7.1.4 Rain water harvesting

•**Recharge of ground water: ZERO DISCHARGE CAMPUS APPROACH**

College has large campus with open grounds, gardens and ample rooftop area. Following methods are adopted by the college for rain water harvesting and ground water recharge thus trying to adopt zero discharge policy.

i). Roof top harvesting: College building, staffquarters and hostels are designed with roof top drain pipes. These are connected to recharge bores.

ii). Ground water recharge: Recharge pits, ~ 6 recharge bores units are prepared in the college campus with different capacities. These were prepared in partnership with local NGO and college which can serve as a model for community.

iii). Rain water storage: Roof top water from the 3 selected quarters are stored in the rain water storage tanks.

iv). College Pond (Percolation Tank): As part of water conservation and creating a natural ecosystem in the campus, college has developed a pond close to the water channel which is fully functional. College has a “Nala” (Runnel) passing through the campus. With an aim to develop a zero discharge campus we have developed a percolation tank past 3 years nearby the channel. The area of the percolation tank is ~ 1200 sq.m . (Please refer photograph)


Latitude: 23.237762
Longitude: 69.657605
Elevation: 102.86±3 m
Accuracy: 3.0 m
Time: 05-01-2021 10:54
Note: pond

Recharge Pits (06 Pits in the campus)

Recharge Bed

Roof top harvesting Tank (2 water tanks)

CASE STUDY OF RAIN WATER HARVESTING IN LALAN CAMPUS BHUJ-KACHCHH

Krupa Chauhan, Jigar Joshi, Meet Ugarejiya, Krupa Acharya

T.Y B.Sc Geology R. R. Lalan college, Bhuj

Abstract

Rain water harvesting is necessary for sustainable development and for environmental balance. To understand the benefits of rain water harvesting structures, the authors used the structures constructed in Lalan college campus. In total six water harvesting structures are established in college campus. The dimensions of all structures were measured. The water percolation also depends on soil properties. So, to identify the soil characteristics the soil sampleswere collected fromvariouslocation. Furthermore, this collected samples were processed for wet sieving. the type of soil associated with college campus is Loamy sand to sandy loam in nature, which have moderate permeability rate. Hence it helps the water percolation and rise the ground water level.

1. INTORDUCTION:

Pioneer college of Kachchh district, Shri Ramji RavjiLalan College of Arts and Science is goverment college of higher education is affiliated to Krantiguru Shyamji Krishna Varma Kachchh University. The old college building collapsed in the devastating earthquake of 2001. The UGC funded Rs. 13 cores for the establishment of new college building. The stone laying ceremony for the new college building was carried on the 3rd Jan, 2004 by Smt. Aanandiben Patel, the Education Minister of Gujarat State. Presently, over 2500 students are enrolled in this large college building standing on the beautiful campus of 26 acres of land situated in Bhuj. As Kachchh district fall under drought zone and understanding the water scarcity, During the construction of new building, parallel rain water harvesting structures were constructed. In total six artificial recharge pit/well were dug. In which three recharge well were made by college authorities during new building constructions and later on more three pits/well were dug with the

help of collaborative work of Arid Communication Technologies (ACT), Jal StrotSamvardhanSimiti- Bhuj, Arghyam and R RLalan college. The purpose of this recharge structure is to rise the ground water level that ultimately benefits mankind.

METHODOLOGY:

To understand area utilization distribution of college campus, the author used the Google earth tool to work out the dimension of different segment. The dimensions are listed in Table-1. To appreciate the water percolation rate, the soil sample were collected from different location and were analyzed for sand and associated finer grain percentage.

Table -1: land cover distribution of college campus

No	Name	Area (sq.mts) approx
2.	Parking ground	50158 sq.ft
3.	Back yard	3,217 sq.mt
4.	Tennis court	33550 sq.ft
5.	Storm drainage	2,569 sq.mt
6.	ValaramUdyan	22980 sq.ft
7.	Garden	41455 sq.ft
8.	Botanical garden	32835 sq.ft
9.	Pond	1,217 sq.ft
10.	Girls hostel	7575 sq.ft
11.	Amphitheatre	12510 sq.ft
12.	College building	80,780sq.ft
13.	Ground	68,269 sq.mt
15.	Staff quarters	25835 sq.ft

Total Roof area in the campus

Building	Area (sq.ft)
College building	80780
Staff quarters	25835
Principal bunglow	2105
ractor bunglows	2930
Girls hostel	7575
Auditorium roof	2864
Total	**122089**

