Rainwater Harvesting Structure in Bhagalpur District of Bihar

I. Background

Honourable Prime Minister Shri. Narendra Modi highlighted the need for rainwater harvesting to tackle the water crisis affecting the rural areas in the major parts of the country. He made a strong pitch for conservation of rainwater and had written a letter to all Gram Panchayatsarpanches regarding the importance of water conservation and harvesting and exhorted them to adopt all appropriate measures to make water conservation a mass movement. [1]

The Jal Shakti Abhiyan (JSA) is a time-bound, mission-mode water conservation campaign.The JSA aims at making water conservation a Jan Andolan through asset creation and extensive communication.[2]

Schools would be the ideal place to create awareness about water conservation and efficient usage. During one of the interventions of SaciWATERs, it has been found there was a dysfunctional rainwater harvesting structure. Renovating an existing structure for serving the need is more efficient that creating a new structure, which involves time and space.

Upon holding detailed interaction and discussions with the school authorities, it had been proposed to revamp the Roof water harvesting structures in the school to make the students understand about water conservation techniques, usage of natural and precious resource like water in a more effective and efficient manner. This will also enable the students to understand the benefits of water conservation and harvesting rain water, so as to plan for the more efficient use of the water resources in the future. This will also enable to meet water requirements throughout the year, without the need for dependence on huge capital expenditure.[3]As a part of the Arsenic Mitigation and Awareness generation program, SaciWaters with financial support from UNICEF has identified a school in Bhagalpur district of Bihar for setting up of a rainwater harvesting structure.

II. Objectives

The main objective of Rainwater harvesting systems repair work at schools is to provide children arsenic free water throughout the year and to educate them about the benefits of conservation of scarce natural resource like water and to encourage an environmentally responsible attitude in the next generation.

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[1](source-https://www.timesnownews.com/india/article/pm-narendra-modi-makes-strong-pitch-for-rainwater-conservation-writes-personal-letter-to-village-pradhans/437189) website accessed in June 2020

[2](source - https://ejalshakti.gov.in/JSA/JSA/Home.aspx)website accessed in June 2020

[3]*(Source- TCHFL - Need Assessment - WAI - RWH structure, Saciwaters)*

III. Methodology of Harvesting Rainwater

a. Selection of structure

The rainwater harvesting can be done either by storage of rainwater for direct usage or recharging the groundwater aquifers by the roof top collected rainwater. The direct usage of rainwater would be the best for places, where the rainfall pattern would be Instead of direct storage of rainwater for consumption, it is often preferred to use rain water to recharge the underground aquifers. Rainwater that is collected on the roof top of the building is diverted.[4]

b. The Design

Typical Roof top Rainwater Harvesting System comprises following components:

1.Screening chamber
2.Soak pit
3.Dug well recharge
4.Elevated Water tank

The calculation for runoff can be illustrated using the following example:

Consider a building with flat terrace area (A) of 190 sq.m located in Bhagalpur. The average annual rainfall (R) in Bhagalpur is approximately 1111mm. The runoff coefficient (C) for a flat tiled terrace may be considered as 0.85. Annual water harvesting potential

from 190 m^2 roof = A x R x C
= 190 x 1.111 x 0.85
= 179.4265cu.m i.e. 179,426.5 litres

(source – of rainfall fig. - https://en.climate-data.org/asia/india/bihar/bhagalpur-2843/)

c. Situation Analysis of the site

KamatTola Middle school profile[5]–

BaldevTiwary Middle School, KamatTola was established in 1946 and it is managed by the Department of Education. It is located in rural area in the Pirpainti block of Bhagalpur district of Bihar. The school consists of grades from 1 to 8. The school is co-educational and it doesn't have an attached pre-primary section. Hindi is the medium of instruction in this school. This school is approachable by an all-weather road. In this school, academic session starts in April. The school has 500 students and 6 teachers.

The school has got 12 classrooms and all the classrooms are in good condition. The school has a separate room for Head master/Teacher. The school has pucca, but broken boundary wall. The school has 3 boys toilet and 3 girls toilet and they are in functional condition. The school is preparing in the school premises and providing mid-day meal.

