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Goverment Of India

TECHNICAL REPORT
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REPORT ON FEASIBILITY OF ARTIFICIAL RECHARGE TO GROUNDWATER IN DEHRADUN DISTRICT, UTTRAKHAND FOR SUBMISSION TO MINOR IRRIGATION DEPARTMENT, GOVT. OF UTTARAKHAND

Central Ground Water Board, Uttaranchal Region

Department of Water Resources, River Development and Ganga Rejuvenation

Ministry of Jal Shakti

Govt. of India

REPORT ON FEASIBILITY OF ARTIFICIAL RECHARGE TO GROUNDWATER IN DEHRADUN DISTRICT, UTTRAKHAND

INTRODUCTION

District Dehradun is situated in NW corner of Uttarakhand state and extends from N Latitude 29^0 58' to 31^0 02' 30" and E Longitude 77^0 34' 45" to 78^0 18' 30". **(Fig: 1.1)** It falls in Survey of India Toposheets Nos. 53E, F, G, J and K. The district is bounded by Uttarkashi district on the north, Tehri Garhwal and Pauri Garhwal districts on the east and Saharnpur district (UP) on the south. Its western boundary adjoins Sirmour district of Himachal Pradesh separated by Rivers Tons and Yamuna.

The total area of Dehradun district is 3088 km^2 with an average altitude of 640 m above MSL. The district comprises of six tehsils, namely Dehradun, Chakrata, Vikasnagar, Kalsi, Tiuni and Rishikesh. Further, it is divided into six developmental blocks, viz: Chakrata, Kalsi, Vikasnagar, Sahaspur, Raipur and Doiwala. There are seventeen towns and 764 villages in this district. The administrative map of the district is shown in **Fig. 1.2.**

The district has within its limits lofty peaks of the Outer Himalayas as well as the Dun Valley with climatic conditions nearly similar to those in the plains. The temperature depends on the elevation. The climate of the district, in general, is temperate. In the hilly regions, the summer is pleasant but, in the Doon Valley, the heat is often intense. The temperature drops below freezing point not only at high altitudes but also even at places like Dehradun during the winters, when the higher peaks are under snow.

OBJECTIVES OF THE SCHEME

In recent meetings of SARRA held on 19/06/2024 and 21/06/2024, the construction of recharge wells across various locations in the Dehradun district was proposed by the Chair. This initiative aimed to enhance groundwater levels by replenishing shallow aquifers through rooftop rainwater harvesting.

Following these discussions, a request was received from the Chief Engineer, Minor Irrigation, Dehradun, dated July 23, 2024 (Ref: 645/la.si./karya/SARRA/2024-25)- Annexure- 1 seeking a feasibility assessment for the proposed recharge structures and specific recommendations on their construction depth. CGWB has received a list of 51 proposed sites from Minor Irrigation for the construction of recharge wells. Based on geo-locations provided, nearly all these sites are situated within the Raipur Block of the District.

HYDROGEOLOGY AND AQUIFER DISPOSITION

The hydrogeology of Dehradun district is influenced by its diverse geological and geomorphological features, which give rise to three distinct hydrogeological units:

1. **Himalayan Mountain Belt:**
    - Groundwater exists as localized bodies under both confined and unconfined conditions.
    - Rock types include quartzite, schist, shale, slate, phyllite, compact sandstone, limestone, and dolomite.
    - Secondary porosity from fissures, fractures, veins, and joints enhances groundwater storage.
    - Alluvial deposits in the form of fans and terraces are highly porous and permeable, suitable for groundwater exploration.
    - Springs exhibit varied discharge rates, from 1400 to 1507000 liters/day.
2. **Siwalik Zone:**
    - Groundwater occurs under confined and unconfined conditions.