Building	Area (sq.ft)	Remarks
No. of Recharge wells in campus	3 (old)	17 to 25 ft depth
Recahrge pit + well	4 New	Please refer photographs
Storage tank with recharge pit	1	Please refer photographs
Roof top water drainage to ground	All quarters and college building	


RECHARGE DEMOSTRATION
RECHARGE PIT WITH BORWELL
ARID COMMUNITIES TECHNOLOGIES
Latitude: 23.235618
Longitude: 69.660392
Elevation: 156.47±16 m
Accuracy: 1.6 m
Time: 05-01-2021 11:17
Note: recharge unit 1


CAMPUS WATER HARVESTING IN R.R.LALAN COLLEGE.
RECHARGE DEMONSTRATION
RECHARGE PIT WITH BORWELL
ARID COMMUNITIES TECHNOLOGIES
Arghyam
Latitude: 23.238315
Longitude: 69.660048
Elevation: 181.81±101 m
Accuracy: 3.2 m
Time: 05-01-2021 11:24
Note: recharge unit 1

g is 105218.267 sq.mt. In which 5, ered by Parking area, 3,217 sq.mt is covered by Backyard, 6,540 sq.mt area covered by Tennis ground, 2,569 sq.mt area is covered by Storm drainage,1,777 sq.mt area is covered by ValaramUdyan, 3,114 sq.mt area covered by garden, 2,490 sq.mt area is covered by Botanical Garden, 1,617 sq.mt area is covered by Pond, 956 sq.mt area is covered by Girls hostel, 1,447 sq.mt area is covered by Amphitheater, 8,704 sq.mt area is covered by Collage building, 68,269 sq.mt area is covered by the Ground, 1,742 sq.mt area is covered by the Boys hostel and 6,471 sq.mt area is covered by Staff quarters.

After the depth measurement of recharge wells the soil samples were collected (figure -2). About 10 cm. of the soil was first scraped out to avoid organic matter and then about 20-30 grams of soil was collected. We took five soil samples from all over the campus which are as follows:

A. Botanical garden
B. South east of the sports ground
C. South west of the sports ground
D. Water storage tank
E. Parking area

These soil samples were sun dried for about a day. Then we did wet sieving of the samples. And oven dried the remaining material for about 24 hours.

2. RESULT:

a. Details or Rain water recharge structures:

There are three old recharge wells that were dug when college building was constructed. One near the residential quarters, one near drinking water place and one near library building (table no -2).

Table -2: Old recharge structure.

Sr. no	Name	Depth
1.	Near water drinking area	17 feet
2.	Residential quarters	25 feet
3.	Near library building	18 feet

Recharge well near residential quarters 17is feet deep, the drinking water place one is 25 feet deep, and the one near library is 18 feet deep (figure -1). Later on, three more rechargewell/structures were placed. The dimensions of the recharge structurers were measured manually figure -1b. First is located near water storage tank which is 10 meter Wide 10 meter long and 3-meter-deep recharge pit with a 130 feet deep recharge well. The pit was later filled with gravel for better percolation. Second is located at south east of the sports ground of the campus which is 4 meter long 4 meter wide and 3-meter-deep pit with 30 feet deep recharge well. This pit too was later filled with gravel. Third is located in the botanical garden which is 3 meter long 3 meter wide and 3-meter-deep pit with a 9 feet deep recharge well. This pit also was later filled with gravel (figure -1).

Table -3: Newly constructed recharge structure.

