegh Bahadur Institute of Technology



Appendix B-1.2: Delhi RWH Inspection

DL-4

**JOINT INSPECTION OF RAIN WATER HARVESTING SYSTEMS IN NCT DELHI
AS PER THE DIRECTIONS OF THE HON'BLE NGT IN THE MATTER OF O A NO.
147/2021 Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT Delhi &
Ors. Carried out on 7th March, 2022**

Inspection Team Members

Central Ground Water Authority

Dr. P.K. Naik, Scientist 'E'

Central Ground Water Board, State Unit Office-Delhi

Faisal Abrar, AHG

Central Pollution Control Board

Ms. Alpana Narula, SSA

Delhi Jal Board

Harish Chander, Addl Chief Engineer (C-8)

Vimal Belani, Executive Engineer (RWH-I)

Rakesh Sharma, AE (RWH-I)

Format of the Site Visit Report for Inspection of RWH Structures
(To be prepared Site-wise)

Introduction:

Site Name: Siri Fort Auditorium, August Kranti Marg, Delhi

Coordinates: 28°33'10" N; 77°12'45" E

Tehsil: Hauz Khas

District: South Delhi District

Ownership and Maintenance Responsibility of the Recharge Structure:

EE (Civil), Civil Construction Wing, All India Radio, Media Division, CGO Complex, New Delhi.

Objective and purpose of RWH Scheme under Reference:

Rain Water Harvesting is the technique of collection and storage of rain water at surface or in subsurface aquifer, before it is lost as surface runoff. In urban areas rain water available from roof tops of buildings goes waste. This water can be recharged to aquifer and can be utilized gainfully at the time of need. The rain water harvesting system needs to be designed in a way that it does not occupy large space for collection and recharge system.

EE (Civil), Civil Construction Wing, All India Radio, Media Division, CGO Complex, New Delhi has installed rain water harvesting system in their premises under the guidance received from the office of Executive Engineer, (RWH/GW), Jhandewalan, Delhi Jal Board.

General Geology and Hydrogeology:

The South Delhi district of NCT Delhi covers 250 sq km area, in which 45.2 sq km area has mountainous undulating terrain with exposures of Delhi quartzite. The district is also characterized by a saucer shaped vast alluvial field in the central part popularly known as Chhattarpur Basin. Virtually this is valley fill deposit and the alluvium thickness varies from 0 to 140 mbgl, below which quartzitic basement rock prevails. Some of the villages like Chhattarpur, Gadaipur, Mandi, Ghitorni, Ayanagar, Fatehpur Beri and Satbari fall within this vast alluvial tract. The overburden is comprised of unconsolidated clay, silt, sand and varying proportions of kankars.

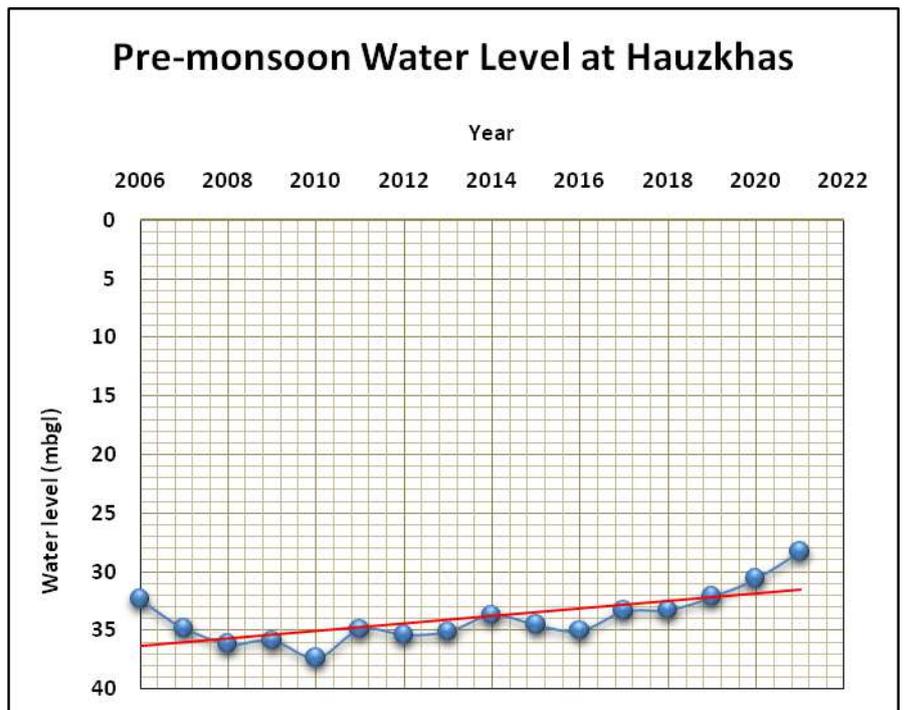
In the deep basin area, depth zone of 38 m to 55 m is characterized as prominent gravel zone admixed with silt and fine sand followed by clayey-silt and fine sand with occasional kankar nodules. At deeper levels, medium sand and angular gravels (ferruginous and gritty type quartzites) are also encountered. At some places viz. Aya Nagar & Fatehpur Beri, near the basement rock, lenses of sticky yellowish clay are

also encountered (Fig. 6.7a and b). The areas across southern Delhi Ridge namely Hauz Khas, Saket, Pushp Vihar, Lalkuan and Sarita Vihar are characterized by marginal alluvium deposits comprising of alternate layers of sand, silt with kankar and clay. The depth of overburden in these areas ranges from 60 to 94m. Below this quartzitic basement rock occurs. At Munirka, thickness of alluvium comprising of silt and sand is 30 m, below which weathred quartzite is encountered. At Madanpur Khadar, thickness of fresh water zone is limited and bedrock has been encountered at 300 m. The bore holes constructed in quartzitic formation (Jaunapur, Asola, Mandi and Tugalakabad) reveal that moderately fractured zones are prevalent in the depth range of 30 to 90 m and the fractures gradually decrease as depth increases. Weathered zone is found at every place above hard rock but thickness of weathered zone varies from place to place. In hard rock terrain and Chhattarpur basin ground water is fresh. The depth of fresh / saline water interface in the alluvial aquifers away from the ridge varies from 27 m near Okhla barrage to 58 m in Sarita Vihar.

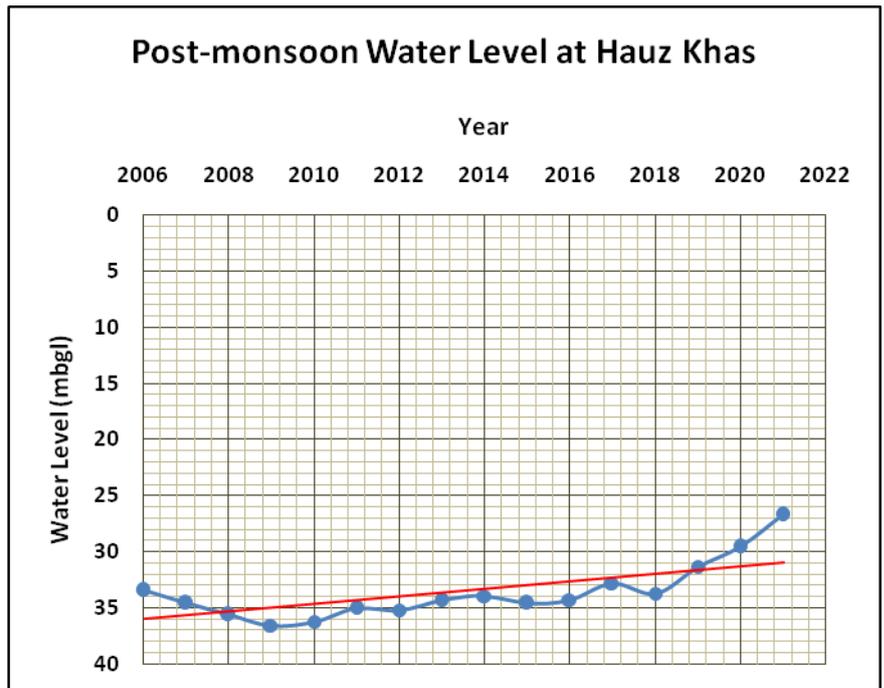
WATER LEVEL:

The nearest CGWB piezometer is located at Hauz Khas which is about 1.06 km from the premises of Siri Fort Auditorium, August Kranti Marg, New Delhi. The water level details are given as under:

Pre-monsoon Water Level at Hauz Khas Pz		
Site Name	WL(mbgl)	Year
Hauz Khas Pz	32.36	2006
Hauz Khas Pz	34.84	2007
Hauz Khas Pz	36.15	2008
Hauz Khas Pz	35.89	2009
Hauz Khas Pz	37.37	2010
Hauz Khas Pz	34.94	2011
Hauz Khas Pz	35.39	2012
Hauz Khas Pz	35.15	2013
Hauz Khas Pz	33.73	2014
Hauz Khas Pz	34.54	2015
Hauz Khas Pz	35.03	2016
Hauz Khas Pz	33.32	2017
Hauz Khas Pz	33.28	2018
Hauz Khas Pz	32.14	2019
Hauz Khas Pz	30.59	2020
Hauz Khas Pz	28.32	2021



Post-monsoon Water Level at Hauz Khas Pz		
Site Name	WL(mbgf)	Year
Hauz Khas Pz	33.48	2006
Hauz Khas Pz	33.38	2006
Hauz Khas Pz	34.6	2007
Hauz Khas Pz	35.62	2008
Hauz Khas Pz	36.59	2009
Hauz Khas Pz	36.25	2010
Hauz Khas Pz	35.07	2011
Hauz Khas Pz	35.21	2012
Hauz Khas Pz	34.39	2013
Hauz Khas Pz	33.97	2014
Hauz Khas Pz	34.59	2015
Hauz Khas Pz	34.32	2016
Hauz Khas Pz	32.81	2017
Hauz Khas Pz	33.72	2018
Hauz Khas Pz	31.37	2019
Hauz Khas Pz	29.58	2020
Hauz Khas Pz	26.72	2021



Type of Recharge Structure: 10 Nos. recharge pits without recharge bore well are present in the premises.

Details of Structures:

Total area of Flat: 22752 sqm
 Total Catchment Area considered for RTRWH Systems: 12536 sqm
 Avg. yearly Rain Water Run-off available for recharge: 650 mm
 Dimensions: All 10 pits have same dimensions i.e., 4.0m×3.0m×2.20m

Design of Structure:

Cost of Structure:

1. Construction Cost: 25 Lakhs
2. Maintenance Cost: Rs. 50,000/-(approx..)

Recharge:

Annual quantum of Recharge: **7920 Cu.m**

Water Quality Analysis Details of CGWB Piezometer located at Hauz Khas:

Basic Chemical Analysis															
Location	pH*	EC* in µS/cm at 25 ⁰ C	CO ₃	HCO ₃	Cl*	SO ₄	NO ₃ *	F*	PO ₄	Ca*	Mg*	Na*	K*	SiO ₂	TH *as CaCO ₃
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Hauz Khas	8	3394	0	159	549	842	25	0.47	<0.10	110	145	430	1.2	25	873

Heavy Metal Analysis													
Location	Source	Cr	Mn	Fe	Ni	Cu	Zn	As	Se	Ag	Cd	Pb	U
		Concentration in PPM						Concentration in PPB					
Hauz Khas	TW	0.0025	0.009	0.276	0.001	0.000	1.536	0.216	0.267	BDL	0.043	1.521	5.578

Any other relevant Information considered to be incorporated

- (a) On the roof top (terrace) mesh should be fixed at the opening of drain pipes so as to stop dust and other particles going into the filter media.
- (b) Display boards giving details of the each rain water harvestings pits should be put up.
- (c) On the entrance of the society gate sign board displaying “Rain water harvested society/campus” may be put up.

Observations/ Conclusion:

- 1. Rain water harvesting pits were found to be clean and working.
- 2. Terrace of the buildings blocks were also found to be clean.
- 3. Following is recommended by the inspection committee:-
- 4. Following is recommended by the inspection committee:-
 - (i) Filter media should be changed every year after proper cleaning of the recharge pits.
 - (ii) Steel mesh should be fitted in the roof intake pipe for filtration of rain water.
 - (iii) All rain water harvesting pits should be properly numbered & geo-tagged.
 - (iv) Display boards giving details of Rain water harvesting pits should be placed.
 - (v) Parking of vehicles at recharge pits to be prohibited at all times for physical verification & maintenance

Annexure:-

- 1. Questionnaire as provided by the Inspection Team (See next page)**
- 2. Documents required:**
 - a) Building Bylaws mandating RTRWH.-Yes, Annexure
 - b) Penal Provision if any for not complying with Building By-laws.- Annexure
 - c) Water Quality impact assessment related to contamination of Ground water.
 - d) Does state has any provision/ Guidelines to prevent contamination from recharged water.- Annexure

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

Not applicable

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

Not applicable

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

Not applicable

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Twice in a month

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Not applicable

6. **Frequency of cleaning/ replacement of filter Media.**

Once in a year

Different components of RWH structures in Siri Fort Auditorium



- (e) The "Exit" requirements in basements shall comply with the provisions of Part 4 'Fire and Life Safety'
- (6) Basement shall not be constructed beyond the zoned area or in case existing adjacent building, setback of 2.4 metres shall be taken from the existing adjacent building.

47. Fire

- (1) Fire protection measures provided in Part IV of National Building Code of India, dealing with the fire protection measures as amended from time to time, shall be followed.
- (2) The fire provisions made in the building wherever applicable, shall have to be got verified from the Competent Authority or office authorized from fire safety point of view and accordingly a certificate shall be submitted by the owner.

48. Rain Water Harvesting

- (1) In the areas specified by the Competent Authority, through a notification arrangement of roof rain-water harvesting within the plot shall have to be made by the plot owner, constructing the building on the plot where the area of the rooftop is 100 square metres or more.
- (2) **Ground Water Recharge:**
- (i) Recharging of ground water shall be mandatory not only for residential buildings but for all types of buildings, including Group Housing Societies having a plot area more than 500 square metres and above.
- (ii) The Ground Water Recharge shall be mandatory for open spaces like parks, parking, plazas, playgrounds and other common areas. The harvesting and recharge structures could be constructed by the Authority with the involvement of community based organizations like Resident Welfare Associations.
- (3) **Rain Water Harvesting System Measures:**
- (i) The system of collection, conveyance and dispersion of rain-water for harvesting shall be made in such a manner that only clear water is able to enter and no contaminated waste water from the building or surrounding area finds its way in this system.
- (ii) The entry points of the rain-water for harvesting shall be designed in such a manner that, in normal days, these remain covered. Arrangements of segregation of the rain-water from the first shower (Containing wash water) shall also be made.
- (iii) The arrangement of quick filtration of rain-water shall also be made in the rain-water harvesting well/ tubewell so that rain-water does not pollute or choke the strata.

- (iv) The complete system of rain-water harvesting shall be constructed within the plot area available with the owner.
 - (v) The recharge well shall be located at a distance of not less than 10 metres away from any structure handling sewage or industrial waste water (such as septic tank or effluent treatment plant etc.). This minimum distance of 10 metres shall not be applicable to manholes or sewer lines although it shall be ensured that they are leak proof.
 - (vi) The detailed proposal of the system comprising collection, conveyance and dispersion of rain-water harvesting well/ tube well shall have to be shown on the building plan submitted for approval.
 - (vii) An Architect/ Engineer duly engaged for supervision and execution of the construction of the building shall submit the certificate stating that the rain water harvesting system is functional at site and same conforms to the provisions of this code. However, if the Architect/ Engineer found guilty of misrepresentation of the facts, penal proceedings shall be initiated along with debarring the concerned Architect/ Engineer from practicing in the State of Haryana.
 - (viii) The provision of Water (Prevention and Control of Pollution) Act, 1974 (Act 6 of 1974), with all amendments made from time to time, shall be applicable.
 - (ix) The construction of the building as laid down in sub-clause (1) shall be the part of occupation certificate. Unless such construction is completed as per the approval, no occupation certificate shall be issued.
 - (x) The owner of every building in the code shall ensure that the rain water harvesting structure is maintained in good repair for storage of water of Non-potable purposes and recharge of ground water at all time.
- (4) The above said provisions of Rain Water Harvesting shall be strictly implemented in following districts/ towns:
- (i) Panchkula
 - (ii) Kurukshetra
 - (iii) Shahabad
 - (iv) Karnal
 - (v) Panipat
 - (vi) Sonapat
 - (vii) Gohana
 - (viii) Faridabad
 - (ix) Yamuna Nagar
 - (x) Gurgaon

Appendix B-2.2: Haryana RWH Inspection**HR-1****Site Visit Report for Inspection of RWH Structures****Company Name: Maruti Suzuki India Limited****Address:** Plot no. 1, Phase 3A , IMT Manesar-Gurugram

Coordinates: 28°22'07"N (Lat.) 76°52'45"E (Long.)

28°22'19"N (Lat.) 76°54'16"E (Long.)

28°21'45"N (Lat.) 76°52'43"E (Long.)

28°21'40"N (Lat.) 76°54'15"E (Long.)

Ownership and Maintenance Responsibility of the Recharge Structure

Maruti Suzuki India Limited

Objective and purpose of RWH Scheme under Reference

Recharge of rain water for ground water table under reference of The Haryana Building code-2017 as attached. Annexure-1

General Geology and Hydrogeology: The area is underlain by alluvial formation of thickness about 100 m below ground level. Below this alluvium, weathered and fractured quartzite is present. Ground water occurs in alluvium and the underlying weathered/fractured quartzites. The alluvium comprises sands silt, Kankar and gravel which form the principal ground water bearing horizon in the area.

Type of Recharge Structure

Lagoons with Rain water harvesting system.

Resources of the unit: HSIIDC Canal water.

2 numbers of digital water level recorder (piezometer) system is installed in MSIL Manesar. Readings of Piezometers are enclosed.

Details of Structures:

6 no's Lagoons with RWH having capacity 119660 CUM.

Design of Structure: Lagoons drawing attached with RWH section.

Annexure – 4 and Annexure -5

Water Level and Quality: Piezometer readings and chemical quality results are given in the end of report. Nitrate has been found above permissible limit (sample taken from TW at Gate No. 3).

Construction Cost: Rupees 388667171.96.**Annual Maintenance cost: Rupees 3413190.85****Annual Recharge Volume: 1,19,660.00 Cum**

The lagoon wise breakup is as given below:

MSIL Manesar rain water lagoons data			
Location	Lagoon Capacity (in Cum)	Annual maintenance cost in INR	Construction Cost in INR
Lagoon-1 -MPT	2,979.00	263027.15	16804538.64
Lagoon-2 -SPD	15,421.00	494385.00	47862973.90
Lagoon-2A-SPD (KC lagoon)	9,000.00	175399.00	29368802.97
Lagoon-3 -COP	46,577.00	1143677.30	146191130.51
Lagoon-4 -JV	5,198.00	374514.55	17387297.81
Lagoon-5 -SND	40,485.00	962187.85	131052428.13
Total	1,19,660.00	3413190.85	388667171.96

Observations/ Conclusion

- 6 no's Lagoons with RWH having capacity 119660 CUM. Lagoons are completely dry and recharge wells are in running condition.
- Two Piezometers with DWLR are installed in the premises.
- Both Effluent Treatment Plant (Capacity: 5840 KL/Day) & Sewage Treatment Plant (Capacity: 1187) KL/Day are installed for treatment of Industrial effluent and sewage respectively as per legal requirements of Haryana State Pollution Control Board.
- Dedicated and separate pipelines are laid for collection of Sewage and effluent. Likewise, separate & isolated pipelines are laid for storm water to lagoons.
- Traps are provisioned for capturing oil/silt from runoff from paved area and transferring to ETP.
- As informed, Cleaning/ replacement of filter Media is done on annual basis.

1. Documents Enclosed:

- a) Building Bylaws mandating RTRWH- Haryana Building Code 2017
- b) Piezometer readings
- c) Rain water harvesting capacity
- d) Design of structure and photographs

1) Industrial effluents discharged (In case if Industrial area)

NO

2) Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal

Both Effluent Treatment Plant & Sewage Treatment Plant are installed for treatment of Industrial effluent and sewage respectively as per legal requirements of Haryana State Pollution Control Board. The capacity of same are as under:

ETP Capacity: 5840 KL/Day

STP Capacity: 1187 KL/Day

3) Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers

Dedicated and separate pipelines are laid for collection of Sewage and effluent. Similarly separate & isolated pipelines are laid for storm water to lagoons

4. Frequency of Cleaning of ROOF Top in case of RTRWH.

Six Monthly

5. If runoff from paved area is being recharged, method to ensure prevention from contamination.

Oil/silt trap available for capturing and transferring them to Effluent treatment plant.

6. Frequency of cleaning/ replacement of filter Media.

Yearly

Recommendations of Joint Committee:

- A Peizometer should be constructed in vicinity of every Lagoon to keep regular checkup on water level and Quality of ground water.
- Regular check-up and maintenance of structure should be done.

Month/Year	January	February	March	April	May	June	July	August	September	October	November	December
2021	37.03	37.19	37.23	37.33	37.38	37.46	37.26	37.22	37.41	37.58	37.61	37.68
2022	37.72	37.89										

MSIL-M Groundwater Level (in mtr)												Check Point: Piezometer near JV Lagoon	
Month/Year	January	February	March	April	May	June	July	August	September	October	November	December	
2021	39.20	39.08	39.08	39.12	39.10	39.08	39.33	39.33	39.44	39.46	39.45	39.45	
2022	39.93	40.10											

Report of Ground Water Sample Collected from Maruti Auto Ltd, Manesar

Location of Samples	TW at Gate No. 3
Latitude	28.368889
Longitude	76.884065
Depth (m)	150
Date of collection	03.03.2023
pH	7.11
EC (µS/cm)	1374
TH (mg/L)	410
Ca (mg/L)	92
Mg (mg/L)	44
Na (mg/L)	164
K (mg/L)	2.2
CO3 (mg/L)	Nil
HCO3 (mg/L)	635
Cl (mg/L)	156
SO4 (mg/L)	ND
NO3 (mg/L)	65
F (mg/L)	0.48
PO4 (mg/L)	BDL
SiO2 (mg/L)	10
Cr (mg/L)	BDL
Mn (mg/L)	0.011
Fe (mg/L)	0.046
Ni (mg/L)	0.005
Cu (mg/L)	0.002
Zn (mg/L)	0.094
As (µg/L)	0.183
Se (µg/L)	0.120
Cd (µg/L)	0.047
Pb (µg/L)	0.282
U (µg/L)	5.023

Photographs 133



1) MPT Lagoon



2) SPD Lagoon



2) SPD Lagoon



3) COP Lagoon



4) JV Lagoon



5) SND Lagoon

Appendix B-2.2: Haryana RWH Inspection**HR-2****Format of the Site Visit Report for Inspection of RWH Structures****(To be prepared Site-wise)**

Introduction:The site is a “Corporate Office Complex” located at Plot No.51, Sector-44, Gurgaon, Haryana. (Owned by M.B Impex Pvt. Ltd.). The site has been leased to Bestech India Pvt. Ltd. Lease agreement is attached as **Annexure-I**.

Block: Badhshahpur

The coordinates of the site are as under:

- Latitude: 28°27'6.95"N
- Longitude: 77°4'15.13"E

Ownership and Maintenance Responsibility of the Recharge Structure:

Ownership: **M.B Impex Services Pvt.Ltd**

Maintenance: Parkview Facilities Pvt. Ltd

Objective and purpose of RWH Scheme under Reference: The objective is to recharge the ground water. The Building code scheme is enclosed as **Annexure-III**

General Geology and Hydrogeology:The area is underlain by alluvial formation of thickness about 100 m below ground level. Below this alluvium, weathered and fractured quartzite is present. Ground water occurs in alluvium and the underlying weathered/fractured quartzites. The alluvium comprises sands silt, Kankar and gravel which form the principal ground water bearing horizon in the area.

Type of Recharge Structure: Rooftop rainwater harvesting system

Details of Structures: 1 no. of RWH pit. RWH structure design calculations is attached as **Annexure-IV**.

Design of Structure: Design of the structure is enclosed.

Water Level and Quality: No borewell is present at site and the water is being sourced from municipality. Chemical quality of sample collected from RWH structure is given at the end of report.

Construction Cost: Rupees 4,50,000.00

RWH pit Cost

S. No	Particular	Cost
1	RWH pit Construction Cost	4.5 Lakhs
2	<ul style="list-style-type: none"> • Maintenance Cost (one time cost) • Twice a year • Expenditure incurred till date (2016-till date) 	<ul style="list-style-type: none"> • 16,000 + taxes • 32,000 + taxes • 1,60,000 + taxes
	Total expenditure	4,70,000/-

Annual Maintenance cost: Rupees32,000+Tax

Annual Recharge Volume:855.41Cum (Annexure-IX)

Any other relevant Information considered to be incorporated

Observations/ Conclusion: The RWH pit is fully operational

Annexure:-

1. Questionnaire as provided by the Inspection Team (See next page)
2. Documents Enclosed:
 - RWH structure design calculation

Questionnaire

1. Industrial effluents discharged (In case if Industrial area)

Not Applicable

This is a corporate office building.

2. Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal

The STP of capacity 20 KLD based on the principle of MBBR technology. The feasibility report is enclosed as **Annexure-VIII**.

3. Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers

The feasibility report is enclosed as **Annexure-VIII**.

4. Frequency of Cleaning of ROOF Top in case of RTRWH.

The frequency of cleaning is once in Six-months i.e. twice a year

5. If runoff from paved area is being recharged, method to ensure prevention from contamination.

Not Applicable

6. Frequency of cleaning/ replacement of filter Media.

Yearly

Recommendations of Joint Committee:

- The frequency of cleaning of RTRWH Pits (Desilting Chamber & Recharge pit) should be four times in a year so that clogging of pits due to silt should be avoided.
- Regular check-up and maintenance of structure should be done.

Report of Ground Water Sample Collected from Best Tech Office Complex, Gurgaon

Location of Samples	RWH Structure
Latitude	28.45180
Longitude	77.07080
Depth (m)	---
Date of collection	04.03.2023
pH	7.25
EC ($\mu\text{S}/\text{cm}$)	671
TH (mg/L)	180
Ca (mg/L)	36
Mg (mg/L)	22
Na (mg/L)	63
K (mg/L)	16
CO ₃ (mg/L)	Nil
HCO ₃ (mg/L)	317
Cl (mg/L)	57
SO ₄ (mg/L)	ND
NO ₃ (mg/L)	2.5
F (mg/L)	0.43
PO ₄ (mg/L)	BDL
SiO ₂	14
Cr (mg/L)	0.001
Mn (mg/L)	0.033
Fe (mg/L)	1.013
Ni (mg/L)	0.003
Cu (mg/L)	0.004
Zn (mg/L)	0.214
As ($\mu\text{g}/\text{L}$)	1.058
Se ($\mu\text{g}/\text{L}$)	0.044
Cd ($\mu\text{g}/\text{L}$)	0.305
Pb ($\mu\text{g}/\text{L}$)	4.420
U ($\mu\text{g}/\text{L}$)	0.504

RAIN WATER HARVESTING

The storm water disposal system for the premises shall be self-sufficient to avoid any collection/stagnation and flooding of water. The amount of storm water run-off depends upon many factors such as intensity and duration of precipitation, characteristics of the tributary area and the time required for such flow to reach the drains. The drains shall be located near the carriage way along either side of the roads. Taking the advantage of road camber, the rainfall run off from roads shall flow towards the drains. Storm water from various plots/shall be connected to adjacent drain by a pipe through catch basins. Therefore, it has been calculated to provide **1 nos.** rainwater harvesting pit at selected locations, which catches the maximum run-off from the area.

- 1) Since the existing topography is congenial to surface disposal, a network of storm water pipe drains is planned adjacent to roads. All building roof water has been brought down through rain water pipes.
- 2) Proposed storm water system consists of pipe drain, catch basins and seepage pits at regular intervals for rain water harvesting and ground water recharging.
- 3) Peak Hourly rainfall of 0.03 m/hour shall be considered for designing the storm water drainage system. Rain water harvesting has been catered to and designed as per the guideline of CGWA. At the bottom of the recharge well, a filter media is provided to avoid choking of the recharge bore. Design specifications of the rain water harvesting plan are as follows:
 - Catchments/roofs would be accessible for regular cleaning.
 - The roof will have smooth, hard and dense surface which is less likely to be damaged allowing release of material into the water. Roof painting has been avoided since most paints contain toxic substances and may peel off.
 - All gutter ends will be fitted with a wire mesh screen and a first flush device would be installed. Most of the debris carried by the water from the rooftop like leaves, plastic bags and paper pieces will get arrested by the mesh at the terrace outlet and to prevent contamination by ensuring that the runoff from the first 10-20 minutes of rainfall is flushed off.
 - No sewage or wastewater would be admitted into the system.
 - No wastewater from areas likely to have oil, grease, or other pollutants has been connected to the system.

S. No.	Type of Surface	Catchment's Area (m ²) [A]	Runoff Co-eff.	Hourly Rainfall	Discharge (Run Off) [Q=CIA] m ³ /hr
			[C]	[I]	
1	Rooftop Area	756	0.9	0.03	20.41
2	Green Area	540	0.2	0.03	3.24
3	Road & Paved Area	864	0.7	0.03	18.14
	Total				41.79

Table 1: Calculation of no. of RWH structures

Total Discharge (run off) : 41.79 m³/hr (1)

Volume of a Recharge pit (free board): ($\pi r^2 h$) = $3.14 \times 2 \times 2 \times 2.5 = 31.40 \text{ m}^3$ (2)

Volume of filter media: ($\pi r^2 h$) x porosity of filter media = $3.14 \times 2 \times 2 \times 2.5 \times 0.35 = 10.99 \text{ m}^3$ (3)

Well capacity: 36 m³/hr (4)

Total capacity of recharge structure (2 + 3 + 4) : 78.39 m³ (5)

No. of pits required = $\frac{\text{Total discharge (1)}}{\text{Total capacity of recharge structure (5)}}$

$$= 41.79/78.39 = 0.53, \text{ says 1 pit.}$$

Hence, Total **1 nos.** of Rain Water Harvesting shall be maintained for artificial rain water recharge within the project premises.

S. No.	Type of Surface	Catchment's Area (m ²) [A]	Runoff Co-eff.	Average annual rainfall	Total volume of water available for RWH (cum/year)
			[C]	[I]	
1	Rooftop Area	756	0.9	614	417.76
2	Green Area	540	0.2	614	66.31
3	Road & Paved Area	864	0.7	614	371.34
	Total				855.41

Table 2: Calculation of Annual Recharge

To annual recharge to ground water regime of the area through rainwater harvesting structure would be **855.41 m³/annum**

BUILDING BYE-LAWS AND RULES FOR RAIN WATER HARVESTING, PENAL PROVISIONS FOR GW CONTAMINATION

Bangalore Water Supply and Sewerage (Amendment) Bill 2009, 2020 and 2021 - Obligation to provide Rain Water Harvesting structure is as per insertion of new section 72A in Bangalore Water Supply and Sewerage (Amendment) Bill 2009, 2020 and 2021 of BWSSB act 1964.

- Bangalore Water Supply and Sewerage Board (BWSSB) has already made **mandatory to adopt Rain Water Harvesting System in the existing buildings constructed on a sital dimension measuring 216 sqmtr. and above and also for new building constructed on a site measuring 108 sqmtr in the year 2009.**
- As per Amended Notification No. BWSSB/C/CAO-S/294/2020 dt 6.5.2020, the capacity of roof top RWH storage/recharge structure was enhanced from 20 litres / sq.m to 60 litres / sq.m, whereas in respect of land based RWH, the capacity was enhanced from 10 litres / sq.m to 20 litres / sq.m.
- **Subsequently, the BWSSB Rain Water Harvesting Act 72A has been amended during the year 2021 wherein every owner who proposes to construct a building on sital area of not less than 1000 sq.mtr shall provide dual piping system and rain water harvesting structure for storage and for use other than drinking, cooking and bathing & ground water recharge based on paved and unpaved areas as per BWSSB regulations and guidelines issued by the Board.**
- For Eligible buildings who have not implemented RWH, penalty is levied in the monthly water bill until the RWH structure is implemented in the building as per the following rates:
 - The Owner or Occupier of a **residential building fails** to provide rain water harvesting structure in the building the additional charges **of 50% of the total water and sanitary charges for the first 3 months and thereafter an additional charges of 100% of the total water and sanitary charges till the rain water harvesting structure is provided to the building is being levied.**
 - The Owner or Occupier of a **non-residential building fails** to provide rain water harvesting structure in the building the additional charges of **100% of the total water and sanitary charges for the first 3 months and thereafter an additional charges of 200%** of the total water and sanitary charges till the rain water harvesting structure is provided to the building is being levied.
- Regular monitoring of RWH structure already implemented is carried out by BWSSB.
 - Total number of buildings implemented with Rain water harvesting : 1,67,031
 - Total number of defaulter buildings who have not implemented Rain Water Harvesting : 45,266

- Total number of awareness programmes conducted on Rain Water Harvesting Implementation and Ground Water Recharge : 120
- Number of Training programmes conducted : 84
- **Existing penal provisions being followed for GW Contamination** - BWSSB has issued guidelines on RWH which contains chapter on water quality and treatment to prevent contamination of recharged water. However, there are no penal provisions for ground water contamination.