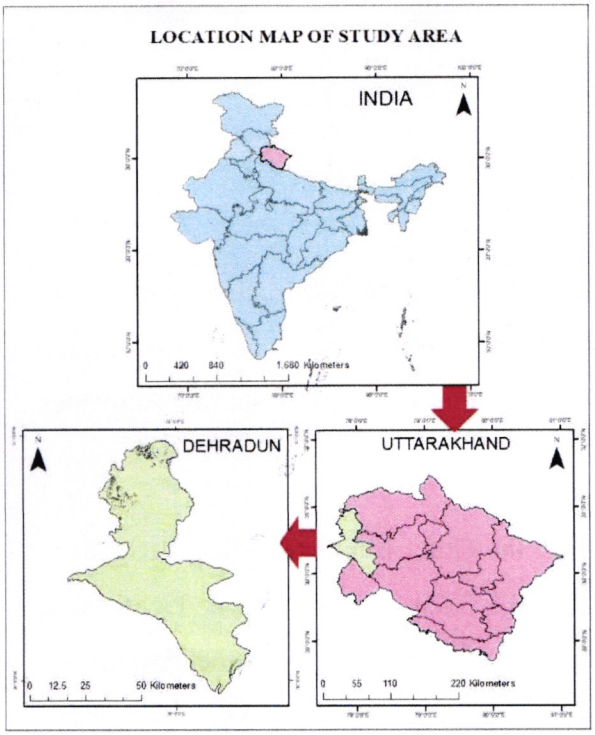

Fig 1.1: Location Map of Dehradun District, Uttarakhand

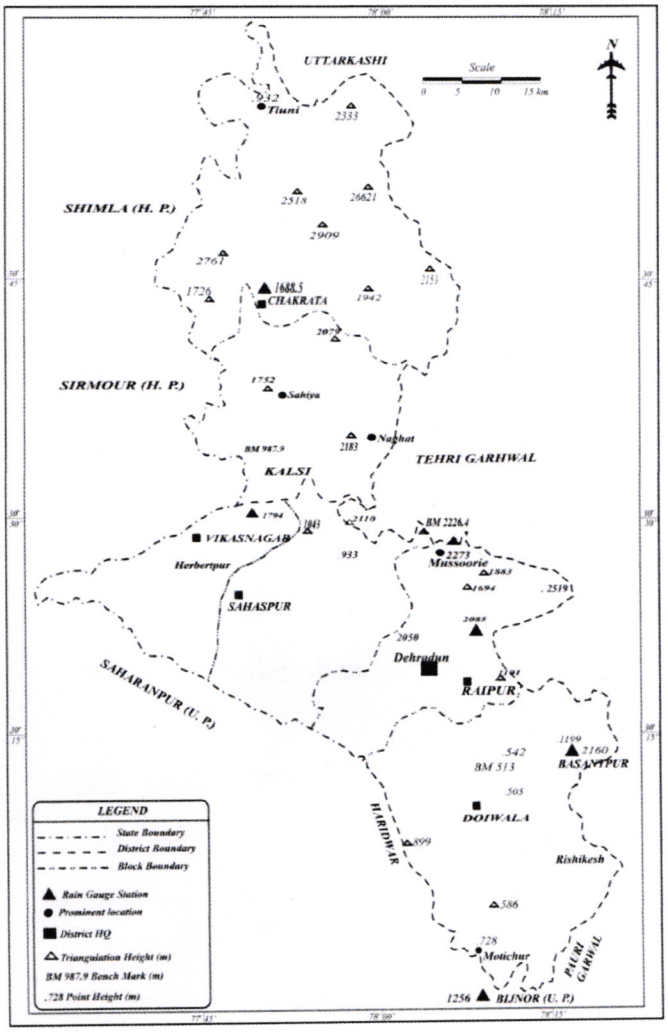

Figure 1.2 Administrative Map of Dehradun District, Uttarakhand

- Upper Siwalik Formation consists of pebble-gravel-conglomerate-boulder beds with high porosity and permeability.
- Freshwater zones are prominent due to these formations, which act as significant groundwater reservoirs.
- Gravitational springs show varying discharge rates, up to 113 liters/second.

3. **Doon Gravels:**
   - Found in the intermontane valley, underlain by alluvial fan deposits derived from the Lesser Himalayan and Siwalik hills.
   - Characterized by boulders, pebbles, sandy, and silty matrix.
   - Highly porous with significant permeability, groundwater occurs under unconfined and semi-confined conditions.
   - Saturated granular zones range in depth from 35.50 to 138.68 meters below ground level (m bgl).
   - Piezometric head ranges from 20.0 to 125.0 meters below ground level (mbgl).
   - Transmissivity varies from 1648.0 to 3500.0 m^2/day, and field permeability ranges from 5.86 to 104.0 m/day.
   - Hydraulic conductivity varies from 13 to 583 m/day.

Overall, the district's hydrogeological map (Fig: 1.3) illustrates these varied conditions, providing a comprehensive understanding essential for effective groundwater management efforts.

The aquifer configuration in the Raipur block, where the majority of recharge sites are proposed, has been delineated using a fence diagram and 3d diagram (Fig: 1.4 and 1.5) based on data from 4 exploratory wells by CGWB. The diagram reveals the presence of a multi-tiered aquifer system that is primarily confined to semi-confined, with instances of unconfined aquifers. These aquifers predominantly consist of boulders and gravel, indicating favorable conditions for groundwater recharge.

The potential zones exhibit promising yield prospects, as evidenced by significant discharge rates observed at key locations. For instance, the Forest Research Institute recorded a maximum

discharge of 2526 liters per minute (lpm) with a drawdown of 7.62 meters. Similarly, at Noorwala, a discharge of 815 lpm was observed.

This characterization underscores the robust groundwater potential in the area, highlighting areas suitable for effective groundwater management and recharge initiatives.