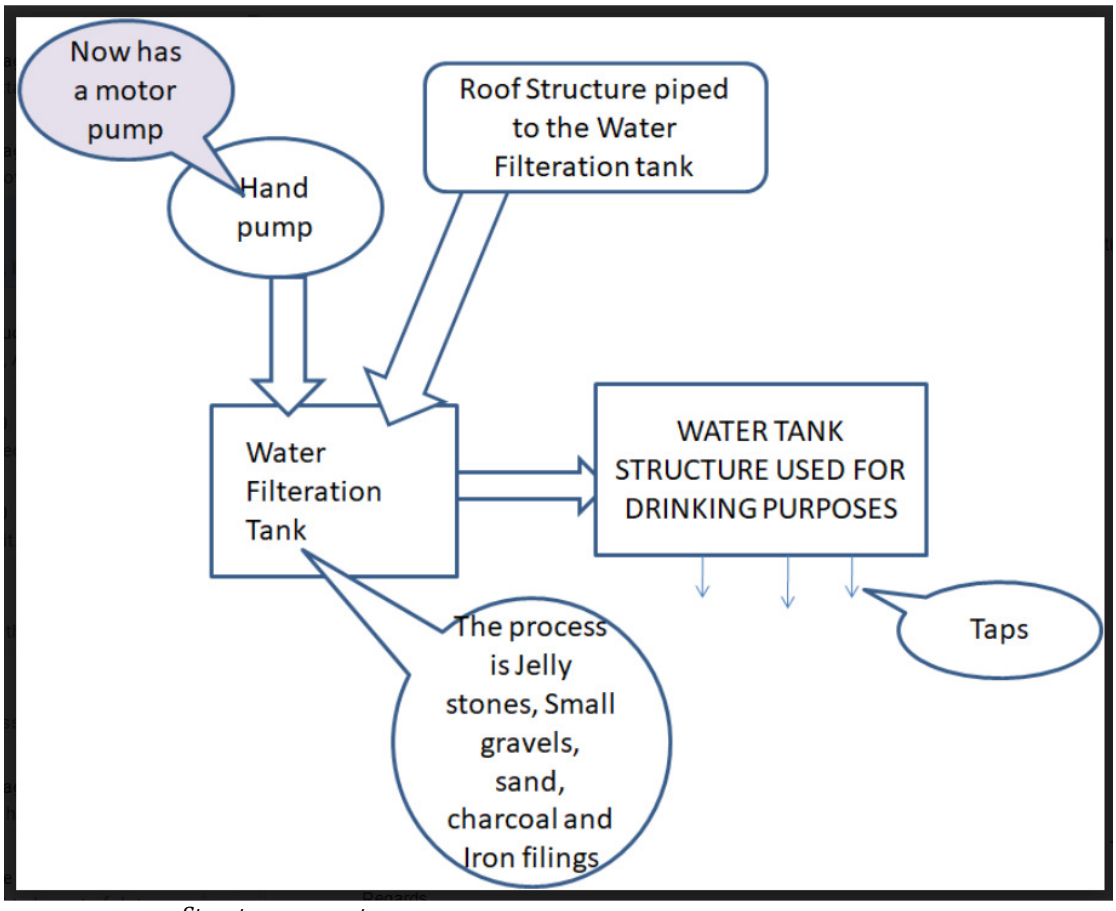
[4](**Source** - IRICEN 2006 Rainwater Harvesting, Pg.15)
[5]https://schools.org.in/bhagalpur/10222604701/b-t-m-s-kamat-tola.html (accessed in June 2020)

At KamatTolaschool, there is a dilapidated rainwater harvesting structure, that will be renovated and it will also be connected to existing tubewell by an electric motor pump. This will ensure yearlong supply of clean and safe drinking water to the school students and the nearby households. The source of Drinking water in the school is the filtered water from the borewell, which gets filtered.

d. Planning of RWH at Kamat Tola

Baldev Tiwari middle school, KamatTola found to be most suitable place for RWH structure. The existing RWH was built by PHED, Bihar in 2005 solely for the purpose of ground water recharge. After the construction of RWH in 2005 it worked for 2-3 years and served the purpose of groundwater recharge. Later the tank started leakingand connection pipe from roof to tank was broken. The existing structure was not in good condition and needed agood amount of repair work.

School children were drinking tube well water which has arsenic contamination beyond permissible limit. Now, the repair work is planned in such a way that during the rainy season, the rainwater will be filtered and used for drinking while rest of the year when there is no rain, the tube well water will be pumped up and filtered so that all children can avail arsenic free water throughout the year.



