K L Deemed to be University

REPORT ON RAINWATER HARVESTING PITS

P&D: WATER AND WASTE MANAGEMENT

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WATER MANAGEMENT

Introduction

Water management is the activity of planning, developing, distributing, and managing the optimum use of water resources. Water is a necessity. The activity of planning, developing, distributing, and optimum use of water resources underwater policies and regulations.

Need for water management:

- Development of water bodies for future
- Protection of available water bodies from pollution, etc
- Withdrawal rates or allocation of water for different purposes.

Rainwater Harvesting

Rainwater Harvesting is a technique that is the process of saving and collecting rainwater using various means of various resources (such as agriculture etc.) for future use. Rainwater can be collected in natural reservoirs or artificial tanks. Storage of roof water is also a way of collecting rainwater. Whenever it rains, rainwater can be stored in man-made ponds or tank.

Rainwater harvesting is the process of saving and collect rainwater through natural resources and artificial design resources to cater to the shortage of water in the future and to stop the water flowing. The amount of water harvesting is affected by many factors like the probability of rainfall, the amount of rainfall, the method of collecting rainwater and the size of the resources to collect water. There are many reasons, such as deforestation and ecological imbalance, the level of ground water is decreasing. Due to urbanization and industrialization in urban areas, demand for water supply is increasing. The reason for this is the use of excessive groundwater which is going downwards. If no immediate action is taken immediately, then the danger of water shortage will increase in the future, and it can prove to be a threat to life. These methods are very important for people living in low-rainfall areas.

Water harvesting is very useful to meet various needs like recharge of ground water, reducing the electricity bill spent in supplying water and supplying simple water at any time whenever it is required.

Necessity of rainwater harvesting pits

Collection of rainwater is very important for people of all areas. It is very good to finish the fear of water shortage in the future. Understanding the following points will help why rainwater harvesting is needed:

- Water demand for water for various purposes cannot be fulfilled.
- All dependents on land water for all needs.
- Due to deforestation, rapidly increasing urbanization, below-ground rainwater, etc., continuously decreasing ground water level.
- Maintains rainwater storage in natural water resources.
- This reduces the risk of flood and soil degradation on the roads and also improves water quality.

- It plays great role in protecting the ground water decline and improving the ground water table.
- It is to bring the old tradition of water conservation among people.
- It is to conserve more water and prevent surface water runoff during the monsoon.
- It helps in reducing the soil erosion.

The main technique for collecting rainwater is as follows:

- Gathering surface water for future use
- Recharge of ground water

Collecting rainwater from the surface is very effective and traditional technique. These small ponds, underground tanks, storage tanks etc. can be used. However, recharge of ground water is a new method of storage. By well charging, excavator, crater, ditch, hand pump, can be opened by digging well.

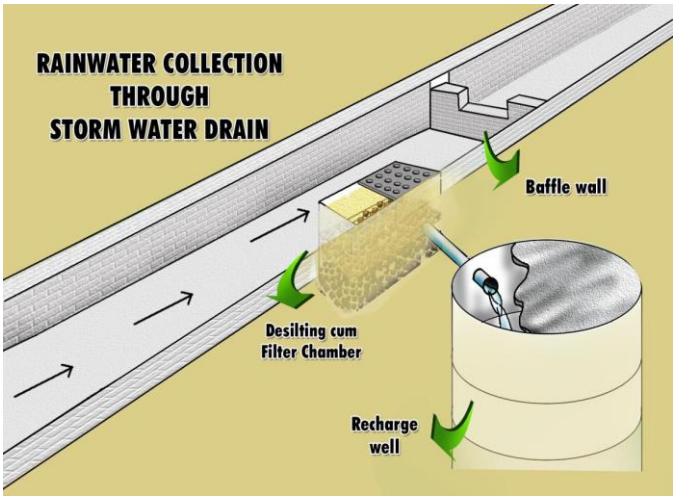
Narrative @ KL Deemed to be University

Rainwater collection strategy was implemented for KLU, Vijayawada. The total rainwater that is available from the roof and non-roof areas 100% of this storm water is recharged into the local aquifer by the means of multiple rainwater recharge wells constructed on the site.

Conveyance of rainwater from roof to recharge well: Storm water collection traps are installed on the building roof at multiple locations, these rainwater traps collect water from various areas on the roof and conveyed directly to recharge wells by the means of PVC pipes.