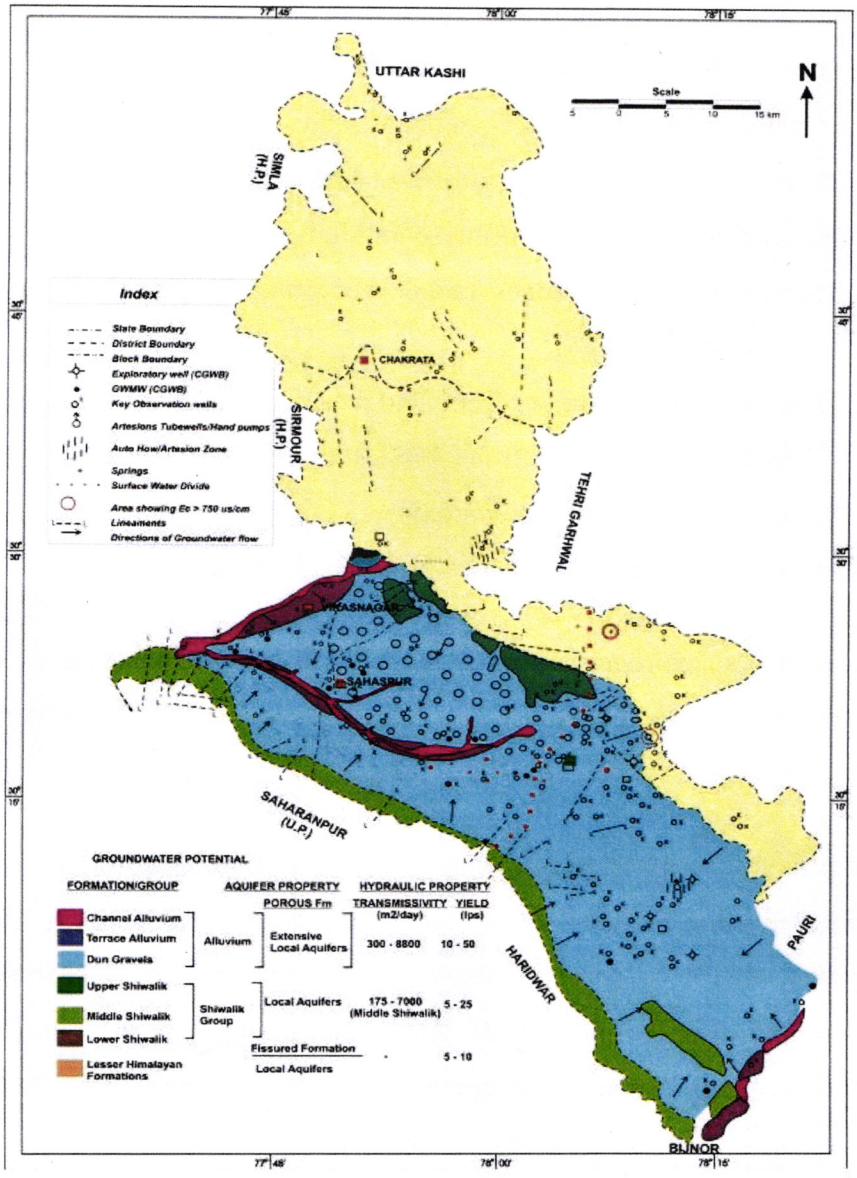

Fig 1.3: Hydrogeological Map of Dehradun District,Uttarakhand

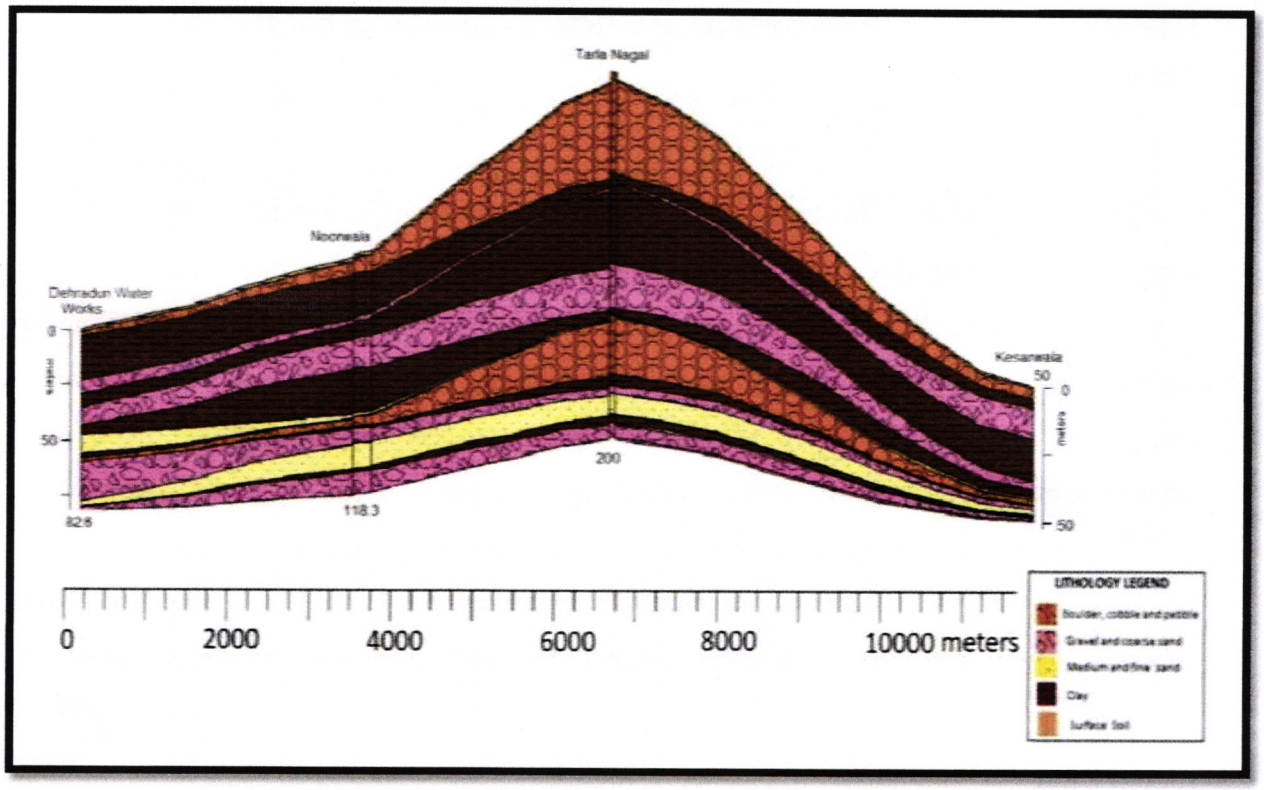

Fig: 1.4 Section Depicting Sub-surface Lithological Variation from Dehradun Water Works to Kesarwala, Raipur Block