State Ground Water Act 2011 - A separate chapter on RWH is included in the Act.

- In Urban areas falling in notified areas, the RWH is to be done in all residential, commercial and other premises having an area of 100 sq.m or more.
- The Municipal Corporations, local authorities may impose stipulated conditions for providing roof top rain water harvesting structures in the building plan in an area of 100 sq.m. or more, while according approval for construction, permanent water and electricity connections shall be extended only after compliance of directions.
- **Existing penal provisions being followed for GW Contamination** - There is no penal provision for contamination of groundwater in Act and Rules of State Govt.

Appendix B-3.2: Karnataka RWH Inspection**KA-1: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – SRI M.VISVESVARAYA RAINWATER HARVESTING THEME PARK****Introduction**

Sir M. Visvesvaraya Rainwater Harvesting Theme Park (12°55'14"N, 77°34'57"E), spread over an area of 4864 sq.m, is located in Jaya Nagar area, Bangalore city, Bangalore South Taluka, Bangalore Urban District. The park was inaugurated on 21stMarch 2011.

Objective and purpose of the RWH Scheme

Main objective of the theme park is to demonstrate different methods of rain water harvesting storage and recharge suitable for urban areas to the public, students, NGO's, architects, engineers, plumbers etc. The theme park has live models for bore well recharge system and RWH model house, and an auditorium wherein RWH films are shown to the visitors to explain the importance of RWH. The park had been one of its kind in entire India. Recently, similar park has come up in Hyderabad.

Ownership and Maintenance Responsibility of Recharge Structure

The park was conceptualized, designed and developed by Shri AR Shivakumar, Scientist (Retd), Karnataka State Council for Science and Technology (**KSCST**). The scheme has been implemented, owned and maintained by the Bangalore Water Supply and Sewerage Board (**BWSSB**), Bangalore.

General Geology and Hydrogeology

Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Depth of weathered zone generally ranges between 10 to 30 m. Fractured and fissured granites and gneisses constitute major aquifer system, with depth of fractures generally extending down to 200m and occasionally to 350 m. Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. Pre-monsoon **depth to water level** in phreatic aquifer **in the area** is around 8.74 to 11.66 m bgl, whereas in post-monsoon it is 3.20 to 9.78 m bgl. **Water level** in the 2 recharge wells **in the premises** is around 5.50 to 6.50 m bgl, whereas the other 2 recharge wells were dry. Long-term water level analysis (2012-2021) of GMMW of CGWB at Jaya Nagar indicates declining trend @ 0.20 m/year during pre-monsoon and rising trend @ 0.25 m/year during post-monsoon.

Rainwater Harvesting System, Conservation and Recharge System

The theme park has 18 RWH storage structures and 4 recharge wells. All the structures have provision for proper filtration and silt trap before entrance of water into structures.

RWH Storage Structures

The 18 RWH storage structures demonstrate different methods of storage of rain water, such as surface tank, underground sump, earthen pot, fibre storage tank, metal drum storage tank, HDPE storage tank, cloth filter storage etc as detailed above. The total storage capacity of these structures is 283829.19 litres or 283.82 m³. Details of the structures are given in Table-1 below.

Table – KA-1.1: Storage Structures in Theme Park, Bengaluru

S. No.	Storage Structure	Nos	Capacity in Ltr
Main Building			
1	Underground sump	1	16900

2	Ferro cement container	1	96.39
3	surface masonry Tank	1	6492
4	First Floor Storage Tank	1	17000
5	Metal Drum	1	176
6	Earthen pot	1	220
7	Plastic circular storage	1	500
8	HDPE Tank	1	500
9	Astral park circular storage	1	4071.5
10	cement pots	5	443.3
11	cloth filter storage	1	80
12	Main Building all around the channel	1	108450
Amphitheatre			
13	Inner Water body around the stage	1	5280
14	Outer Water body around Amphitheatre	1	123620
TOTAL		18	283829.19

Recharge wells

Four Recharge Wells are located in different parts of the premises, with cumulative capacity of ≈25468 Litre. Recharge Wells are 5.20-6.70m deep and have diameter ranging between 0.90-1.20m. The wells have cement rings with weep holes.

Maintenance of RWH System

Roof tops are cleaned at regular intervals. Proper care is taken to recharge the run-off from paved area through proper filtration, silt trap, pervious pavers, pavers with grass joint, grass land scape etc. Filter media is cleaned/ replaced every six months.

Quality of Groundwater/ Harvested Water

Two samples were collected from one Recharge Well located at the back side of main building. One sample was analysed at Jayanagar Water Testing Laboratory of Quality Assurance Division of BWSSB Laboratory and the other at CGWB Lab. Sample was also collected from the nearest borewell in the premises and analysed at CGWB Lab. Results of the analyses are presented in **Table KA-1.2**.

Table KA-1.2: Ground Water Quality Report of Collected Samples

Location	BW at RWH Theme Park, Jayanagar, Bangalore (CGWB Lab)	Recharge Well Analysed at CGWB Lab	Recharge Well Analysed at BWSSP Lab
Latitude	12.5514N	12.5514N	12.5514N
Longitude	77.3457E	77.3457E	77.3457E
Depth (Mbgf)	45m		
Date of collection	26.02.2022	26.02.2022	02.03.2022
pH	7.17	----	7.55
EC (µS/cm)/ TDS (mg/L)	564/---	----	---/634
TH (mg/L)	125	----	344
Alkalinity (mg/L)			280
Turbidity (NTU)			1.6
Ca (mg/L)	40	----	96
Mg (mg/L)	6.1	----	25.2
Na (mg/L)	60	----	----
K (mg/L)	4.97	----	----
CO ₃ (mg/L)	0	----	----
HCO ₃ (mg/L)	281	----	----
Cl (mg/L)	32	----	----
SO ₄ (mg/L)	8	----	68
NO ₃ (mg/L)	0.36	----	<1.0
F (mg/L)	0.45	----	<0.10
U (ppb)	89.88	10.68	----
Pb (ppm)	ND	ND	0.15
Iron (ppm)			<0.05
Alluminium			<0.10
Manganese			<0.01

Colour			5
Total Coliform (CFU/100ml)			Present
E.coli(CFU/ 100ml)			Absent

It may be seen from the table that as per BIS Standards (2012, amended in 2015), sample analysed at BWSSB Lab has all the parameters within permissible limits, except Lead (Pb) and total coliform. However, in the sample from same recharge well analysed at CGWB laboratory, lead was not detectable (ND). Sample from the nearest borewell in the premises has Uranium beyond permissible limit of 30 ppb.

Quantum of Annual Rainwater Harvested/ Conserved

Normal annual rainfall of the area is 1049 mm. As per the Table KA-1.1, the annual estimated water which can be conserved/recharged is 283.82 m³/year.

Utilization of Conserved Water

As per the information provided by BWSSB, the conserved water is used for gardening, bathroom and toilet flushing within the theme park.

Cost Involved in Construction of System and Annual Maintenance

As per information provided by BWSSB, cost of each recharge well\ constructed in year 2010-11 as approximately Rs. 50,000/- (Total approximately Rs. 2.00 lakh). There is virtually no maintenance cost as the system is maintained through in-house maintenance work of the theme park.

Observations/ Conclusions and Recommendations

- The theme park in Bengaluru is a novel idea to demonstrate different simple techniques of Rain Water Harvesting to common people through 18 RWH storage structures and 4 recharge wells within the premises. The RWH storage structures consist of different methods of storage of rain water. The park is propagating the idea of RWH to the general public, students, NGO's, architects, engineers, plumbers etc in a very scientific, user friendly and interactive ways.
- Ground water quality report of water in a recharge well (5-6m depth) shows **higher** concentration of **Lead (Pb)** in **BWSSB analysis**. However, **sample from same well does not show lead** in analysis at **CGWB Lab**. Total **coliform** is present in BWSSB analysis, indicating that **filter media cannot eliminate pathogens**.
- Sample from nearest borewell (45m depth) within the premises analysed at CGWB has Uranium concentration of ≈ 90 ppb, which is beyond the desirable limit of 30 ppb. Higher concentration of Uranium appears to be geogenic. Since there are no agricultural and industrial activities in the surroundings of the theme park, the higher uranium concentration is most probably due to the geogenic sources.
- As per BWSSB officials maintaining the park all the recharge and storage structures are well maintained and there is no scope of contamination of ground water due to artificial recharge in the premises.

Picture Gallery



Fig.KA-1.1: Team Visit to Sir M Visvasaraiyya Theme Park, Bengaluru

		
<p>Recharge Well</p>	<p>Barrel system – An infiltration gallery of reused plastic barrels/drums</p>	<p>Infiltration trenches at frequent intervals in open storm water drain</p>

Fig.KA-1.2: Some structures in Theme Park, Bengaluru

Appendix B-3.2: Karnataka RWH Inspection**KA-2: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – PRESTIGE FALCON CITY, DODDAKALASANDRA, KANAKPURA ROAD, BANGALORE SOUTH TALUK, BANGALORE URBAN DISTRICT****Introduction**

Prestige Falcon City (12°53'09"N, 77°33' 49"E) is a residential housing complex located at Kanakpura Main Road, Bangalore Urban district. The complex is spread over an area of **27 acres**. The residential housing society is planned in 2 phases and Phase-1, comprising of 20 towers with 2520 residential units of different sizes, has already been completed (2019). The complex currently inhabits ≈1940 souls. The firm has valid NOC from KGWA (State Government) for 8 borewells in the premises vide NOC no. KGWA/GW/NOC/35/2020-21/4259 dt. 30.03.2021 for 329 m³/day, not exceeding 1,20,085 m³/year with validity of 2 years from 30.03.2021 to 29.03.2023.

Objective and purpose of the RWH Scheme

Main objective of the RWH scheme is to harvest the entire rainfall incident on the premises (wherever feasible) and store, reuse and recharge the ground water. The firm is also required to mandatorily undertake RWH/Recharge as per the bye-laws of BWSSB.

Ownership and Maintenance Responsibility of Recharge Structure

The recharge structures have been constructed and, are owned and maintained by Prestige Property Management & Services, Bangalore City.

General Geology and Hydrogeology

Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Depth of weathered zone generally ranges between 10 to 30 m. Fractured and fissured granites and gneisses constitute major aquifer system, with depth of fractures generally extending down to 200m and occasionally to 350 m. Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. **Depth to water level** in the nearest Pz observation well located at a distance of 3.5 km north at Geological Survey of India is 14.38 mbgl during Pre-monsoon (2019) and 11.55 mbgl in post-monsoon (2021). Long-term water level analysis (2011-2020) of GMMW of CGWB (GSI Pz) indicates declining trend @ 0.35 m/year during pre-monsoon and rising trend @ 0.11 m/year during post-monsoon for the period (2014-2021).

Rainwater Harvesting System, Conservation and Recharge System

Prestige Falcon City has constructed about **68 Recharge Pits** spread across the entire area of Phase-I residential complex to harvest the rainwater incident on the premises in **addition to 3 big rain water storage tanks** having combined storage capacity of 7 lakh litres. **STP treated** sewage water is also being **reused**.

RWH Storage Structures

There are **3 large rain water storage tanks** having combined storage capacity of 7 Lakh litres (2 tanks of 2.50L litres and 1 tank of 2L litres).

Recharge Pits

Each of the 68 recharge pits is 3m deep with dia of 1.20-1.50m. The pits have cement rings with weep holes and filter media at the bottom.

Quantum of Annual Rainwater Harvested/ Conserved

Total estimated rainfall runoff quantum which is harvested for recharge through these 68 recharge pits is about 38928 m³ as per the following break-up of the area provided by the project proponent (Table KA-2.1).

Table – KA-2.1: Estimated Annual Recharge Falcon City, Bengaluru

S. No.	Type of Surface	Area* (Sqm)	Rain-fall (m)	Runoff Coefficient	Quantum of Run-off available (Cum/Year)
	1	2	3	4	5 (2*3*4)
1	Roof Top of building/Shed	14378	0.82	0.85	100211
2	Open Land / Road/Paved area	73223	0.82	0.42 (average for open & paved area)	252181
3	Green Belt	30000	0.82	0.15	3690
4	Total (sqm)	117600			38929

*This break-up of area excludes rooftop area specified for RWH storage / reuse tanks.

Reuse of Treated Water

Sewage Treatment Plant (STP) with Sequential batch reactor (SBR) and ABG mechanisms is being used for treatment supported with sand and carbon filter and auto chlorine dosage. The present capacity of operational STP is 1750 KLD and the treated water is used for flushing, landscaping/gardening and green belt maintenance.

Maintenance of RWH System

To prevent mixing of contaminated water, Sewage water is collected directly from the flats to STP bar screen chamber through PVC pipe line. Gratings are being used before entrance of water into recharge pits and frequent reconditioning of recharge pits are being done. Roof tops are cleaned every week. Filter media replacement/ cleaning is scheduled once a year and also as and when required as per water quality standards.

Quality of Groundwater/ Harvested Water

Since there has been no rainfall during recent months, there was only very little water at the bottom of recharge pits. Ground water samples were collected from one of the recharge pits and nearest borewell within the premises during the visit and analysed at CGWB, SWR (Table KA-2.2).

Table KA-2.2: Report of Ground Water Samples Collected from Falcon City, Bengaluru

Location of Samples	BW in Prestige Falcon City, Kanakapura Rd, Bangalore	Recharge Pit in Prestige Falcon City, Kanakapura Rd, Bangalore
Latitude	12.5308	12.5308
Longitude	77.3352	77.3352
Depth (Mbgf)	----	3m
Date of collection	26.02.2022	26.02.2022
pH	7	7.76
EC (µS/cm)/ TDS (mg/L)	1460	1553
TH (mg/L)	305	400
Ca (mg/L)	92	70
Mg (mg/L)	18.2	54.5
Na (mg/L)	140	166
K (mg/L)	10.63	12.71
CO ₃ (mg/L)	0	0
HCO ₃ (mg/L)	226	424
Cl (mg/L)	238	252
SO ₄ (mg/L)	72	92
NO ₃ (mg/L)	43.88	18.44
F (mg/L)	0.06	0.11

The chemical analysis indicates that the measured values for the all parameters are within desirable limits of BIS standards (2012), except, the total hardness value, which is more than desirable limit, but within permissible limits.

Utilization of Conserved/ Treated Water

As per the information provided by project proponent, the conserved/ stored rain water is collected in storage tanks, then mixed with borewell water and Cauvery water supply, which is then treated and used for drinking/ domestic use. Whereas STP treated water is used for gardening/ green belt maintenance.

Cost Involved in Construction of System and Annual Maintenance

The total cost of the completed 68 structures as per the project proponent was approximately Rs. 20,40,000 @ Rs. 30,000/- per structure. Annual maintenance cost of the structures is approximately Rs. 1,36,000/- per annum @ Rs. 2000/- per structure.

Observations/ Conclusions and Recommendations

- As per bye-laws of BWSSB, the firm is required to mandatorily undertake RWH/ Recharge in Prestige Falcon City, Bengaluru.
- The annual estimated rainfall runoff quantum which is being harvested for recharge is about 38928 m³ through 68 recharge pits (as per the break-up of the area provided by the project proponent).
- Rooftop run-off collected in Storage Tanks is treated and blended with Cauvery Water supply, and then utilized for drinking/ domestic purposes.
- Present capacity of operational STP within the premises is 1750 KLD and treated water is being used for flushing, landscaping/gardening and green belt maintenance.
- The nearest monitoring well of CGWB located at around 3.5 km north of site shows rising trend in post-monsoon. There is decline during pre-monsoon period.
- Analyses of groundwater samples from recharge pit and nearest borewell within the premises indicate that the measured values for the all parameters are within permissible limits of BIS standards (2012), except, the total hardness value, which is more than desirable limit, but within permissible limits.
- All the recharge and storage structures are well maintained. Proper mechanism is in place to prevent sewage water from mixing into run-off/ recharged water.
- The management/ maintenance team has been advised to by-pass first flush and to prevent water from paved area having vehicular movement from entering into the RWH system.



Fig.KA-2.1: Recharge Pit in Falcon City Bengaluru

Appendix B-3.2: Karnataka RWH Inspection**KA-3: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – ASIA BROWN BOVERI (ABB), PEENYA, BANGALORE NORTH TALUK, BANGALORE URBAN DISTRICT****Introduction**

Spread over an area of 14.60 acre ABB India Ltd, Peenya Complex (13°01'54"N, 77°30'55"E) is located in Plot No. 5-6, Peenya Industrial Estate, Peenya, Bangalore North taluk, Bangalore Urban district. The firm is engaged in manufacturing of electrical equipments i.e., industrial motors, AC drives, electric panels, flow meters, field instrumentation etc. The firm has valid NOC from KGWA (State Government) for 2 borewells in the premises vide NOC no. DE0011218130991 Dt. 02.02.2022 for 54 m³/day, not exceeding 19710 m³/year with validity of 2 years from 02.02.2022 to 01.02.2024.

Objective and purpose of the RWH Scheme

RWH system in the premises has been installed to harvest the entire rainfall incident on the premises (wherever feasible) and recharge the ground water. The firm is also required to mandatorily undertake RWH/ Recharge as per the bye-laws of BWSSB. The RWH system in the premises has been in place since Oct-Nov 2021.

Ownership and Maintenance Responsibility of Recharge Structure

The recharge structures have been constructed, and are being owned and maintained by ABB. They are having a RWH management team. The RWH scheme and technical guidance was provided by Ashwath Infratech.

General Geology and Hydrogeology

Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Depth of weathered zone generally ranges between 10 to 30 m. Fractured and fissured granites and gneisses constitute major aquifer system, with depth of fractures generally extending down to 200m and, on rare occasions, down to 350m.

Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. **Depth to water level** in the nearest observation well located at a distance of 5.50 km east (IISc Pz, 160m deep) was 31.28 mbgl Pre-monsoon (2021) and 15.40 mbgl in post-monsoon (2021). Long-term water level analysis (2012-2021) of above Pz indicates rising trend, both during pre-monsoon, as well as post-monsoon.

Rainwater Harvesting System, Conservation and Recharge System

There are 5 storage-cum-recharge structures, four of which have been constructed with cross-wave technology. Another storage-cum-recharge structure and 2 RWH storage tanks for reuse are under construction. Each storage-cum-recharge structures have 2 recharge wells of 6m depth. Dimensions of storage-cum-recharge tanks are provided in **Table KA-3.1**.

Table KA-3.1: Dimensions of RWH Structures in the Premises of ABB Ltd, Bengaluru

Tank No.	Location within Premises	Dimensions ((lxbxd) in m	Capacity (cum)	Status of Construction
SCR1	Disha Bldng Gate	5x2.5x2	25	Completed
SCR2	Drives Garden Area	13.5x3.75x1.6	81	Completed
SCR3	CSS Yard Junction	7x6x1.6	67	Completed
SCR4	Car Parking Location	20x3.5x1.6	112	WIP
SCR5	Material Gate	7x6x1.6	67	Completed
SCR6	Conventional Soak Pit	5m Diax4m deep	75	Completed
Reuse1	Disha Roof Top		100	WIP

Reuse2	Motors Roof Top		45	WIP
Total			672	

SCR = Storage-cum-Recharge

RWH Storage-cum Recharge Structures

Out of the 5 completed, 4 structures are using cross wave technology, with storage tank made by stacking up blocks of Polypropylene (highly water-resistant resin). With the use of cross-wave technology having a void ratio of almost 95%, bigger water storage spaces can be created in a much smaller area compared to conventional tanks. Installation can be done manually. The tank is then covered with non-woven geo-textile. The filter media is outside the tank and, therefore, requires less maintenance and easy operation. These 4 structures have 2 recharge wells of 60 m depth in each pit. The remaining storage-cum-recharge structure is with conventional storage tank with 1 recharge well of 60 m depth.

RWH Storage Structures

Two RWH storage tanks one-time cumulative storage capacity of 145 m³ are under construction for harvesting rooftop rainwater.

Quantum of Annual Rainwater Harvested/ Conserved

Normal annual rainfall of the area is 1004 mm. One-time cumulative storage/ recharge capacity of the 5 completed and 1 under-progress storage-cum-recharge structures is 427.40m³. The two under-construction RWH storage tanks for reuse have one-time cumulative storage capacity of 145 m³.

The firm has also installed flow meters at storage-cum-recharge structures to quantify the amount of rainwater being recharged into the ground water. Trials were conducted to ascertain the functionality of flow meters and it has shown that 6.20 m³ of water has dissipated into the structure in 1.5 to 2.0 hours, thus the **initial intake capacity of structure is around 3 cum/ Hr**. The system, however, has not witnessed monsoon since installation of flow-meters.

Reuse of Treated Water

Sewage Treatment Plant with Sequential Batch Reactor (SBR: type of activated sludge process) Technology of 96 KLD capacity meeting KSPCB water discharge standard is operational in the project and the treated water is used for gardening/ green belt maintenance.

Maintenance of RWH System & Prevention of Run-off from Contamination

The firm has quarterly rooftop cleaning schedule with in-house facility management team. Pre-monsoon cleaning is carried out in the month of April and May.

De-silting chamber and pure rain filter have been provided for filtration before cross wave chambers of RWH. Cross-wave technology does not have media filtration unit and has rain filter FRP Shell with SS304 grade strainer with steel bucket off 600 micron capable of eliminating finer particulate matter up to 160 micron. The bucket is cleaned weekly during monsoon and quarterly during winters.

The industry does not have any effluents. To insulate sewage from recharge, there are separate pipelines for sewage collection which are connected directly from building toilets to STP collection tank. The firm has periodic plan for maintenance and checking to avoid any leakage in sewage pipeline. There is separate storm water drain to collect and channelize rainwater to rainwater harvesting system.

Quality of Groundwater/ Harvested Water

The recharge wells were dry during inspection as there had been no rainfall in the preceding months. Ground water sample was collected from the nearest borewell within the premises. Results of the chemical analysis carried out at CGWB Laboratory is given in **Table KA-3.2**.

Table KA-3.2: Ground Water Quality Report of Nearest Borewell by CGWB

Location of Samples	BW in ABB Ltd, Peenya Premises
Latitude	13.0200
Longitude	77.3046
Depth (m)	77
Date of collection	26.02.2022
pH	7.8
EC (μ S/cm)/ TDS (mg/L)	698
TH (mg/L)	150
Ca (mg/L)	38
Mg (mg/L)	13.3
Na (mg/L)	81
K (mg/L)	16.18
CO ₃ (mg/L)	0
HCO ₃ (mg/L)	207
Cl (mg/L)	121
SO ₄ (mg/L)	34
NO ₃ (mg/L)	3.94
F (mg/L)	0.13

The chemical analysis indicates that the measured values for the all parameters are within desirable limits of BIS standards (2012).

Utilization of Conserved/ Treated Water

The rain water harvested from 6 SCR's is recharged to the ground water. In addition to these, the rain water conserved in 2 storage tanks of 100 and 45 m³/day capacity will also be transferred to SCR-1 and SCR-3 and used for recharge only after its completion. **STP-treated** water is used for gardening/green belt maintenance.

Cost Involved in Construction of System and Annual Maintenance

Total cost of the completed 5 structures as per ABB was 1.20 Cr. Annual maintenance cost is yet to be established as the structure has been constructed recently.

Observations/ Conclusions and Recommendations

- ABB Ltd has constructed rain water storage-cum-recharge structures using cross wave technology – i.e., storage tanks made of Polypropylene (highly water-resistant resin) with a void ratio of almost 95%, enabling creation of larger water storage space in a smaller area compared to conventional tanks. Cross-wave technology does not have media filtration unit and has rain filter FRP Shell with SS304 grade strainer with steel bucket off 600 micron capable of eliminating finer particulate matter up to 160 micron.
- There are separate pipelines for sewage collection which are connected directly from building toilets to STP collection tank. The firm has periodic plan for maintenance and checking to avoid any leakage in sewage pipeline.
- The recharge wells were dry during inspection. Ground water quality report of the nearest borewell within the premises (77m Deep) indicates that the measured values for the all parameters are within BIS standards/permissible limits.
- The firm has also installed flow meters at storage-cum-recharge structures to quantify the amount of rainwater being recharged into the ground water. During trial run to ascertain the functionality of flow-meters, the initial intake capacity of structure was observed

around 3 cum/ Hr. The system, however, has not witnessed monsoon since installation of flow-meters.

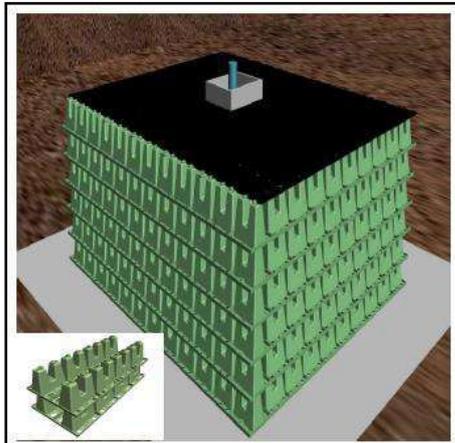


Fig.KA-2.1: Schematic Diagram of Cross-wave Technology



Fig.KA-2.2: Stages of Execution of RWH System using Cross-wave Technology in M/s ABB Ltd Premises, Bengaluru



Fig.KA-2.3: Inspection of RWH Structure and Measurement of WL in Recharge Well, ABB Ltd, Bengaluru

राजस्थान सरकार
नगरीय विकास विभाग

क्रमांक प.11(9) नविवि/3/2020 पार्ट-1

जयपुर, दिनांक 22 SEP 2021

आदेश

पर्यावरण संरक्षण हेतु मॉडल राजस्थान (नगरीय क्षेत्र शहर का नाम.....(भवन विनियम)) 2020 के विनियम-10.11.1, 10.11.2 पर क्रमशः वर्षा जल संरक्षण/संचयन तथा अपशिष्ट जल शुद्धिकरण एवं रिसाईकिलिंग के आवश्यक प्रावधान अंकित किये गये हैं, अनुसूची-2 के क्रम संख्या-5 के अनुसार वर्षा जल संरक्षण/संचयन हेतु अमानत राशि निर्धारित है। सक्षम स्तर से लिये गये निर्णयानुसार उक्त प्रावधानों में निम्नानुसार संशोधित किया जाता है :-

1. वर्षा के पानी द्वारा भू-गर्म का जल स्तर बढ़ाने के संबंध में :-

225 व.मी. अथवा ज्यादा क्षेत्रफल के भूखण्डों में सैटबैक क्षेत्र में भू-गर्म का जल स्तर बढ़ाने हेतु वॉटर हार्वेस्टिंग इकाई/संरचना निर्मित करने का प्रावधान अनिवार्य है।

नोट :- उपरोक्तानुसार निर्मित किये जाने वाले वॉटर हार्वेस्टिंग इकाई/संरचना के कार्य करने में सक्षम हैं तथा इसका उपयोग प्रभावी ढंग से हो रहा है अथवा नहीं, के परीक्षण हेतु भू-जल विभाग/जन संसाधन विभाग एवं इस क्षेत्र में अनुभवी सेवा निवृत्त अभियंता से कराया जाकर अभियंता से सुचारु संचालन रिपोर्ट प्राप्त करने के उपरान्त ही धरोहर राशि लौटाई जा सकेगी। ऐसे तकनीकीविज्ञो द्वारा प्रमाण पत्र जारी करने हेतु स्थानीय निकाय से निर्धारित शुल्क, फीस के रूप में आवेदक से सीधे ही ली जा सकेगी।

2. अपशिष्ट जल का शुद्धिकरण एवं रिसाईकिलिंग के संबंध में :-

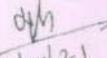
(i) 2500 व.मी. तथा उससे बड़े भूखण्डों में स्नानागार तथा रसोई के अपशिष्ट जल (waste water) के शुद्धिकरण एवं रिसाईकिलिंग की व्यवस्था करनी होगी। इसमें टॉयलेट से निकलने वाला जल शामिल नहीं होगा।

(ii) टॉयलेट में उपयोग में ली जाने वाली वॉटर क्लोजेट में ड्र्यूल प्लश बटन वाले सिस्ट्रन ही अनुमत होंगे।

3. उपरोक्त संशोधनों के अतिरिक्त विनियम-10.11.1, 10.11.2 के शेष प्रावधान यथावत रहेंगे।

4. अनुसूची -2 के क्रम संख्या-5 में भूखण्ड (300 से अधिक व 500 व.मी. तक) के स्थान पर भूखण्ड (225 अथवा अधिक 500 व.मी. तक) पढा जावे।

राज्यपाल की आज्ञा से,


(मन्त्री, गौरवल)

संयुक्त शासन सचिव-प्रथम

प्रतिलिपि निम्नांकित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित है :-

1. विशिष्ट सहायक, माननीय मंत्री महोदय, नगरीय विकास विभाग, राजस्थान सरकार
2. निजी सचिव, प्रमुख शासन सचिव, नगरीय विकास विभाग।
3. निजी सचिव, शासन सचिव, स्वायत्त शासन विभाग, जयपुर।
4. निदेशक, स्थानीय निकाय विभाग, राजस्थान, जयपुर को उनके अधीन समस्त नगर निगम/नगर परिषद/नगर पालिका को निर्देशित किये जाने हेतु।
5. सचिव, जयपुर/जोधपुर/अजमेर विकास प्राधिकरण, जयपुर/जोधपुर/अजमेर।
6. संयुक्त शासन सचिव प्रथम/द्वितीय/तृतीय, नगरीय विकास विभाग, जयपुर।
7. मुख्य नगर नियोजक, राजस्थान, जयपुर।
8. सचिव, नगर विकास न्यास, समस्त।
9. उप नगर नियोजक, नगरीय विकास विभाग।
10. वरिष्ठ उप शासन सचिव, नगरीय विकास एवं आवासन विभाग को विभागीय वेबसाईट पर अपलोड किये जाने हेतु निर्देशित किया जाता है।
11. रक्षित पत्रावली।

संयुक्त शासन सचिव-प्रथम

Appendix B-4.2: Rajasthan RWH Inspection**RJ-1****Site Visit Report for Inspection of RWH Structures****Introduction:**

Site name: M/S ANKIT ROOFINGS LTD., Village; DAHAMI KHURD, Block: SANGANER, District: JAIPUR, RAJASTHAN.

Coordinates : 26°48'57.66;75°34'21.96

Ownership and Maintenance Responsibility of the Recharge Structure: M/S ANKIT ROOFINGS LTD

Objective and purpose of RWH Scheme under Reference: to comply the CGWA NOC condition.

General Geology and Hydrogeology :

The soils in this region, are mostly wind blown sands overlying the base rock encountered at an average of 60 to 70 m in the region near Bagru . Lithology varies from young to older alluvial deposits consisting of fine to medium sand, silt, clay and Kankar (gravel). The predominant is fine sand. The site falls in the Sanganer block of the Jaipur district and the Sanganer block is the assessment unit for groundwater resource and the details are below;

Annual extractable Groundwater is 3948.66 ham; Groundwater extraction for all uses; 10759.59 ham; Groundwater stage of development is 272.48%.

Type of Recharge Structure: Silting pit and Injection well

Details of Structures: size of storage tank = 6.0 x 2.10 x 2.0 m = 25.20 m³ and 3.6 meter deep, 2 meter long filtering pit with 60 meter deep and 200 mm dia. Injection well.

Design of Structure :-Desiltation pit with injection well design (Annexure-2) and photographs is enclosed (Annexure-3).

Water Level and Quality : Depth to water of the piezometer constructed by the firm were decline from 32.92 mbgl (pre-monsoon 2013) to 36.98 mbgl (February 19.02.2022) almost 0.40m / year.

Chemical quality	(Year 2017)	At present
TDS:	1153 mmhos/cm. at 25 ^o C	1541 mmhos/cm. at 25 ^o C
Cl:	172.97 ppm	206 ppm
No ₃ :	8.15 ppm	13 ppm
F:	0.82 ppm	0.48 ppm

Enclosed as annexure-(Annexure-4)

Quantum of the recharge annually: 2600 cubic meter/year (each structure)

Construction cost and maintenance cost: Rs.80,000/- & Rs.18,000/-

Any other relevant Information considered to be incorporated:

Observations/ Conclusion:

Roof Top Rain Water Harvesting Structure (RTRWH) constructed during the year 2005-2006 by the Ground the Industry has been found in good condition.

Annexure:-

1. **Questionnaire as provided by the Inspection Team (See next page)**
2. **Documents required:**
 - a) Building Bylaws mandating RTRWH- **Annexure -1**
 - b) Penal Provision if any for not complying with Building By-laws -
Annexure -1 order dated 07.09.2021
 - c) Water Quality impact assessment related to contamination of Ground water- **Annexure -1**
 - d) Does state has any provision/ Guidelines to prevent contamination from recharged water.-
Annexure -1 order dated 07.09.2021

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

NA

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

NA

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

NA

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Twice a year

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Runoff recharge through filter media.

