Rainwater harvesting Opportunities and challenges

S.Vishwanath Biome Environmental Trust zenrainman@gmail.com

The land of rivers



C Robert Szucs/Grasshopper Geography

The monsoon is everything – June to September



....and why are our rivers dry ?

- Population 1947 330 million
- 2020 1380 million

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- Food grain production 1951 50 million tonnes
 - 2020-21 305.43 million tonnes
- Electricity generation 1947 1362 MW
 - 2020 374.20 GW (Installed capacity)
- Dams 1947 300
- 2020 5202

We are a groundwater dependent civilization

- Over 40 million wells and bore-wells
- Over 65 % of our total water requirements
- Over 85 % of our drinking water needs
- Over 250 cu km of groundwater extracted annually . More than China and USA combined . Worlds largest user of groundwater.
- ...and the only source for recharge is RAIN

Groundwater: vulnerability to exploitation and contamination

- 60% districts vulnerable to exploitation and/or contamination
- "Slipback" habitations / villages...drinking water supply
- Unhealthy competition, potential conflicts...
- Health-related hazards: arsenicosis, fluorosis, selenicosis, Uraniumpoisoning and varying degrees of morbidity
- Source: ACWADAM



Raghu Rai's classic photograph





Rainwater harvesting – an old tradition Dholavira – 2900 BCE <u>Lothal – 2300 BCE</u>





The 'tank' ecosystem of water harvesting











Neerugantis – water managers Gangamma – spiritual connect



Livelihood – 65 % of Indian agriculture is rainfed





Food security





Aquifer replenishment







The architecture of groundwater



Drinking water security





Water for livestock and nature



Tankas

Tankas of Bikaner, Barmer, Phalodi - Rajasthan



The modern

What is rainwater harvesting ?

- Collection and storage/recharge of rain for future productive use
- Catchment
- Conveyance
- Filtration
- Storage
- Recharge





At its simplest -



Photo credits : Shree Padre



EVERY ROOF CAN BE A CATCHMENT



The system



Rural Homes- Arsenic and Fluoride free water for drinking and cooking



An above the ground storage tank



In schools – for sanitation





Resources – Site, watershed, city, river basin

- Rainwater
- Soil Moisture
- Surface water lakes and rivers
- Groundwater
- Piped water usually form outside the city
- Used water or waste-water
- Demand management

Water and Rain is Everybody's business



The new rainwater harvesting bye-law

- For every plot create recharge or storage
 - @ 60 litres per square metre of roof area
 - @ 30 litres per square metre of paved area

Minimum depth of recharge well is 3 metres





MONTH	DAYS	QUANTITY (mm)
JAN	0.2	2.70
FEB	0.5	7.20
MAR	0.4	4.40
APR	3.0	46.30
MAY	7.0	119.60
JUN	6.4	80.80
JUL	8.3	110.20
AUG	10.0	137.00
SEP	9.3	194.80
OCT	9.0	180.40
NOV	4.0	64.50
DEC	1.7	22.10
TOTAL	59.8	970.00

NOTIFICATION

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

In exercise of the powers conferred by section 16, 72-A and 88 of the Bangalore Water Supply & Sewerage Act, 1964 (Karnataka Act 36 of 1964) with previous approval of the State Government is hereby published as required by the sub section (2) of Section 88 of Bangalore Water Supply and Sewage Act, 1964 vide Notification No.BWSSB/C/CAO-S/5524/2019-20 Dtd: 23.3.2020 in Part-III of Karnataka Gazette dated: 26.3.2020.