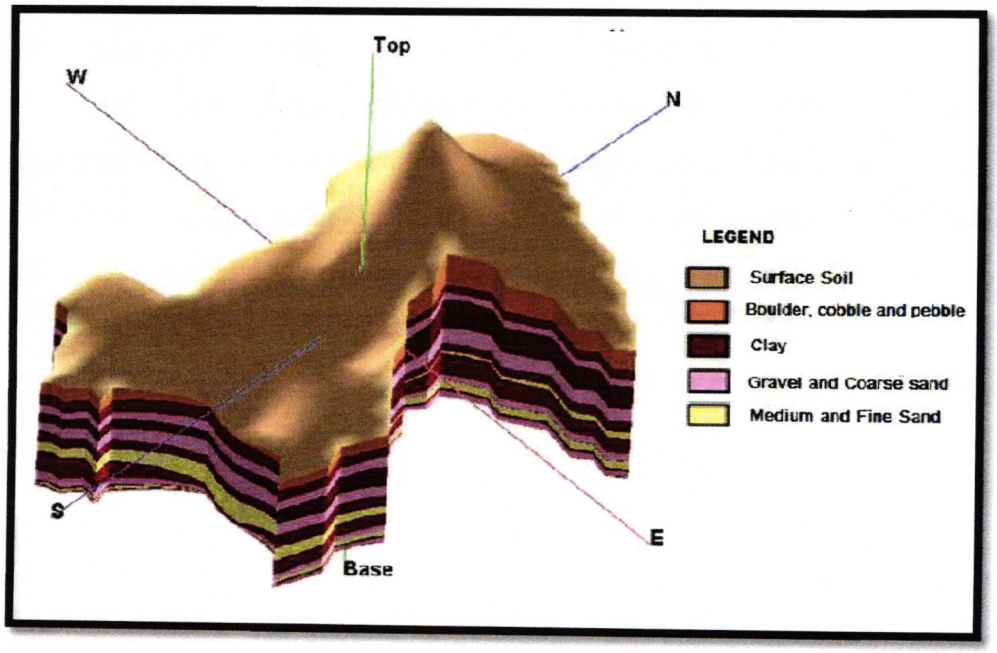

Fig: 1.5 3D Model of Raipur block depicting Sub-surface Lithological Variation

IMPLEMENTATION OF MEASURES FOR ARTIFICIAL RECHARGE TO GROUNDWATER IN DEHRADUN DISTRICT

Artificial recharge to groundwater through recharge wells is a method aimed at replenishing depleted aquifers by directing surface runoff or collected rainwater into vertical wells. These shafts are strategically positioned to facilitate efficient percolation of water into underlying aquifers, thus enhancing groundwater levels. Designed with filtration systems to maintain water quality, recharge wells offer a sustainable solution to combat groundwater depletion. This approach not only improves water availability in regions prone to water scarcity but also contributes to environmental conservation by minimizing reliance on unsustainable water extraction practices. Effective implementation hinges on careful site selection based on hydrogeological conditions, ensuring optimal recharge rates and long-term water security benefits.

Based on the latest groundwater level map of May 2024 (Fig: 1.6) across Dehradun district, areas suitable for implementing recharge measures have been delineated, and corresponding depths for recharge structures have been specified (Annexure- 2). Adhering to established guidelines, it has been determined that groundwater recharge efforts are feasible in locations where post-monsoon water levels remain more than 5 meters. According to the water level map, all sites identified by the Minor Irrigation department for recharge initiatives meet this criterion, affirming their suitability for targeted interventions aimed at bolstering groundwater resources. This strategic alignment ensures that recharge efforts align with current hydrological conditions, maximizing effectiveness in sustainable water management practices across the district.