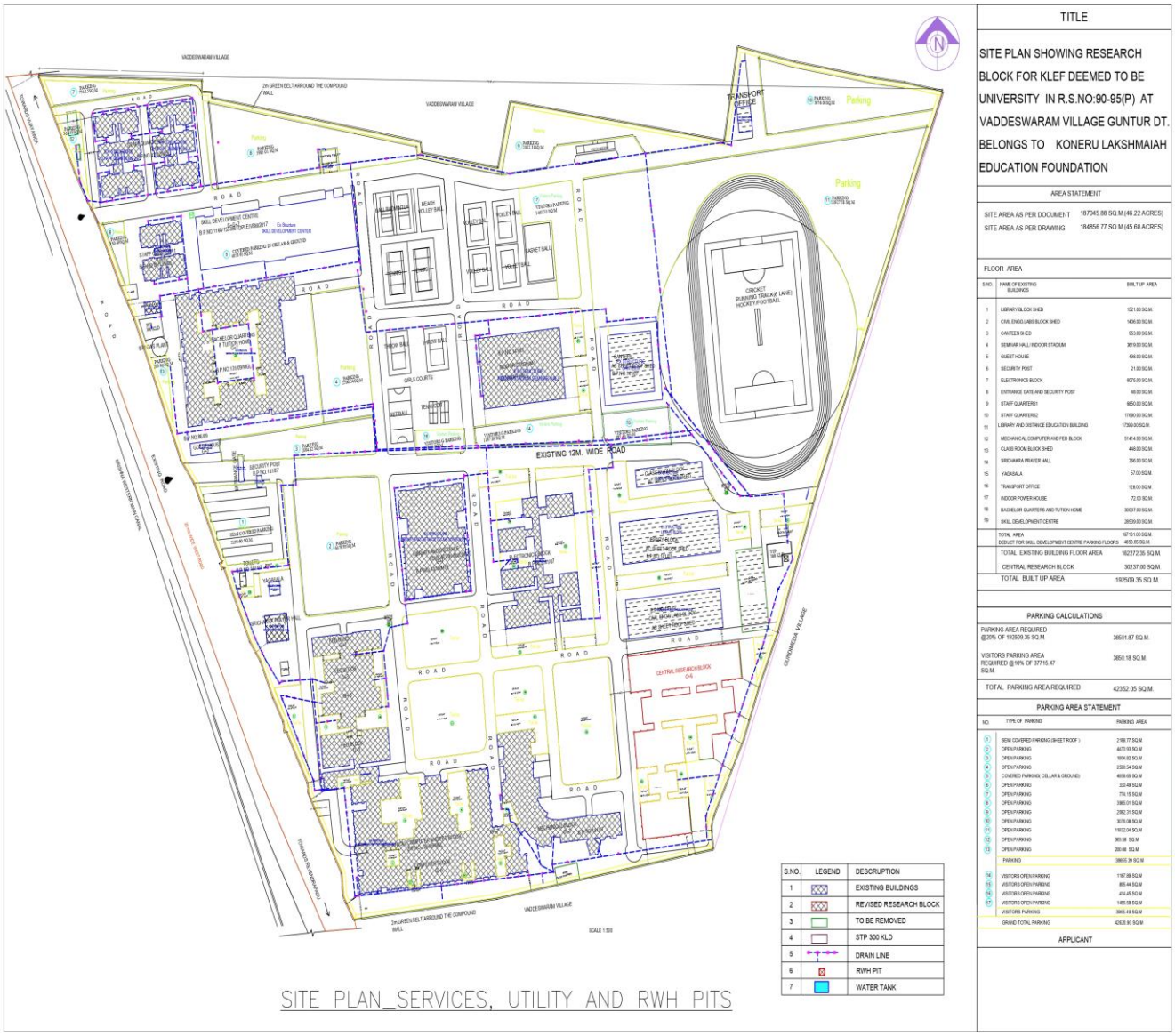
Conveyance of rainwater from non-roof to recharge well: Storm water from the non-roof areas is diverted naturally into multiple recharge wells within the campus by the means of natural slopes of the site Recharge wells are installed at different areas in the campus site to collect and recharge water from the whole site.

Water Treatment: 100% rainwater from site and roof is directed to recharge pits for aquifer recharge and no rainwater collection is implemented on site. As there is no rainwater collection on site, 100% potable water requirement is met by bore water / municipal water supply.



Site Plan Showing KLEF Deemed to Be University

AT VADDESWARAM VILLAGE GUNTUR DT. BELONGS TO KONERU LAKSHMAIAH EDUCATION FOUNDATION



S.NO.	LEGEND	DESCRIPTION
1		EXISTING BUILDINGS
2		REVISED RESEARCH BLOCK
3		TO BE REMOVED
4		STP 300 KLD
5		DRAIN LINE
6		RWH PIT
7		WATER TANK

SITE PLAN_SERVICES, UTILITY AND RWH PITS

TITLE

SITE PLAN SHOWING RESEARCH BLOCK FOR KLEF DEEMED TO BE UNIVERSITY IN R.S.NO:90-95(P) AT VADDESWARAM VILLAGE GUNTUR DT. BELONGS TO KONERU LAKSHMAIAH EDUCATION FOUNDATION

AREA STATEMENT

SITE AREA AS PER DOCUMENT	187045.88 SQ.M (46.22 ACRES)
SITE AREA AS PER DRAWING	184856.77 SQ.M (45.68 ACRES)