6. **Frequency of cleaning/ replacement of filter Media.**

Once a year

Photographs M/S ANKIT ROOFINGS LTD





NOIDA TESTING LABORATORIES
(An ISO : 9001 : 2008, 14001 : 2004 & OHSAS : 18001 : 2007 Certified & NABL Accredited Laboratory)
MoEF & CC (Ministry of Environment, Forest & Climate Change) Recognized Laboratory.
+91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-131217-07	21/12/2017

Issued To: M/s ARL Infratech Limited
Address: Village – Dhami Khurd, Bagru, Jaipur (Raj.)

SAMPLING & ANALYSIS DATA

Sample Received On : 14/12/2017
Sample Drawn By : NTL
Sample Quantity : 2.0 lit.
Sampling Location : Bore well Water No. - 02
Sample Description : Bore well Water
Analysis Duration : 14/12/2017 to 21/12/2017

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units	Desirable Limit	Extended Limit
1.	pH	IS:3025(Part-11)	7.36	-	6.5 – 9.0	-
2.	Turbidity	IS-3025(P-10)	<1.00	NTU	1	5
3.	Odour	IS:3025(Part-5)	Agreeable	-	-	-
4.	Total Hardness(as CaCO ₃)	IS:3025(Part-21)	71.34	mg/l	200	600
5.	Fluoride (as F)	APHA 22nd edit	0.83	mg/l	1.0	1.5
6.	Chloride(as Cl)	IS:3025(Part-32)	173.82	mg/l	250	1000
7.	Calcium (as Ca)	IS: 3025 (P- 40)	18.80	mg/l	75	200
8.	Nitrate (as NO ₃)	IS: 3025 (P- 34)	8.17	mg/l	45	No Relaxation
9.	Total Dissolved Solid	IS:3025(Part-16)	1160.0	mg/l	500	2000
10.	P-Alkalinity (as Ca CO ₃)	IS: 3025 (P- 23)	Nil	mg/l	200	600
11.	M-Alkalinity (as Ca CO ₃)	IS: 3025 (P- 23)	170.9	mg/l	200	600
12.	Sulphate (as SO ₄)	IS: 3025 (P- 24)	46.51	mg/l	200	400
13.	Magnesium (as Mg)	IS: 3025 (P-46)	5.30	mg/l	30	100
14.	Iron (as Fe)	IS: 3025(P-53)	BDL <0.01	mg/l	1.0	No Relaxation
15.	Sodium (as Na)	IS-3025(P-45)	173.8	mg/l	-	-

MICROBIOLOGICAL REQUIREMENT

S.No.	Parameter	Test Method	Results	Required as per IS-10500:2012
1.	<i>Escherichia coli</i>	IS-1622	Absent	Absent/100ml
2.	<i>Coliform Bacteria</i>	IS-1622	Absent	Absent/100ml

Notes:

- The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
- Responsibility of the Laboratory is limited to the invoiced amount only.
- This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
- This test report will not be used for any publicity/legal purpose.
- The test samples will be disposed of after two weeks from the date of issue of test report, unless until specified by the customer.

[Signature]

CHECKED BY



AUTHORIZED SIGNATORY

Laboratory : GT-20, Sector-117, Noida, Gautam Budh Nagar - 201301
E. : noida.laboratory@gmail.com, info@noidalabs.com **W.:** www.noidalabs.com



Accreditation NABL Certificate No. TC-5808
 Sender: Shri Jagjit Kumar Sr. D
 Test Item: Ground water
 Lab ID No. 14151/5

1. Chemical Testing

1. Water

PROTOCOL OF TEST AND METHOD

ph-	APHA 23rd Edition, 4500 H B
EC-	APHA 23rd Edition, 2510 B
Cl-	APHA 23rd Edition, 4500 Cl B
F-	APHA 23rd Edition, 4500 F D
NO ₃ -	APHA 23rd Edition, 4500 NO ₃ B

Later: DATED 21.2.22

Receipt: Dt 21.2.22

ਸ਼੍ਰੀ ਜਗਜੀਤ ਕੁਮਰ ਸੀ. ਡੀ.
 ਸ਼੍ਰੀ ਗਰਾਊਂਡ ਵਾਟਰ
 ਟੈਸਟ ਰਿਪੋਰਟ

TEST REPORT



Container: Polyethylene
 Quantity: 1 ltr
 Sample Condition: OK

PROTOCOL OF TEST AND METHOD

Ti-	APHA 23rd Edition, 2340 C
Ca ²⁺	APHA 23rd Edition, 3500 Ca B
Mg ²⁺	APHA 23rd Edition, 3500 Mg B
Na ⁺	APHA 23rd Edition, 3500 Na B
K ⁺	APHA 23rd Edition, 3500 K B

*Parameter under NABL.

Lab ID No.	District	Block	Location	Depth in m.	Type of Study	Sampling Date	Systematic/Polynomial/Thiograph Network/Short Term/Continuous/Seasonal	Lang.	Temp.	pH*	OC ⁻ at 25°C	CO ₂	HCO ₃	Ca ²⁺	SO ₄	NO ₃ ⁻	PO ₄	F ⁻	TDS	Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	TDS
11141	JALPUR	SHRIYAWADA	RADHWADA	NM	REGULATED P	19.2.21	Feb-22	NM	NM	7.33	560	NM	159	60	71	2.3	0.03	0.36	156	44	10	56	17.10	364
11142	JALPUR	SHRIYAWADA	RADHWADA	NM	TW	19.2.21	Feb-22	NM	NM	7.08	1850	NM	403	224	188	200	0.04	0.12	720	140	90	128	500	1203
14143	JALPUR	SANANBER	ANANTHPOORI	NM	TW	19.2.21	Feb-22	NM	NM	7.96	2370	NM	671	355	162	38	0.06	3.50	170	36	19	500	240	1541
11144	JALPUR	SANANBER	ANANTHPOORI	NM	REGULATED P	19.2.21	Feb-22	NM	NM	8.99	2016	24.00	122	206	557	13	0.18	0.48	60	16	5	221	370	1310
11145	JALPUR	SANANBER	GWDOBTLE	NM	TW	21.2.21	Feb-22	NM	NM	7.22	1150	NM	303	106	101	140	0.02	0.18	440	88	54	76	10.80	748

Note: 1. The Test results relate only to the sample tested.
 2. Results Apply to Sample as received
 3. Sample will be destroyed after retention time of 15 days unless specially specified otherwise.

Remarks:
 Analyzed by
 Arvina Shah
 Assistant Chemist

Authorised signatory
 Dr. JAYPAL GARG
 Chemist
 TM
 DATE: 22.2.22

4. BDL - under Detection Limit
 5. NSC - No sample submitted
 6. NS/NM - Not Measured

Appendix B-4.2: Rajasthan RWH Inspection**RJ-2****Format of the Site Visit Report for Inspection of RWH Structures****(Ground Water Department Campus)**

Introduction: State Ground Water Campus located in block Sanganer, District-Jaipur of Rajasthan State. The latitude: 26°52' 25" and Longitude 75°49'10.8"

Ownership and Maintenance Responsibility of the Recharge Structure: State Ground Water Department has ownership of this Roof Top Rain Water Harvesting Structure (RTRWH) and Executive Engineer (Civil) , GWD is maintaining the RTRWH structure.

Objective and purpose of RWH Scheme under Reference: The RTRWH Constructed during the year 2000-2001 under Central Sector Scheme by the Ground Water Department. The purpose of the RTRWH is to artificial recharge of Ground by means of Roof Top Rain Water and also regular monitoring of Water level by Telemetric Digital Water level Recorder installed in Piezometer is being carried out.

General Geology and Hydrogeology:

1. Geological Formation : Thick Quaternary formations underlain by the formations of Delhi Super group.
2. Depth to Water level: Pre monsoon 2012- 62.75 meters bgl and pre monsoon 2021 52.6 meters bgl. at present 51.4 meters. The rise of 10.15 meters water level have been observed from pre monsoon 2012 to pre monsoon 2021. (Annexure-1 & 2)
3. Piezometer Water level trend enclosed form the year 2012 to 2021. (Annexure-1)

Type of Recharge Structure: 40 meter depth Injection well /recharge shaft and recharge trench.

Details of Structures: 40 meter depth Injection well /recharge shaft and recharge trench.

Design of Structure : Enclosed as annexure : (Annexure-3)

Water Level and Quality :

Chemical quality	(Year 2001)	At present
Ec:	760 mmhos/cm. at 25°C	1150 mmhos/cm. at 25°C
Cl:	35ppm	106 ppm
No ₃ :	30ppm	140 ppm
F:	0.8 ppm	0.18 ppm

, Enclosed as Annexure : (Annexure-4a & 4b)

Any other relevant information considered to be incorporated

Observations/ Conclusion : Roof Top Rain Water Harvesting Structure (RTRWH) constructed during the year 2000-2001 by the Ground Water Department in the Central Sector Scheme has been found in good condition after a long span of 20 years. No debris found choked in recharge trench and also no water has been found in the recharge trench. Therefore it is concluded that this structure is working properly since 2001. The rise of 10.15 meters water level have been observed from pre monsoon 2012 to pre monsoon 2021.

Annexure:-

1. **Questionnaire as provided by the Inspection Team (See next page)**

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

No industrial effluents discharge.

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

No industrial effluents discharge

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

No industrial effluents discharge.

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Every before the onset of monsoon and during the monsoon 2-3 times cleaning of ROOF Top.

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Only rooftop area has been taken for the runoff and no paved area has been taken.

6. **Frequency of cleaning/ replacement of filter Media.**

Every year before the onset of monsoon only cleaning/desalting of Upper surface of Filter Media and no replacement of filter media replaced till date.

2. **Documents required:**

- a) Building Bylaws mandating RTRWH
- b) Penal Provision if any for not complying with Building By-laws
- c) Water Quality impact assessment related to contamination of Ground water-No

- d) Does state has any provision/ Guidelines to prevent contamination from recharged water-
(NA)

CENTRAL GROUND WATER BOARD,
WESTERN REGION, JAIPUR.

ARTIFICIAL RECHARGE TO GROUND WATER
CONCEPT PLAN AND DESIGN OF ROOF TOP RAIN WATER RUN
OFF HARVESTING STRUCTURE AT GROUND WATER
DEPARTMENT BUILDING PREMISES, JAIPUR RAJASTHAN

1. INTRODUCTION

1. Location : Ground Water Department, Jhalan
Doongri, Jaipur
Block - Sanganer, District Jaipur.
Basin - Banas, Sub basin - Morel.
Latitude : 26°53'45"
Longitude : 75°48'10"
2. Area of Population : Urban.
3. Agriculture : Soil Type - Fine sand with clay and
kankar.
Thickness - 1.5 to 2.0 m
Extent - wide aerial extent
4. Climate
 - i. Type of Climate - Semi arid.
 - ii. Rainfall

Average annual (1990-99) - 640 m.
(Average of Sanganer and Jaipur Rain
gauge stations).

Average Monsoon (1990-99) - 577 m.
(Average of Sanganer and Jaipur Rain
gauge stations).

Normal annual (1901-70) - 668 mm.
(Average of Sanganer and Jaipur Rain gauge
stations).

Normal Monsoon (1901-70) and raiy days

512 mm and 27 days. (Average of Sanganer and Jaipur Rain gauge station).

iii. Maximum temp. (Av.) - 31.7°C.

Minimum temp. (Av.) - 18.4°C

iv. Humidity (Av.) - 53 (0830 hrs.), 37 (1730 hrs.)

v. Potential Evapotranspiration - 1744.7 mm

vi. Wind speed (Av.) - 12.4 km/hr.

2. AIM OF OBJECTIVE OF THE SCHEME

Due to excessive withdrawal of ground water in Jaipur Urban area, particularly in Sanganer block of Jaipur district, where this building is located, sharp decline in water level up to 11.20 m over the period from 1990 to 1999 i.e. @ 1.12 m/year (Based on the data generated from the hydrograph station located in OTS campus has been observed).

3. JUSTIFICATION OF THE SCHEME

Nature of problem requiring Artificial Recharge of Ground water.

i. Quantity Problem

(a) Extent of Area showing water level depletion on long term basis.

Area falls under the category of "over exploited" (as on 01.01.98) with 239% stage of development.

(b) Average decline in water levels per year :

Average decline in water level per year
1.12 m/year (Pre monsoon 1990-99).

ii. Quality Problem

Ground water quality potable and it will further improve with the artificial recharge to ground water.

4. HYDROGEOLOGY

Geomorphology

i. Elevation 423 - 425 m above m.s.l.

ii. Land Form : Plain alluvial area.

Surface Water
Bodies

: These are not existing in the vicinity of the area.

Hydrogeology.

i. Geological Formation : Thick Quaternary formations underlain by the formations of Delhi Supergroup (refer Ann. 1 - lithological log).

ii. Nature of unsaturated zones : Aeolian sand, Water level - 32.0 m/bgl.

a. Moisture conditions : from 25 m down the formations are moist.

b. Presence / Absence of impervious Layers in vadose zone (hardpans) : Presence of lenses of clay in vadose zone.

iii. Aquifer systems : Phreatic.

iv. Depth of Aquifer zones : 76.0 m bgl.

v. Hydraulic Characteristics of Aquifers : Based on Bajaj Nagar exploratory well.

a. Transmissivity : $166 \text{ m}^3 / \text{day} / \text{m}$

b. Specific yield 1.8×10^{-2} .

c. Hydraulic Conductivity $6.64 \text{ m}^3 / \text{day} / \text{m}^2$.

vi. Aquifer boundaries : Phreatic aquifer with wide aerial extent.

vii. Depth of water level and its seasonal Long Term fluctuation. : 32.0 m bgl.,

11.20 m decline during 1990-99.

viii. Ground water flow direction in the scheme area : Westerly

ix. Ground water structures :

(Ground Water Department, Jaipur)

a. Type, Number : Tube well,
(successful - one), Piezometer - one.

b. Depth : 76 m. (Tube well), 55 m
(Piezometer).

c. Yield Range : 4000 gph (T/W)

d. Aquifer tapped : Fine sand and silt

x. Ground Water Resources as on
01.01.98 :

a. Annual Recharge : 36.97 MCM.

b. Net Annual Draft : 88.41 MCM.

c. Present Ground water balance : -51.44
MCM (Negative).

d. Stage of Ground Water Development :
239%.

xi. Ground Water Level trends : Pre
monsoon (1990-99) decline in water
level by 1.12 m/year..

i. Concentration of chemical constituents
in the ground water In the proposed
area :

ii. Chemical Analyses Results

EC : 760 mmhos / cm. at 25°C

Hydrochemistry.

Cl : 35 ppm

No₃ : 30 ppm

F : 0.8 ppm

Geophysical
investigations

- i. Subsurface geology as deciphered from the results of electrical logging of the CGWB exploratory borehole drilled at Bajaj Nagar.

Depth Range (m)	Inferences
00.0 - 14.0	Data Not Recorded
14.0 - 15.0	Clay
15.0 - 16.5	Sand
16.5 - 19.0	Clay
19.0 - 22.0	Sand clay
22.0 - 27.0	Sand
27.0 - 33.0	Sand and gravel
33.0 - 35.0	Sand
35.0 - 36.0	Clay
36.0 - 37.5	Sand
37.5 - 42.0	Sand clay
42.0 - 45.5	Sand silt
45.5 - 49.5	Sand silt clay
49.5 - 54.0	Clay
54.0 - 55.5	Sand
55.5 - 57.5	Clay
57.5 - 60.5	Sand silt clay
60.5 - 65.5	Clay silt
65.5 - 68.0	Clay
68.0 - 69.0	Sand

H:
IA:C/
L.1
-6
2.

- 69.0 - 70.5 Clay
- 70.5 - 73.5 Sand clay
- 73.5 - 74.0 Clay
- 74.0 - 75.5 Sand
- 75.5 - 76.0 Clay
- 76.0 - 78.5 Sand, silt
- 78.5 - 79.5 Clay
- 79.5 - 82.0 Sand clay silt mixed.

- Water Requirements
- i. Present requirement for different uses
 - a. Domestic and Industrial : 82.03 MCM
 - b. Irrigation : 9.12 MCM.
 - ii. Projected requirement after 25 year
Domestic and Industrial : 191.5900 MCM

- Ground Water
- i. Unconfined aquifers having potable water.

- Sub-surface
Potential for Ground
Water recharge
- i. Thickness of unsaturated zone (below 3 mbgl) : 29.0 metres.

- ii. Surplus Rain water run off available from roof top for recharge :
26.77 m³/hr (85% of actual rain fall).
- iii. Total Roof Top area from which rain water is likely to be drained : 1050m².

5. AVAILABILITY OF SURPLUS RAIN WATER.

Source	Location	Quantity	Period of availability
Rain water	Ground Water Department, Jaipur	456.96 m ³ /year (85% of Roof Top rain water run off).	During Monsoon.

6. ARTIFICIAL RECHARGE STRUCTURE PROPOSED FOR GWD BUILDING, JAIPUR

A. Dimensions of Structure :

- a. Installation of vertical Drain : 34 nos. A.C. pipes of 100 mm. Diameter. Total length - 170 m. (Approx.) (includes vertical extension 3.90 m; horizontal extension 0.40 m. On ground and 3 Nos. 'L' bands for each roof top drain outlet).
- b. Laying of collecting Drain pipe : R.C.C. Non pressure pipe 200 mm. Diameter total length 265 m. (Approx.).
on or below ground surface around the building periphery upto the recharge shaft as per the layout plan (Plate 3 & 4) maintaining gradient of 1 Cm./meter.
- c. Construction of Pillars for : Number of pillars and their respective resting collecting drain pipe heights and spacing has to be worked out by the Civil Work Execution Agency.
(Brick work 0.25 m including 10 to 12 mm. Finished plaster) between point A1-A3 (Plate-3), Point B1-B2, B10-SP-5, and SP6-B13 (Plate-4)
- d. Construction of Siphon Pits (7 nos.) of 0.50 m length of 0.50 m width (Brick work 0.25. includes 8 mm. rough plaster on exterior surface and 10 to 12 mm. Finished cement sand plaster on inner surface). Depth of siphon pits is variable (Plate 2 & 3).
 - i. SP1/SP2-1.10 m (0.50 m. below plinth level and 0.60 m above)
 - ii. SP3/SP4-1.00 m. (0.75 m. below plinth level and 0.25 m above).
 - iii. SP5/SP6/SP7 - 1.25 m (1.00 m. below plinth level and 0.25 m. above).

- c. Construction of Filter Pit (Brick : Finished dimensions work 0.25 m including 8 mm rough cement sand plaster on exterior side and 10 to 12 mm furnished plaster on inner surface) with installation of 3 nos. Centilever stairs of stone slabs or 'U' Angle Iron at 0.30 m. rise on any of the side long wall.
- Length - 3.0 m
Width - 2.0 m
Depth - 3.0 m.
- f. Construction of one Injection : 40 m depth and 508 mm diameter well injection well. Its upper zone will be cased with 508 mm diameter MS casing pipe and the remaining 37 m will be naked.
- Providing back filling of gravel : Three beds of filter material. 0.30.m thick gravel (5-7 mm) 0.30 m thick gravel (3-5 mm) and 0.30 m coarse sand.
- g. Installation of Air line of 25 mm dia in the center of filter pit and injection well for passage of formation air from the vadoze zone. : 31 m length of 25 mm diameter MS pipe (1.0 m AGL to 30 m BGL) with 'T' open ends a top side and slotted from 2.30 m BGL to 30 m. BGL.
- h. Installation of Floating Material : Mild Steel Flat Beads (20 mm width x Retention Cage towards the run-off 3 mm thickness) with welded mesh of inlet side portion of the Filter Pit 16 gauge steel wire (5 x 5 mm opening below 0.10 m depth from the bottom level of the run-off collecting drain pipes extending 0.5 m horizontally and 0.20 vertically). Spacing of Flat Beads at 5 cm.

B. Surplus rain water run off available for harvesting

i. Rainfall Intensity for which : 30 mm / hour
the system has been designed

ii. Quantum of run off likely to : $1050 \times 0.03 \times 0.85 = 26.77 \text{ m}^3/\text{hr.}$
be available for artificial (85% of actual rainfall).
Recharge from the 1050 sq. m.
run-off area at 30 mm / hour
rain fall intensity.

iii. Annual Recharge : $456.96 \text{ m}^3/\text{annum. (1050 sq.m area).}$

iv. Life of the structure : 20 years

v. Total recharge : $9139.2 \text{ m}^3.$

7. COST ESTIMATES

Forecast estimates for construction of roof top / Pavement rain water run off harvesting structure has been estimated as 3.02 lacs. (refer Annx. II) as per prevailing market rates.

8. BENEFITS OF THE SCHEME

By artificial recharge of ground water, declining trend in water level will be minimized

9. IMPLEMENTING AGENCY FOR CIVIL WORK

Ground Water Department, Government of Rajasthan.

10. TECHNICAL COORDINATION COMMITTEE :

The committee will include the officers from Central Ground Water Board, Govt. of India, GWD, PHED, Government of Rajasthan.

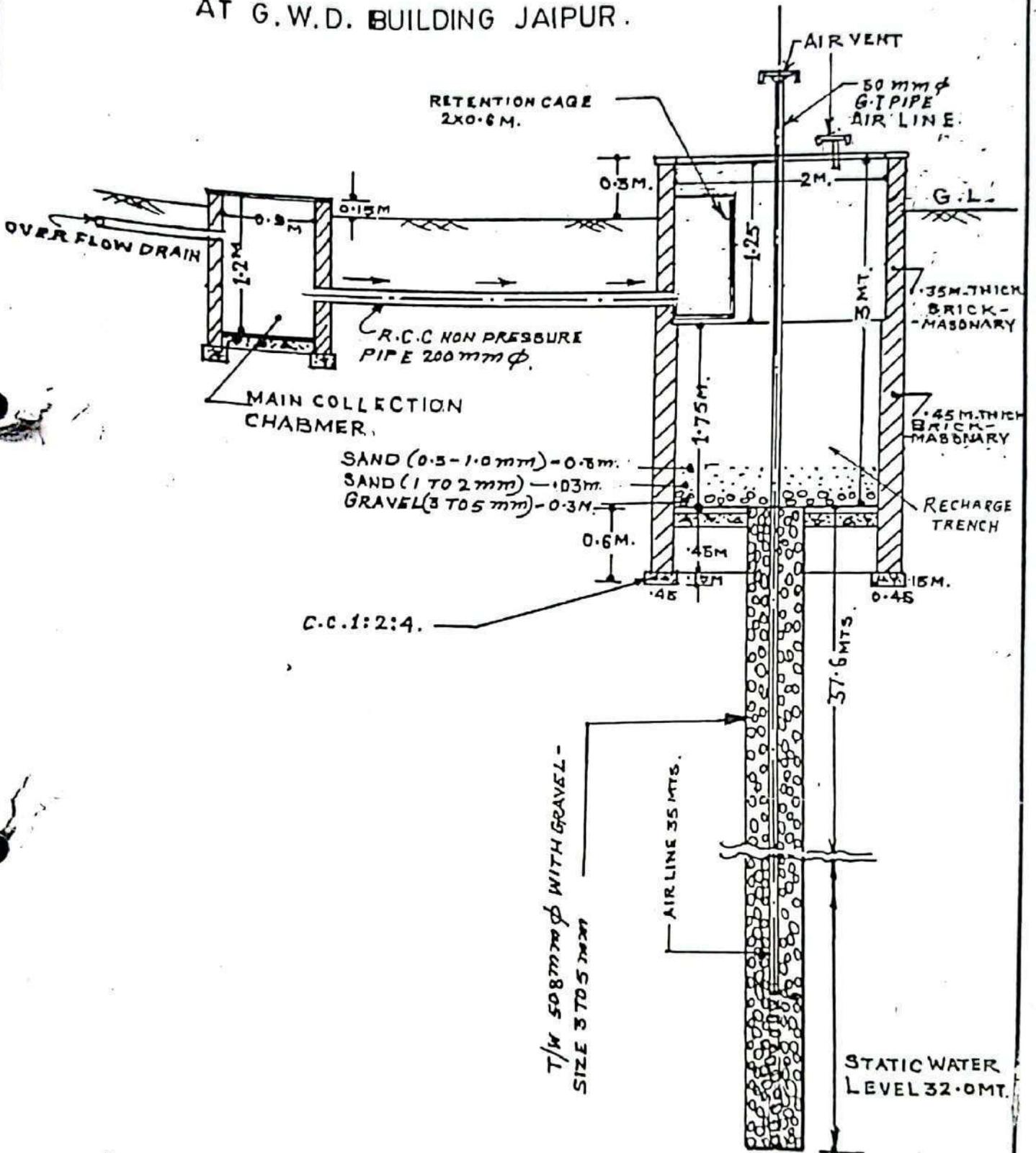
11. TIME SCHEDULE

It is proposed to complete the construction work during the current monsoon.

Sr.no	Well Type	Block	Village	Address/Location	latitude			Longitude			RL (m) (in mtr.)	Hyd_Formation	175 Age	Total_Depth_bgl (in mtr.)	WL_pre_12 (in mtr.)	WL_pre_13 (in mtr.)	WL_pre_14 (in mtr.)	WL_pre_15 (in mtr.)	WL_pre_16 (in mtr.)	WL_pre_17 (in mtr.)	WL_pre_18 (in mtr.)	WL_pre_19 (in mtr.)	WL_pre_20 (in mtr.)	WL_pre_21 (in mtr.)	Fluctuation Premonsoon 2012_ Premonsoon 2021	
					D	M	S	D	M	S															(in mtr.)	
1	PZ	Jhotwara	Raj Bhawan	In the back side of Main Raj Bhawan building, RAC batalion office.	26	54	30	75	47	1.9	428.3	Yr. Alluvium	A	100	26.4	24.3	23.91	24.5	24.47	23.8	22.3	26.9	24.8	22.7	3.7	
2	PZ	Sanganer	Gwd Campus	In front of A. En. Office, GWD campus , Jhalan Dungri	26	52	25	75	49	10.8	444.7	Older Alluvium	Ao	112	62.75	58.03	58.45	55.18	55.98	54.2	54.2	54.11	53.56	52.6	10.15	

Drishti-2018 : Encardio-rite Electronics Pvt. Ltd.							
SiteName : GWD_Jaipur_Campus							
Date : From 2022-01-01 11:25:17 To 2022-02-17 11:25:17							
Datetime	DATA LOGGER ID	BATTERY VOLTAGE (V)	WATER LEVEL (mWC)	TEMPER ATURE (degC)	BARO METRI C	INSTANT RAIN (mm)	DAILY RAIN (mm)
2022-01-01 18:00:00		7.11	-51.49	28.5	966.8	0	0
2022-01-02 06:00:00		6.99	-51.49	28.6	966.7	0	0
2022-01-02 18:00:00		7.11	-51.48	28.5	965.5	0	0
2022-01-03 06:00:00		6.99	-51.47	28.6	965	0	0
2022-01-03 18:00:00		7.11	-51.46	28.5	964.2	0	0
2022-01-04 06:00:00		6.97	-51.46	28.6	964	0	0
2022-01-04 18:00:00		7.1	-51.45	28.5	963.1	0	0
2022-01-05 06:00:00		7.05	-51.45	28.5	963.3	0	0
2022-01-05 18:00:00		7.05	-51.42	28.5	960.4	0	0
2022-01-06 06:00:00		7.04	-51.44	28.5	962	2.6	2.6
2022-01-06 18:00:00		7.04	-51.43	28.5	961.4	0	0
2022-01-07 06:00:00		7.03	-51.44	28.5	962.3	0	0
2022-01-07 18:00:00		7.07	-51.43	28.5	961	0.2	0.2
2022-01-08 06:00:00		6.99	-51.42	28.6	960.1	2.2	2.4
2022-01-08 18:00:00		7.04	-51.43	28.5	961.2	1.6	1.6
2022-01-09 06:00:00		6.98	-51.43	28.6	961	2	3.6
2022-01-09 18:00:00		7.01	-51.44	28.5	961.6	7.4	7.4
2022-01-10 06:00:00		6.91	-51.45	28.5	962.7	2.4	9.8
2022-01-10 18:00:00		7.02	-51.46	28.5	964.3	8.8	8.8
2022-01-11 06:00:00		6.9	-51.46	28.6	964.4	2.2	11
2022-01-11 18:00:00		7.03	-51.45	28.5	963.1	9	9
2022-01-12 06:00:00		6.89	-51.45	28.5	962.9	9.6	18.6
2022-01-12 18:00:00		7	-51.45	28.5	963.3	9.2	9.2
2022-01-13 06:00:00		6.88	-51.45	28.5	962.9	9.6	18.8
2022-01-13 18:00:00		7	-51.45	28.5	962.7	9	9
2022-01-14 06:00:00		6.88	-51.45	28.5	963.3	9.6	18.6
2022-01-14 18:00:00		7.01	-51.45	28.5	963.1	9.2	9.2
2022-01-15 06:00:00		6.91	-51.47	28.6	964.8	8.8	18
2022-01-15 18:00:00		6.99	-51.48	28.5	965.8	8.8	8.8
2022-01-16 06:00:00		6.9	-51.47	28.6	965.1	8.6	17.4
2022-01-16 18:00:00		7.02	-51.48	28.5	965.8	8.4	8.4
2022-01-17 06:00:00		6.9	-51.48	28.6	966.1	8.8	17.2
2022-01-17 18:00:00		6.99	-51.48	28.5	966.1	8.4	8.4
2022-01-18 06:00:00		6.83	-51.47	28.5	964.9	9.6	18
2022-01-18 18:00:00		7.03	-51.45	28.5	963.1	9	9
2022-01-19 06:00:00		6.87	-51.45	28.5	963.2	9.6	18.6
2022-01-19 18:00:00		7.05	-51.42	28.5	959.8	8.6	8.6
2022-01-20 06:00:00		6.89	-51.39	28.6	957.3	8.2	16.8
2022-01-20 18:00:00		7.03	-51.38	28.5	955.9	7.2	7.2
2022-01-21 06:00:00		6.87	-51.39	28.6	957.5	8.8	16
2022-01-21 18:00:00		6.99	-51.39	28.5	956.8	8.6	8.6
2022-01-22 06:00:00		6.92	-51.34	28.6	952.1	3.6	12.2
2022-01-22 18:00:00		6.98	-51.33	28.5	951.3	8	8
2022-01-23 06:00:00		6.86	-51.37	28.5	954.8	7.6	15.6

SECTIONAL VIEW OF ROOF TOP RAIN WATER HARVESTING STRUCTURE AT G.W.D. BUILDING JAIPUR.



SAND (0.5-1.0mm) - 0.03m.
 SAND (1 TO 2mm) - 0.03m.
 GRAVEL (3 TO 5mm) - 0.3m.

C.C. 1:2:4.

T/W 508mm φ WITH GRAVEL -
 SIZE 3 TO 5 mm

AIR LINE 35 MTS.

STATIC WATER LEVEL 32.0MT.

G.W.D. JU.
 DRAWN BY ABDUL AZIZ

Regional Chemical Laboratory, Ground Water Department, Jaipur
Water Analysis Report

S No	Lap No	Location	EC	pH	TDS	Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺	Cl ⁻	SO ₄ ⁼⁼	CO ₃ ⁻	HCO ₃ ⁻	NO ₃ ⁻	F ⁻	TH	Na%	RSC	SAR	Year
			μS/cm at 25 C		---mg/L---													---meq/L---		
246	377	GWD Campus	910	7.80	546	73	5	36	51	106	110	0	159	84	0.04	300	34.2	0	1.8	2021
245	378	GWD Campus	1000	7.90	696	82	6	62	44	113	130	0	244	137	0.20	335	34.2	0	2.0	2020
242	376	GWD Campus	970	8.20	704	73	5	42	54	121	115	0	220	185	0.08	325	32.5	0	1.8	2019
205	582	GWD Campus	1000	8.00	595	70	5	46	57	135	34	0	189	154	0.60	350	29.9	0	1.6	2015
208	208	GWD Campus	790	8.00	466	77	5	42	34	99	5	0	268	69	0.10	245	40.1	0	2.2	2014



केन्द्रीय भूमिजल बोर्ड,
क्षेत्रीय रासायनिक प्रयोगशाला
पश्चिमी क्षेत्र, जयपुर



TEST REPORT

Accreditation NABL Certificate No. TC-5898

Sender : Sujeet Kumar Sc.D

Test Item- Ground water

Lab ID No. 141S/1-5

1. Chemical Testing

1. Water

PROTOCOL OF TEST AND METHOD

pH-	APHA 23rd Edition, 4500 H B
EC-	APHA 23rd Edition, 2510 B
Cl-	APHA 23rd Edition, 4500 Cl B
F-	APHA 23rd Edition, 4500-F D
NO ₃ -	APHA 23rd Edition, 4500 NO ₃ B

Letter N DATED 21.2.22

Receipt Da 21.2.22

Container: Polyethylene

Quantity: 1 lt

Sample Condition: OK

PROTOCOL OF TEST AND METHOD

TH-	APHA 23rd Edition, 2340 C
Ca-	APHA 23rd Edition, 3500 Ca B
Mg-	APHA 23rd Edition, 3500 Mg B
Na	APHA 23rd Edition, 3500- Na B
K	APHA 23rd Edition, 3500 K B

*Parameter under NABL.