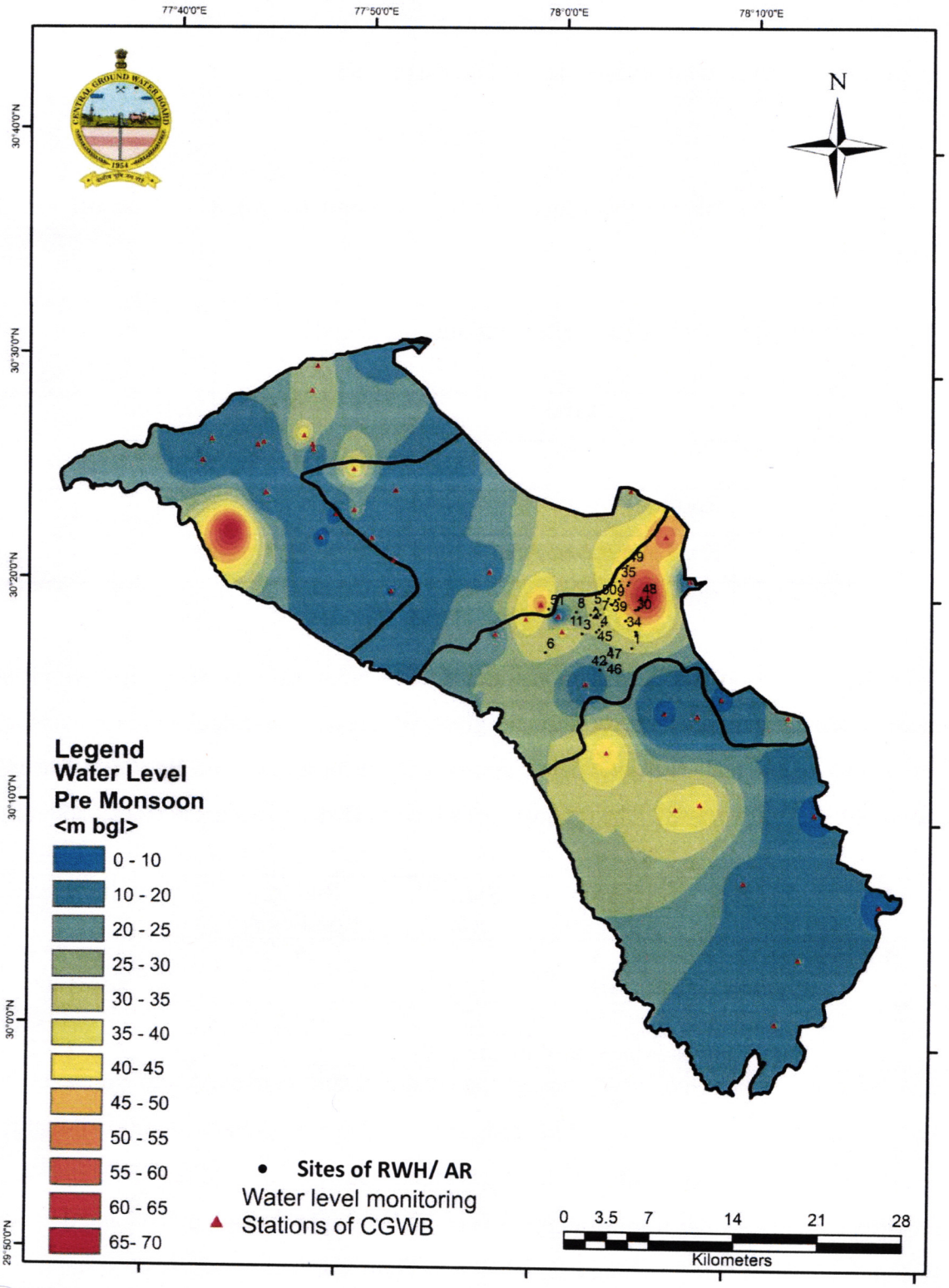

Fig: 1.6 Water Level Map of Dehradun District (Pre Monsoon 2024)

CALCULATION OF RAINFALL RUNOFF FROM ROOFTOP FOR ARTIFICIAL RECHARGE

The amount of rainwater harvested is computed as follows:

A X R X C

Where: A = Area of catchment (in sq.m), R = Rainfall (in m), C = Run off coefficient of catchment

As per the norms, the following coefficients are considered:

Sl No.	Type	Run off Coefficient
1	**2**	**3**
a	Rooftop	0.8
b	Road and Paved Area	0.6
c	Greenbelt	0.15

A model calculation has been demonstrated for a catchment area of 0.1 hectare (1000 square meters), which includes both rooftop and greenbelt areas. This calculation serves as a template for estimating the recharge potential of similar catchment areas (**Sample sheets for calculation provided in Annexure- 3**). The rainfall for Dehradun District is considered as 2500 mm.

Sl No.	Type	Area (sq.m)	Rainfall (m)	Run off Coefficient	Volume (m3/year)
1	**2**	**3**	**4**	**5**	**6= 3*4*5**
a	Rooftop	700	2.5	0.8	1400
b	Greenbelt	300	2.5	0.15	112
	Total rainwater harvested in one year				**1512**

The rainwater will be collected through piped drains and conveyed into rainwater harvesting system. Storm water drains should be designed for adequate size and slope such that there shall not be any flooding in the site. Water pipes should be UV resistant (ISI HDPE/PVC pipes) of required capacity. Water from sloping roofs could be caught through gutters and down take pipe. It shall be ensured that no wastewater shall enter into storm water drainage system. At terraces, mouth of the each drain should have wire mesh to restrict floating material. The first shower of rains needs to be flushed-off to avoid contaminating storable/rechargeable water by the probable

contaminants of the atmosphere and the catchment roof. Provisions of first rain separator should be made at outlet of each drainpipe. The water will be stored in a storage tank and then recharged through recharge well.

Considering a peak rainfall event with intensity of rainfall 25 mm/ hr, the amount of water that will be generated as runoff in one hour is calculated as below:

Sl No.	Type	Area (sq.m)	Rainfall (m/ hr)	Run off Coefficient	Volume (m^3/hr)
1	**2**	**3**	**4**	**5**	**6= 3*4*5**
a	Rooftop	700	0.025	0.8	14
b	Greenbelt	300	0.025	0.15	1.2
	Total rainwater harvested in one hour				**15.2**

Considering runoff generated from rooftop and greenbelt area, structures should be constructed to accommodate 15.2 m3 of water. The storage cum recharge tanks are recommended of the dimensions 2m (Length) X 1.5 m (Breadth) X 1 m (Height) divided into 2 chambers- de-siltation chamber and recharge chamber. Effective storage area of each tank is **3 cubic meter**.

A recharge well(6 inch dia) of 50 m depth is recommended to be drilled. The pipe should be perforated for infiltration of the rainwater. The perforated area should be covered with a mesh cloth which will act as a filter. This mesh cloth should be periodically changed for maintaining the structure. Dual V wire screen filters can also be used to reduce maintenance costs.

Considering the discharge of the tubewells in the area is around 1000 lpm, the recharge capacity of the well is assumed to be 25 % of the discharge. Hence the recharge capacity of the well will be 15 m^3/hr.

The total capacity of the structure = 3 m^3 + 15 m^3 = 18 m3

Hence a storage cum recharge tank along with 1 recharge well is recommended to accommodate the total runoff during peak rainfall as shown in schematic diagram Fig 1.7.