FLOOR AREA

S.NO.	NAME OF EXISTING BUILDINGS	BUILT UP AREA
1	LIBRARY BLOCK SHED	1521.00 SQ.M.
2	CIVIL ENGG LABS BLOCK SHED	1406.00 SQ.M.
3	CANTEEN SHED	953.00 SQ.M.
4	SEMINAR HALL/ INDOOR STADIUM	3019.00 SQ.M.
5	GUEST HOUSE	496.00 SQ.M.
6	SECURITY POST	21.00 SQ.M.
7	ELECTRONICS BLOCK	8075.00 SQ.M.
8	ENTRANCE GATE AND SECURITY POST	48.00 SQ.M.
9	STAFF QUARTERS1	665.00 SQ.M.
10	STAFF QUARTERS2	17660.00 SQ.M.
11	LIBRARY AND DISTANCE EDUCATION BUILDING	17569.00 SQ.M.
12	MECHANICAL, COMPUTER AND FED BLOCK	51414.00 SQ.M.
13	CLASS ROOM BLOCK SHED	448.00 SQ.M.
14	SRICHAKRA PRAYER HALL	300.00 SQ.M.
15	YAGASALA	57.00 SQ.M.
16	TRANSPORT OFFICE	128.00 SQ.M.
17	INDOOR POWER HOUSE	72.00 SQ.M.
18	BACHELOR QUARTERS AND TUTION HOME	3007.00 SQ.M.
19	SKILL DEVELOPMENT CENTRE	2850.00 SQ.M.
	TOTAL AREA	92713.00 SQ.M.
	DEDUCT FOR SKILL DEVELOPMENT CENTRE PARKING FLOORS	4838.65 SQ.M.
	TOTAL EXISTING BUILDING FLOOR AREA	162272.35 SQ.M.
	CENTRAL RESEARCH BLOCK	30237.00 SQ.M.
	TOTAL BUILT UP AREA	192509.35 SQ.M.

PARKING CALCULATIONS

PARKING AREA REQUIRED @20% OF 192509.35 SQ.M	38501.87 SQ.M.
VISITORS PARKING AREA REQUIRED @10% OF 37715.47 SQ.M.	3850.18 SQ.M.
TOTAL PARKING AREA REQUIRED	42352.05 SQ.M.

PARKING AREA STATEMENT

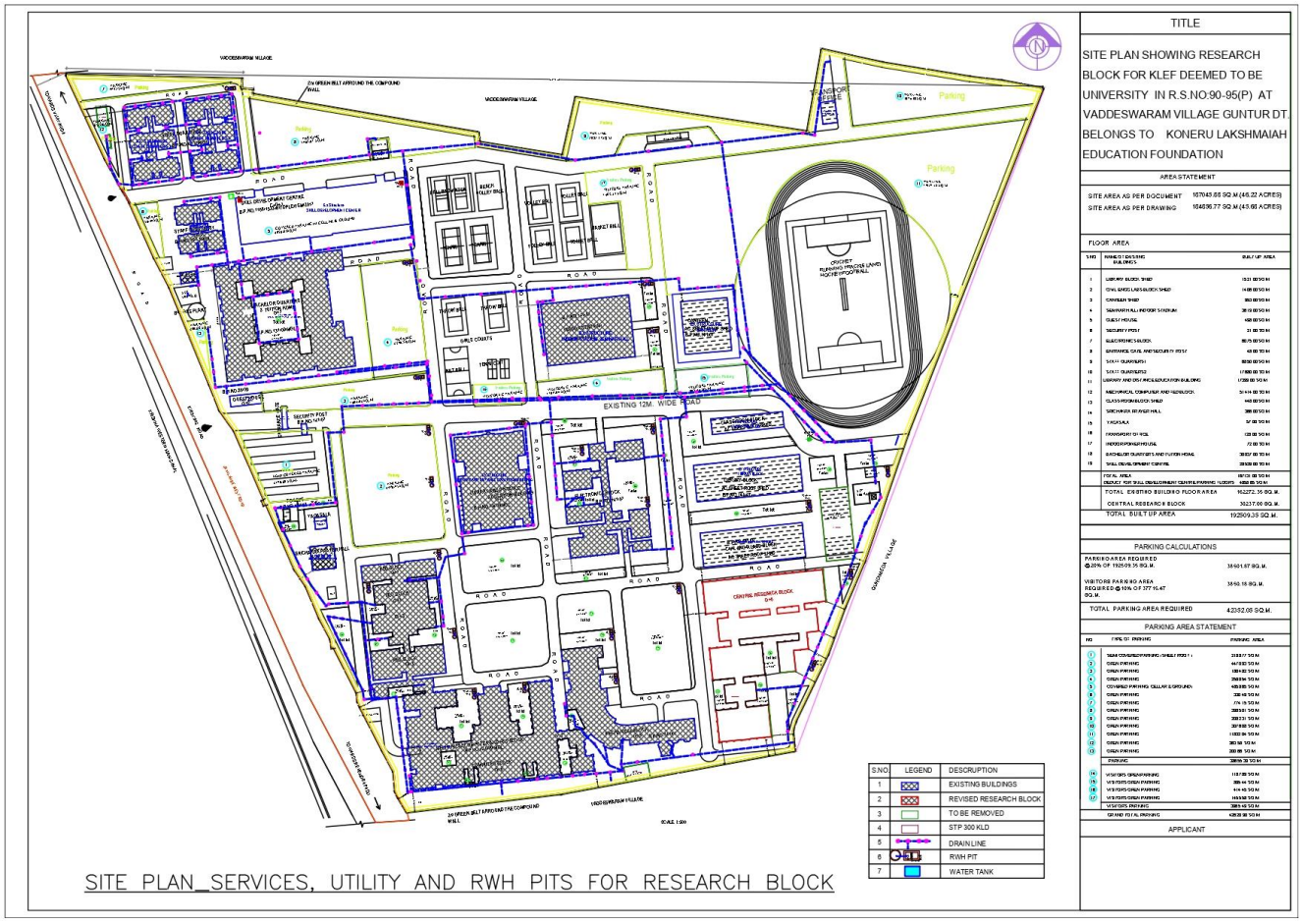
NO.	TYPE OF PARKING	PARKING AREA
1	SEMI COVERED PARKING (SHEET ROOF)	2186.77 SQ.M.
2	OPEN PARKING	4470.93 SQ.M.
3	OPEN PARKING	1694.82 SQ.M.
4	OPEN PARKING	2586.54 SQ.M.
5	COVERED PARKING (CELLAR & GROUND)	4898.66 SQ.M.
6	OPEN PARKING	330.48 SQ.M.
7	OPEN PARKING	775.15 SQ.M.
8	OPEN PARKING	3985.01 SQ.M.
9	OPEN PARKING	2982.31 SQ.M.
10	OPEN PARKING	3078.08 SQ.M.
11	OPEN PARKING	11932.04 SQ.M.
12	OPEN PARKING	363.58 SQ.M.
13	OPEN PARKING	200.68 SQ.M.
	PARKING	38655.39 SQ.M.
14	VISITORS OPEN PARKING	1167.88 SQ.M.
15	VISITORS OPEN PARKING	899.44 SQ.M.
16	VISITORS OPEN PARKING	414.48 SQ.M.
17	VISITORS OPEN PARKING	1405.58 SQ.M.
	VISITORS PARKING	3845.49 SQ.M.
	GRAND TOTAL PARKING	42828.80 SQ.M.