Type of study Systematic/Pollution/Hydrograph Network/Short Term/Exploration/Naqum/ Others

Lab Id No.	District	Block	Location	Depth in m.	Aquifer	Sampling Date	Analysis Date	Lat.	Long.	Temp.	pH*	EC* μS/cm at 25°C	CO ₂	HCO ₃	Cl*	SO ₄	NO ₃ *	PO ₄	F*	TH*	Ca*	Mg*	Na*	K*	TDS		
													mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
141S/1	JAIPUR	JHOTWARA	RAJBHWAN	NM	RECHARGE P	19.2.21	Feb-22	NM	NM	NM	7.33	560	Nil	159	60	72	2.3	0.03	0.36	150	44	9.7	56	17.10	364		
141S/2	JAIPUR	JHOTWARA	RAJBHWAN	NM	TW	19.2.21	Feb-22	NM	NM	NM	7.08	1850	Nil	403	224	188	200	0.04	0.12	720	140	90.0	128	3.00	1203		
141S/3	JAIPUR	SANGANER	ANKITROOF ING LTD	NM	TW	19.2.21	Feb-22	NM	NM	NM	7.96	2370	Nil	671	355	162	38	0.06	3.50	170	36	19.5	500	2.40	1541		
141S/4	JAIPUR	SANGANER	ANKITROOF ING LTD	NM	RECHARGE P	19.2.21	Feb-22	NM	NM	NM	8.99	2016	24.00	122	206	557	13	0.18	0.48	60	16	4.9	225	370	1310		
141S/5	JAIPUR	SANGANER	GWD OFFICE	NM	TW	21.2.21	Feb-22	NM	NM	NM	7.32	1150	Nil	305	106	101	140	0.02	0.18	440	88	53.5	76	10.80	748		

Note: 1. The Test results relate only to the sample tested

2. Results Apply to Sample as received

3. Sample will be destroyed after retention time of 15 days unless specially specified other

4. BDL - Below Detection Limit

5. NSS- No sample submitted

6. NM-Not Mentioned

Remark:

Analysed by
Aruna Saini
Assistant Chemist

Authorised signatory

Dr. JAIPAL GARG

Chemist

TM

DATE-22.2.22

Appendix B-4.2: Rajasthan RWH Inspection**RJ-3****Format of the Site Visit Report for Inspection of RWH Structures****(Raj Bhawan)**

Introduction: Raj Bhawan located in block Jhotwara, District-Jaipur of Rajasthan State. The latitude: 26°54' 30" and Longitude 75°47'19"

Ownership and Maintenance Responsibility of the Recharge Structure: Govt. Of Rajasthan has ownership of this Roof Top Rain Water Harvesting Structure (RTRWH) and Executive Engineer (Civil) , GWD is maintaining the RTRWH structure constructed by Ground Water Department.

Objective and purpose of RWH Scheme under Reference: The RTRWH Constructed during the year 2000-2001 under Central Sector Scheme by the Ground Water Department. The purpose of the RTRWH is to artificial recharge of Ground by means of Roof Top Rain Water and also regular monitoring of Water level by Telemetric Digital Water level Recorder installed in Piezometer is being carried out.

General Geology and Hydrogeology:

1. Geological Formation : Quaternary formations underlain by the formations of Delhi Super group.
2. Depth to Water level: Pre monsoon 2012- 26.4 meters bgl and pre monsoon 2021 22.7 meters bgl. at present 21.90 meters. The rise of 3.7 meters water level have been observed from pre monsoon 2012 to pre monsoon 2021. (Annexure 1 & 2)
3. Piezometer Water level trend enclosed form the year 2012 to 2021. (Annexure 1)

Type of Recharge Structure: 19 meter depth Injection well /recharge shaft in the existing dug well.

Details of Structures: 19 meter depth Injection well /recharge shaft in the existing dug well.

Design of Structure : Enclosed as annexure-(Annexure-3)

Water Level and Quality :

Chemical quality	(Year 2014)	At present
Ec:	910 mmhos/cm. at 25°C	1850 mmhos/cm. at 25°C
Cl:	113 ppm	224 ppm
No ₃ :	89 ppm	200 ppm
F:	0.30 ppm	0.12 ppm

Enclosed as annexure-(Annexure-4a & 4b)

Any other relevant Information considered to be incorporated

Observations/ Conclusion : Roof Top Rain Water Harvesting Structure (RTRWH) constructed during the year 2000-2001 by the Ground Water Department in the Central Sector Scheme has been found in good condition after a long span of 20 years. No debris found choked in recharge trench and also no water has been found in the recharge trench. Therefore it is concluded that this structure is working properly since 2001. The rise of 3.7 meters water level have been observed from pre monsoon 2012 to pre monsoon 2021.

Annexure:-

1. **Questionnaire as provided by the Inspection Team (See next page)**

Questionnaire

1. **Industrial effluents discharged (In case if Industrial area)**

No industrial effluents discharge.

2. **Is there any Effluent/ Sewage disposal mechanism; details of same including treatment procedure, if any, before disposal**

No industrial effluents discharge

3. **Mechanism for insulation of effluent/ sewage from Recharge feeder channel (s)/ chambers**

No industrial effluents discharge.

4. **Frequency of Cleaning of ROOF Top in case of RTRWH.**

Every before the onset of monsoon and during the monsoon 2-3 times cleaning of ROOF Top.

5. **If runoff from paved area is being recharged, method to ensure prevention from contamination.**

Only rooftop area has been taken for the runoff and no paved area has been taken.

6. **Frequency of cleaning/ replacement of filter Media.**

Every year before the onset of monsoon only cleaning/desalting of Upper surface of Filter Media and no replacement of filter media replaced till date.

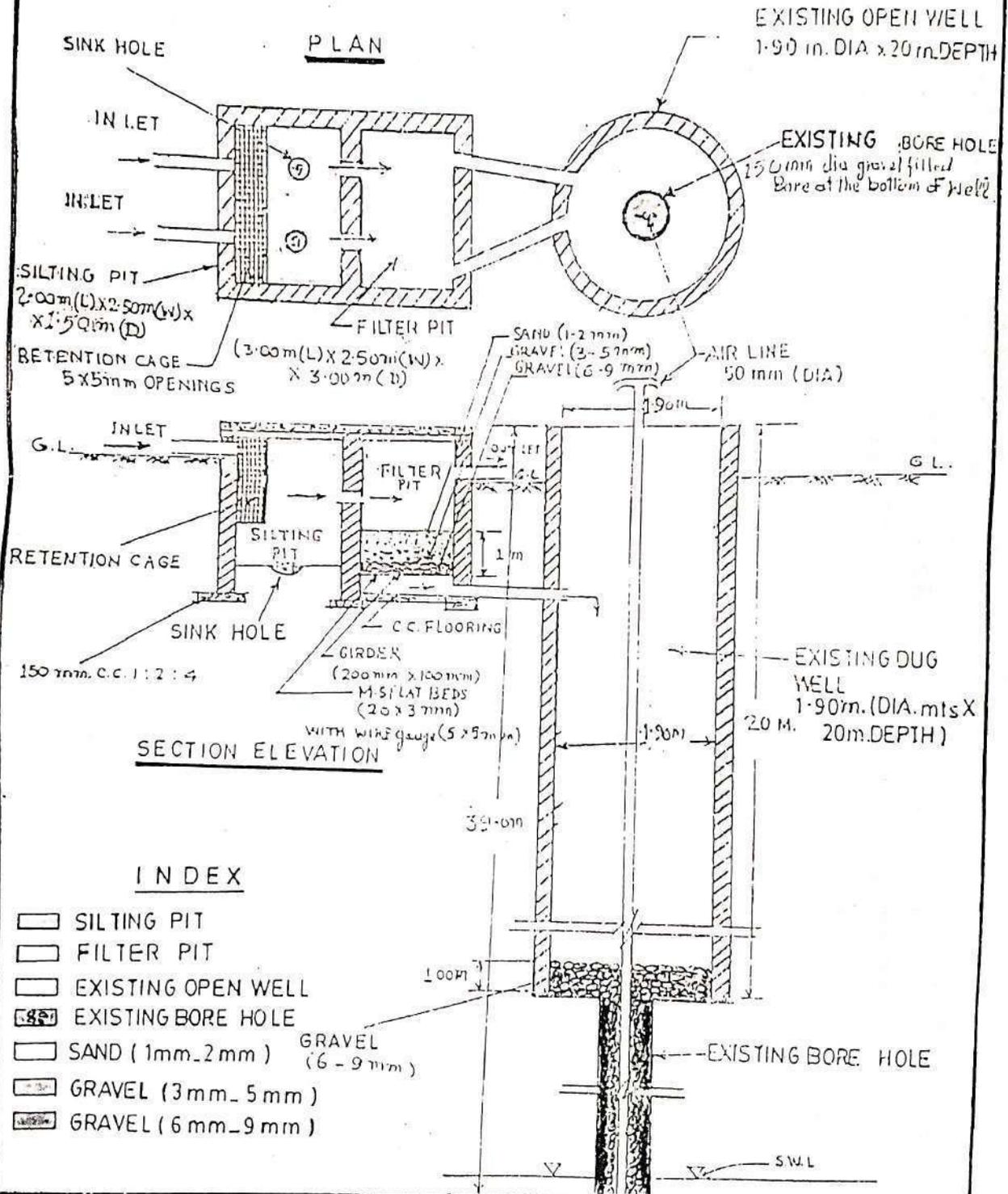
2. **Documents required:**

- a) Building Bylaws mandating RTRWH enclosed an annexure-
- b) Penal Provision if any for not complying with Building By-laws
- c) Water Quality impact assessment related to contamination of Ground water-No contamination found.
- d) Does state has any provision/ Guidelines to prevent contamination from recharged water-

(NA)

LAY OUT PLAN AND VERTICAL SECTION OF RAIN WATER HARVESTING STRUCTURE IN THE PREMISES OF RAJ BHAWAN (REST HOUSE AND OFFICE BUILDING) JAIPUR.

NOT TO SCALE



SENIOR HYDROGEOLOGIST, GWD, JAIPUR.

Ground Water DepartmentNOTE ON ROOF TOP RAIN WATER HARVESTING STRUCTURES CONSTRUCTED IN
RAJ BHAWAN CAMPUS AND THEIR IMPACT ON WATER LEVEL TRENDS

In Jaipur urban area, the withdrawal of ground water is much greater than recharge to aquifers which has resulted into depletion of water levels @ 1.50 meter per year in early years as demand increased many folds with expanding population due to urbanization, expansion of industries and large livestock etc.

As per Ground Water Resources Assessment Report, 2013, Jaipur district has been categorized as "Over Exploited" and "Notified" by CGWA, MoWR, Gol, New Delhi. In Notified areas Ground Water can be abstract with the permission of concerning District Collector only for the drinking purpose.

Looking to the Ground water declining trend and deterioration of Quality, Roof Top Rain Water Harvesting structures (RTRWHS) for the augmentation of Ground Water Resources and for the sustainability of ground water 11 RWH have been constructed at Raj Bhawan campus. The details of these RWH have been described in Table: 1.

Table: 1Details of Roof Top Rain Water Harvesting Structures In Raj Bhawan Campus:

Sr. No.	Location of RTWRWHS	No. of Structure	Quantity of Water likely To be Recharge Annually
1	Back Lawn Near Main House	1	378.0 cubic mtr/year
2	R.A.C. Campus	1	373.0 cubic mtr/year
3	Near Shiv Temple	1	788.7 cubic mtr/year
4	Office Bungalows (Small Structures)	8	595.0 cubic mtr/year
	Total Number of RWHS	11	2134.7 cubic mtr/year

Hence an approximately 21.34 lacs liters of Rain water is being recharge annually to ground water by artificial means.

Monitoring of Recharge Structure by Digital Telemetry Water Level Recorder:

To monitor the impact of Recharge structures on water levels in the Raj Bhawan Campus Piezometers was installed in the month of May, 2008. Initially the water levels were recorded during pre and post monsoon period and after sometimes later on Telemetry Digital Water Level Recorder was installed to monitor water level two times in a day. The water level trend from the year 2010 to 2017 is shown in Table:2.

Table:2.

Pre and Post Monsoon Water Levels From the Year 2010 to 2017.

Sr. No.	Year	Pre Monsoon Water Level(m)	Post Monsoon Water Level (m)	Change In water Level (m)
1	2010	30.8	27.6	+3.2
2	2011	27.6	25.4	+2.2
3	2012	26.4	26.15	+0.25
4	2013	24.3	24.55	-0.25
5	2014	23.91	23.10	+0.81
6	2015	24.5	23.8	+0.70
7	2016	24.47	22.95	+1.52
8	2017	23.8	23.02	+0.78
Average		25.72	24.57	+1.15

The trend of water level indicates that during the last eight years the pre monsoon water level has risen from 30.80(Year 2010) to 23.80(Year 2017) meters i.e 7.0 meter rise. Whereas change or recharge in water level shows that average rise is 1.15 meter/year. Rise in water level is due to the positive impact on ground water regime by these RWHs and on the other hand the water supply is based on Bisalpur. So many Production Wells of PHED are not in use in the area. At present the Rain Water Harvesting Structures are maintained by the PWD.

If such practice of Rain Water Harvesting structure implemented in Urban/Rural area of State the picture of Ground Water may change. This example of Rain Water Harvesting Structure may be used for mass awareness.

Sr.no	Well Type	Block	Village	Address/Location	latitude			Longitude			RL (m) (in mtr.)	Hyd_Formation	Zone	186 Total Depth_bgl (in mtr.)	WL_pre_12 (in mtr.)	WL_pre_13 (in mtr.)	WL_pre_14 (in mtr.)	WL_pre_15 (in mtr.)	WL_pre_16 (in mtr.)	WL_pre_17 (in mtr.)	WL_pre_18 (in mtr.)	WL_pre_19 (in mtr.)	WL_pre_20 (in mtr.)	WL_pre_21 (in mtr.)	Fluctuation	
					D	M	S	D	M	S															Premonsoon 2012_ (in mtr.)	Premonsoon 2021 (in mtr.)
1	PZ	Jhotwara	Raj Bhawan	In the back side of Main Raj Bhawan building, RAC batalion office.	26	54	30	75	47	1.9	428.3	Yr. Alluvium	A	100	26.4	24.3	23.91	24.5	24.47	23.8	22.3	26.9	24.8	22.7	3.7	
2	PZ	Sanganer	Gwd Campus	In front of A. En. Office, GWD campus , Jhalan Dungri	26	52	25	75	49	10.8	444.7	Older Alluvium	Ao	112	62.75	58.03	58.45	55.18	55.98	54.2	54.2	54.11	53.56	52.6	10.15	

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Station Name: RJGW_4389

Station Code: RJGW_4389

State: Rajasthan

District: JAIPUR

Tehsil: JHOTWARA

Block: JHOTWARA

Village: Raj Bhawan

Date(IST)

Parameter: GGZ(GPRS-Water Level)-m

18/03/2021 00:00:00.00	-21.359
18/03/2021 06:00:00.00	-21.35
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18/03/2021 18:00:00.00	-21.342
19/03/2021 00:00:00.00	-21.356
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19/03/2021 18:00:00.00	-21.366
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20/03/2021 06:00:00.00	-21.362
20/03/2021 12:00:00.00	-21.435
20/03/2021 18:00:00.00	-21.372
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21/03/2021 06:00:00.00	-21.383
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21/03/2021 18:00:00.00	-21.353
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201

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202

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206

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25/12/2021 00:00:00.00	-21.968
25/12/2021 06:00:00.00	-21.952
25/12/2021 12:00:00.00	-21.914
25/12/2021 18:00:00.00	-21.98
26/12/2021 00:00:00.00	-21.95
26/12/2021 06:00:00.00	-21.932
26/12/2021 12:00:00.00	-21.879
26/12/2021 18:00:00.00	-21.942
27/12/2021 00:00:00.00	-21.911
27/12/2021 06:00:00.00	-21.894
27/12/2021 12:00:00.00	-21.859
27/12/2021 18:00:00.00	-21.924
28/12/2021 00:00:00.00	-21.896
28/12/2021 06:00:00.00	-21.885
28/12/2021 12:00:00.00	-21.829
28/12/2021 18:00:00.00	-21.893
29/12/2021 00:00:00.00	-21.869
29/12/2021 06:00:00.00	-21.859
29/12/2021 12:00:00.00	-21.852
29/12/2021 18:00:00.00	-21.917
30/12/2021 00:00:00.00	-21.874
30/12/2021 06:00:00.00	-21.852
30/12/2021 12:00:00.00	-21.827
30/12/2021 18:00:00.00	-21.838
31/12/2021 00:00:00.00	-21.855
31/12/2021 06:00:00.00	-21.842
31/12/2021 12:00:00.00	-21.881
31/12/2021 18:00:00.00	-21.816
01/01/2022 00:00:00.00	-21.842
01/01/2022 06:00:00.00	-21.833
01/01/2022 12:00:00.00	-21.873
01/01/2022 18:00:00.00	-21.839
02/01/2022 00:00:00.00	-21.832
02/01/2022 06:00:00.00	-21.841
02/01/2022 12:00:00.00	-21.886
02/01/2022 18:00:00.00	-21.876
03/01/2022 00:00:00.00	-21.924
03/01/2022 06:00:00.00	-21.821

03/01/2022 12:00:00.00	-21.821
03/01/2022 18:00:00.00	-21.829
04/01/2022 00:00:00.00	-21.825
04/01/2022 06:00:00.00	-21.82
04/01/2022 12:00:00.00	-21.827
04/01/2022 18:00:00.00	-21.83
05/01/2022 00:00:00.00	-21.828
05/01/2022 06:00:00.00	-21.825
05/01/2022 12:00:00.00	-21.823
05/01/2022 18:00:00.00	-21.822
06/01/2022 00:00:00.00	-21.825
06/01/2022 06:00:00.00	-21.826
06/01/2022 12:00:00.00	-21.829
06/01/2022 18:00:00.00	-21.82
07/01/2022 00:00:00.00	-21.824
07/01/2022 06:00:00.00	-21.824
07/01/2022 12:00:00.00	-21.82
07/01/2022 18:00:00.00	-21.824
08/01/2022 00:00:00.00	-21.824
08/01/2022 06:00:00.00	-21.826
08/01/2022 12:00:00.00	-21.826
08/01/2022 18:00:00.00	-21.821
09/01/2022 00:00:00.00	-21.828
09/01/2022 06:00:00.00	-21.823
09/01/2022 12:00:00.00	-21.821
09/01/2022 18:00:00.00	-21.821
10/01/2022 00:00:00.00	-21.821
10/01/2022 06:00:00.00	-21.825
10/01/2022 12:00:00.00	-21.823
10/01/2022 18:00:00.00	-21.83
11/01/2022 00:00:00.00	-21.823
11/01/2022 06:00:00.00	-21.825
11/01/2022 12:00:00.00	-21.828
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12/01/2022 00:00:00.00	-21.821
12/01/2022 06:00:00.00	-21.829
12/01/2022 12:00:00.00	-21.823
12/01/2022 18:00:00.00	-21.823
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13/01/2022 06:00:00.00	-21.829
13/01/2022 12:00:00.00	-21.826
13/01/2022 18:00:00.00	-21.824
14/01/2022 00:00:00.00	-21.822
14/01/2022 06:00:00.00	-21.829
14/01/2022 12:00:00.00	-21.824
14/01/2022 18:00:00.00	-21.821
15/01/2022 00:00:00.00	-21.83
15/01/2022 06:00:00.00	-21.83
15/01/2022 12:00:00.00	-21.82
15/01/2022 18:00:00.00	-21.823
16/01/2022 00:00:00.00	-21.824
16/01/2022 06:00:00.00	-21.828
16/01/2022 12:00:00.00	-21.83
16/01/2022 18:00:00.00	-21.823
17/01/2022 00:00:00.00	-21.823

Regional Chemical Laboratory, Ground Water Department, Jaipur
Water Analysis Report

S No	Lap No	Location	EC	pH	TDS	Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺	Cl ⁻	SO ₄ ⁻⁻	CO ₃ ⁻	HCO ₃ ⁻	NO ₃ ⁻	F	TH	Na%	RSC	SAR	Year
			μS/cm at 25°C		---mg/L---													---meq/L---		
159	290	Raj Bhawan	1240	8.20	743	106	6	26	86	227	101	0	110	136	0.04	420	35.0	0	2.2	2021
159	291	Raj Bhawan	1290	8.10	756	98	6	38	79	220	77	0	183	147	0.46	420	33.2	0	2.1	2020
155	289	Raj Bhawan	1300	8.30	868	101	4	52	74	220	163	12	159	162	0.34	435	33.3	0	2.1	2019
133	303	Raj Bhawan	1050	8.10	577	158	11	16	35	128	19	0	378	21	1.64	185	63.3	2.5	5.0	2017
133	897	Raj Bhawan	910	7.90	595	95	7	40	66	113	106	24	110	89	0.30	370	35.4	0	2.2	2016



केन्द्रीय भूमिजल बोर्ड,
क्षेत्रीय रासायनिक प्रयोगशाला
पश्चिमी क्षेत्र, जयपुर



TEST REPORT

Accreditation NABL Certificate No. TC-5898

Sender : Sujeet Kumar Sc.D

Test Item- Ground water

Lab ID No. 141S/1-5

1. Chemical Testing

1. Water

PROTOCOL OF TEST AND METHOD

pH-	APHA 23rd Edition, 4500 H B
EC-	APHA 23rd Edition, 2510 B
Cl-	APHA 23rd Edition, 4500 Cl B
F-	APHA 23rd Edition, 4500- F D
NO ₃ -	APHA 23rd Edition, 4500 NO ₃ - B

Letter N DATED 21.2.22

Receipt Date 21.2.22

Container: Polyethylene

Quantity: 1 lt

Sample Condition: OK

PROTOCOL OF TEST AND METHOD

TH-	APHA 23rd Edition, 2340 C
Ca-	APHA 23rd Edition, 3500 Ca B
Mg-	APHA 23rd Edition, 3500 Mg B
Na	APHA 23rd Edition, 3500- Na B
K	APHA 23rd Edition, 3500 K B

*Parameter under NABL

Type of study Systematic/Pollution Hydrograph Network/Short Term/Exploration/Naqum Others

Lab Id No.	District	Block	Location	Depth in m.	Aqui-fer	Sampling Date	Analysis Date	Lat.	Long.	Temp.	pH*	EC* µS/cm at 25°C	CO ₂	HCO ₃	Cl*	SO ₄	NO ₃ *	PO ₄	F*	TH*	Ca*	Mg*	Na*	K*	TDS
													mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
141S/1	JAIPUR	JHOTWARA	RAJBHWAN	NM	RECHARGE P	19.2.21	Feb-22	NM	NM	NM	7.33	560	Nil	150	60	72	2.3	0.03	0.36	150	44	9.7	56	17.10	364
141S/2	JAIPUR	JHOTWARA	RAJBHWAN	NM	TW	19.2.21	Feb-22	NM	NM	NM	7.08	1850	Nil	403	224	188	200	0.04	0.12	720	140	90.0	128	5.00	1203
141S/3	JAIPUR	SANGANER	ANKITROOF ING LTD	NM	TW	19.2.21	Feb-22	NM	NM	NM	7.96	2370	Nil	671	355	162	38	0.06	3.50	170	36	19.5	500	2.40	1541
141S/4	JAIPUR	SANGANER	ANKITROOF ING LTD	NM	RECHARGE P	19.2.21	Feb-22	NM	NM	NM	8.99	2016	24.00	122	206	557	13	0.18	0.48	60	16	4.9	225	370	1310
141S/5	JAIPUR	SANGANER	GWD OFFICE	NM	TW	21.2.21	Feb-22	NM	NM	NM	7.32	1150	Nil	305	106	101	140	0.02	0.18	440	88	53.5	76	10.80	748

Note: 1. The Test results relate only to the sample tested

2. Results Apply to Sample as received

3. Sample will be destroyed after retention time of 15 days unless specially specified other

4. BDL - Below Detection Limit

5. NSS- No sample submitted

Remark:

Analysed by

Aruna Saini

Assistant Chemist

3/2/22
Authorised signatory

Dr. JAIPAL GARG

Chemist & S

TM

DATE-22.2.22



ABSTRACT

Rules – Framing of the Tamil Nadu Combined Development and Building Rules, 2019 – Notification - Issued.

MUNICIPAL ADMINISTRATION AND WATER SUPPLY (MA.I) DEPARTMENT

G.O.(Ms) No.18

Dated: 04.02.2019
(Thiruvalluvar Aandu 2050,
Vilambi, Thai - 21)

Read:

1. From the Secretary, MoUD, GOI, D.O.No.K-14011/ 83/2016-UD-II, dated 12.09.2016.
2. From the Member-Secretary, CMDA, letter No.C1/ 20172/2013, dated 09.03.2017 and 02.06.2017.
3. G.O.Ms.No.81, MAWS(MA1) Dept, dated 21.08.2018.
4. From the Principal Secretary/Member-Secretary, CMDA, D.O.Ir.No.C1/14867/2018, dated 24.10.2018.
5. Meeting held on 22.11.2018 to discuss the recommendations of the Committee on the comments from public.
6. From the Principal Secretary/Member-Secretary, CMDA, D.O.Ir.No.C1/14867/2018, dated 29.11.2018.
7. The Public (SC) Department, letter No.C.D No.18 (02/2019), dt.19.01.2019, communicating the Extract of the Minutes the meeting of the Council of Ministers held on 18.01.2019.

ORDER:

There is a need to ensure more efficient and sustainable utilization of scarce land, ensuring availability of land for various purposes to make housing more affordable, ensure effective enforcement of regulations relating to development and building construction and to promote ease of doing business in the State of Tamil Nadu. Therefore, the Government after careful consideration, have decided to revise and re-issue various existing Building Rules under various Acts for Corporations, Municipalities, Town Panchayats and Village Panchayats and Development Rules/Regulations issued under the Tamil Nadu Town & Country Planning Act, 1971 as the Tamil Nadu Combined Development and Building Rules, 2019.

2. The Tamil Nadu Combined Development and Building Rules, 2019 are aimed at simplifying the rules and procedure for approval, for development of layouts and buildings with focus on safety, security and sustainability as also to enhance consistency and transparency. This exercise

is based on a number of studies, reports and International consensus reflected in the United Nations Habitat's New Urban Agenda, which advocate greater urban density and compactness of cities to promote better use of scarce land and the easing of Floor Space Index (FSI) restrictions to enable persons belonging to the Low Income Group to buy houses at affordable prices. Provisions of the National Building Code, 2016 and the Model Building Bye-laws, 2016 have also been incorporated. The Rules cover the provision of barrier free environment for differently abled, elderly, children, Rain Water Harvesting, Re-cycling of Grey Water, Solar Energy Capture, Provision of Closed Circuit Televisions and Regulation of Swimming Pools.

3. Accordingly, the appended Notification will be published in an Extra-Ordinary issue of the Tamil Nadu Government Gazette dated 04.02.2019.

4. This G.O. issues with the concurrence of Housing & Urban Development Department vide its U.O.No.2167/ UD4(3)/2019, dated 01.02.2019.

(BY ORDER OF THE GOVERNOR)

**HARMANDER SINGH
PRINCIPAL SECRETARY TO GOVERNMENT**

To

The Works Manager, Government Central Press, Chennai – 600 079.
The secretary to Governor, Raj Bhavan, Chennai - 600 022.
The Additional Chief Secretary, RD&PR Dept, Chennai – 600 009.
The Principal Secretary, Hg&UD Dept, Chennai – 600 009.
The Member Secretary, Chennai Metropolitan Development Authority, Chennai – 600 008.
The Commissioner, Greater Chennai Corporation, Chennai – 600 003.
The Commissioner of Municipal Administration, Chennai – 600 005
The Director of Town and Country Planning, Chennai – 600 002.
The Director of Town Panchayats, Chennai 600 108.
The Director of Rural Development and Panchayats Raj, Chennai-600 015.

Copy to

The Secretary to Chief Minister, Chennai – 600 009.
The Senior Personal Assistant to Dy.Chief Minister, Chennai – 600 009.
The Sr P.A. to Minister (MA&RD and Impl, Spl, Prgm), Chennai – 600 009.
The Law Department, Chennai – 600 009.
The Hg&UD Dept, Chennai – 600 009.
The RD&PR Dept, Chennai – 600 009.
SF/SC.

// forwarded by order //

R. Kosalaya

Section Officer.

©
GOVERNMENT OF TAMIL NADU
2019

[Regd. No. TN/CCN/467/2012-14.
[R. Dis. No. 197/2009.
[Price: Rs. 86.40 Paise.



TAMIL NADU GOVERNMENT GAZETTE

EXTRAORDINARY PUBLISHED BY AUTHORITY

No.43]

CHENNAI, MONDAY, FEBRUARY 4, 2019
Thai 21, Vilambi, Thiruvalluvar Aandu-2050

Part III—Section 1(a)

**General Statutory Rules, Notifications, Orders, Regulations, etc.,
issued by Secretariat Departments.**

NOTIFICATIONS BY GOVERNMENT

MUNICIPAL ADMINISTRATION AND WATER SUPPLY DEPARTMENT

TAMIL NADU COMBINED DEVELOPMENT AND BUILDING RULES, 2019,

[G.O. Ms. No. 18, Municipal Administration and Water Supply (MA 1), 4th February 2019,
Thai 21, Vilambi, Thiruvalluvar Aandu-2050.]

No.SRO-A-2(c)/2019.

In exercise of the powers conferred by sub-section (4) of section 32 and section 122 of the Tamil Nadu Town and Country Planning Act, 1971 (Tamil Nadu Act 35 of 1972), section 191 and 303 of the Tamil Nadu District Municipalities Act, 1920 (Tamil Nadu Act V of 1920), section 242 of the Tamil Nadu Panchayats Act, 1994 (Tamil Nadu Act 21 of 1994), section 230 and 347 of the Chennai City Municipal Corporation Act, 1919 (Tamil Nadu Act IV of 1919), section 268 and 431 of the Madurai City Municipal Corporation Act, 1971 (Tamil Nadu Act 15 of 1971), section 268 and 430 of the Coimbatore City Municipal Corporation Act, 1981 (Tamil Nadu Act 25 of 1981), section 11 of the Tiruchirappalli City Municipal Corporation Act, 1994 (Tamil Nadu Act 27 of 1994), section 11 of the Tirunelveli City Municipal Corporation Act, 1994 (Tamil Nadu Act 28 of 1994), section 11 of the Salem City Municipal Corporation Act, 1994 (Tamil Nadu Act 29 of 1994), section 10 of the Tiruppur City Municipal Corporation Act, 2008 (Tamil Nadu Act 7 of 2008), section 10 of the Erode City Municipal Corporation Act, 2008 (Tamil Nadu Act 8 of 2008), section 10 of the Vellore City Municipal Corporation Act, 2008 (Tamil Nadu Act 26 of 2008), section 10 of the Thoothukudi City Municipal Corporation Act, 2008 (Tamil Nadu Act 27 of 2008), section 10 of the Thanjavur City Municipal Corporation Act, 2013 (Tamil Nadu Act 24 of 2013), and section 10 of the Dindigul City Municipal Corporation Act, 2013 (Tamil Nadu Act 25 of 2013), the Governor of Tamil Nadu, hereby makes the following Rules:-

Annexure – XXII

[See rules 35 (5) and 63 (1)]

Rainwater Conservation**Water Conservation:****A. Rain Water Harvesting**

Effective measures shall be taken within each premises (roof top and campus) for conservation of rainwater, and RWH structures to the following standards shall be provided; the same shall be shown in the plan applied for planning permission.

a) Non High Rise Buildings – Buildings of height up to 12m

Following are the recommended designs that can be adopted in the non High Rise Buildings ie., Independent Houses and Apartments with Ground + two floor or Stilt + 3 floors and not more than 16 dwelling units).

- (i) In plots that are being developed/buildings with a dug (source) well, rooftop water to be diverted to a sump for immediate use (if that is relevant), through a first flush cum pebble-sand filter combination or a Special filter and the overflow to be diverted to the source well. The rain falling on the driveway or paved setback areas (around campus) and from rooftop pipes that are not connected to the sump or source well to be intercepted near the gate(s) either by means of a gutter (provided with a perforated lid) or a bump/speed breaker arrangement and led to a recharge well. **(Drawing 1A & 1D)**.
- (ii) In plots to be developed/buildings without an open well, rooftop water to be diverted to a sump for immediate use (if that is relevant), through a first flush cum pebble-sand filter combination or a Special filter and the overflow to be diverted to a recharge well. The rain falling on the driveway or paved setback areas and from rooftop pipes that are not connected to the sump or recharge well to be intercepted near the gate(s) either by means of a gutter (provided with a perforated lid) or a bump/speed breaker arrangement and led to a recharge well. **(Drawing 1B & 1D)**
- (iii) In plots to be developed/buildings where the setback area is very small, not enough to dig a recharge well or sewers, water line, electrical cable running below, rooftop water brought down by pipes should be led to percolation pits, one per pipe. **(Drawing 1C)**

b) Non High Rise Buildings more than 12m height and upto 18.3m height and Industries and Institutional Buildings

In case of Non High Rise developments, Industries, Institutional Buildings as mentioned in all the above cases, rooftop water can be diverted to a sump for immediate use (if that is relevant), through a first flush cum pebble-sand filter combination or a Special filter that is available in the market and the overflow to be

diverted to either a dug (source) well or a recharge well depending on the availability of a source well. Depending on the need and relevance any combination of the above methods can be chosen.