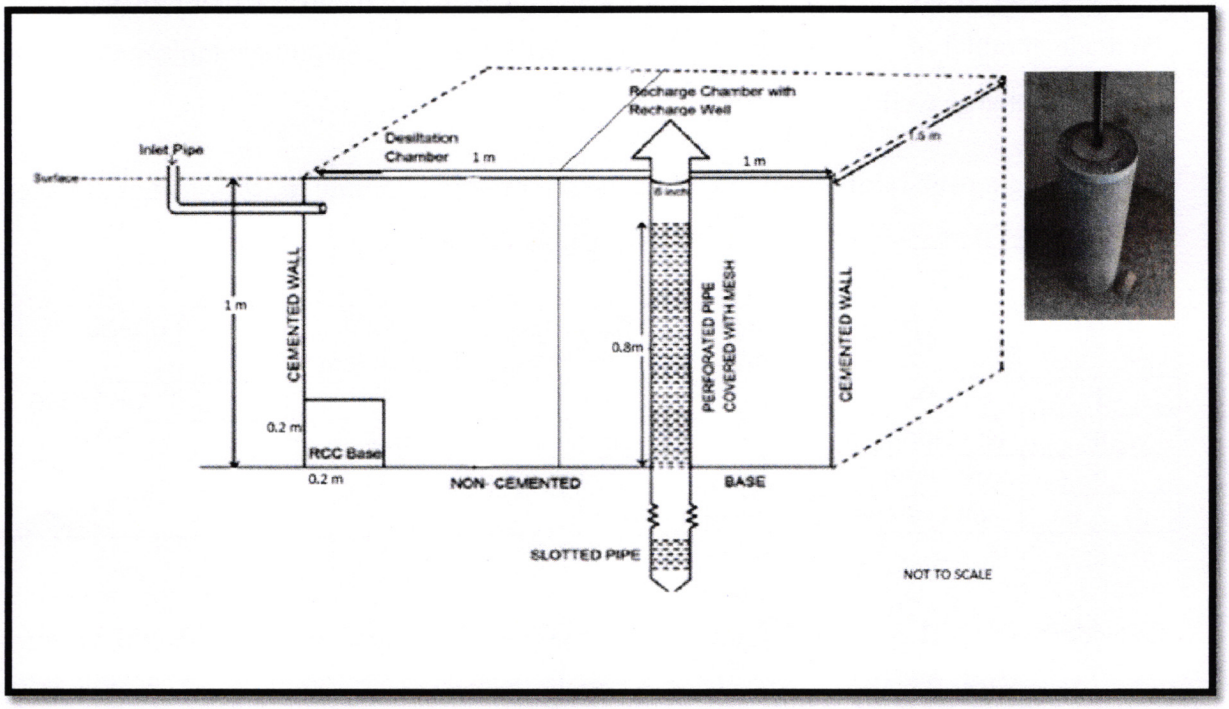

Fig: 1.7 Schematic diagram of recharge well along with storage tank; dual V wire screen filter displayed at the right

RECOMMENDATIONS

It is suggested that the recharge schemes should only be taken up in those areas where water level is more than 5 m below ground level (post monsoon). The following measures should be taken during implementation of artificial recharge.

- As per the directions of Hon'ble NGT, the Ministry of Jal shakti, Govt of India has directed to avoid Rain Water Harvesting System for the purpose of Artificial Recharge in the vicinity of sewerage system components/ landfill sites etc where chances of contamination are high through mingling of untreated sewerage water/domestic wastes. Therefore, it is suggested that only non-polluted rainwater from the rooftops has to be diverted to recharge structure through connection of downpipe.

- In areas prone to heavy traffic congestion, such as ISBT premises and district transport offices, it is crucial to prevent rainfall runoff from open land. Similarly, at hospitals or

clinics, it is essential that runoff from rooftop rainwater is directed exclusively to recharge structures to prevent groundwater contamination. These measures are vital for safeguarding groundwater quality in urban environments affected by high traffic and medical activities.

- There should be proper arrangements in place to prevent sewage water or contaminated water from paved area from mixing into run-off/ recharged water.
- The design of RWH should have provision to by-pass first rooftop harvested rainwater. Mixing of drain water with rooftop run off or with runoff from paved areas, where vehicular movement takes place, should be prevented.
- The water should be made silt free before it enters into the recharge well. For this purpose, first flush system should be installed in the RWH system.
- Development of the recharge well should be done with the air compressor as it will help to clear the screen of the well and surrounding formation material, if groundwater is encountered during construction of the recharge well.
- After development of the recharge well, intake capacity of the recharge well should be determined, using slug test.
- The catchments should be neat and clean. The rooftop/terrace of the building spaces should not be used for dumping of unwanted items and scrap material.
- Precaution should be taken to avoid domestic waste water entering into the recharge structures.
- Before the arrival of monsoon, the roof top as well as drains should be properly cleaned.

For any technical guidance, below-mentioned office may be contacted as and when required.

Regional Director, Central Ground Water Board, Ministry of Jal Shakti, Government of India, Uttaranchal Region, 419 – A, Kanwali Road, Balliwala, Dehradun – 248 001

Email: rdur-cgwb@nic.in

ANNEXURE 1

प्रेषक,

मुख्य अभियन्ता एवं विभागाध्यक्ष,
लघु सिंचाई विभाग, उत्तराखण्ड,
देहरादून।

सेवा में,

निदेशक,
केन्द्रीय भूजल बोर्ड,
देहरादून।

संख्या 645 **/ल0सिं0/कार्य0/SARRA/2024–25** **दिनांक** 23 **जुलाई, 2024**

विषयः **राज्यान्तर्गत देहरादून, हरिद्वार एवं नैनीताल के शहरी क्षेत्रों में चिन्हित रिचार्ज शाफ्ट की प्रस्तावित स्थानों पर भूजल स्तर की सूचना उपलब्ध कराये जाने के सम्बन्ध में।**

महोदय,

उपरोक्त विषयक दिनांक 21.06.2024 को अपर मुख्य सचिव महोदय, उत्तराखण्ड शासन की अध्यक्षता में SARRA के अन्तर्गत भू–जल संभरण कार्यो की समीक्षा हेतु आहुत बैठक में निर्देश दिये गये है कि जनपद देहरादून, हरिद्वार एवं नैनीताल के शहरी क्षेत्रों में भूजल संभरण हेतु चिन्हित/प्रस्तावित रिचार्ज शाफ्ट योजनाओं को केन्द्रीय भू–जल बोर्ड, भारत सरकार से चिन्हित स्थानों का प्रथम स्टेटा भूजल स्तर प्राप्त कर लिया जाये जिससे की उक्त आधार पर रिचार्ज शॉफ्ट की गहराई का आंकलन किया जा सकें।