APPLICANT

Site Plan Showing Rainwater Harvesting Pits (RWH)

IN KLEF DEEMED TO BE UNIVERSITY AT VADDESWARAM VILLAGE GUNTUR DT.

BELONGS TO KONERU LAKSHMAIAH EDUCATION FOUNDATION



Technical Details of Rainwater Harvesting Pits (RWH)

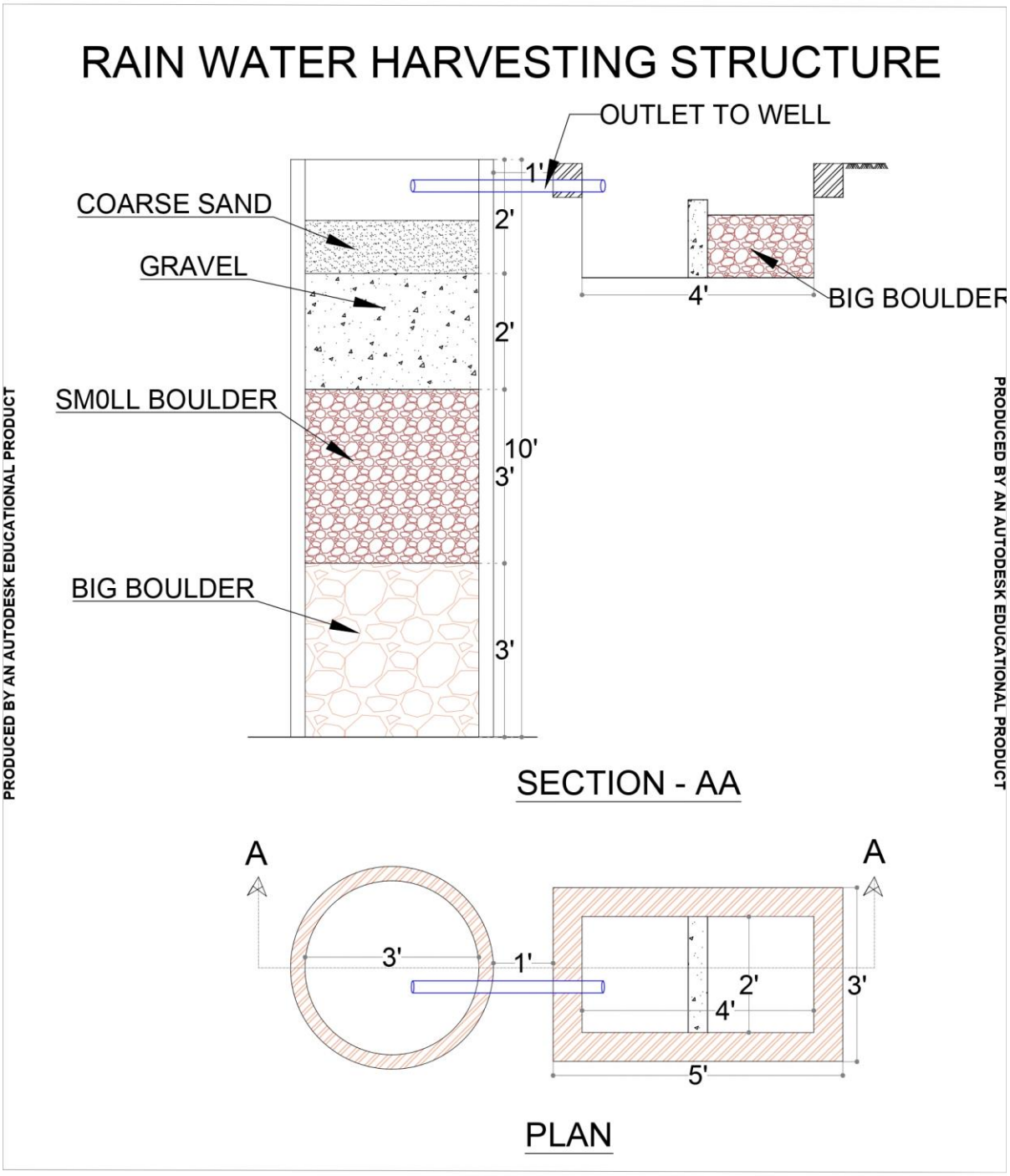
Total number of rainwater harvesting pits constructed = 28 No’s

Total Volume of rainwater harvesting pit A≈245.04 Sq.ft.