(i) In the above mentioned categories, rain falling on the setback areas as well as some of the rooftops will flow on the driveway itself and runoff to the streets and get wasted. This runoff should be intercepted by means of a bump/speed breaker arrangement constructed in one or more locations within the premises and discharged into suitably designed recharge well (s) located nearby. **(Drawing 3A.)**

(ii) Rain falling on the setback areas as well as some of the rooftops will flow into the storm drains constructed along the periphery of the building, whose slope will always be towards the gate(s) in order to discharge the runoff onto the street. This flow within the drain can be intercepted inside the drain by a baffle wall and injected into several recharge wells located close to the drain. **(Drawing 3B.)**

c) High Rise Buildings (Residential/Commercial)

(i) In plots that are being developed/buildings with a source well, rooftop water to be diverted to a sump for immediate use (if that is relevant), through a first flush cum pebble-sand filter combination or an Special filter that is available in the market and the overflow to be diverted to the source well. The rain falling on the driveway or paved setback areas or from rooftop pipes not connected to the sump or source well to be intercepted near the gate(s) either by means of a gutter (provided with a perforated lid) or a bump and led to a recharge well. **(Drawing 2A & 2D)**

(ii) In plots to be developed/buildings without an open well, rooftop water to be diverted to a sump for immediate use (if that is relevant), through a first flush cum pebble-sand filter combination or a Special filter that is available in the market and the overflow to be diverted to a recharge well. The rain falling on the driveway, paved setback areas, and from rooftop pipes that are not connected to the sump or recharge well to be intercepted near the gate(s) either by means of a gutter (provided with a perforated lid) or a bump/speed breaker arrangement and led to a recharge well. **(Drawing 2B, 2C & 2D)**

B. Recycling Of Grey Water:

Effective measures shall be taken within each premise for recycling of Grey water (water used for washing of cloths and bathing) and structures to the following standards shall be provided, the same shall be shown in the plan applied for Planning permission.

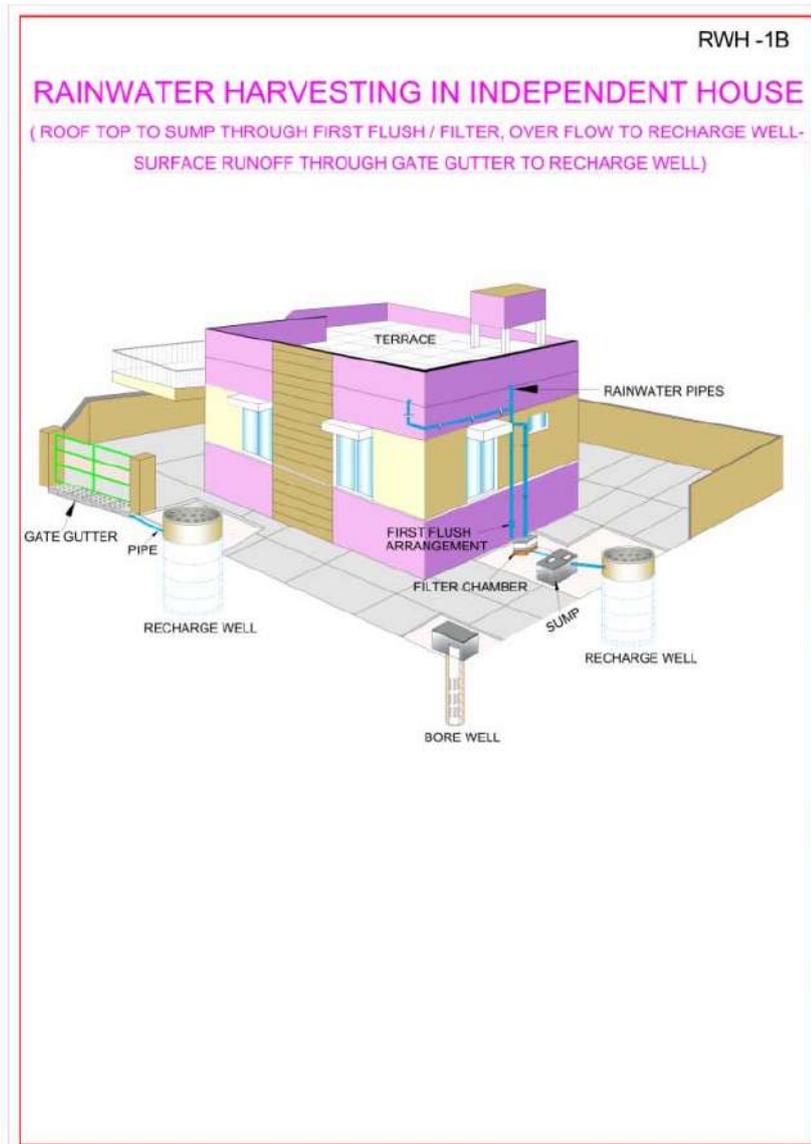
The methodology for the recycling of Grey water for the uses of Ground water recharge (Drawing 4) and flushing of toilet (Drawing No.4B).

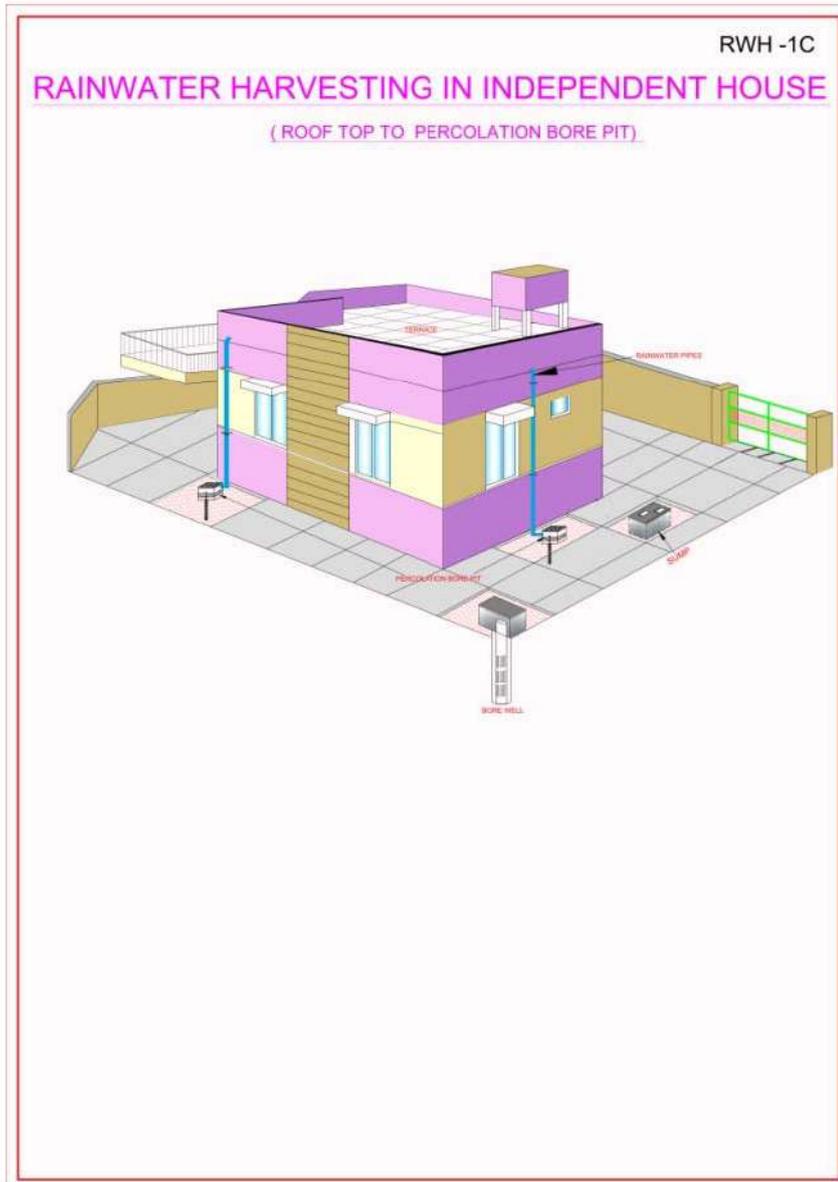
Prepare a soil bed of garden soil whose area should be at least 2.5 sq ft per each individual. Lay the water-loving plant at a distance of one foot from each other laterally and longitudinally. The soil area need not have a regular shape. It can have any shape as long as the requisite area is provided. But the level of the soil bed should be uniform so that the grey water will spread over the entire bed and soil over the entire area is available for cleaning the water. If there are slopes, water will tend to flow more in the lower areas alone and the purification will be incomplete. The plants must receive at least moderate amount of sunlight so that they will grow in a healthy manner.

The plants should be watered with fresh water for two or three weeks till they take root and are stabilised and then the grey (used) water should be diverted to it in progressively increased volumes over a week. Thereafter, the process is practically self-sustaining. **(Drawing 4A)**

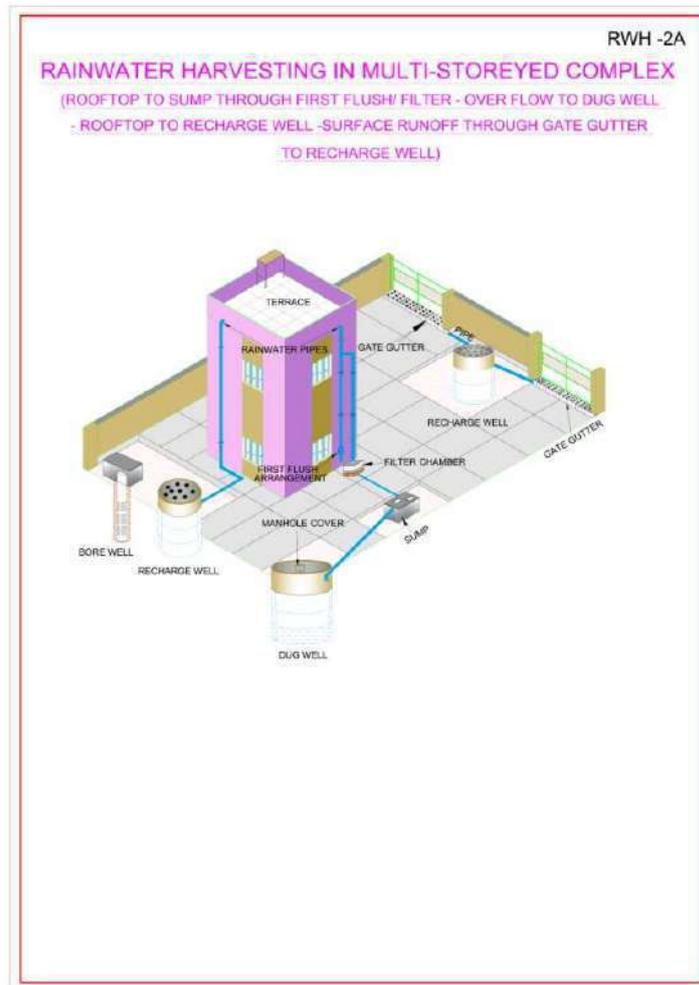
If the treated water is to be physically recovered, a sump has to be built for this purpose. The treated water can then be pumped to the relevant compartment of the overhead tank or to an exclusive tank, for flushing. If there is excess of treated water, the overflow can be connected to a suitable water recharge structure. **(Drawing 4B)**

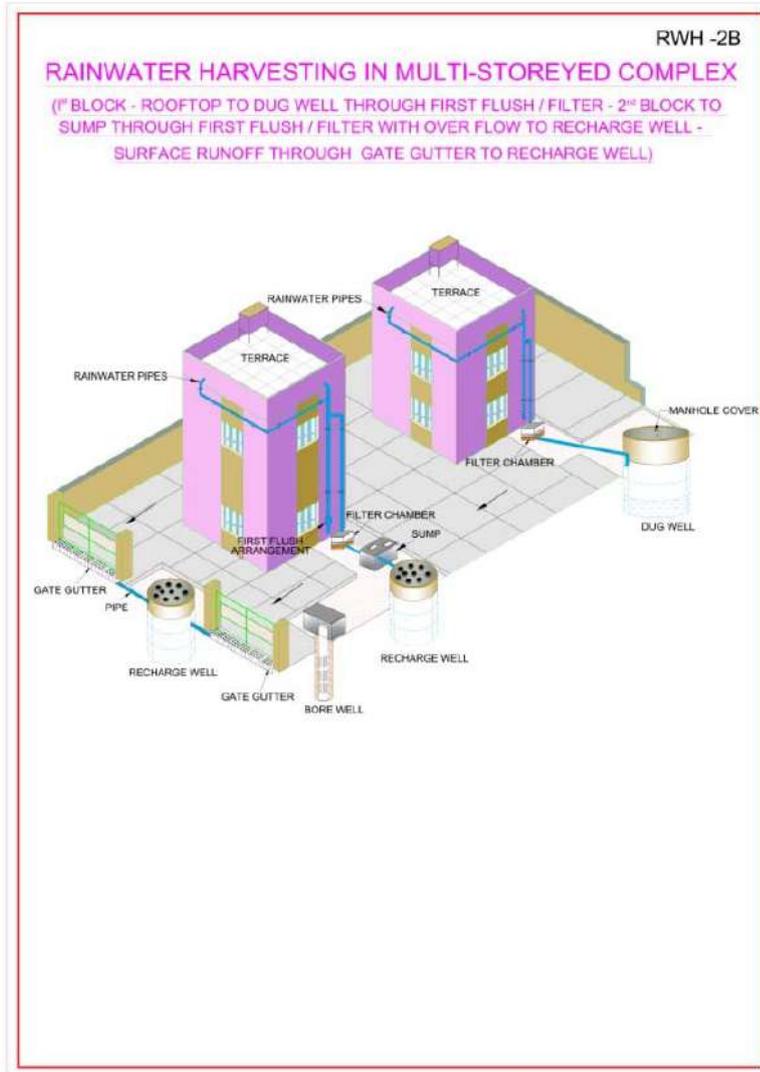




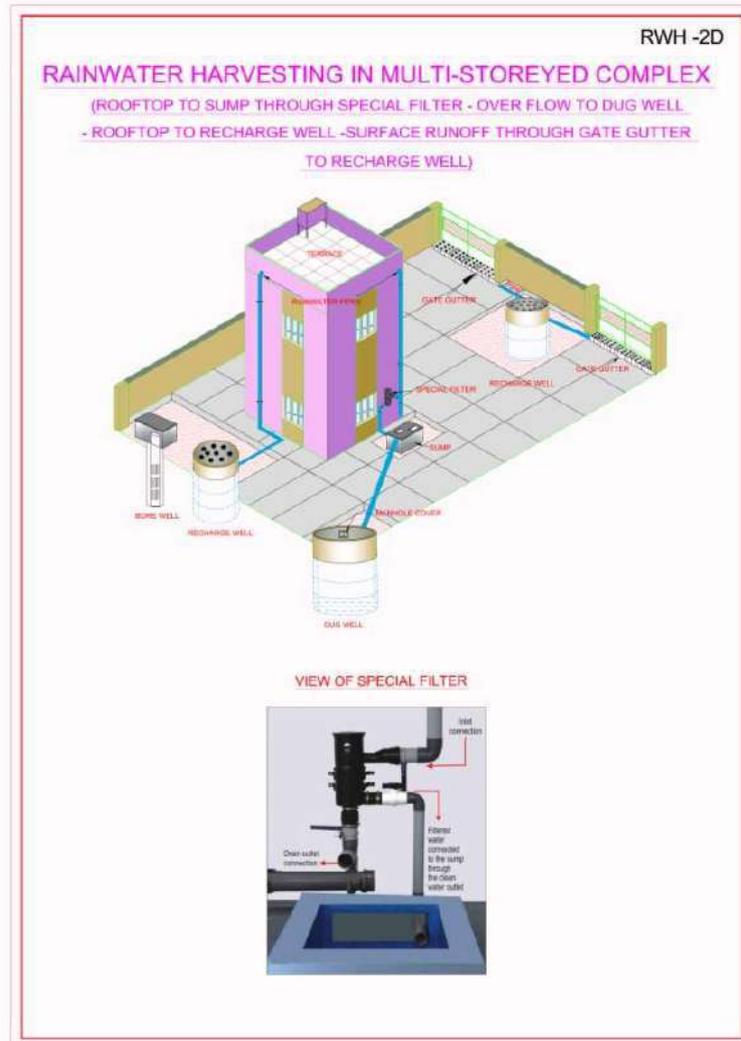




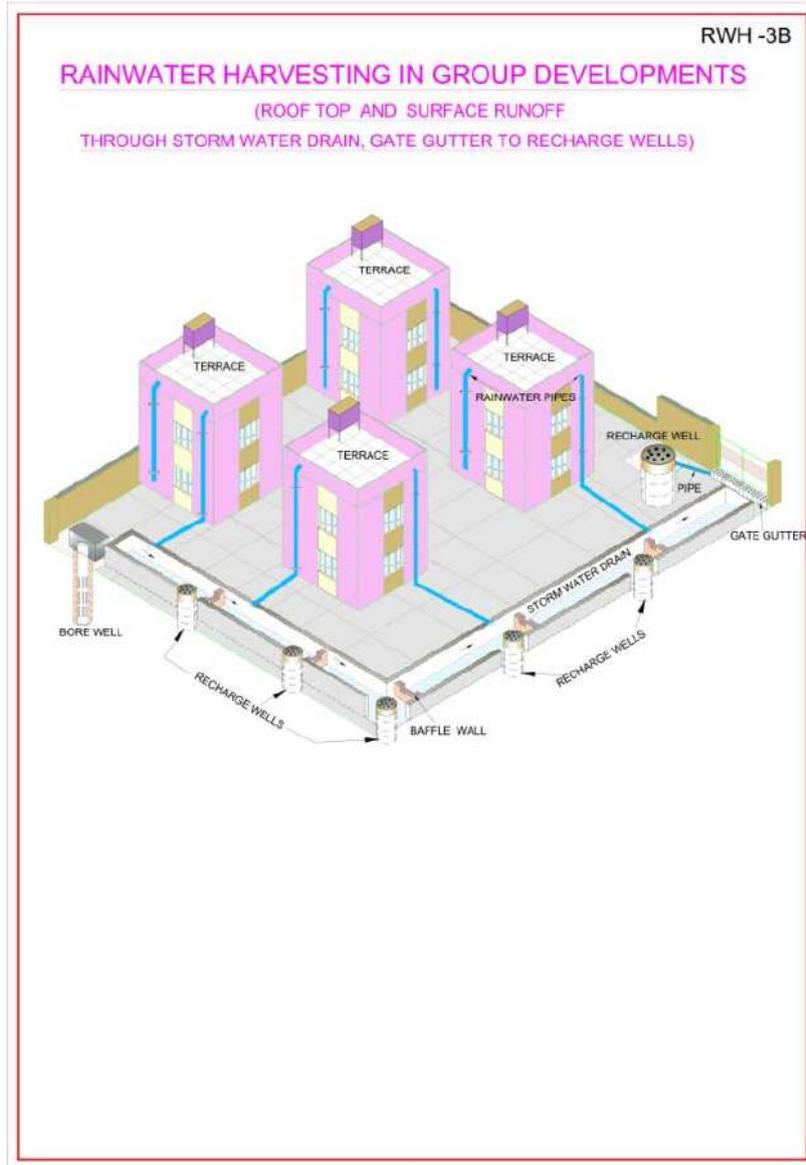


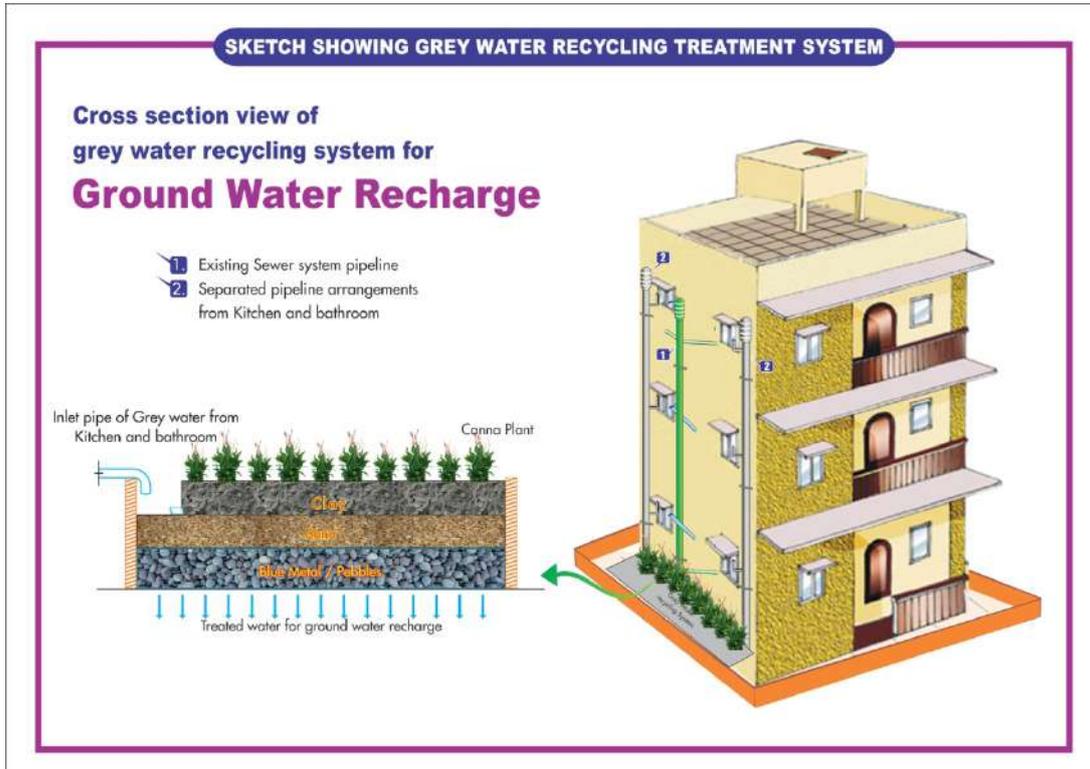




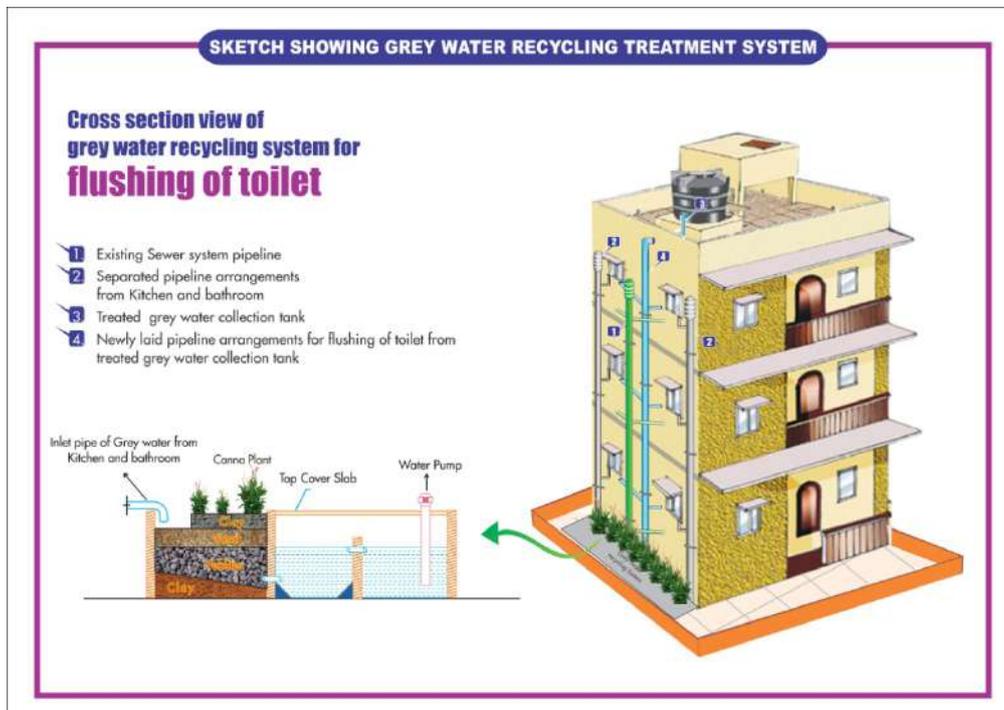








Drawing – 4B



TN-1: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – ROOFTOP HARVESTING SYSTEM AT AKASH GANGA TRUST RAIN CENTRE, ADYAR, CHENNAI, TAMIL NADU

Introduction

Akash Ganga Trust Rain centre, a non-profit service organization, has established a model house on rainwater harvesting (RWH), located at Gandhi Nagar, Adyar Chennai (Coordinates: 13000'33"N, 80015'15.7"E). The Rain Centre has been founded by Shri Sekar Raghvan, who established the centre in **January, 2002** to educate common people about benefits of Rain Water Harvesting and to encourage them to adopt same in their houses. The centre also helps the people implement RWH in independent houses, flat complexes, offices, factories, Institutions etc. in an efficient and cost-effective manner, with trained plumbers and masons.

Objective and purpose of the RWH Scheme

The Roof Top Rainwater Harvesting System is a demonstrative model to educate people about RWH and its importance in urban water management.

Ownership and Maintenance Responsibility of Recharge Structure

The recharge structures present in the Rain centre is owned and maintained by Akash Ganga Trust Rain Centre, Adyar, Chennai. The centre has been set up by.

General Geology and Hydrogeology

The geology is identified as Topsoil of 1.5m, followed by a layer of black clay and sand (down to around 4m and 9m respectively), underlain by highly weathered Charnokite. Water level in the open well inside the premises of Rain centre was 1.80 mbgl on 23.02.2022 (day of visit).

Rainwater Harvesting, Conservation and Recharge System

Fig. TN-1.1 schematically represents the RWH system in the premises.

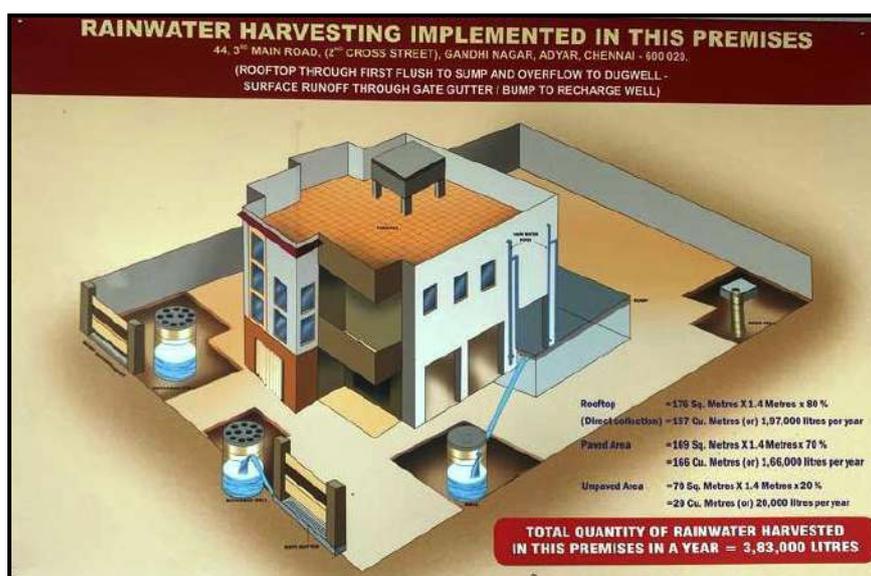


Fig.TN-1.1: Schematic Diagram of all the recharge structures implemented in the premises with its total capacity.

Rainwater Storage Tank/ Sump/ Source Well

Rainwater falling on the clean terraces is brought down by the rooftop pipes. Rainwater is passed through a filter media fitted into the roof top pipes and collected in a sump of 4.5mx3mx3.7m (LxBxD) dimension. The water from the sump is lifted to loft tank for immediate use. The over-flow from the sump gets collected in an open well (termed as Source Well). Groundwater naturally flowing into this well also gets mixed with collected water. This water can be drawn and used after minor treatment. For the domestic purpose and household uses they are using this rainwater. For 4 to 5 months they are using the water from this sump even after the monsoon period. It was informed that the roof top is cleaned before the onset of monsoon and the first flush is by-passed through another pipe line. Rooftop is again cleaned after monsoon season is over.

Driveway Runoff Harvesting through Recharge well

Rainwater falling in the driveway area (all around the built-up area) is quite large and there is also a sizeable contribution from rooftop. This run-off is captured through a shallow gutter (covered with a perforated RCC slab) near the gates and directed to a recharge well of 15 feet depth ($\approx 4.5\text{m}$). This rainwater percolates through the soil and recharges the aquifer. As regard to collection of silt, it was informed that amount of silt getting collected in the well during a season is almost equal to a flowerpot, which is cleaned out after the season.

Quality of Groundwater/ Harvested Water

Samples of water were collected from the sump and the Source Well. Analysis was done at Chemical Laboratory, CGWB, SECR, Chennai. Results of the analysis are summarized in following table.

Table-TN-1.1: Chemical Quality of the water collected from premises

Structure	RWH-Sump	Open Well
Latitude	13.0090	13.0090
Longitude	80.2540	80.2540
PH	6.92	7.05
EC	120	1214
TH	36	295
Ca	13	80
Mg	0.97	23
Na	3.9	121
K	1.7	4.1
CO ₃	0	0
HCO ₃	37	354
SO ₄	9.1	89
Cl	7.1	128
F	0.03	0.61
NO ₃	2.7	0.29
U in ppb	0.512	9.254
Inference	All the water quality parameters well within the desirable limit for drinking	Except Calcium (slightly higher than the desirable limit of 75 mg/l) rest of the

	purpose.	parameters are well within the desirable limit for drinking purpose.
--	----------	--

It can be clearly seen that due to mixing of water due to additional natural flow into open well, the chemical constituents have higher values.

Quantum of Annual Rainwater Harvested/ Conserved

It is estimated that a total quantity of 3,83,000 litres of rainwater is being harvested in a single year.

Cost Involved in Construction of System and Annual Maintenance

Construction cost of the structure was around Rs 35 Lakh (2002) and maintenance cost is approximately 3 Lakh/ annum.

Observations/ Conclusions and Recommendations

1. The run-off from paved areas is being collected through drains covered with perforated slabs and water is allowed into recharge shaft/ well of 15 feet depth directly, without passing through any filter media. Founder of Rain Centre Shri. Sekar Raghavan maintains that providing filter inhibits recharge as the filter is gets choked quickly after one or two rains. Shri Raghvan also encourages common people to adopt this technique. It was pointed out to him that without filter, there is always the possibility of aquifer material getting choked.
2. Apart from the direct recharge without filter, the demonstrative Rain Water Harvesting system is an excellent step Shri Raghvan towards creating awareness about RWH and educating the common people about the methods for RWH.
3. It can be seen from quality analysis that due to **mixing of water due to additional natural flow into open well (source well)**, the chemical constituents have higher values in comparison to water collected in sump.
4. Sufficient amount of rainwater is recharged to the aquifer and a good amount of water is used for the domestic purpose from the rooftop harvesting.
5. Shri Raghvan has been advised to let the water pass through filter media before recharge.

Appendix B-5.2: Tamil Nadu RWH Inspection**TN-2: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – UNDERGROUND STORAGE TANK IN THARAMANI CAMPUS OF WATER RESOURCES DEPARTMENT****Introduction**

A rainwater harvesting system with underground storage tank of total capacity of 6 lakh liters has been constructed in Tharamani Campus of **Water Resources Department**, Saidapet Taluk of Chennai District (12°59'07.5"N, 80°14'40'E). The project is sponsored by Japan International Cooperation Agency (**JICA**) and the construction was completed in **2018**.

Ownership and Maintenance Responsibility of Recharge Structure

The rainwater harvesting structure is owned and maintained by SG & SWRDC wing of Water Resources Department, Tharamani, Chennai.

Objective and purpose of RWH Scheme under reference

The prime objective and purpose of the system is to harvest rooftop rainwater for collection in the tank, to be utilized for domestic purpose in order to tide over the tailing non-rainy days.

General Geology and Hydrogeology

The geology in and around Velachery is identified as topsoil of around 1.5m, followed by a layer of thick black clay up to 12m, underlain by highly weathered Charnokite. There is pegmatitic intrusion between 18-23m. As per the Department's piezometer (PZ125904801438), maintained at the WRD Campus, Tharamani, water level ranges between 0.22-3.62 mbgl. Water level recorded for the month of February 2022 is 1.12 mbgl.

Rainwater Harvesting System, Conservation/ Recharge

Main structure is an Underground Storage tank/Sump where all the roof-top rainwater run-off gets collected for domestic use.