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

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

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

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

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

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

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



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



Rainfall data

- Indian Metrological Department
- Karnataka State Natural Disaster Monitoring Committee
- Daily rainfall data is best
- Work out daily water balance

WWW.KSNDMC.ORG Megha Sandesha App





Daily water balance – Demand vs Rainfall supply

Total Rainfall in the Year 2014									2							
Year	1-May	2-May	З-Мау	4-May	5-May	б-Мау	7-May	8-May	9-May	10-May	11-May	12-May	13-May	14-May	15-May	15-May
2148																
2014	0.8	0	0.3	0.6	0	0	0	2.4	4.15	5.4	0	3.5	0.0	0.0	δ.1	0
Average	0.8	0.0	0.3	0.6	0.0	0.0	0.0	2.4	4.2	5.4	0.0	3,5	0.0	0.0	6.1	0.0
Harvestable water	114	0	42.75	85.5	D	0	0	342	591.375	769.5	0	491.625	0	D	869.25	D
Opening water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	169.5	0.0	0.0	0.0	0.0	269,3
Total water available	114.0	0.0	42.8	85.5	0.0	0.0	0.0	342.0	591.4	769.5	169.5	491.6	0.0	0.0	869.3	269.3
Tank size	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Water stored in tank	114.0	0.0	42.8	85.5	0.0	0.0	0.0	342.0	591.4	769.5	169.5	491.6	0.0	0.0	869.3	269.3
Water Used	114.0	0.0	42.8	85.5	0.0	0.0	0.0	342.0	591.4	600.0	169.5	491.6	0.0	0.0	600.0	269.3
Closingwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	169.5	0.0	0.0	0.0	0.0	269.3	0.0
Overflow water	0.0	0.0	0.0	0.0	0,0	0,0	0.0	0.0	0.0	0.0	0.0	0,0	0.0	0.0	0.0	0.0
Serviced days	0.19	0	0.07125	0.1425	a	D	0	0.57	0.985625	1	D.2825	0.819375	D	D	1	0.44875

Sizing of down-pipes

National Building code (NBC) guidelines on providing Rainwater Pipes for Roof Drainage Annexure-5

Table 23 Sizing of Rainwater Pipes for Roof Drainage in mm/h (Clause 4.5.11.6.8)

SI. No	Dia of Pipe mm	Roof Area, in m ² for Average Rate of Rainfall in mm/h							
(1)	(2)	50 (3)	75 (3)	100 (3)	125 (3)	150 (3)	200 (3)		
1	50	29.80	19.80	14.85	11.88	9.90	7.42		
ii .	65	57.23	38.15	28.61	22.89	19.08	14.31		
ill	75	81.84	54.56	40.92	32.74	27.28	20.46		
iv	100	168.00	112.00	84.00	67.20	56.00	42.00		
٧ -	125	293.48	195,66	146.74	117.39	97.83	73.37		
vi	150	462.95	308.64	231.48	185.18	154.32	115.74		

Note- For rainwater pipes of other materials, the roof areas shall be multiplied by (0.013/coefficient of roughness of surface of that material). For example, for rainwater pipes of PVC (coefficient of roughness = 0.009), the above values of roof area shall be multiplied by 0.013/0.009 = 1.44.

If you want to make apple pie from scratch , you will need to reinvent the universe – Carl Sagan





First rain separator



















Understand lithology and geology for recharge





The Mannu Vaddar community - digging wells since centuries



Groundwater – rainwater for recharge

With 400,000 borewells and 500 MLD withdrawal and unmanaged

• Well diggers as partners







All dimensions in millimetres unless specified.

NOTE — Depending on site soil condition and keeping the above plumbing details and dimensions in view, the detailed structural/ shop drawing to be prepared, before executing the work.

FIG. 11 ARTIFICIAL GROUND WATER RECHARGE STRUCTURE









Recharge Well in storm water drains









Don't forget the maintenance





Demand management is key

- Rainwater filters and harvesting
- Wastewater treatment and recycling
- Smart meters
- Designing IUWM at community scale
- Aquifer mapping and management





Rainbow Drive Layout, Bangalore















What Rainbow Drive did

- Banned private bore-wells
- Shared community bore-wells 3 numbers
- Made recharge as a community , over 300 recharge wells
- Put in a place a tariff system based on true cost
- Treated wastewater from WWTP being used for non-potable use
- Now completely self sufficient for water









The Jal Jeevan Mission

- India is running one of the largest drinking water missions in the world
- Approximately a 120 million rural homes are getting/to get 55 litres per capita per day from a functional tap at the house.
- Rainwater harvesting will be essential to keep the systems ecologically sustainable

The only thing we learn from history is that we do not learn from history

- Hegel