Dimensions of rainwater harvesting pits = 10’ Depth X 3’ Width

Dimensions of Desiltation Chamber = 5’ X 2’

Cross section details of Rainwater Harvesting Pits (RWH)



Location of Rainwater Harvesting Pits (RWH) in the campus

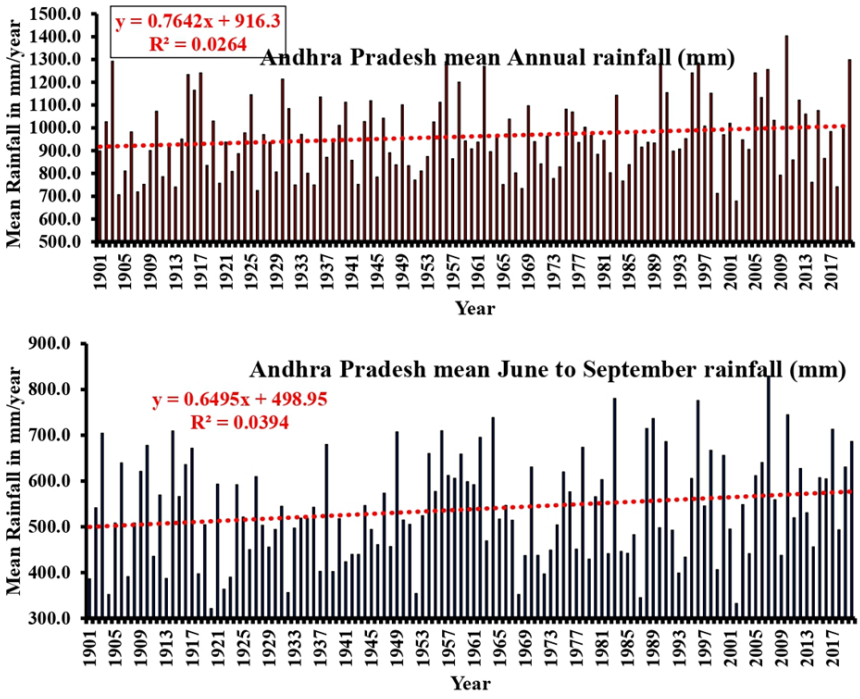
DECRIPTION	LOCATION OF RWH PIT
RWH PIT-1	Vindhya Hostel (Hostel - B block) Northeast
RWH PIT-2	SDC building Northwest
RWH PIT-3	SDC building Northeast
RWH PIT-4	Girls hostel entrance Road southeast (Near south side in garden)
RWH PIT-5	North side bike parking Northeast
RWH PIT-6	FED Block Front Garden (parking area) Northeast
RWH PIT-7	FED Block Front Garden (parking area) east side Middle
RWH PIT-8	FED block West North
RWH PIT-9	FED block Northeast
RWH PIT-10	Fed Block east side Middle
RWH PIT-11	C-Block Entrance Northwest
RWH PIT-12	C-Block entrance Northeast (Near Jasmin Hall)
RWH PIT-13	Mechanical block Near M007 Front east
RWH PIT-14	M007 Northeast
RWH PIT-15	Open air theatre Northeast
RWH PIT-16	EEE block Southeast side (near server room)
RWH PIT-17	EEE block Northwest (Near Saraswathi statue)
RWH PIT-18	EEE block Northeast
RWH PIT-19	New library Northeast
RWH PIT-20	Indoor stadium entrance Southeast
RWH PIT-21	Indoor stadium Northeast
RWH PIT-22	Backet ball ground 's garden Northeast
RWH PIT-23	R & D block Back side East
RWH PIT-24	R & D block Middle Near ground floor Lab east side
RWH PIT-25	R & D block Theatre Northeast
RWH PIT-26	Soil lab and old library middle East side
RWH PIT-27	STP Northeast
RWH PIT-28	Cricket ground Southwest

Rainfall Data Analysis

District wise Map of the Andhra Pradesh state

Mean rainfall (mm) and coefficient of variation (CV) of the Andhra Pradesh state for the SW monsoon months, SW monsoon season and annual.

	June	July	August	September	JJAS	Annual
Mean	96.3	127.5	142.5	146.3	512.6	903.6
CV	55.4	37.7	31.1	32.7	21.2	18.0



Time series of yearly mean rainfall in mm/year (a) Annual, (b) Southwest monsoon season for the period 1901 to 2020.