Underground Storage Tank/ SUMP (Fig. TN-2.1a & b)

This rainwater harvesting structure/underground storage tank is made largely using plastic components, like uPVC pipes as the structural vertical members. 216mm dia 1.76m long uPVC pipes are vertically placed on the bottom slab. The pipe's both ends are provided with load distributors, namely an assembly of partition plates-adapter-cone. Only the outer periphery adjacent to the wall is provided with 4 numbers of 164.6mm dia, 485mm long pipes for every intermittent partition plates. Inner 216mm dia, 6.5mm thick vertical pipes carry the vertical loads and the peripheral 164.6mm dia, 5.1mm thick vertical pipes/partition plate assembly carry the vertical load and predominantly, the lateral earth pressure. Hence, the soil reaction on the bottom of the base slab acts as a Uniformly Distributed Load (UDL) at 680mm ctc in both directions. Similarly, the self weight and live load on the roof slab act as a UDL at 680mm ctc in both directions. The span being negligible, the base slab is of minimum thickness and provided as 250mm from workability and counter weight perspective; it is provided with a two layer rebar mat of 10mm-200mm ctc in the middle and 12mm-200mm ctc at the edges. The roof slab is of minimum thickness and provided as 120mm with one layer of 10mm-200ctc spacing bothways. The side wall is also of minimum thickness and provided as 200mm thickness from workability perspective. It is provided with a two layer rebar mat of 12mm-200mm ctc at the bottom and 10mm-200mmc ctc at top. M20 concrete mix was used for RCC.

Top of the sump is used as parking space. Thus, the above technique is unique and easy to construct. But, considering the cost of imported materials, cost of the total system is on the higher side by 30%, when compared to conventional system.

Roof-top run-off is passed through filter material comprising sand and pebbles before entrance into the sump. It was informed that roof top is cleaned twice in a year and filter media is cleaned/ replaced once a year.

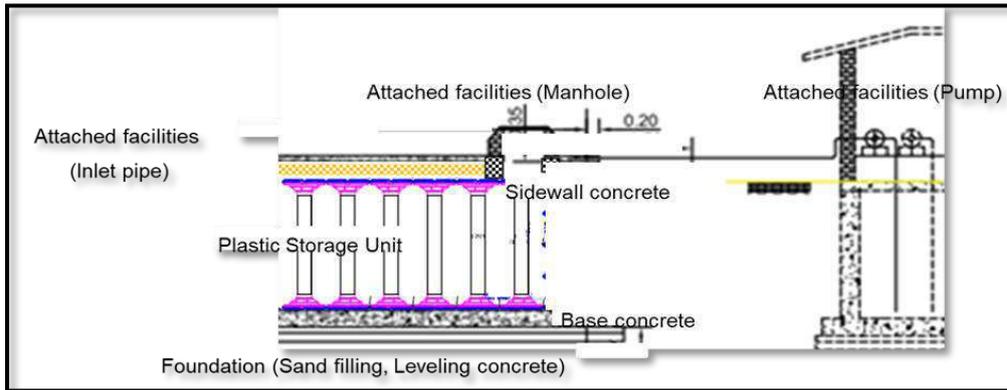


Fig.TN-2.1a: Schematic Diagram of Underground Storage Tank made up of uPVC material.



Fig.TN-2.2b: Construction of Underground Storage Tank with uPVC Pipes

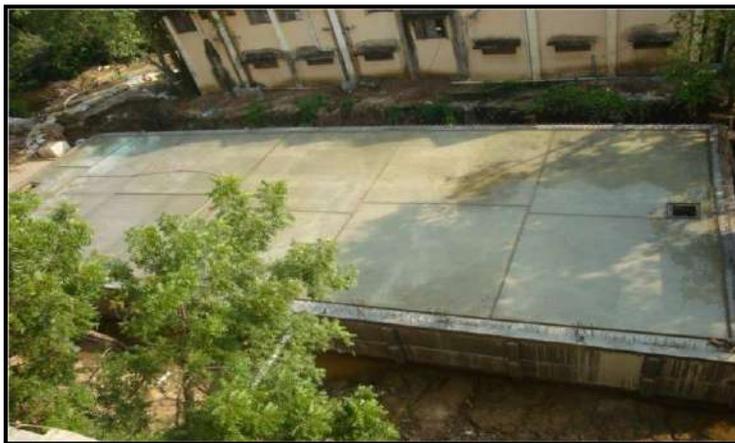


Fig.TN-2.3c: Underground Tank after completion

Quality of Groundwater/ Harvested Water

Sample of water was collected from the sump. Analysis was done at CGWB, SECR, Chennai Laboratory. Results of the analysis are summarized in following table.

Latitude	12.9850
Longitude	80.2440
PH	7.24
EC	609
TH	155
Ca	44
Mg	11
Na	44
K	4.6
CO3	0
HCO3	104
SO4	94
Cl	71
F	0.26
NO3	1.9
U in ppb	1.486
Inference	All the water quality parameters will within the desirable limit for drinking purpose.

Quantum of Annual Rainwater Harvested/ Conserved

It is estimated that total around 6 Lakh litre water is being harvested annually.

Cost Involved in Construction of System and Annual Maintenance

Cost of construction is Rs 1 Crore and annual maintenance involved approximately Rs 50,000/-.

Observations/ Conclusions and Recommendations

1. This Rain water harvesting structure project has been a successful venture from the very beginning of installation.
2. Efficiency of structure provides adequate amount of water for the office use nearly for 5 to 6 months in a year. This project had been a boon even in the driest days of the year. After implementation, sufficient water is available to meet the requirement of water supply to the office establishment thereby saving the amount spent before for transportation of water through tanker lorries.
3. The main problem is the cleaning of the storage tank due to the narrow passage between the vertical column pipes. However there is no requirement of frequent cleaning in the past five years.
4. Water is being tested for quality periodically and found suitable for domestic purposes as also evident from the result of analysis of sample collect during the visit.
5. Technique used in construction saves space as well provided strength to the structure and is therefore suitable for large buildings.
6. It was advised that first flush should be by-passed and should not be allowed into sump.
7. The technique used is unique and easy to construct. But, considering the cost of imported materials, cost of the total system is on the higher side by 30%, when compared to conventional system.

Appendix B-5.2: Tamil Nadu RWH Inspection

TN-3: SITE VISIT REPORT ON RAINWATER HARVESTING SYSTEM WITH – PERCOLATION PITS AND SHAFTS INSIDE THE PREMISES OF CLASSIC MALL DEVELOPMENT COMPANY PVT LTD, PHOENIX MARKETCITY CHENNAI, VELACHERY

Introduction

Phoenix Marketcity Chennai(12°59'34"N, 80°13'06'E) is a joint venture of Phoenix Mills Ltd & Crest Ventures Pvt Ltd. It is located in Velachery, Saidapet Taluk of Chennai District and is spread over 16 acres.

Objective and purpose of RWH Scheme under reference

The prime objective and purpose is to capture the rooftop rainwater and the runoff from the paved areas and divert to percolation pits for groundwater recharge.

Ownership and Maintenance Responsibility of Recharge Structure

The recharge structures which are percolation pits with shaft is owned and maintained by Phoenix Marketcity Chennai, Velachery, Chennai.

General Geology and Hydrogeology

The geology in and around Velachery is identified as topsoil of around 1.5m, followed by a layer of thick black clay up to 12m, underlain by highly weathered Charnokite. There is pegmatitic intrusion between 18-23m. As per the Department's piezometer (PZ125904801438), maintained at the WRD Campus, Taramani, approximately 3 Km from the mall, the highest and lowest values of water level obtained are 3.62 m and 0.22 m respectively. And the water level recorded for the month of February 2022 is 1.12 m from the ground level.

Rainwater Harvesting System, Conservation/ Recharge**Details of RWH System**

A total of 60 recharge pits with shafts has been constructed in the premises of Phoenix Marketcity, Velachery all along the periphery of the campus. Dimension of each pits 60cmx60cmx60cm. Pits are filled with blue metal and pebbles as filter media. The shafts contain perforated PVC pipe of 8" diameter up to a depth of 15 meter. A 10" PVC pipe is kept around the 8" pipe and gravel is filled in the annular space. This gravel also acts as filter and also prevents choking of perforations. Rainwater falling in the rooftop and driveway area (all around the built-up area) is captured and channelized through small channels/trenches and is diverted to these recharge pits where the collected rainwater is filtered and gets recharged through shafts. Design is shown in **Fig. TN-3.1** and photographs are presented in **Fig. TN-3.2**

Maintenance of RWH System

The roof top is cleaned twice annually, before onset of monsoon, as well as after monsoon season is over. Feeder channels/ trenches are cleaned every month by a special team.

In and around the premises of Phoenix Marketcity Chennai, they have made around 60 (existing) and 20 (under progress) percolation pits with shafts up to a depth of 15 meters having a 2 feet depth filter media on the top.

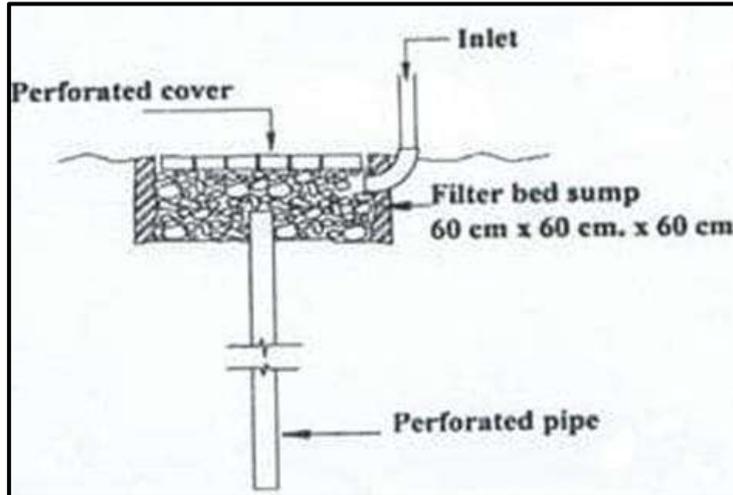


Fig.TN-3.1: Schematic Diagram of Recharge Pit with Shaft at Phoenix Market City, Chennai

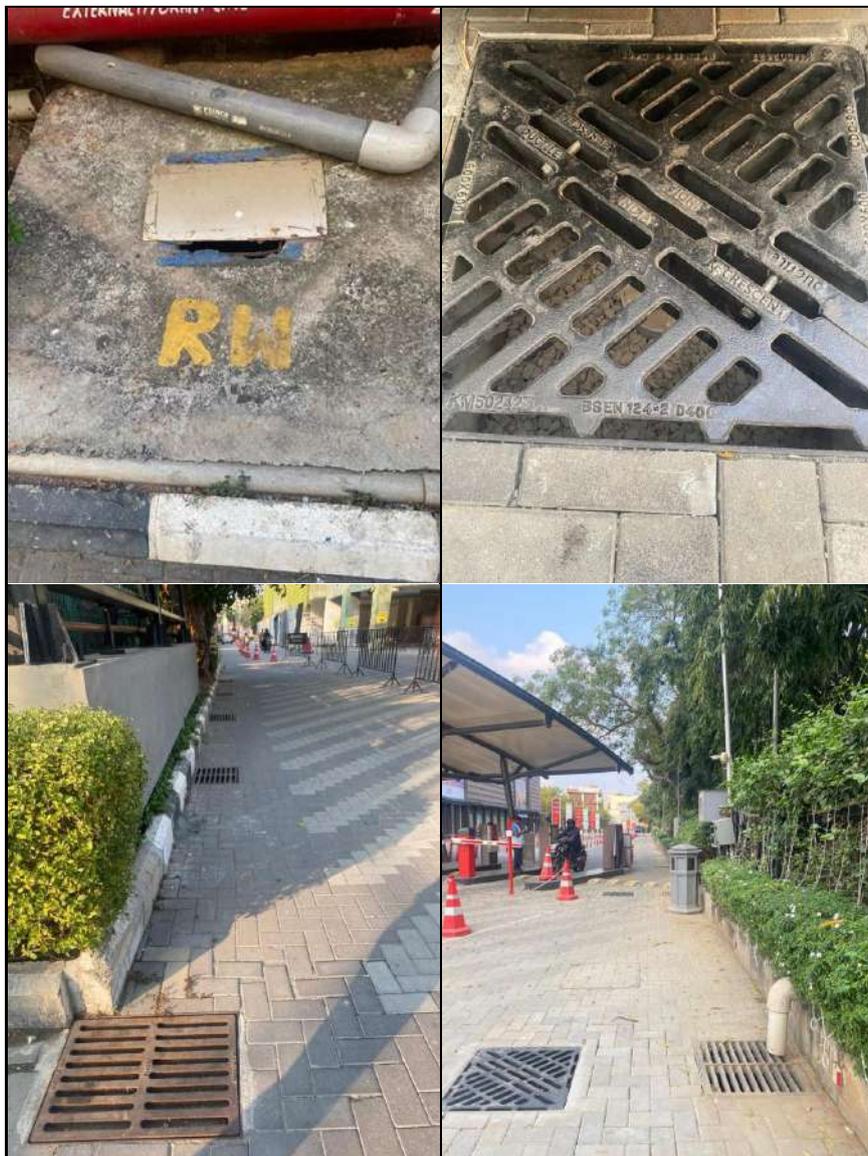


Fig.TN-3.2: Images of Percolation Pits at Phoenix Marketcity Chennai

Quality of Groundwater/ Harvested Water

Sample of water was collected from a Percolation Pit. Analysis was done at CGWB, SECR, Chennai Laboratory. Results of the analysis are summarized in following table.

Latitude	12.9910
Longitude	80.2170
PH	7.47
EC	1537
TH	350
Ca	88
Mg	32
Na	137
K	6.6
CO3	0
HCO3	390
SO4	60
Cl	220
F	0.49
NO3	24
U in ppb	7.741
Inference	Calcium, Magnesium, TH and TDS are higher than the desirable limit for drinking purpose.

Higher concentrations of certain constituents indicate mixing from other sources (through water or other source).

Quantum of Annual Rainwater Harvested/ Conserved

Average **rainfall** of the area is **1040mm**. Estimated quantum of recharge from the premises of Phoenix Marketcity, Chennai is 46,325 cum/ annum.

Type of Recharging Area	Area in m ²	Run-off Coefficient	Total quantity in m ³
Roof Area	25,574.25	0.80	21,277.78
Area available for recharge excluding plant roof area	33,817.08	0.70	24,618.83
Total			45896.61

Cost Involved in Construction of System and Annual Maintenance

Cost of construction is Rs 2 Crore and annual maintenance involved approximately Rs 1,00,000/-.

Observations/ Conclusions and Recommendations

- In the event of over-flow, the surplus run-off is diverted to nearest lake (Velachery Lake), approximately 250m south of Phoenix Market City.
- Higher concentrations of certain constituents indicate that there is mixing of these into rainwater from other sources (through water or other source). This is to be avoided.
- The management and maintenance team was advised to by-pass the first flush.

Appendix B-5.2: Tamil Nadu RWH Inspection**TN-4: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – SSM BUILDERS & PROMOTERS A RESIDENTIAL BUILDING COMPLEX, NEDUNKUNDRAM VILLAGE, VANDALUR TALUK, CHENGALPATTU DISTRICT****Introduction**

SSM Builders & Promoters is a Residential Building Complex (12°53'25"N, 80°07'04"E) situated at Nedunkundram Village of Guduvanchery Firka, Chengalpattu District. The complex houses 1850 Dwelling Units in 66 Blocks units and has a population of 6800 Nos residing in the complex.

Objective and purpose of RWH Scheme under reference

The prime objective and purpose of the rainwater harvesting is to capture excessive rainwater in order to utilize the conserved water for domestic purpose to tide over the tailing non-rainy days.

Ownership and Maintenance Responsibility of Recharge Structure

RWH structures are owned and maintained by SSM Builders & Promoters, Nedunkundram Village. The RWH system was constructed in 2017.

General Geology and Hydrogeology

Geology in and around Nedungundram is identified as Topsoil of about 2m, followed by highly weathered/ weathered Charnockite up to 15m, underlain by jointed Charnockite. Water level in a monitoring bore well inside the premises of SSM Residential Complex is 1.10 mbgl on 23.02.2022. Water level is observed every month by the firm and it is being recorded. As per recorded data, post-monsoon water level from 2017 to 2020 has fluctuated between Ground Level (2017) to 2.67 mbgl (2018).

Rainwater Harvesting System, Conservation/ RechargeDetails of RWH System

The Rain Water Harvesting System in the premises comprises of 172 Recharge Pits and 20 Recharge pits are constructed with 3m deep concrete rings of 1.2m dia. Bottom one third part is filled with filter media consisting of blue metal at the top underlain by river sand (**Fig. TN-4.1**) Rainwater from rooftop and paved area is channelized towards pits and percolates through filter media to recharge the aquifer. Overflow from these pits is stored in Sumps/ Storage Tanks, which are 5m long, 2.5m wide and 2m deep. In addition, the run-off from driveways is also diverted to these sumps. Dimensions of these structures and capacity are summarized in following table.

Sl.No	Type of structure	Length/ diameter (m)	Breadth (m)	Depth (m)	No.of AR Struct- ures	Total Capacity or volume in M ³
1.	Recharge Pit	1.2	-	3	172	583
2.	Rainwater sump	5	2.5	2	20	500
Total						1,083

Rainwater collected in sump is used only for gardening purpose.

Maintenance of RWH System

Rooftop is cleaned thoroughly twice annually – before the onset of monsoon and after monsoon.

The complex is divided into linear blocks with alternate bays for sewage and RWH channels.

There is dual supply. STP treated water is used only for sanitation/ flushing and horticulture. Drinking water supply is met by borewells (valid NOC from State Government).



Fig.TN-4.1: Recharge Pit in the premises of SSM Residential Complex, Nedunkundaram, Chengalputtu District

Quality of Groundwater/ Harvested Water

Sample of water was collected from RWH Sump. Analysis was done at CGWB, SECR, Chennai Laboratory. Results of the analysis are summarized in following table.

Latitude	12.8930
Longitude	80.1180
PH	7.36
EC	175
TH	80
Ca	25
Mg	4.4
Na	4.7
K	4
CO3	0
HCO3	73
SO4	17
Cl	4.3
F	0.27
NO3	1.2
U in ppb	0.355
Inference	All the water quality parameters will within the desirable limit for drinking purpose.

Low concentrations indicate that the water is rainwater.

Quantum of Annual Rainwater Harvested/ Conserved

It is estimated that total around 6 Lakh litre water is being recharged and 6 Lakh litre is being conserved in sumps annually.

Cost Involved in Construction of System and Annual Maintenance

Construction cost of RWH system is Rs 60 Lakhs and annual maintenance cost is around 5.40 Lakhs.

Observations/ Conclusions and Recommendations

- The RWH system provides adequate amount of water for gardening for this Residential Building Complex nearly for 5 to 6 months in a year. This project had been a boon even in the driest days of the year.
- The complex is divided into linear blocks with alternate bays for sewage and RWH channels.
- The maintenance team was advised to by-pass the first flush. It was also advised to avoid water from stilt car parking areas into the system and to connect the rooftop pipe directly to the pits to avoid the mixing up of other polluted water.

Appendix B-5.2: Tamil Nadu RWH Inspection

TN-6: SITE VISIT REPORT FOR INSPECTION OF RAINWATER HARVESTING STRUCTURE – ASIAN PAINTS LIMITED, PONDURVILLAGE, SRIPERUMBUDUR TALUK, KANCHEEPURAM DISTRICT

Introduction

Asian Paints Limited (12°55'46"N, 79°54'51"E) is situated at Pondur Village of Sriperumbudur Taluk, Kancheepuram District. Area of the premises is 32 Acres.

Objective and purpose of RWH Scheme under reference

The prime objective and purpose of the tank is to capture rainwater run-off in a storage tank in order to utilize for industrial, green belt and sanitation purposes to tide over the tailing non-rainy days.

Ownership and Maintenance Responsibility of Recharge Structure

The rainwater harvesting structure is owned and maintained by Asian Paints Limited, Pondur. The RWH system was constructed in 2016.

General Geology and Hydrogeology

The geology in and around Pondur is identified as Topsoil up to about 3m, followed alternate layers of sandy clay and sand up to 80m (as per information available). Water level in a monitoring bore well inside the premises of Asian Paints Ltd is 2.40mbgl on 24.02.2022. The water level is observed every month by the firm and it is being recorded.

Rainwater Harvesting System, Conservation/ Recharge**Rainwater Storage Tank**

Rooftop rainwater run-off is collected through roof top pipes and trenches into a large storage tank (**Fig. TN-6.1 & TN-6.2**) constructed in the southeastern fringes of the industry premise. Location for tank has been decided on the basis of topography and slope within the premises. Profile of the tank is of a trapezium having length of 280 m and 270 m at top and bottom respectively. The tank is 12m wide at top and 10m at the bottom. Depth of tank is 5m. Thus, total holding capacity is 6000 kilo liters. The tank is divided into two separated portions. First portion is where all the rainwater is collected and undergoes silt settling. The de-silted water passes into the next portion through a gate and from there water is taken for industrial purpose through Activated Carbon filtration and Pressure Sand filtration.

Recharge pits

Two recharge pits had been earlier maintained by the firm to recharge the aquifer. Post notification of **guidelines** of **Central Ground Water Authority**, which advise only conservation for certain categories of industries, the industry has closed the recharge pits. During the present visit, the pits were found closed.

Schematic**Maintenance of RWH System**

Rooftop is cleaned thoroughly twice annually – before the onset of monsoon and after monsoon. Silt settling tank is cleared twice annually. The industry is ZLD. Hence, chances of contamination are virtually non-existent. Recharge pits have been closed post notification of CGWA guidelines.

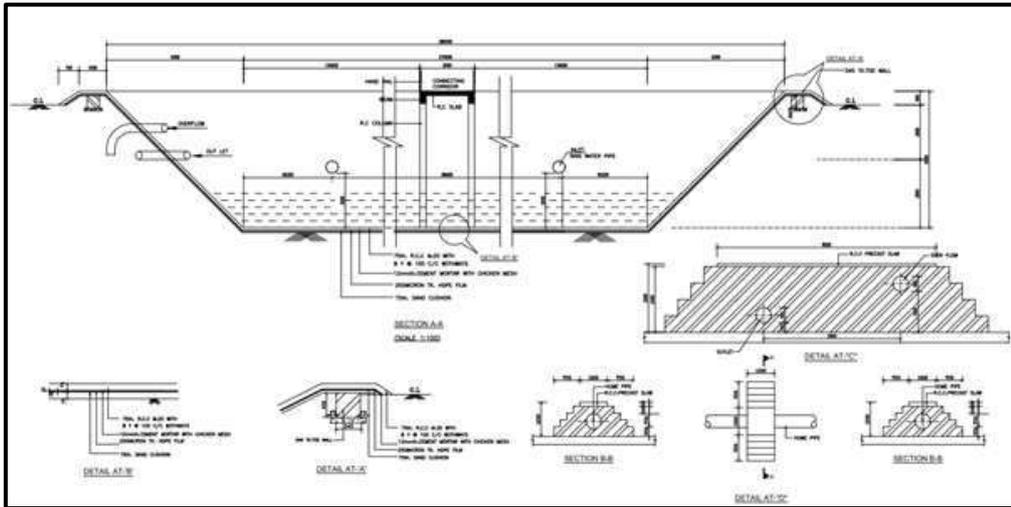


Fig.TN-6.1: Schematic design of RWH System in the premises of Asian Paints Ltd, Sriperambudur, District Kancheepuram



Fig.TN-6.2: RWH Storage Tank in the premises of Asian Paints Ltd, Sriperambudur, District Kancheepuram

Quality of Groundwater/ Harvested Water

Sample of water was collected from RWH Tank. Analysis was done at CGWB, SECR, Chennai Laboratory. Results of the analysis are summarized in following table.

Latitude	12.9330
Longitude	79.9150
PH	8.97
EC	598
TH	95
Ca	34
Mg	2.4
Na	61
K	13
CO3	24
HCO3	55
SO4	31
Cl	85
F	0.55
NO3	18

U in ppb	1.06
Inference	All the water quality parameters will within the desirable limit for drinking purpose.

Quantum of Annual Rainwater Harvested/ Conserved

It is estimated that total around 60,00,000 litre water is being conserved in RWH Tank annually.

Cost Involved in Construction of System and Annual Maintenance

-----Tentative cost of construction of system is Rs 50,00,000/-. Annual maintenance cost comes around Rs 30,000/-

Observations/ Conclusions and Recommendations

Efficiency of structure provides adequate amount of water for the industrial, sanitation and gardening purposes domestic use nearly for 5 to 6 months in a year.

Industry took necessary step to close down the recharge pits as per CGWA guidelines. State Government, however does not have any such restriction on recharge.

Site No.	Site Name	Rule/ law existing reg mandatory RWH	Penal provision for non-maintenance	Penal provision for contamination due to recharge (faulty design/lack of maintenance)	Effective Monitoring/ Compliance mechanism Exists	General Post monsoon Water Level in the Area (mbgl)	Is the design as per respective norms/ guidelines	Filter Media (Y/N)	Rainwater Storage system	Recharge Well (Y/N)/ or Depth in m (indicating Y)	Recharge Pit (Y/N)/ or Depth (if Y)	Quality of ground-water in RWH System	Quality of ground-water in the vicinity	Vetted Design of RWH System available	Properly maintained or not	Insulation from sewage/ effluent
DL-1	Gold Croft CGHS Ltd., Delhi	Building By-laws, 1983 (Amendment, 2001) of MoUD and its further reinforcement through provisions in DJB's DW&S(T&M) Regulation, 2012 and Amendment, 2016 thereof.	N	N	N	17	Y	Y	Y	N	Y/1.8-2m 1 borewell depth 20m	NA	Within the permissible limit	Y	Y	Y
DL-2	Hind CGHS Ltd., Delhi					17	Y	Y	Y	N	Y/2.2m	NA	Within the permissible limit	Y	Y	Y
DL-3	GTBIT, New Delhi					16.2	Y	Y	Y	N	Y/1.85m-2.97m	NA	EC is high	Y	Y	Y
DL-4	Siri Fort Auditorium, New Delhi					26.72	Y	Y	Y	N	Y/2.2m	NA	EC is high	Y	Y	Y
HR-1	Maruti Suzuki India Ltd, Manesar	Haryana Building Code, 2016. The Code also includes provisions of Water (Prevention & Control) of Pollution Act, 1974	N	N	N		Y	Y	Y	Y	Y	NA	Nitrate is above Permissible Limit	Y	Y	Y
HR-2	Bestech India Pvt Ltd, Gurugram						Y	Y	Y	Y	Y	All Basic and HM analysed OK	NA	Y	Y	Y
KA-1	RWH Theme Park, Bengaluru.	BWSS (Amendment) Bill 2009, 2020 & 2021, BWSSB RWH Act 72A Amendment 2021 and State GW Act 2011	N	N	N	6	Y	Y	Y	N	5-7m	Total coliform present	Uranium more than permissible limit (Geogenic)	Y	Y	Coliform found
KA-2	Falcon City , Bengaluru					12	Y	Y	Y	N	3m	OK, Sample from very little stagnated water at the bottom	OK; BW in the premises	N	Y	Y
KA-3	ABB Limited, Bengaluru					16	Y	Y	Y	60m	Y	Dry at the time of visit	Within Permissible limits			
RJ-1	ARL, Jaipur	Urban Area (Name of City) Building Regulation, 2020	N	N	N	32.92	Y	Y	Y	50m	Y	TDS 1541 mmhos/cm. at 250C	Above Permissible limits	Y	Y	Y
RJ-2	GWD Campus, Jaipur					52.6	Y	Y	Y	40m	Y	TDS 1150 mmhos/cm. at 250C	Above Permissible limits	Y	Y	Y
RJ-3	Rajbhawan, Jaipur					22.7	Y	Y	Y	19m	Y	TDS 1850 mmhos/cm. at 250C	Above Permissible limits	Y	Y	Y
TN-1	Rain Centre, Chennai.	Tamil Nadu Combined Development & Building Rules, 2019 of Municipal Administration and Water Supply Department	N	N	N	1-2	Y	N	Y	N	5m	EC and other constituents comparatively much higher in open well than sum	No other sample	Y	Y	Overall Yes, but cannot be ascertained for Open (source well) and recharge pit
TN-2	WRD, Chennai					1-3	Y	Y	Y	N	N	All Basic Parameters analysed OK	No other sample	Y	Y	Y (Only RT water collected)
TN-3	Phoenix Market City, Chennai					1-2	Y	Y	Y	15m Shafts in Pits	Y	TDS of Pit water high , indicating mixing with rainwater	No other sample	Y	Y	Y (as claimed)
TN-4	SSM Residential Complex, Chengalpattu					2-3	Y	Y	Y	N	3m	OK (Sample from storage sump); Pit dry	No other sample	N	Only one pit shown	Y (alternate bays for RWH channel and sewage)
TN-6	Asian Paints Ltd, Sriperumbudur					2-3	Y	Y	Y	N	N (closed as per CGWA guidelines)	OK (RWH Tank)	No other sample	N	Y	Y (as claimed); ZLD industry

भारतीय मानक
छतों पर वर्षा जल संग्रहण — मार्गदर्शी सिद्धान्त

Indian Standard
ROOF TOP RAINWATER
HARVESTING — GUIDELINES

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Ground Water and Related Investigations Sectional Committee had been approved by the Water Resources Division Council.

Rainwater harvesting is an option which has been adopted in many parts of the world where due to increase in population conventional water supply system has failed to meet the needs of the people. The term 'Water Harvesting' connotes collection and storage of rainwater and also other activities aimed at harvesting surface water, prevention of loss through evaporation and seepage.

Natural recharge to ground water has reduced due to shrinkage of open area consequent to increased urban activities. Ground water levels have registered a marked decline, unplanned disposal of waste has resulted in deterioration of ground water quality. In view of the gap between demand and supply there is an utmost need for adopting roof top rainwater harvesting and augmenting ground water storage.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***ROOF TOP RAINWATER
HARVESTING — GUIDELINES****1 SCOPE**

This standard lays down guidelines for roof top rain-water harvesting.

2 REFERENCE

The following standard contains provision, which through reference in this text constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard given below:

<i>IS No.</i>	<i>Title</i>
14476 (Part 6) : 1998	Test pumping of water wells — Code of practice: Part 6 Special tests

3 GENERAL

Roof top rainwater collection is one of the solutions for solving or reducing the problem of water availability, where there is inadequate ground water supply and surface sources are either lacking or insignificant. In this system, rainwater falling on roofs of houses and other buildings is collected through a system of pipes and semi-circular channels of galvanized iron or PVC and stored in tanks suitably located on the ground or underground for direct use or for recharging ground water aquifers. Urban housing complexes/residential buildings and institutional buildings have large roof area and are amendable for rainwater harvesting. This practice is in vogue at the individual household level in remote hilly areas with high rainfall and in some semi-arid areas in the plains.

4 ADVANTAGES OF ROOF TOP RAINWATER HARVESTING

- a) One of the appropriate options for augmenting ground water recharge/storage in urban areas, where natural recharge has been considerably reduced due to increased urban activities and not much land is available for implementing any other artificial recharge measure. In rural areas also, roof top rainwater harvesting can supplement the domestic requirements.
- b) Rainwater runoff, which otherwise flows through sewers and storm drains and is wasted, can be harvested and utilized.
- c) Helps in reducing the frequent drainage congestion in urban areas where fast rate of urbanization has reduced availability of open surfaces.
- d) Recharging of aquifers with harvested water improves the quality of ground water through dilution.
- e) The harnessed rainwater can be utilized when needed at the time and place of scarcity.
- f) The structures required for harvesting are simple, economical and Eco-friendly.
- g) In coastal areas over extraction of ground water leads to saline water ingress. Therefore, recharging of ground water aquifer in such areas helps to control saline water ingress.
- h) Storing of harvested water under ground through aquifer recharge, wherever feasible, is advantageous as such storage is not exposed to evaporation and pollution. Aquifers serve as a distribution system as well supplying water when required.

5 FACTORS DETERMINING TYPE/SYSTEM OF RAINWATER HARVESTING

5.0 There are many factors that determine the total quantity of rainwater 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 in 5.1 to 5.5.

5.1 Rainfall Quantity

The total volume of rainwater 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 and using Tables 1 and 2, the water availability for flat and sloping roof can be worked out.