उक्त निदेर्शो के परिपालन में जनपद देहरादून, हरिद्वार एवं नैनीताल के शहरी क्षेत्रों में भूजल संभरण हेतु चिन्हित/प्रस्तावित रिचार्ज शाफ्ट योजनाओं की सूची आपको इस अनुरोध के साथ प्रेषित की जा रही है, कि प्रस्तावित योजनाओं का प्रथम स्टेटा यथाशीघ्र इस कार्यालय को उपलब्ध कराने का कष्ट करें, ताकि तदानुसार आवश्यक कार्यवाही की जा सकें।

संलग्नः उपरोक्तानुसार।

भवदीय,

23/7/2023

(सुरेश चन्द्रा)
स्टाफ अधिकारी,
कृते मुख्य अभियन्ता एवं विभागाध्यक्ष,
लघु सिंचाई विभाग, उत्तराखण्ड,
देहरादून।

ANNEXURE-2

Location	Name of Place	Longitude	Latuitude	Catchment (Ha)	WL Range during pre monsoon 2024 (m bgl)	Tentative Depth of Recharge Well (meters)	Remarks
1	मुख्य अभियन्ता एवं विभागाध्यक्ष, लघु सिंचाई विभाग, उत्तराखण्ड, देहरादून कार्यालय परिसर।	78.071618	30.293286	1.0	30-35	30	A
2	सनातन धर्म (बन्नू) इंटर कालेज परिसर रेसकोर्स, देहरादून	78.035365	30.317128	1.0	30-35	30	A
3	राजकीय लक्ष्मण विद्यालय इंटर कालेज परिसर, पथरी बाग, देहरादून	78.02838889	30.30305556	1.0	30-35	30	A
4	एम0एल0ए0 ट्रांजिट हॉस्टल परिसर, देहरादून	78.043224	30.306357	1.0	30-35	30	A
5	सी0एन0आई0 इंटर कालेज, परिसर, पल्टन बाजार, देहरादून	78.03922222	30.3225	1.0	30-35	30	A
6	आई0एस0बी0टी0 परिसर, देहरादून।	77.997571	30.288091	2.0	30-35	30	B
7	महादेवी कन्या पाठशाला इंटर कालेज परिसर, तिलक रोड, देहरादून	78.04366667	30.3175	1.0	30-35	30	A
8	एस0बी0आई0 आवासीय कालोनी परिसर, केशव पुरम शिमला बाई पास	78.02283333	30.31888889	2.0	25-30	30	A
11	हिन्दु नेशनल इंटर कालेज परिसर, सहारनपुर चौक, देहरादून	78.02283333	30.31888889	2.0	25-30	30	A
12	गुरू नानक बालिका इंटर कालेज परिसर, खुड्बुडा, देहरादून	78.045703	30.309324	1.0	30-35	30	A
37	थाना नेहरू कालोनी, परिसर, देहरादून।	78.053611	30.29138889	1.0	25-30	30	A
38	दूरदर्शन केन्द्र, परिसर, देहरादून	78.053333	30.29277778	1.0	25-30	30	A
40	राजकीय बालिका सुधार गृह, केदारपुरम, देहरादून	78.049444	30.28194444	1.0	20-25	30	A
41	राजकीय शिशु सुधार गृह, केदारपुरम, देहरादून	78.049722	30.28194444	1.0	20-25	30	A
42	राजकीय नारी निकेतन, केदारपुरम, देहरादून	78.044722	30.27666667	1.0	20-25	30	A
43	जिलाधिकारी, कार्यालय परिसर, देहरादून	78.04	30.31611111	1.0	30-35	30	B
44	जिला प्रोबेशन, अधिकारी, कार्यालय परिसर,देहरादून	78.041111	30.31611111	1.0	30-35	30	A
45	पुलिस लाईन, रेसकोर्स, देहरादून	78.040556	30.30444444	1.0	30-35	30	B
46	सचिवालय कॉलोनी, परिसर, केदारपुरम, देहरादून	78.049444	30.28194444	1.0	20-25	30	B
47	सचिवालय कॉलोनी, परिसर द्वितीय, केदारपुरम, देहरादून	78.049444	30.28194444	1.0	20-25	30	B
9	डी0ए0बी0 डिग्री कालेज परिसर, करनपुर, देहरादून	78.05644444	30.32861111	1.0	40-45	50	A