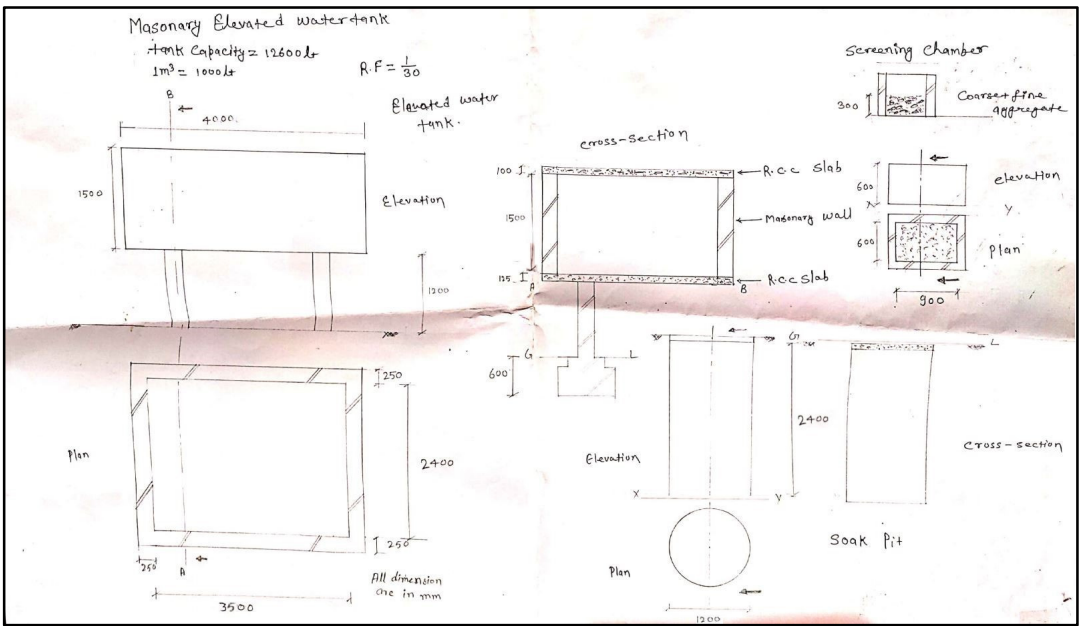
Structure concept

e. Construction work

The dimensions of the storage tank are as follows:

Length: 2.10 meter
Breadth: 1.80 meter
Height: 1.20 meter

There are two parts of the same dimension i.e. two tanks have been constructed to remove arsenic from water.Tube well distance is 72 meter from the plant. Slow sand filter was constructed near the tube well which will also be safe and durableas it is located at one corner of the school where children doesn't go. One soak pit of size=1.2*1.2*2.1 meter(B:H:L) was made. Pipes were procured and tube well is not connected to the tank.Filter was made with brick,Charcoal and fork.Iron fillings were used to reduce arsenic in the water.Size of filter will be 3*4 in feet.



Schematic design of the structure with measurements

Detailed measurements of the construction work

S.No.	Description of item	No.	Length	Breadth	Depth /Height	Quantity	Explanatory notes
1	Short wall	4*2	1.8m	1.2m	-	17.28 sqm	4 wall and both side Plastering work i.e. in and out
2	Long wall	4*2	2.1m	1.2m	-	20.16sqm	
						Total =37.44 Sqm.	
3	Pvc Pipe	2	80m	25mm Dia	-	160	To carry and bring water into the tank with a hand Pump
4	Pvc Pipe	1	10m	75mm dia	-	10	To carry rain water into the tank
5	Electric motor	1	-	-	-	01	
6	Colour washing	1				18.72sqm	37.44/2=18.72sqm
7	RCC Slab	2	2.1m	1.2m	75mm	0.378 cum.	Covering for top portion of tank
8	Soak Pit	1	1.2	1.2	1.8	2.592cum	

f. Required material and costing–

The list of required material are as follows:

Material	Quantity	Price
Cement	8 bags	3200
Sand	60 cuft.	4000
Aggregate	12cuft	1000
Iron steel	50 kg	2500
Brick	200 Pics	2000
Electric motor and switch & Wire	1Pics	8000+2000
Pvc Pipe 25mm	160meter	5000
Pvc Pipe 75mm	10 meter	2000
Colour washing	18.72	500
Slow sand filter		2000
Soak Pit excavation	2.592cum	
Total-		**32200/-**

The cement sand ratio was =1:4

g. Labour requirement and wages

LABOUR	No.	Rate
Mistri	5	500*5=2500
Mazdoor	18	400*18=7200
Sundries T&P	Lump Sum	200
Motor and wire fitting charge	Lump Sum	500
Slow sand filter	Lump Sum	2000
Total-		**12400/-**

Total amount spent for the repair and construction work is 44600/-

IV. Sustainability plan and awareness generation among the school children

Awareness generation was done among the school children and teachers. They are told about importance of consumption of safe drinking water also about conservation of rainwater. The filter is to be cleaned at least once in a year. Elder children took the responsibility of cleaning the same. They have been informed about the cleaning process. School Principal Shri. Ambika Prasad Mandal (8789702300) co-operated throughout the process and assured about the regular maintenance of the structure.

V. Challenges

The major challenges faced were the availability of labourers for the intervention due to the lockdown. Hence the time duration was affected. The community participation activities were also affected due to COVID. Heavy rainfall and thunderstorm obstructed work for a while.

VI. Photo Gallery

Screening tank put into gravel and sand mix then rain water will enter whereas clean dust of rain water.

Finishing of tank

Breaking plaster because plaster is very poor

In this laid down pipeline from electric motor which is connected to tubewell and returned into again water filter Which will be near the Tubewell under the stair case.

Increase the tank capacity and the pipe has also been laid

Finished water tank and fitting pipe with tank

Brick work of soakpit for RWH when rain water over from tank then water will enter in soakpit by pvc pipe

Top cover for soakpit

Half water tank

Fitting motor and pipe with tube well