5.2 Rainfall Pattern

Rainfall pattern as well as total rainfall, will often determine the feasibility of a rainwater harvesting system. In areas where rainfall occurs regularly in most parts throughout the year, implies that the storage requirement is low and hence the system cost will be

Table 1 Water Availability for a Given Roof Top Area and Rainfall (For Flat Roofs)
(Clause 5.1)

Sl No.	Roof Top Area m ²	Rainfall, mm												
		100	200	300	400	500	600	800	1 000	1 200	1 400	1 600	1 800	2 000
		Water availability (m ³)												
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
i)	20	1.6	3.2	4.8	6.4	8	9.6	12.8	16	19.2	22.4	25.6	28.8	32
ii)	30	2.4	4.8	7.2	9.6	12	14.4	19.2	24	28.8	33.6	38.4	43.2	48
iii)	40	3.2	6.4	9.6	12.8	16	19.2	25.6	32	38.4	44.8	51.2	57.6	64
iv)	50	4	8	12	16	20	24	32	40	48	56	64	72	80
v)	60	4.8	9.6	14.4	19.2	24	28.8	38.4	48	57.6	67.2	76.8	86.4	96
vi)	70	5.6	11.2	16.8	22.4	28	33.6	44.8	56	67.2	78.4	89.6	100.8	112
vii)	80	6.4	12.8	19.2	25.6	32	38.4	51.2	64	76.8	89.6	102.4	115.2	128
viii)	90	7.2	14.4	21.6	28.8	36	43.2	57.6	72	86.4	100.8	115.2	129.6	144
ix)	100	8	16	24	32	40	48	64	80	96	112	128	144	160
x)	150	12	24	36	48	60	72	96	120	144	168	192	216	240
xi)	200	16	32	48	64	80	96	128	160	192	224	256	288	320
xii)	250	20	40	60	80	100	120	160	200	240	280	320	360	400
xiii)	300	24	48	72	96	120	144	192	240	288	336	384	432	480
xiv)	400	32	64	96	128	160	192	256	320	384	448	512	576	640
xv)	500	40	80	120	160	200	240	320	400	480	560	640	720	800
xvi)	1 000	80	160	240	320	400	480	640	800	960	1 120	1 280	1 440	1 600
xvii)	2 000	160	320	480	640	800	960	1 280	1 600	1 920	2 240	2 560	2 880	3 200
xviii)	3 000	240	480	720	960	1 200	1 440	1 920	2 400	2 880	3 360	3 840	4 320	4 800

Table 2 Water Availability for a Given Roof Top Area and Rainfall (For Sloping Roofs)
(Clause 5.1)

Sl No.	Roof Top Area m ²	Rainfall, mm												
		100	200	300	400	500	600	800	1 000	1 200	1 400	1 600	1 800	2 000
		Water availability (m ³)												
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
i)	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
ii)	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
iii)	40	3.8	7.6	11.4	15.2	19	22.8	30.4	38	45.6	53.2	60.8	68.4	76
iv)	50	4.8	9.5	14.3	19	23.8	28.5	38	47.5	57	66.5	76	85.5	95
v)	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
vi)	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
vii)	80	7.6	15.2	22.8	30.4	38	45.6	60.8	76	91.2	106.4	121.6	136.8	152
viii)	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
ix)	100	9.5	19	28.5	38	47.5	57	76	95	114	133	152	171	190
x)	150	14.3	28.5	42.8	57	71.3	85.5	114	142.5	171	199.5	228	256.5	285
xi)	200	19	38	57	76	95	114	152	190	228	266	304	342	380
xii)	250	23.8	47.5	71.3	95	118.8	142.5	190	237.5	285	332.5	380	427.5	475
xiii)	300	28.5	57	85.5	114	142.5	171	228	285	342	399	456	513	570
xiv)	400	38	76	114	152	190	228	304	380	456	532	608	684	760
xv)	500	47.5	95	143	190	237.5	285	380	475	570	665	760	855	950
xvi)	1 000	95	190	285	380	475	570	760	950	1 140	1 330	1 520	1 710	1 900
xvii)	2 000	190	380	570	760	950	1 140	1 520	1 900	2 280	2 660	3 040	3 420	3 800
xviii)	3 000	285	570	855	1 140	1 425	1 710	2 280	2 850	3 420	3 990	4 560	5 130	5 700

correspondingly low and *vice versa*. Conversely, 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.

5.3 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.

5.4 Collection Surface Area

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

5.5 Storage Capacity

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

6 STORAGE OF WATER IN A STORAGE TANK FOR DIRECT USE

6.1 Design of System Components

A roof top catchment system has three main components, namely, a roof, a guttering and first flush device and a storage tank:

- a) *Roof* — In this system, only roof top is the catchment as shown in Fig. 1 and Fig. 2. The roofing should be of galvanized iron sheets (G.I.), aluminium, clay tiles, asbestos or

concrete. In case of thatch-roof, it may be covered with waterproof LDPE sheeting. The roof should be smooth, made of non-toxic material sufficiently large to fill the tank with the available rainfall conditions. Existing roofs of houses and public buildings can be used for a roof top catchment system. In some cases enlarged or additional roofed structures can be built.

- b) *Guttering and First-Flush Device* — Guttering is intended to protect the building by collecting the water running of the roof and direct it, via a downpipe, to the storage tank. Gutter is provided along the edge of the roof. It is fixed with a gentle slope towards downpipe, which is meant for free flow of water to the storage tank. This may be made up of G.I. sheet, wood, bamboo or any other locally available material. The downpipe used should be at least 100 mm diameter and be provided with a 20 mesh wire screen at the inlet to prevent dry leaves and other debris from entering it. The gutter size may be worked out using any standard formula of hydraulics or using Table 3.

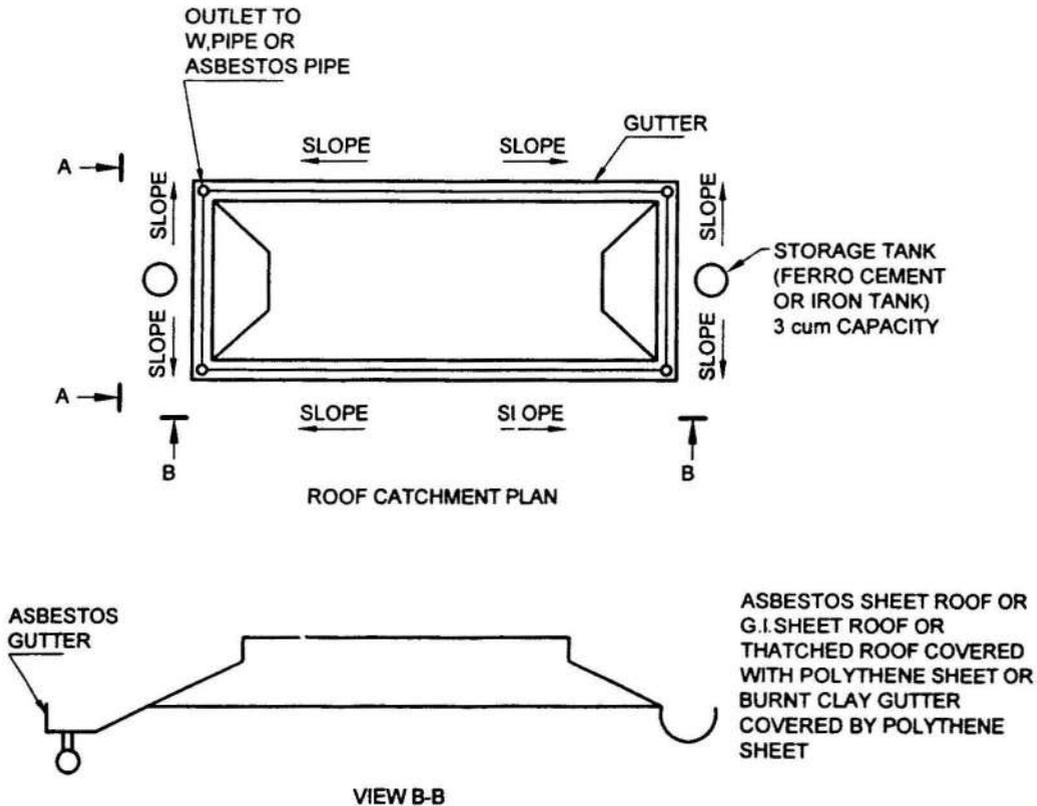
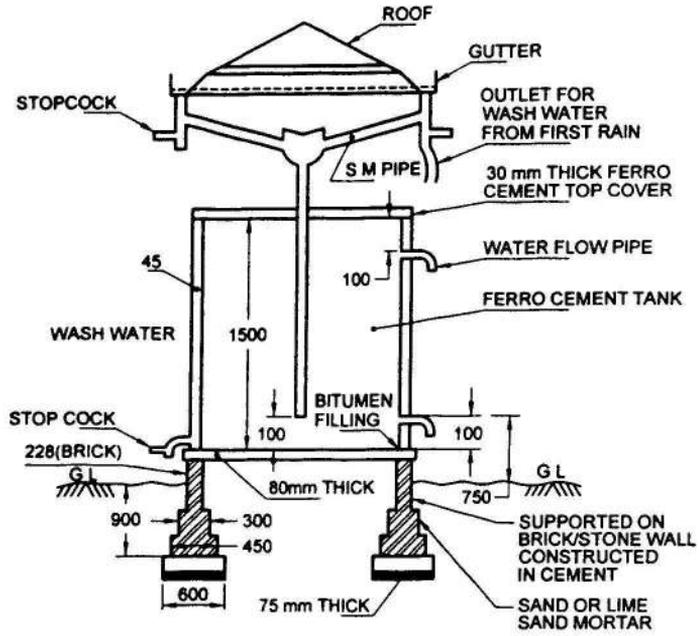
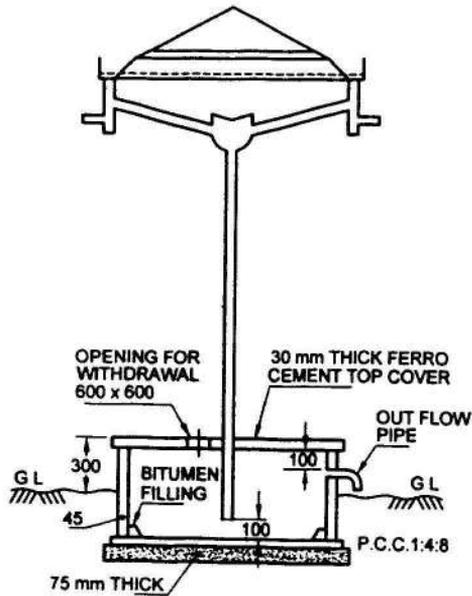


FIG. 1 RAINWATER HARVESTING SYSTEM



WATER TANK ABOVE GROUND



WATER TANK UNDER GROUND

All dimensions in millimetres.

FIG. 2 RAINWATER HARVESTING STRUCTURES

Table 3 Diameter of Gutter and Width of G.I. Sheet
[Clause 6.1(b)]

Sl No.	Roof Top Area m ²	Rainfall Intensity, mm h														
		10	15	20	25	30	35	40	45	50	60	70	80	90	100	
		Diameter (D) of Channel and Width (W) of G.I. Sheet (mm)														
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
i)	10	D	20	23	26	28	30	32	33	35	36	39	41	43	45	47
		W	51	56	60	64	67	70	72	74	77	81	84	88	91	93
ii)	20	D	26	30	33	36	39	41	43	45	47	50	53	56	58	61
		W	60	67	72	77	81	84	88	91	93	99	103	108	112	115
iii)	30	D	30	35	39	42	45	48	50	52	54	58	62	65	68	71
		W	67	74	81	86	91	95	99	102	106	112	117	122	127	131
iv)	40	D	33	39	43	47	50	53	56	58	61	65	69	72	76	79
		W	72	81	88	93	99	103	108	112	115	122	128	134	139	144
v)	50	D	36	42	47	51	54	58	61	63	66	71	75	79	82	86
		W	77	86	93	100	106	111	115	120	124	131	138	144	149	154
vi)	60	D	39	45	50	54	58	62	65	68	71	76	80	84	88	92
		W	81	91	99	106	112	117	122	127	131	139	146	152	158	164
vii)	70	D	41	48	53	58	62	65	69	72	75	80	85	89	93	97
		W	84	95	103	111	117	123	128	133	138	146	153	160	167	172
viii)	80	D	43	50	56	61	65	69	72	76	79	84	89	94	98	102
		W	88	99	108	115	122	128	134	139	144	152	160	167	174	180
ix)	90	D	45	52	58	63	68	72	76	79	82	88	93	98	102	107
		W	91	102	112	120	127	133	139	144	149	158	167	174	181	188
x)	100	D	47	54	61	66	71	75	79	82	86	92	97	102	107	111
		W	93	106	115	124	131	138	144	149	154	164	172	180	188	194
xi)	150	D	54	63	71	77	82	87	92	96	100	107	113	119	124	129
		W	106	120	131	141	149	157	164	170	176	188	197	207	215	223
xii)	200	D	61	71	79	86	92	97	102	107	111	119	126	132	138	144
		W	115	131	144	154	164	172	180	188	194	207	218	228	237	246
xiii)	250	D	66	77	86	93	100	105	111	116	121	129	137	144	150	156
		W	124	141	154	166	176	186	194	202	209	223	235	246	256	266
xiv)	300	D	71	82	92	100	107	113	119	124	129	138	146	154	161	167
		W	131	149	164	176	188	197	207	215	223	237	250	262	273	283
xv)	400	D	79	92	102	111	119	126	132	138	144	154	163	172	179	186
		W	144	164	180	194	207	218	228	237	246	262	276	290	302	313
xvi)	500	D	86	100	111	121	129	137	144	150	156	167	177	186	195	203
		W	154	176	194	209	223	235	246	256	266	283	299	313	326	339
xvii)	1 000	D	111	129	144	156	167	177	186	195	203	217	230	242	253	263
		W	194	223	246	266	283	299	313	326	339	361	381	400	417	433
xvii)	2 000	D	144	167	186	203	217	230	242	253	263	282	298	314	328	341
		W	246	283	313	339	361	381	400	417	433	462	489	513	535	556
xviii)	3 000	D	167	195	217	236	253	268	282	294	306	328	347	365	382	397
		W	283	326	361	391	417	441	462	482	501	535	566	594	620	644

NOTES

- 1 Provide minimum diameter of channel of 100 mm and width of sheet 176 mm.
- 2 Diameter to be limited to 300 mm and width of sheet 510 mm.

For all tanks having roof catchment, the first runoff of rainwater from the roof should be discarded. This helps keep the water potable because this first flush contains large quantities of dust, leaves and other impurities. This can also be prevented by installation of a gate valve at the end of down pipe at ground level.

- c) *Tank* — 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. The surface tank may be of G.I. Sheet, R.C.C., Plastic/HDP or Ferrocement Tank placed at elevation on a raised platform as shown in Fig. 3. Choice of the tank depends on locally available materials and space available. When the tank is constructed underground, at least 30 cm of the tank should remain above ground. Water

tanks using ferrocement technology come in different designs with volumes ranging between 2 m^3 and 200 m^3 . For example, a free standing cylindrical tank can be built in sizes between 10 m^3 and 30 m^3 , while a capacity of up to 200 m^3 is possible with sub-surface covered tanks. The latter is economical when the capacity exceeds 50 m^3 .

An alternate design, avoiding framework, involves erecting a circular frame made of welded-mesh bars spaced at 15 cm and covered with chicken wire mesh (2.5 cm gauge) onto a reinforced concrete base. This is then covered on the outside with sacks or cloth and two coats of a 1.5 cm layer of mortar (1 part cement, 3 parts sand) and plastered along the inner walls to produce the tank wall. Two further coats of plaster are added, one on the outside after removing the sacks and one on the inside to provide a tank wall thickness of 5 cm. A waterproof coat of cement and water is then added to the tank's inner wall.

When the wall is complete, a wooden frame is constructed inside the tank to support the metal template made from old oil drums, which forms the mould for the domed roof. The roof is also reinforced with welded-mesh and chicken wire. For quality, the floor, walls and the roof need to be cured by moistening their surface for at least a week. This should start immediately after each component is ready.

To facilitate cleaning of the tank, an outlet pipe may be fitted and fixed in the tank at bottom level. The size of the tank will depend upon the factors such as daily demand, duration of dry spell, catchment area and rainfall.

The tank is provided with:

- a) A manhole of $0.60 \text{ m} \times 0.60 \text{ m}$ size with cover,
- b) Vent pipe/overflow pipe of 100 mm diameter, and
- c) Drain pipe of 100 mm diameter at bottom.

The withdrawal of water from the underground tank is

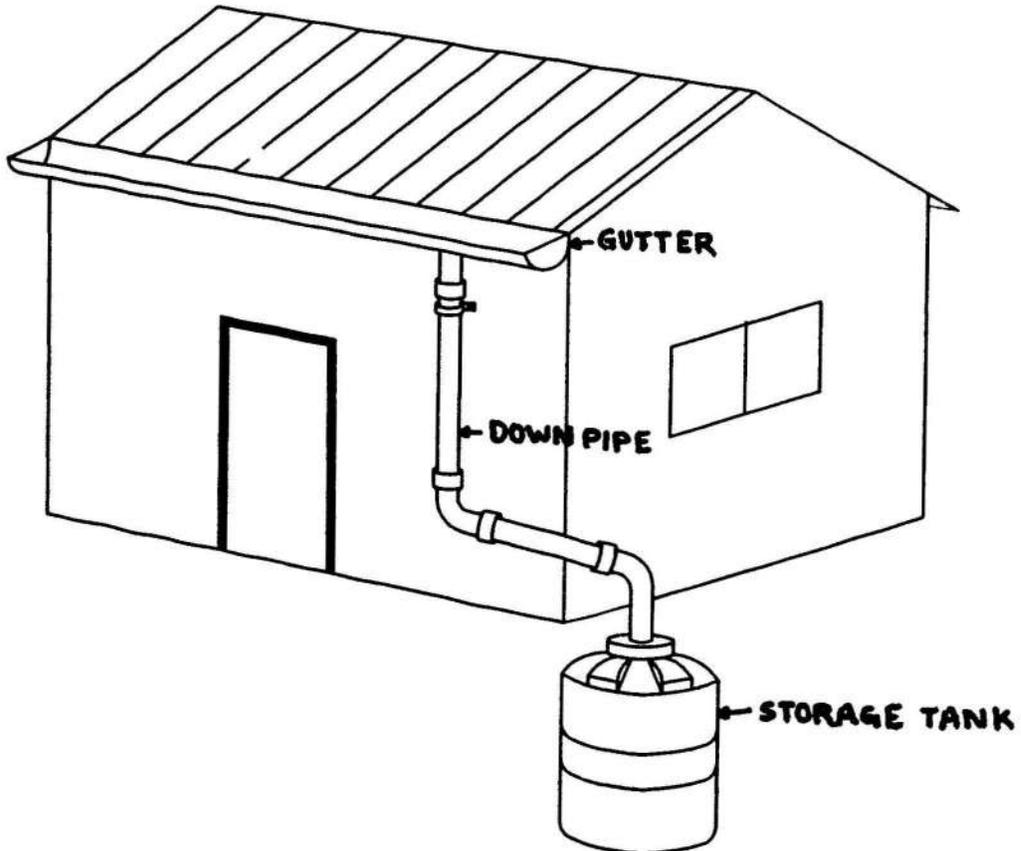


FIG. 3 STORAGE OF RAINWATER IN A HDPE TANK

done by installing a hand pump . In case of surface tank, taps may be provided. The overflow pipe should be connected to a drain/recharge pit.

Before the tank is put into use it should be thoroughly cleaned and disinfected with high dosage of chlorine. Since the water should remain stored for quite a long time, periodical disinfection of stored water is essential to prevent growth of pathogenic bacteria.

6.2 Site Assessment

Assessing the site conditions is the first step towards a sound system design. The five main site conditions to be assessed are:

- a) Availability of suitable roof catchment,
- b) Foundation characteristics of soil near the house,
- c) Location of trees,
- d) Estimated runoff to be captured per unit area of the roof, and
- e) Availability and location of construction material.

6.3 Estimating the Size of the Required System

The size of the catchment area and tank should be enough to supply sufficient water for the users during the dry period. Assuming a full tank at the beginning of the dry season (and knowing the average length of the dry season and the average water use), the volume of the tank can be calculated by the following formula:

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

where

- V = volume of tank, in litres;
 t = length of the dry season (days);
 n = number of people using the tank; and
 q = consumption in litres per capita per day.

If, for example, 20 lpd (q) is agreed upon and a dry period of 100 days (t) is normally not exceeded, a storage volume of 10 m³ would be required for a family of 5 members (n).

$$V = 100 (t) \times 5 (n) \times 20 (q) = 10\,000 \text{ litre or } 10 \text{ m}^3$$

The required catchment area (that is the area of the roof) can be determined by dividing the volume of the tank by the accumulated average rainfall volume (in litres) per unit area (in m²) over the preceding wet months and multiplying this with the runoff coefficient, which varies from 0.8 to 0.95 depending upon type of roof.

6.4 General Design Features

Roof top water harvesting systems can provide good

quality potable water, if the design features outlined below are taken into account:

- a) The substances that go into the making of the roof should be non-toxic and chemically inert.
- b) Roof surfaces should be smooth, hard and dense since they are easier to clean and are less likely to be damaged and release materials/fibres into the water.
- c) Roof painting is not advisable since most paints contain toxic substances and may peel off.
- d) No overhanging trees should be left near the roof.
- e) Nesting of birds on the roof should be prevented.
- f) All gutter ends should be fitted with a wire mesh screen to keep out leaves, etc.
- g) Appropriate arrangement for discarding the first flow of rainfall should be made.
- h) A hygienic soak away channel should be built at water outlets and a screened overflow pipe should be provided.
- j) The storage tank should have a tight fitting roof that excludes light, a manhole cover and a flushing pipe at the base of the tank (for standing tanks).
- k) There should be a reliable sanitary extraction device such as a gravity tap or a hand pump to avoid contamination of the water in the tank.
- m) There should be no possibility of contaminated wastewater flowing into the tank (especially for tanks installed at ground level).
- n) Water from other sources, unless it is a reliable source, should not be emptied into the tank through pipe connections or the manhole cover.

6.5 Management and Maintenance

Roof top catchment tanks, like all water supply systems, demand periodic management and maintenance to ensure reliable and quality water supply. If the various components of the system are not regularly cleaned, water use is not properly managed, problems are not identified or necessary repairs not performed, the roof catchment system will cease to provide reliable and good quality water.

Following is a time table of maintenance and management requirements that can provide a basis for monitoring and checking:

- a) During the rainy season, the whole system (roof catchment, gutters, pipes, screens, first-

flush and overflow) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.

- b) At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed of all sediment and debris (the tank should be refilled afterwards with a few centimeters of clean water to prevent cracking). Ensure timely service (before the first rains are due) of all tank fixtures, including replacement of all worn screens and servicing of the outlet tap or hand pump.

6.6 Water Use Management

Control over the quantity of water abstracted from the tank is important to optimize water use. Water use should be managed so that the supply is sufficient to last through the dry season. Failure to do so will mean exhausting all the stored water. On the other hand, underutilization of the water source due to severe rationing should also be avoided.

7 RECHARGE OF HARVESTED RAINWATER IN AQUIFERS

7.0 The runoff water collected from roof tops can artificially recharge and 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 greater than 8 m below ground level and underlain by permeable strata are suitable for artificial recharge.

7.1 Design of Efficient Artificial Recharge Structures

The design involves consideration of data on hydrological and hydrogeological aspects and hydrometeorological parameters. The background information to be collected is as given below:

- a) Layout plan of the area.
- b) Demarcation of the roof, paved and open areas.
- c) Delineation of storm water drains and flow of storm water.
- d) Details of the existing ground water abstraction structures in and around the vicinity of the project site.
- e) 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. The recharge scheme as prepared may also be got vetted by appropriate authorities and experts to incorporate suggestions for improvement.

7.2 Recharge Structures

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

- a) Recharge pits;
- b) Recharge trenches;
- c) Recharge through dry or operational dugwells;
- d) Recharge through abandoned/existing tube wells; and
- e) Recharge wells, etc.

7.2.1 Recharge Pits

- a) In alluvial areas where permeable rocks are exposed on the land surface or at very shallow depth, recharge pits are suitable for artificial recharge of water collected from the roof tops.
- b) The technique is suitable for buildings having a roof area of 100 m². The recharge pits are constructed for recharging the shallow aquifers.
- c) 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 backfilled 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.
- d) A mesh should be provided at the roof so that leaves or any other solid waste/debris are 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.
- e) The top layer of sand should be cleaned periodically to maintain the recharge rate.

7.2.2 Recharge Trenches

- a) Recharge trenches are suitable for buildings having roof area of 200-300 m² and where permeable strata is available at shallow depths.
- b) 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.

- c) These are backfilled 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.
- d) A mesh should be provided at the 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.
- e) The top layer of sand should be cleaned periodically to maintain the recharge rate.

7.2.3 Recharge Through Dry or Operational Dug Wells (see Fig. 4)

- a) Dry/operational dug wells if exist in the area may be utilized as recharge structures after cleaning and desilting the same.
- b) 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.

- c) Recharge water should be silt-free. For removing the silt content, the runoff water should pass either through a desilting chamber or filter chamber.
- d) Periodic chlorination should be done for controlling the bacteriological contamination in operational dug well.
- e) Wire mesh filter should be provided just before the inlet to avoid entry of any foreign material, tree leaves, etc, in to the dug well.

7.2.4 Recharge Through Abandoned/Existing Tube Wells (see Fig. 5 and Fig. 6)

- a) Abandoned/existing tube wells may be used as recharge structures.
- b) The abandoned tube well should be properly developed before use as recharge structure.
- c) PVC pipes of 10 cm diameter are connected to roof drains to collect rainwater.
- d) The first roof runoff is drained through the bottom of drain pipe if existing tube well is used as recharge structure. After closing the bottom pipe, the rainwater of subsequent rain showers is taken through a 'Tee' to an online PVC filter in case of small roofs. If the roof area is larger, a filter pit may be provided. Rainwater from roofs is taken to collection/

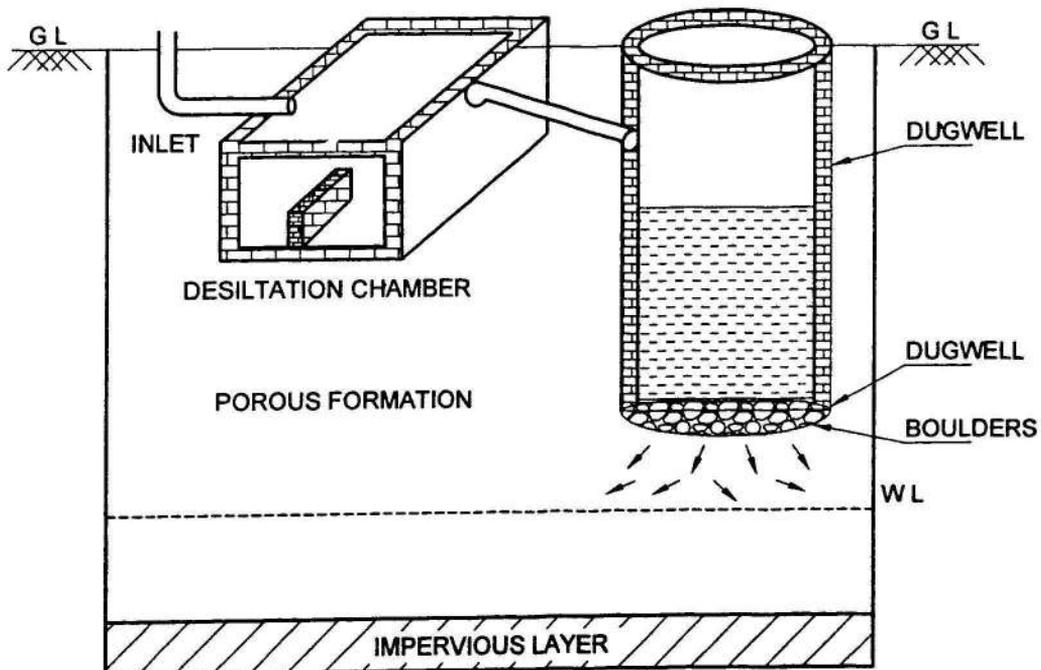


FIG. 4 RECHARGE THROUGH DUG WELL

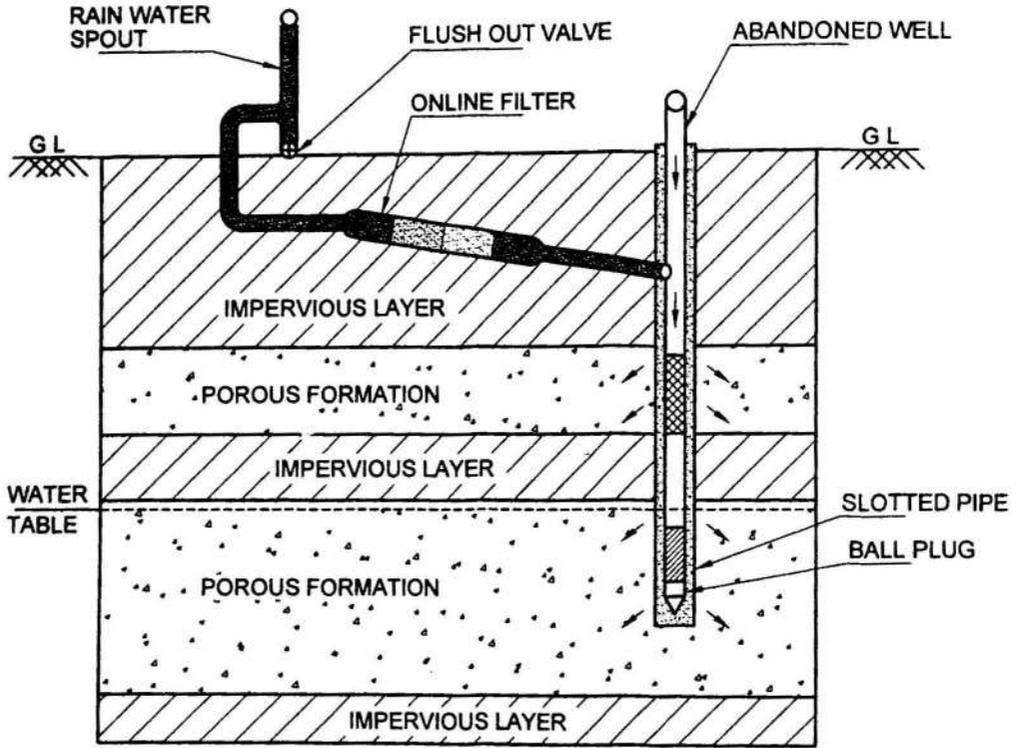


FIG. 5 RECHARGE THROUGH ABANDONED TUBE WELL

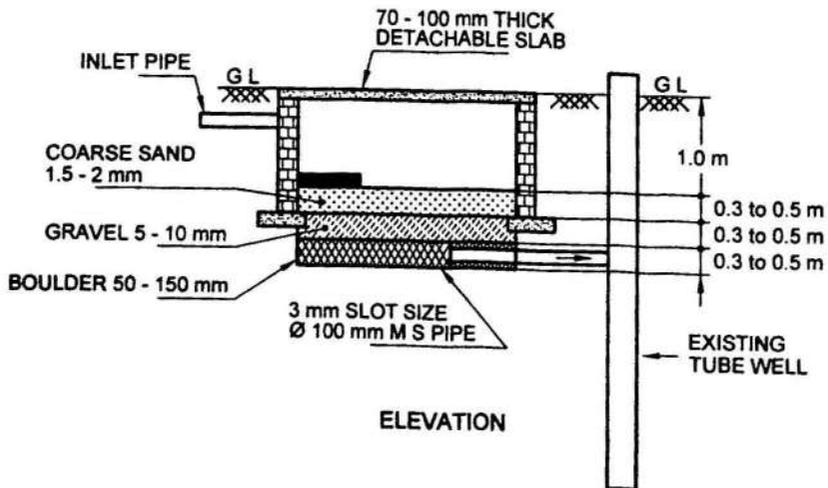
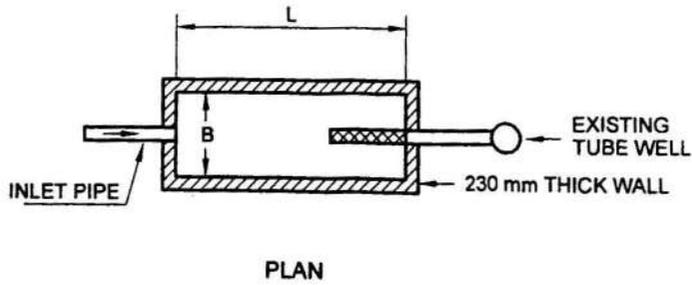


FIG. 6 RECHARGE THROUGH EXISTING TUBE WELL

desilting chambers located on ground. These collection chambers are interconnected as well as connected to the filter pit through pipes.

- e) A connecting pipe with recharge well is provided at the bottom of the pit for recharging of filtered water through well.
- f) Wire mesh filter should be provided just before the inlet to avoid entry of any foreign material, tree leaves, etc., in to the system.

7.2.5 Recharge Wells (see Fig. 7)

- a) In areas where the aquifers are overlain by a considerable thickness of impervious formation, a new recharge tube well can be constructed for recharging the harvested rainwater.
- b) It is used for recharging single/multiple aquifers.
- c) A settlement-cum-storage tank is constructed near the tube well for settlement of silt particles and storage of excess water.
- d) Roof top water is diverted to the settlement tank through pipes.

- e) Clear water of storage tank is diverted to the recharge tube well for recharge.
- f) It is suitable for recharging roof top rainwater of big buildings/blocks.
- g) If runoff availability is less, then online filter may be used in the pipe line connecting roof water with recharge well.

7.2.5.1 Construction of recharge well

These are drilled by deploying the appropriate rig unit or by hand boring as per the site conditions and depth of the tube wells.