10	डी0बी0एस0 डिग्री कालेज परिसर, करनपुर, देहरादून	78.05922222	30.32972222	1.0	40-45	50	A
13	राजीव गांधी नवोदय विद्यालय, परिसर, नालापानी, देहरादून	78.081667	30.32777778	2.0	60-65	50	A
14	राज्य शैक्षिक अनुसंधान और प्रशिक्षण परिषद, कार्यालय परिसर, उत्तराखण्ड	78.083056	30.32972222	1.0	65-70	50	A
15	खण्ड विकास अधिकारी, कार्यालय परिसर, रायपुर	78.076667	30.32277778	1.0	55-60	50	B
16	पी0आर0डी0 मुख्यालय, परिसर, तपोवन रोड, देहरादून	78.076944	30.32388889	1.0	55-60	50	B
17	ग्रामीण निर्माण विभाग, कार्यालय परिसर, तपोवन रोड, देहरादून।	78.075833	30.32194444	1.0	55-60	50	A
18	शिक्षा निदेशालय, परिसर, नूनरखेडा आमवाला, देहरादून	78.083056	30.32972222	1.0	65-70	50	A
19	उत्तराखण्ड चिकित्सा महानिदेशालय, परिसर, आई0टी0पार्क0, देहरादून।	78.078056	30.32916667	1.0	60-65	50	B
20	जी0आई0सी0 इंटर कालेज, परिसर, नालापानी, देहरादून	78.084167	30.33194444	1.0	65-70	50	A
21	राजकीय पॉलिटेक्निक, परिसर, आमवाला, देहरादून	78.086944	30.34111111	1.0	60-65	50	A
22	सूचना भवन परिसर, उत्तराखण्ड, देहरादून	78.074722	30.30277778	1.0	35-40	50	B
23	निर्वाचन आयोग, कार्यालय परिसर, देहरादून।	78.074167	30.30555556	1.0	35-40	50	B
24	ैजंउच दक त्महपेजतंजपवद क्मचंतजउमदजए त्पदह त्वंक क्मीतंकनद न्जजतींदक	78.075	30.30305556	1.0	35-40	50	A
25	ब्वउउमतबपंस ज्ंग क्मचंतजउमदज भ्मंकुनंतजमतेए नजजतींदक	78.074722	30.30277778	1.0	35-40	50	A
26	वंपिबम वि जीम बैपमि त्मअमदनम ब्वउउपेपवदमतए क्मीतंकनद	78.075	30.30527778	1.0	35-40	50	A
27	किसान भवन, परिसर, रिंग रोड, देहरादून	78.075	30.30333333	1.0	35-40	50	A
28	कार्यालय आयुक्त कर उत्तराखण्ड, परिसर, रिंग रोड देहरादून।	78.074722	30.30277778	1.0	35-40	50	A
29	मुख्य शिक्षा अधिकारी कार्यालय, परिसर,मयूर विहार, देहरादून।	78.066389	30.34	1.0	50-55	50	B
30	थाना रायपुर, परिसर, देहरादून।	78.073611	30.32166667	1.0	50-55	50	B
31	अल्पसंख्यक भवन, परिसर, भगत सिंह कालोनी, देहरादून	78.065833	30.31361111	1.0	40-45	50	A
32	गढवाल मण्डल विकास निगम, कार्यालय परिसर, राजपुर रोड, देहरादून।	78.060556	30.34	1.0	45-50	50	A
33	अम्बेडकर छात्रावास, परिसर, मयूर विहार, अधोईवाला, देहरादून	78.0675	30.34222222	1.0	50-55	50	A
34	अम्बेडकर छात्रावास, परिसर, भगत सिंह कॉलोनी, देहरादून।	78.065278	30.31333333	1.0	40-45	50	A
35	जिला परिवहन कार्यालय परिसर, राजपुर रोड, देहरादून।	78.059167	30.34305556	1.0	40-45	50	B

36	थाना डालनवाला, परिसर, रायपुर रोड, देहरादून।	78.053889	30.325	1.0	35-40	50	A
39	विद्युत वितरण खण्ड, कार्यालय परिसर, सर्वे चौक, देहरादून	78.0525	30.32555556	1.0	35-40	50	A
48	एन0सी0सी0 हेड क्वाटर, परिसर, तपोवन, देहरादून	78.078056	30.33083333	1.0	60-65	50	A
49	राष्ट्रीय दृष्टि बाधितार्थ संस्थान, राजपुर रोड, देहरादून	78.065556	30.35472222	1.0	40-45	50	A
50	पुलिस मुख्यालय, देहरादून	78.050278	30.32972222	1.0	35-40	50	B
51	जलागम प्रबन्ध निदेशालय परिसर, इन्दिरा नगर देहरादून।	77.999086	30.32055	1.0	35-40	50	A

Remarks A- Artificial recharge from open areas should only be contemplated under conditions where there is no risk of rainwater contamination by sewage, excessive dirt such as oil, or grease, which could otherwise contaminate groundwater.

Remarks B- Only Rooftop area to be considered

ANNEXURE 3

ESTIMATION OF QUANTUM OF RUNOFF AVAILABLE THROUGH RAIN WATER HAVESTING IN A YEAR					
S. No	Particulars	Area (sq m)	Rainfall in meters	Run off coefficient#	Quantum of Runoff available (cum/ year)
	1	2	3	4	5 = 2*3*4
1	Rooftop area of building				
2	Road/ Paved area				
3	Open Land Area				
4	Greenbelt Area				
	Total Area (sq. meter)				

#Ref: Manual of Artificial Recharge of Groundwater (CGWB, 2007);
https://cgwb.gov.in/cgwbpnm/publication-detail/81

ESTIMATION OF QUANTUM OF RUNOFF AVAILABLEPER HOUR AT PEAK RAINFALL					
S. No	Particulars	Area (sq m)	Rainfall in meters	Run off coefficient#	Quantum of Runoff available (cum/hour)
	1	2	3	4	5 = 2*3*4
1	Rooftop area of building				
2	Road/ Paved area				
3	Open Land Area				
4	Greenbelt Area				
	Total Area (sq. meter)				

#Ref: Manual of Artificial Recharge of Groundwater (CGWB, 2007)
https://cgwb.gov.in/cgwbpnm/publication-detail/81

Intake capacity of recharge Well (Site Specific)

DESIGN OF RECHARGE STRUCTURE				
	Length/ Radius	Breadth	Depth	Volume
Recharge Pit (Rectangular)				
Recharge Pit (Circular)				
Total Retention Capacity of Recharge Pit (Rectangular) in One Hour				
Total Retention Capacity of Recharge Pit Circular) in One Hour				