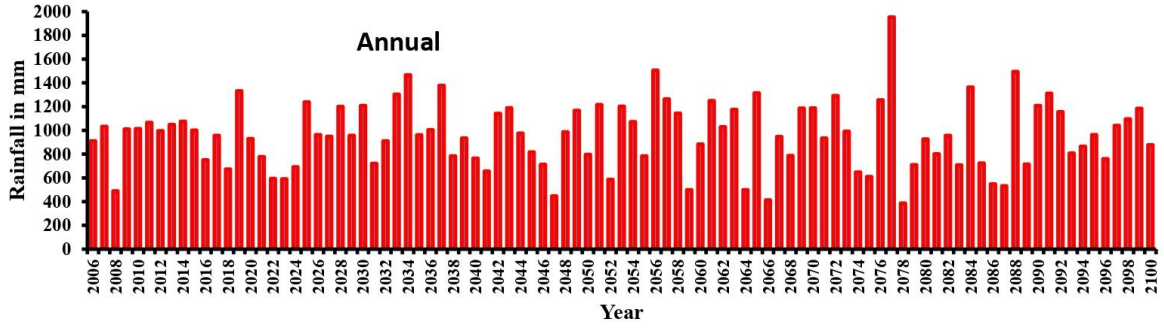
Rainfall statistics for the districts of Andhra Pradesh for the four monsoon months, southwest monsoon season and annual

DISTRICT	JUNE		JULY		AUGUST		SEPTEMBER		MONSOON		ANNUAL	
	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV	MEAN	CV
ANANTAPUR	62.4	60	55.3	66	81.3	55	115.7	55	314.7	32	558.5	76
CHITTOR	80.3	66	99.2	55	114.8	48	133.6	37	427.9	27	946.0	24
KADAPA	70.8	289	88.6	64	109.4	52	116.5	49	385.3	72	714.7	66
EAST GODAVARI	141.2	56	205.5	39	197.2	40	188.9	52	732.7	26	1151.1	53
GUNTUR	104.2	201	146.3	48	166.1	42	157.0	49	573.6	55	884.4	59
KRISHNA	128.5	57	196.6	42	207.7	39	166.2	48	699.0	26	1048.6	55
KURNOOL	89.5	86	103.6	50	128.3	45	135.6	47	456.9	31	674.2	51
NELLORE	58.7	345	81.0	57	93.8	55	93.4	44	327.0	81	1060.6	55
PRAKASAM	65.5	86	87.4	53	107.9	60	127.3	47	388.1	32	815.9	62
SRIKAKULAM	146.1	52	192.8	32	207.5	37	196.2	37	742.6	18	1154.6	40
VISAKHAPATNAM	151.0	56	182.4	36	187.7	32	202.2	37	723.4	19	1170.1	53
VIZIANAGARAM	143.7	154	171.7	30	196.6	36	196.2	38	708.2	47	1094.2	69
WEST GODAVARI	132.5	59	227.0	37	233.5	43	180.8	47	773.9	27	1125.3	54

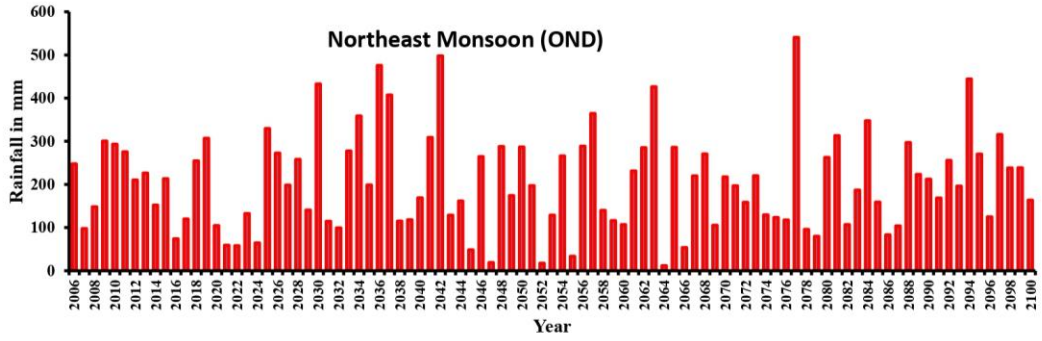
Vijayawada Future Climatology

Vijayawada (Krishna), Andhra Pradesh: Future Climatology

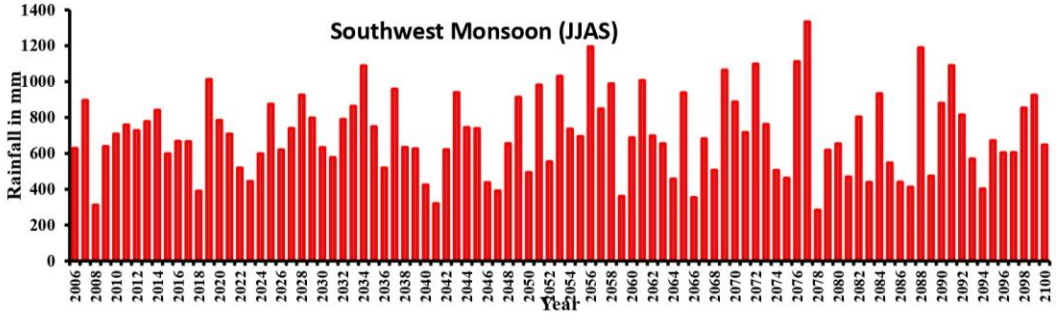
Annual Rainfall (mm/year) from 2006 to 2100