A well assembly of pipes with diameters varying from 100 to 250 mm may be lowered throughout the depth. Both M.S. and PVC pipes can be used. PVC pipes are rigid, light pipes in 6 or 9 m lengths available in all diameters. The main advantage of PVC pipes is their resistance to corrosion and slots of the pipes will not close with time. As the slotted pipes in recharge wells are in fluctuation zones of water levels, slots of M.S. pipes may become closed due to rusting. The main drawback of PVC pipes is that, these pipes can not be used in large diameter recharge wells. M.S. Pipes may be coated with bituminous coating to avoid rusting.

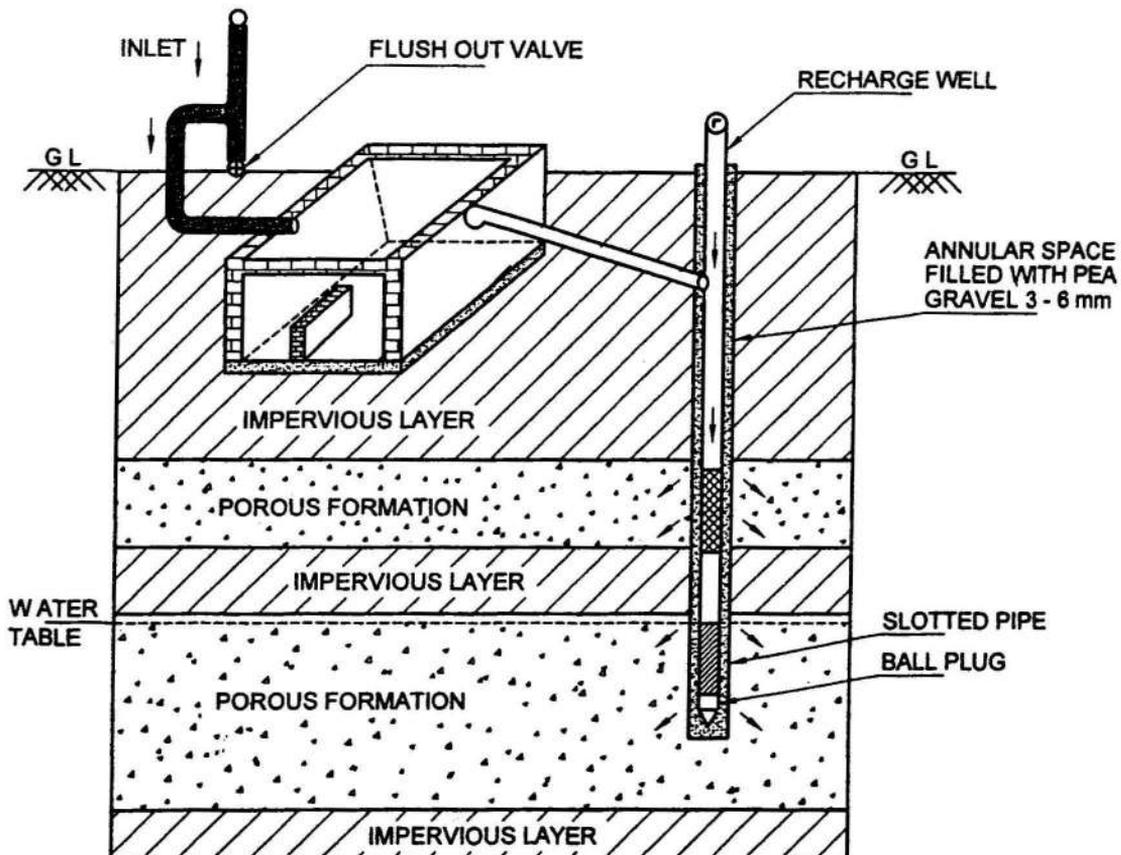


FIG. 7 RECHARGE THROUGH BORE WELL

After excavation of the recharge trench/shaft or filtration chamber is over, pipes should be rechecked and cleaned with wire brush. Depth sounding of recharge wells should be taken with tape to make sure that no silt or soil has gone into the recharge wells during the excavation of trench/shaft. Width of slots in recharge well should be in accordance with the aquifer system encountered. Slotted pipes should be placed against the aquifer or dried-up aquifers encountered in the recharge wells. A slotted pipe at the top of the recharge well will need to be placed to permit the entry of clean/clear water into the recharge well.

The annular space around the well assembly may be shrouded with appropriate size of gravel. The gravel should be washed so that it is silt-free. The recharge tube well should be developed by low capacity air compressor or by bailing method as required. The well may also be cleaned and developed by pouring the water from outside if required. The water levels of the tube well should be recorded and the well covered with cap with a provision to monitor the well in future. A vent pipe of about one inch diameter is also recommended which can act as escape for gases and for measuring the water levels. Once the recharge trench or shaft is constructed around the recharge tube well, recharge wells may be developed with hand bailers to avoid the disturbance of filter media.

7.2.5.2 Recharge ability test

To test the recharge ability of the tube well, a slug test may be conducted [see IS 14476 (Part 6)].

7.3 Filters

Generally, the following two types of filters are used :

- a) *Online Filter*
 - 1) This filter is used when availability of runoff as well as recharge rate of recharge well is less.
 - 2) Manufactured from reinforced engineering plastic material.
 - 3) Available in various sizes and flow rates ranging from 3 to 25 m³/h.
 - 4) Easy to open and clean.
- b) *Purpose Built Filter*
 - 1) The filter material recommended is coarse sand of 1.5 to 2 mm size at the top, followed by gravel of 5 to 10 mm size, and boulders of 5 to 20 cm at bottom. The thickness of each layer should be about 0.5 m. Coarse sand should be placed at the top so that the silt content that comes with runoff will be deposited on the top of the coarse sand/

pea gravel and can easily be removed. For smaller roof area the pit may be filled with overburnt broken bricks/cobbles.

- 2) After excavation of filter chamber, boulders and gravel should be filled up first to the foundation of wall of the structure.
- 3) After filling of boulder and gravel, filter material should be covered with polythene/jute bags to avoid spilling of construction material, which may damage the filter bed. After the construction of walls, the polythene/jute bags should be removed and the sand/pea gravels filled up to the recommended depth as per the design.
- 4) Filter media should be free from silt and any other foreign material. Before putting the filter material into the chamber, filter material should be sieved and washed to remove all the finer material. During operation the scouring effect of flow of water into the structure should be checked upon and if flow is disturbing the filter media, the water can be released near the filter media. This can be done by providing an 'I' shape joint in the inlet pipe in trench.
- 5) Regular inspection of filter material is essential in recharge structures. Silt deposited on the filter media should be cleaned regularly. Once in a year the top 5-10 cm sand/pea gravel layer should also be scraped to maintain a constant recharge rate through filter material.
- 6) Growth of grass or bushes hampers the filtration rate of the chamber. The grass and bushes should be cleared regularly.

7.4 Maintenance of Catchment Area, Water Drains and Recharge Structures

- a) The catchments should be neat and clean. The roof top/terrace of the building spaces around the buildings should not be used for dumping of unwanted items and scrap material.
- b) The washing machine water having heavy dose of detergents should not be allowed to enter into the water drains which are connected with recharge structures.
- c) 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 as well as close to the suspected silt and waste accumulation places within the channel.
- d) Protect the drainage system from tree leaves, polythene bags, plastic bottles and pouches of eatables.
 - e) Put up sign boards mentioning that the campus of building is equipped with rainwater 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 staff maintaining the storm water drains to keep the drains neat and clean.
 - f) Provide wire mesh filter just before the inlet. Provide silt check wall within the drain bed at a convenient place. If more silt is expected provide check wall at regular intervals in the storm water drains.
 - g) The periodic removal of the material deposited on the surface be done by scraping
- h) Precaution should be taken to avoid domestic waste water entering into the recharge structures.
 - j) Recharge tube wells should be developed periodically by hand bailers to avoid clogging of the slots.
 - k) Before the arrival of monsoon, the roof top as well as drains should be properly cleaned.
 - m) Length and placement of the slotted pipe should be finalized after drilling of pilot hole for tube well.
 - n) Recharge water should be introduced into the structure at its lowest point to prevent erosion and disturbance of filter material.
 - p) A wire mesh should be placed at the entrance of recharge structures.
 - q) Periodic cleaning of collection chambers should be carried out to remove the plastic bags, leaves, etc, which may choke the entry of water recharge structures.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Ground Water and Related Investigations Sectional Committee, WRD 3

<i>Organization</i>	<i>Representative(s)</i>
Central Ground Water Board, New Delhi	SHRI B. M. JHA (<i>Chairman</i>) [Member (SAM)]
Central Electricity Authority, Hyderabad	SHRI MAJOR SINGH SHRI S. B. ATRI (<i>Alternate</i>)
Central Ground Water Board, Faridabad	DR S. K. JAIN SHRI S. K. SINHA (<i>Alternate</i>)
Central Pollution Control Board, New Delhi	DR R. C. TRIVEDI DR SANJEEV AGRAWAL (<i>Alternate</i>)
Central Soil and Salinity Research Institute, Karnal	DR S. K. GUPTA
Central Water & Power Research Station, Pune	DR N. GHOSH SHRI R.S. RAMTEKA (<i>Alternate</i>)
Central Water Commission, Faridabad	SUPERINTENDING ENGINEER (PLANNING CIRCLE) DIRECTOR (WM) (<i>Alternate</i>)
Centre for Water Resources Development & Management, Kozhikode	HEAD DR E. J. JAMES (<i>Alternate</i>)
Geological Survey of India, Lucknow	SHRI S. KUMAR SHRI Y. DEVA (<i>Alternate</i>)
Ground Water Surveys and Development Agency, Pune	DR B. S. CHANDRASEKHAR SHRI S. P. BAGDE (<i>Alternate</i>)

<i>Organization</i>	<i>Representative(s)</i>
Gujarat Water Resources Development Corporation, Gujarat	SHRI J. P. RAVAL SHRI A. D. GOHIL (<i>Alternate</i>)
India Meteorological Department, New Delhi	SHRI N. Y. APTE
Indian Institute of Technology, Roorkee	DR DEEPAK KHARE
Irrigation Department, Government of Punjab, Chandigarh	CHIEF ENGINEER DIRECTOR (<i>Alternate</i>)
Irrigation Department, Government of Uttarakhand, Dehra Dun	CHIEF ENGINEER SUPERINTENDING ENGINEER (I & PI) (<i>Alternate</i>)
Ministry of Environment & Forests, New Delhi	ADVISOR DR (SMT) NALINI BHAT (<i>Alternate</i>)
National Bureau of Soil Survey & Land Use Planning, New Delhi	DIRECTOR
National Geophysical Research Institute, Hyderabad	DR D. MURALIDHARAN
National Hydroelectric Power Corporation Ltd, Faridabad	SHRI IMRAN SAYEED SHRI P. PUNETHA (<i>Alternate</i>)
National Institute of Hydrology, Roorkee	DR A. K. BHAR DR N. C. GHOSH (<i>Alternate</i>)
National Remote Sensing Agency, Hyderabad	HEAD, HYDRO GEOLOGY DIVISION
North Eastern Region, Tejpur	DR P. V. SEETHAPATHI DR S. C. PATRA (<i>Alternate</i>)
River Research Institute, Government of West Bengal, Kolkata	SHRI R. CHAKRABORTY
Survey of India, New Delhi	BRIG G. S. CHANDELA SHRI C. B. SINGH (<i>Alternate</i>)
Water & Land Management Institute, Aurangabad	DR B. M. SAHNI SHRI B. B. JADIA (<i>Alternate</i>)
Water Technology Centre for Eastern Region, Orissa, Bhubaneswar	SHRI R. C. SRIVASTAVA
BIS Directorate General	SHRI A. M. DAVID, Director (WRD) [Representing Director General (<i>Ex-officio</i>)]

Member Secretary
Ms BHAVANA SHARMA
Assistant Director (WRD), BIS

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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PARWANOO. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Minutes of the meeting held on 16.03.2023 at 4:30 PM under the Chairmanship of Secretary(WR,RD&GR), MoJS on the presentation of the Report of the Committee constituted on the directions of Hon'ble NGT in the matter of OA No. 147/2021.

A meeting was held under the chairmanship of the Secretary, DoWR, RD &GR, Ministry of Jal Shakti in the Conference Room of the Ministry of Jal Shakti on 16.03.2023 at 4:30 PM on the presentation of the Report of the Joint Committee of CPCB, MoJS and MoH&UD constituted in the matter of Rainwater Harvesting Systems in India as per the directions of Hon'ble NGT in **Original Application (OA No. 147/2021, Mahesh Chandra Saxena Vs the Chief Secretary, Govt. of NCT of Delhi & Ors)**. The meeting was held in hybrid mode. List of the officers who attended the meeting is given in **Annexure-I**.

The Member (CGWA) and Member Secretary of the committee made the presentation on RWH report prepared by the committee, explaining background of the matter, salient findings from the field visits of committee and suggestions/recommendations made by the committee.

After detailed deliberations following observations were made:

- While referring to BIS Standard for RTRWH System, relevant parts should be highlighted to make it easily comprehensible by users.
- The recommendation that there should be Single Nodal Agency in each State for RWH may not be practically feasible. Hence, it may be dropped.
- The recommendation regarding artificial recharge sites to be located at safe distance from possible contaminant sources may be qualified with the words 'as far as possible' considering the dense population in large cities.
- Recommendation regarding penal provisions in case of contamination due to faulty design of RWH structures may be advised as the last resort.
- Efforts should be to make all stakeholders aware about proper RWH system through simple Do's and Don'ts in order to fill the gaps existing between the scientific requirements of a RWH system and its actual implementation.
- The observed increase in nitrate level in RWH sites visited at Jaipur may be studied further to find out the reasons behind the phenomenon.

The Following Actionable Points emerged from the meeting:-

- i. Study should be undertaken to find out reasons for steady increase in EC and Nitrate values at visited RWH sites in Jaipur. The present Joint Committee for RWH should carry out this study in association with State Nodal Agency for RWH.
- ii. Advisory may be issued to all the States/UTs for prevention of potential contamination from unscientific implementation of RWH systems. The Advisory may be shared with NWM for its amplification.
- iii. An easily comprehensible SOP with simple Do's and Don'ts may be prepared and circulated, which shall be amplified by NWM.
- iv. Advisory for the States may be prepared, incorporating above observations and may be shared with them for compliance.
- v. The action taken on NGT's directions may be submitted to NGT.

Meeting ended with vote of thanks to the Chairperson.

Annexure-I

LIST OF ATTENDEES

In-chair: Shri Pankaj Kumar, Secretary, DoWR, RD & GR, MoJS.

DoWR, MoJS

1. Ms Archana Varma, Additional Secretary, DoWR and Mission Director, NWM
2. Shri Subodh Yadav, Joint Secretary (A, IC & GW), DoWR, RD&GR, MoJS
3. Shri A S Goel, Commissioner, SPR, DoWR, RD&GR, MoJS
4. Ashish Kumar, Director (GW), DoWR, RD&GR, MoJS
5. Shri Madhukar Singh, Scientist C& TS to JS, DoWR, RD&GR, MoJS
6. Shri Rajendra Kumar Sahu, US(GW), DoWR, RD&GR, MoJS
7. Shri Jaiprakash Yadav, ASO, GW Desk, DoWR, RD&GR, MoJS

CGWA/ CGWB

7. Shri Sunil Kumar, Chairman, CGWB and Chairman of Joint Committee.
8. Shri A.K. Agrawal, Member, CGWA and Member Secretary, Joint Committee
9. Dr B R Lamsoge, Scientist E and HoO, CGWA, New Delhi
10. Dr Vikas Ranjan, Scientist D, CGWA, New Delhi
11. Regional Director/ HoO/ Officers, CGWB, NWR, Chandigarh/ CGWB, WR, Jaipur/ CGWB, SUO, New Delhi/ CGWB, SWR, Bengaluru/ CGWB, SECR, Chennai (**Joined Online**).

CPCB (Joined Online)

12. Shri J C Babu, Scientist, CPCB, Bengaluru and Member of Joint Committee
13. Ms Alpana Narula, SSA, CPCB, New Delhi, Member of Joint Committee

MoH&UA

14. Dr. Ramakant, Deputy Advisor, PHE, CPHEEO and Member of Joint Committee
15. Shri Vinay Pratap Singh, Director, MoH&UA

MoRD (Joined Online)

16. Shri Amrendra Pratap Singh, Director (MGNREGA), MoRD

Delhi State

17. Shri M C Ram, Chief Engineer, Delhi Jal Board
18. Shri Harish Chander, Additional Chief Engineer (GW/ RWH), Delhi Jal Board

Haryana State (Joined Online)

19. Shri Pankaj Mahala, Chief Hydrologist, GW Cell, WRD, Haryana

Karnataka State (Joined Online)

20. Shri Vijaykumar Kadakbhavi, Chief Environmental Officer-2, KSPCB
21. Shri B.G. Ramachandraiah Director, GW Directorate, Karnataka
22. Shri G. Jayanna, Deputy Director, GW Directorate, Karnataka
23. Smt Ambika T, Deputy Director, GW Directorate, Karnataka
24. Smt. Jagadeshwari, M Senior Geologist, GW Directorate, Karnataka
25. Dr UT Vijay, Executive Secretary, Karnataka State Council of Science & Technology
26. Sri. Vaghesh, Additional Chief Engineer (N)-1, BWSSB
27. Smt. Vinay Kumari, Deputy Chief Engineer(M)-2, BWSSB
28. Smt. Vidya Kanoji, EE(QA), BWSSB

Rajasthan State

29. Shri Ashvani Kumar Yadav, Superintending Engineer, WRD, Rajasthan

Tamil Nadu State (Joined online)

30. Shri Sreedhar, Deputy Director, WRD, Tamil Nadu

By-Email**F.No. T-81011/77/2021 - GW Section-MOWR**

भारत सरकार

Government of India

जल शक्ति मंत्रालय

Ministry of Jal Shakti

जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

D/o WR, RD & GR**(भूजल अनुभाग / Ground Water Section)**

Shram Shakti Bhawan, Rafi Marg
New Delhi, Dated: 31/03/2023

To,

The Chief Secretaries/Administrators of all the States/UTs of India. (as per the Standard list)

Subject:- Prevention of potential contamination of ground water from Rain Water Harvesting systems in Urban Areas - reg.

Sir/ Madam,

I am directed to invite your kind attention towards Hon'ble NGT's observations, expressing concern over Rain Water Harvesting (RWH) system being one of the potential source of contamination of ground water in the country. The Principal Bench, Delhi of Hon'ble NGT, while disposing of matter related to societies in Dwarka area, Delhi (OA 147/2021), vide their order dated 10.12.2021 directed that *at many places where RWH systems are installed, the same are either not functional or resulting in contamination of ground water which situation needs to be remedied not only in Delhi but pan India. This may be urgently looked into by a joint Committee of CPCB, Ministry of Jal Shakti (MoJS) and Ministry of Urban Development, Government of India. MoJS will be the nodal agency for the purpose.*

2. In this regard, a Committee as per directions of Hon'ble NGT was constituted by this Department which visited selected RWH sites in 05 States i.e. Delhi, Haryana, Karnataka, Rajasthan and Tamil Nadu and submitted its report. The committee found that deficiency do exist in implementation of RWH system at certain places and due attention

was not given to possibility of contaminants breaching into the RWH system and eventually finding way into groundwater, particularly where the harvested water is directly used for Artificial Recharge (AR). From the report of the committee and their experience gained during site visits, it is quite likely that similar situations may exist in other States too. In view of this, a **guideline on RWH** system and **SoP with Do's and Dont's** as per **Annexure-I & Annexure-II** respectively are enclosed herewith.

3. It is requested to kindly direct/ instruct concerned Departments/ agencies to strictly follow the guidelines including Do's & Dont's while implementing the RWH systems in your State. Further, the concerned Department/agency in the State may approach Regional Director Offices of Central Ground Water Board (CGWB) for technical guidance/ support, if any.

4. This issues with the approval of the Competent Authority.

Yours sincerely,

(Rajendra Kumar Sahu)

Under Secretary to the Govt. of India

Ph: 011-23766907

Email: gwdesk-mowr@nic.in

Copy to:

- i. Sr. PPS to Secretary, DoWR, RD & GR, MoJS
- ii. SPPS to Special Secretary, DoWR, RD & GR, MoJS
- iii. Sr PPS to AS&MD, NWM
- iv. PPS to JS(A,GW & IC), DoWR, RD & GR, MoJS
- v. Sr PPS to Secretary, MoH&UA
- vi. PPS to Chairman, CPCB
- vii. PPS to Chairman, CGWB

Annexure-I

- i. The Committee recommended to give stress on contamination

aspect while designing and implementing the RWH systems and suggested for strictly adhering to the **BIS Standard - IS 15797:2008 (for implementation of Roof Top Rain Water Harvesting System in the country)** which is a very comprehensive document (a copy is enclosed for ready reference). Section 6.5 of the document deals with general 'Management and Maintenance' of the system and Section 7.4 specifically tells about 'Management of Catchment Area, Drains and Recharge Structures'. Section 7 provides designs of AR structures suitable at various different situations.

- ii. It has also been suggested to avoid Rain Water Harvesting System for the purpose of Artificial Recharge in certain urban areas especially in congested places in the vicinity of sewerage system components/ landfill sites etc where chances of contamination are high through mingling of untreated sewerage water/domestic wastes.
- iii. The Committee has further suggested that in case of small households, cluster based RWH system should be promoted in place of individual household schemes.
- iv. States may promote incentivization for adopting RWH, either in the form of rebate or subsidy in water-stressed areas.
- v. Large-scale RWH system, such as those in large industrial, residential and commercial complexes, should have piezometer(s) installed at appropriate site(s) for periodic monitoring of water level and water quality. These parameters are the most important and reliable indicators of functioning status and health of RWH system.
- vi. The design of RWH should by-pass first roof top harvested rainwater. Mixing of drain water with rooftop run off or with runoff from paved areas, where vehicular movement takes place, should be prevented.
- vii. As water quality may not be strictly checked, the water stored in harvesting structures may be used strictly for non-potable purposes.
- viii. Concept like RWH Theme Park, Bengaluru may be promoted for proper guidance to general public/ individual households.
- ix. All RWH sites should be geo-tagged for better visibility for monitoring purpose.
- x. There should be mechanism to avoid misuse of the recharge tube-wells for pumping purposes.
- xi. Suitable online filters can be considered in the pipeline to avoid minor contaminants, if any, while harvesting the rooftop rainwater to the recharge tube-wells.
- xii. District Jal Shakti Kendras may be strengthened and general public may be sensitised to follow correct RWH system through regular awareness generation by means of mass media, print media etc.
- xiii. District administration may randomly check few RWH sites on monthly basis and suitable directions/corrective action may be suggested to the owner(s) of the RWH system(s) and the same may be followed up for strict implementation post inspection.

Annexure-II

DOS AND DON'TS WHILE IMPLEMENTING ROOF TOP RAIN WATER HARVESTING AND ARTIFICIAL RECHARGE

A. While Planning Implementation of Scheme/ Construction of Structures

Dos

- **Choose the right recharge technique:** RWH schemes should have Artificial Recharge provisions depending upon local hydrogeological/ site-specific conditions. In this regard, the BIS Standard - IS 15797:2008, for implementation of Roof Top Rain Water Harvesting System may be referred to. Section 7 provides designs of AR structures suitable to different situations.
- **Source Water:** Only non-polluted rainwater from the roof tops and other catchment areas has to be diverted to recharge structure through connection of downpipe.
- **RWH/ AR Sites at Safe Distance:** Depending upon groundwater flow direction, RWH/AR sites should be located at safe distance from possible contaminant source such as sewage drains/ landfill sites/ cesspool/ sewage system having hydrogeological connectivity with the aquifer.
- **Insulation from Possible Contaminant Source:** There should be proper arrangements in place to prevent sewage water or contaminated water from paved area from mixing into run-off/ recharged water.
- **Provision of Filters:** There should be proper mechanism to let the water pass through filter media before entering into recharge system in order to minimize the possibility of aquifer material getting choked. Online filters (filters fitted in pipelines carrying roof top water) can also be used to avoid minor contaminants, if any, for diverting the rooftop rainwater to the recharge tubewells.
- **Provision for By-pass of First Flush:** RWH system should be designed in a way to allow by-pass first flush (first rainwater).
- **Provision for pre-treatment of water:** The Water should be pre-treated to remove suspended solids, organic matter, and other contaminants before recharge. This will help prevent clogging of the recharge structure and protect the groundwater quality.
- **Dual pipe system for utilization of harvested water:** Dual pipe system should be installed for utilization of harvested water for non-potable purposes, i.e other than drinking, cooking and bathing.
- **Cluster-based RWH System:** In the areas of only small households, cluster-based RWH system should be promoted in place of individual household scheme.
- **Installation of Piezometers:** Large-scale RWH system, such as those in large residential and commercial complexes, should have piezometer(s) installed at appropriate site(s) for periodic monitoring of water level and water quality. These parameters are the most important and reliable indicators of functioning status and health of RWH system.
- **Geotagging of RWH/ AR Sites:** All RWH/ AR sites should be geo-tagged for better visibility for monitoring purpose.

Don'ts

- It is better to avoid RWH/ AR in areas having shallow ground water levels (say shallower than 5 metre below ground level (mbgl)).
- Recharge should be avoided in areas where there is possibility of contamination of groundwater. RTRWH with AR in buildings such as hospital buildings may be avoided. In such cases storage of rainwater for non-potable uses should be encouraged.
- There should be no mixing of drain water with rooftop run off.
- Run-off from paved area having vehicular movement should not be diverted towards RWH system.
- RWH/ AR sites should not be located in the vicinity of possible contaminant source such as sewage drains/ landfill sites/ cesspool/ sewage system having hydrogeological connectivity with the aquifer.
- Contaminated water should not be recharged as it can pollute the groundwater and make it unfit for human consumption.
- Domestic waste water should not be diverted directly to Recharge Pits, particularly in areas where water levels are shallow.
- Recharge wells should not be constructed beyond water level. Direct recharging below water level should not be done.
- Recharge structures should not be constructed in areas prone to flooding as they can be damaged or washed away during heavy rains.
- Recharge should not be unplanned. Unplanned recharge can lead to groundwater contamination, soil erosion, and other environmental problems.

B. Maintenance and Monitoring of RWH/ AR System

Maintenance of recharge structures is important to ensure their long-term effectiveness and sustainability. Here are some key maintenance practices that can help keep recharge structures functioning properly.

- First flush should be by-passed.
- Rooftops should be cleaned regularly.
- Filter material should be regularly cleaned/ replaced.
- Sediment and debris can accumulate in recharge structures over time, which can clog the pores and reduce the infiltration capacity. Regular cleaning can prevent clogging and help maintain the recharge capacity of the structure
- Regular monitoring and inspection of recharge structures can help detect any signs of damage, erosion, or clogging or damage early on, before they become more serious. This can include checking for cracks or damage to the structure, as well as monitoring the inflow and outflow of water.
- Water level and groundwater quality around the recharge structure should be regularly monitored through purpose-built piezometers.
- Monitoring mechanism should be effective through involvement of officials trained to evaluate functioning of installed RWH system as per BIS.
- Any damage or erosion to the recharge structure should be repaired immediately to prevent further damage. For example, if a recharge well has a

crack or a hole, it should be repaired as soon as possible to prevent soil from entering the well and clogging it. Prompt repair and maintenance can help prevent further damage and ensure the long-term effectiveness of the recharge structure.

- Vegetation can grow around recharge structures and block the inflow of water. Regular trimming of vegetation can help maintain the flow of water into the recharge structure.
- Keep a record of maintenance activities and observations for each recharge structure. This can help identify patterns or trends in maintenance needs and guide future maintenance activities.

Don'ts

- Do not dump pollutants or waste near or inside the RWH/ AR structure.
- Never leave the covers of RWH chamber/ AR structures open.
- Do not allow wastewater to flow towards RWH/ AR structures.

C. Other Suggestions

- Underground Storage tank/ sump, made using cross-wave technology or uPVC pipes saves space, besides providing strength to the structure. As it is costly, the technology may be used in large Government Buildings, commercial complexes and industrial premises.
- In the new buildings, the complex is divided in a way to have alternate bays for sewage and RWH channels.



File No: CGWA-26/1/2022-CGWA

Date: 31.03.2023

To

The Additional Chief Secretary/ Principal Secretary/ Secretary
Irrigation/ Water Resources/ Ground Water/ PHE
All States/ UTs (as per list)

Sub: Prevention of potential contamination of ground water from Rain Water Harvesting systems – Reg

Sir/ Madam

May I invite your kind attention towards Hon'ble NGT observations, expressing concern over Rain Water Harvesting system being one of the potential sources of contamination of ground water. The Principal Bench, Delhi of Hon'ble NGT, in its order dated **10.12.2022** while disposing of matter related to societies in Dwarka area, Delhi (OA 147/2021 ground water in the country. The Principal Bench, Delhi of Hon'ble NGT, while disposing of matter related to societies in Dwarka area, Delhi (OA 147/2021), vide their order dated 10.12.2021 directed that '*at many places where RWH systems are installed, the same are either not functional or resulting in contamination of ground water which situation needs to be remedied not only in Delhi but pan India. This may be urgently looked into by a joint Committee of CPCB, Ministry of Jal Shakti (MoJS) and Ministry of Urban Development, Government of India. MoJS will be the nodal agency for the purpose.*'

A committee constituted by the Ministry visited selected RWH sites in 5 States – Delhi, Haryana, Karnataka, Rajasthan and Tamil Nadu and submitted its report. On the basis of the findings of committee, Department of Water Resources, RD & GR, Ministry of Jal Shakti has issued advisory to all States vide letter No. T-81011/77/2021 - GW Section-MOWR, dated 31.03.2023 along with recommendations of committee and SOP for implementing Rain Water Harvesting schemes.

The advisory is enclosed herewith for compliance. Action taken on the advisory may please be communicated by 04.04.2023 for submission to Hon'ble NGT before the next hearing scheduled on 10.04.2023.

Yours faithfully

(A K Agrawal)

Member Secretary
Central ground Water Authority

To

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Email

Fwd: Advisory from DoWR, MoJS regarding prevention of contamination from Rain Water Harvesting Structures

From : Central Ground Water Authority <cgwa@nic.in> Fri, Mar 31, 2023 09:54 PM
Subject : Fwd: Advisory from DoWR, MoJS regarding prevention of contamination from Rain Water Harvesting Structures 3 attachments
To : N Varadaraj <rdcr-cgwb@nic.in>, ANADI GAYEN <rder-cgwb@nic.in>, M Santhana Subramani <rdkr-cgwb@nic.in>, Thakur Brahmanand singh singh <rdmer-cgwb@nic.in>, Dr. P. K. Naik <rdnccr-cgwb@nic.in>, Sh A K Biswal <rdncr-cgwb@nic.in>, Suresh Chandra Kapil <rdner-cgwb@nic.in>, Basant Kumar Oraon <rdnhr-cgwb@nic.in>, RD CGWB NR Lucknow <rdnr-cgwb@nic.in>, RD NWHR Jammu <rdnwhr-cgwb@nic.in>, RD NWR CGWB <rdnwr-cgwb@nic.in>, M.Sivakumar Regional Director <rdsecr-cgwb@nic.in>, RD SER CGWB <rdser-cgwb@nic.in>, J Siddhardha Kumar <rdsr-cgwb@nic.in>, Sh N Jyothi Kumar <rdsr-cgwb@nic.in>, Prashant Rai <rdur-cgwb@nic.in>, G KRISHNAMURTHY <rdwcr-cgwb@nic.in>, Regional Director <rdwr-cgwb@nic.in>
Cc : A.K.Agrawal <mcgwa-cgwb@gov.in>, RD, CGWA <rdcgwa-cgwb@nic.in>

To
All Regional Directors, CGWB
Sir/ Madam
Please refer to trailing mail for follow-up with the State Government
Regards
Dr Vikas Ranjan
Sc D

O/o सदस्य सचिव Member Secretary,

केंद्रीय भूजल प्राधिकरण Central Ground Water Authority

जल शक्ति मंत्रालय, भारत सरकार Ministry of Jal Shakti, Govt. of India

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Sent: Friday, March 31, 2023 9:52:57 PM

Subject: Advisory from DoWR, MoJS regarding prevention of contamination from Rain Water Harvesting Structures

Sir

Please find attached letter No. CGWA-26/1/2022-CGWA, dated 31.03.2023 from the Member Secretary, Central Ground Water Authority regarding compliance to advisory issued by DoWR, RD & GR, MoJS for prevention of contamination to ground water from Rain Water Harvesting.

Action taken on the advisory may please be communicated by 04.04.2023 for submission to Hon'ble NGT before the next hearing scheduled on 10.04.2023.

Regards,

O/o सदस्य सचिव Member Secretary,

केंद्रीय भूजल प्राधिकरण Central Ground Water Authority

जल शक्ति मंत्रालय, भारत सरकार Ministry of Jal Shakti, Govt. of India

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 **CGWA Letter Advisory from DoWR for compliance.pdf**

957 KB

 **DoWR Advisory for prevention of GW contamination from RWH.pdf**

124 KB

 **BIS_standard_RooftopRainWaterHarvesting.pdf**

8 MB