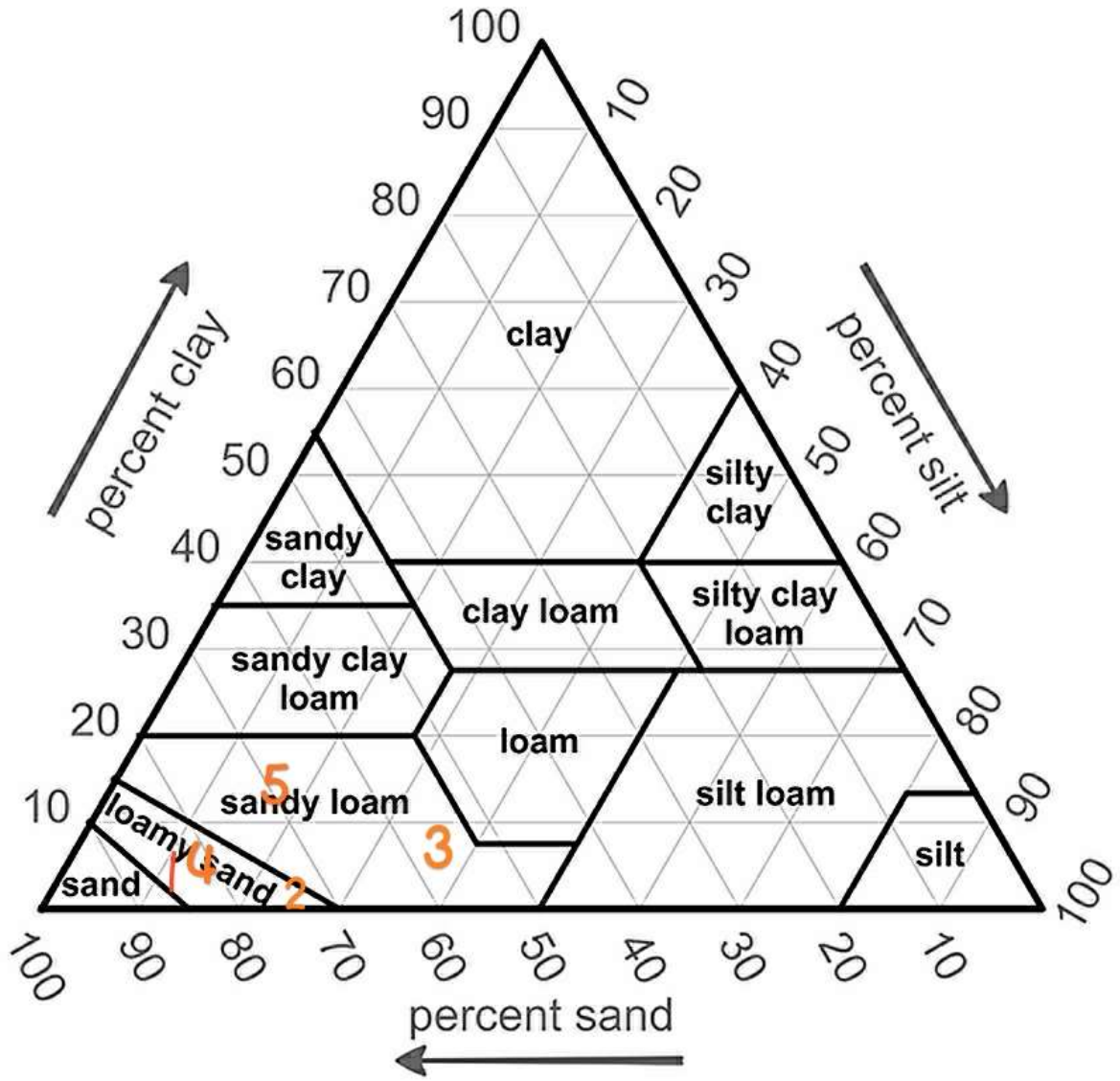
Sr. no	Name	Depth
1.	Botany garden	9 feet
2.	Water storage tank	49.5 feet
3.	Sports ground	22 feet

Figure 1a and 1b: Google earth image showing Lalan college, college building, and recharge well locations.

b.Soil analysis:

Wet sieving is a method to separate the coarse material with water or another type of liquid before drying, identifying and analyzing. In this process, the sample is washed through the sieveA.S.T.M (200). The samples remained in the sieve were of sand size. Later on, the sediments remaining in sieve were collected and oven dried. After those dried sediments were weighed and converted to fraction. The processed samples were plotted on the soil triangular diagram to identify the soil nature.

Figure 2: Google earth image showing the college campus, college building, and soil samples locations in orange square.



Form the above figure, the first soil sample was collected from Botanical garden having 87.3% sand which belongs to loamy sand, second soil sample was collected from cricket ground (left side) having 73.65% of sand which belongs to loamy sand, third soil sample was collected from cricket round (right side) 59.5% sand which belongs to sandy loom, fourth soil sample was collected from water reservoir having 87.05% sand which belongs to loamy sand and the fifth soil sample was collected from parking area having 70.9% sand which belongs to sandy loom.