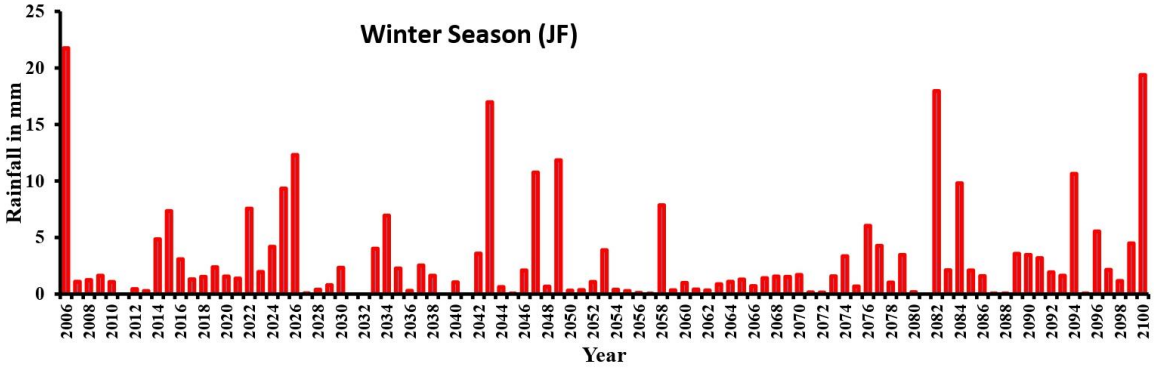
Northeast Monsoon season Rainfall (mm/year) from 2006 to 2100 (October, November and December)



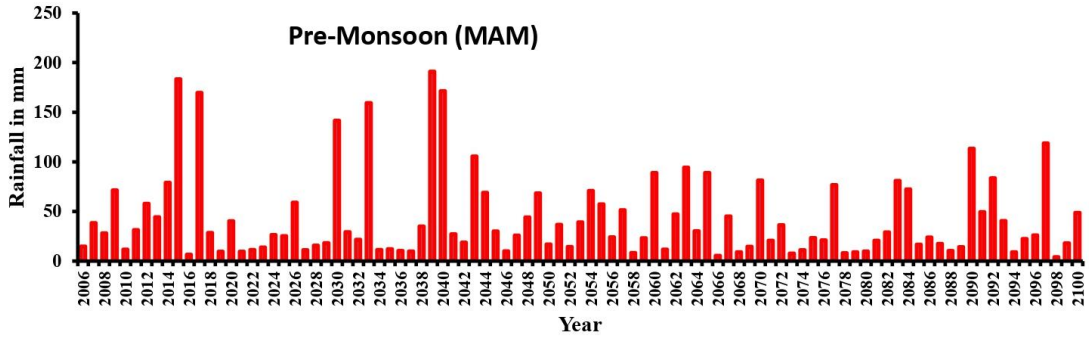
Southwest Monsoon season Rainfall (mm/year) from 2006 to 2100 (June, July, August, September)



Winter season Rainfall (mm/year) from 2006 to 2100 (January and February)



Pre-monsoon season Rainfall (mm/year) from 2006 to 2100 (March, April and May)



Water Demand Calculations

WORKING CALENDAR				
Project: KL UNIVERSITY, VIJAYAWADA				
S.No	Month	No. of Days per month	No. of non-working days per month	No. of working days per month
1	July	31	8	23
2	August	31	10	21
3	September	30	8	22
4	October	31	8	23
5	November	30	10	20
6	December	31	5	26
7	January	31	8	23
8	February	28	8	20
9	March	31	10	21
10	April	30	8	22
11	May	31	31	0
12	June	30	30	0
Total			144	221

365

Note: 2months summer holidays i.e., June & May.

Example R-Block Calculations of rainwater harvesting pits

LIST OF TREES & PLANTS USED IN LANDSCAPING

KLU R&D BLOCK					
S.No	**Scientific name**	**Common name**	**No of trees**	**Plant Type**	**Canopy area of species (sqm)**
1	Cocos nucifera	Coconut tree	36	Existing mature Tree	8
2	Borassus Flabellifer	Palmyra tree	56	Existing mature Tree	8
3	Tectona Grandis	Teak tree	8	Existing mature Tree	12.5
4	Saraca asoca	Ashoka tree	3	Existing mature Tree	3
5	Ficus Virens	White fig	3	Existing mature Tree	12.5
6	Azadirachta indica	Neem Tree	2	Existing mature Tree	12.5
7	Samanea saman	Rain Tree	2	Existing mature Tree	12.5
8	Cordia dichotoma	Indian Cherry	12	Existing mature Tree	12.5
9	Mangifera Indica	Mango Tree	2	Existing mature Tree	12.5
10	Bamboo & other	shrubs	0	Adaptive/ Native shrubs	1597
11	Poemacea	Lawn Grass	0	Lawn Ground cover	2457
Total Landscape cover					**5161.50**

MONTHLY LANDSCAPE WATER REQUIREMENT

Project: KL UNIVERSITY, VIJAYAWADA			
Month wise Landscape water calculations			
S.No	**Month**	**No. of Days per month**	**Monthly LWU Kilolitres**
1	July	31	**719.78**
2	August	31	**688.19**
3	September	30	**668.65**
4	October	31	**678.58**
5	November	30	**632.04**
6	December	31	**640.25**
7	January	31	**678.70**
8	February	28	**722.16**
9	March	31	**861.99**
10	April	30	**875.50**
11	May	31	**931.91**
12	June	30	**818.96**
Total			**8,916.71**