CONCLUSION:

After computing the result of soil samples of college campus, we conclude that the soil of the campus is Loamy sand and Sandy loam in nature.These types of soil are moderately permeable and help more water to percolate. The recharge pits and wells are constructed in such a way that it adds up to the total percolation of the rain water. So, this recharge system is supportive for raising the water table of the campus area as well as commercial and residential area surrounding the college campus. Thus, with this case study we suggest that rain water harvesting is highly beneficial and should be constructed wherever possible.

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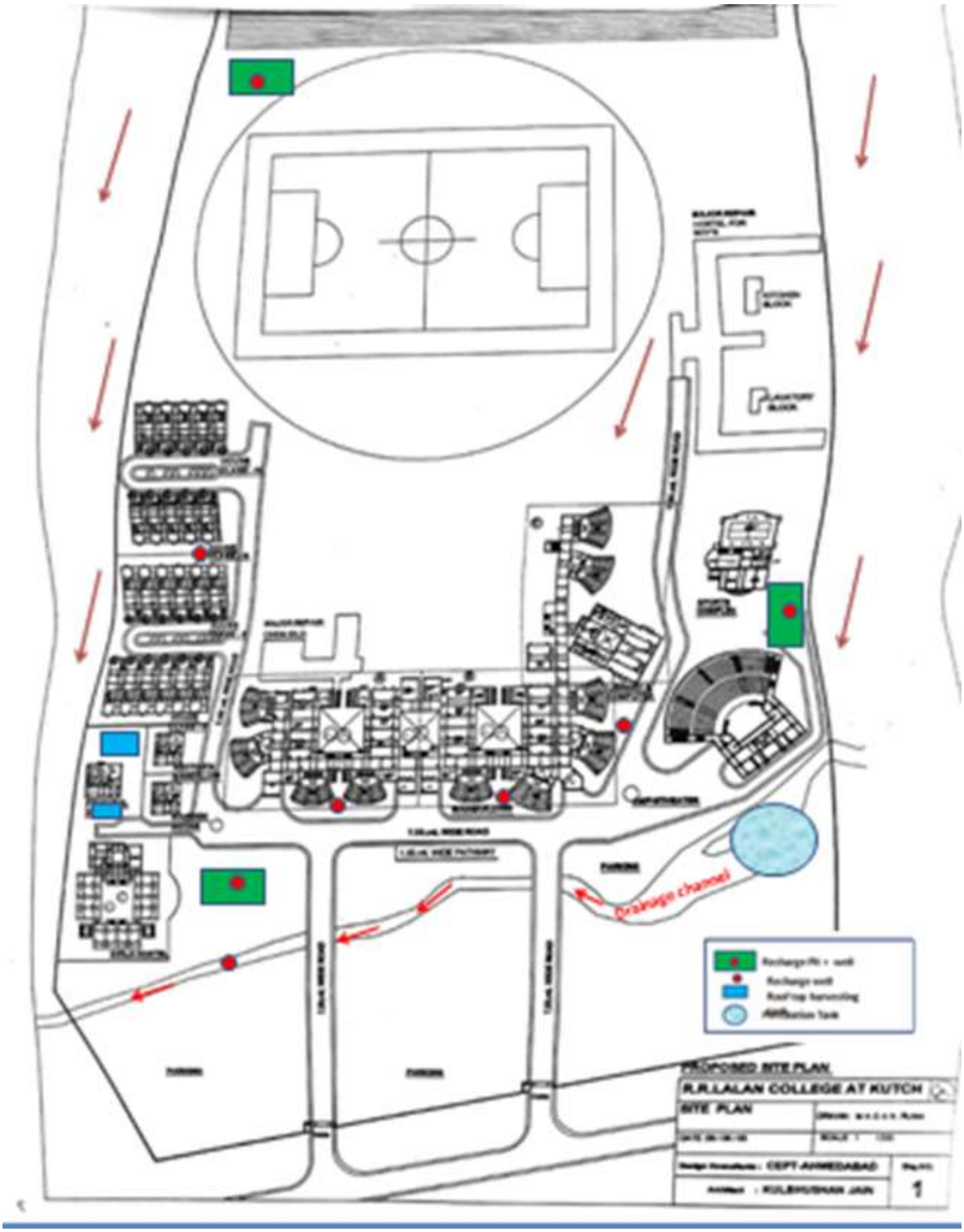
Water recharge



Green Square: Recharge pit and well,, Red circle: Recharge well, Blue square: Water harvesting bed