CALCULATION FOR WATER USE REDUCTION

Project: KL UNIVERSITY, VIJAYAWADA

Design Case scenario

Input data

Building Occupancy - students and staff	2,856	Regular students	2,398
Male	1,428	Handicapped stu.	128
Female	1,428	**Students**	**2,526**
		Faculty	330
		Admin. Staff	-
Non-working days	144	Maintenance staff	-
Working days	221	**Management**	**330**

S. No.	Flush Fixture	Total No of fixtures	Total No. of working days	Total No. of users	Model	No. of uses	Total number of uses	Flow rate (lpf)	Duration	Water Consumption(l)
1	Water Closets (solid)	0	221	2856.00	KHOLER Insta Flush 3/6	0.1	285.6	6.00	1.00	**1,713.60**
2	Water Closets (liquid)	0	221	1428.00	KHOLER Insta Flush 3/6	3.0	4284.0	3.00	1.00	**12,852.00**
3	Urinals	0	221	1428.00	KOHLER	3.0	4284.0	1.00	1.00	**4,284.00**
	Flow Fixture							Flow rate (lpm)		
4	**Lavatory fixtures**									
	Hand wash basin Faucet	164	221	2856.00	Parryware	0.75	2142.00	8.00	0.50	**8,568.00**
	Two way bib-cock + Health faucet	164	221	2856.00	KHOLER	0.75	2142.00	4.20	1.00	**8,996.40**
5	Kitchen faucet		221	2856.00	KHOLER	0.50	1428.00	12.00	1.00	**17,136.00**
	Daily Potable Water Consumption - KLU (Litres)									**34,700.40**
	Daily Treated Water Consumption - KLU (Litres)									**18,849.60**
	Daily Water Consumption (Potable water+ Treated water)- KLU (Litres)									**53,550.00**
	Annual Water Consumtion - KLU (Kilo Litres)									**11,834.55**

KLU OVERALL SAVINGS WITH FIXTURES (DESIGN CASE vs BASE CASE)	
Total Annual Water Consumption in design case (KL)	**11,834.55**
Total Annual Water Consumption in Base case (KL)	**25,499.51**
Total water savings corresponds to base case	**13,664.96**
percentage of total water savings corresponds to base case	**53.59%**

MONTHLY WATER USE - DESIGN CASE

Project: KL UNIVERSITY, VIJAYAWADA

S.No	Month	No. of Days	No. of working days	Campus Occupancy	Treated water use per day	Potable water use per day	Building water use per day	Monthly Treated water use - Campus		Monthly Potable water use - Campus	Total water use per month - Campus
		per month	per month	%	Litres	Litres	Litres	Kilo litres		Kilo litres	Kilo litres
1	July	31	23	100%				433.54		798.11	1,231.65
2	August	31	21	100%				395.84		728.71	1,124.55
3	September	30	22	100%				414.69		763.41	1,178.10
4	October	31	23	100%				433.54		798.11	1,231.65
5	November	30	20	100%				376.99		694.01	1,071.00
6	December	31	26	100%	18,849.60	34,700.40	53,550.00	490.09		902.21	1,392.30
7	January	31	23	100%				433.54		798.11	1,231.65
8	February	28	20	100%				376.99		694.01	1,071.00
9	March	31	21	100%				395.84		728.71	1,124.55
10	April	30	22	100%				414.69		763.41	1,178.10
11	May	31	0	100%				-		-	-
12	June	30	0	100%				-		-	-
	Total	**365**	**221**					**4,165.76**		**7,668.79**	**11,834.55**

CALCULATION FOR WATER USE REDUCTION

Project: KL UNIVERSITY, VIJAYAWADA			
Base case scenario - KLU			
Input data			
Building Occupancy - students and staff	2,856	Regular students	2,398
Male	1,428	Handicapped stu.	128
Female	1,428	**Students**	**2,526**
		Faculty	330
		Admin. Staff	-
Non-working days	144	Maintenance staff	-
Working days	221	**Management**	**330**

S. No.	Total No of fixtures	Flush fixture	Total No. of working days	Total No. of users	Model	No. of uses	Total number of uses	Flow rate (lpf)	Duration	Water Consumption(l)
1		Water Closets (males)	221	2856	conventional	0.1	285.6	9.0	1.0	2570.40
2		Water Closets (females)	221	1428	conventional	3.0	4284.0	9.0	1.0	38556.00
3		Urinals	221	1428	conventional	3.0	4284.0	4.0	1.00	17136.00
	Total No of fixtures	**Flow Fixture**								
4		Hand wash basin Faucet	221	2856	conventional	0.75	2142.00	10.00	1.00	21420.00
		Two way bib-cock + Health faucet	221	2856	conventional	0.75	2142.00	10.00	1.00	21420.00
5		Kitchen Faucet	221	2856	conventional	0.50	1428.00	10.00	1.00	14280.00
Daily Potable Water Consumption - KLU (Litres)										**57,120.00**
Daily Treated Water Consumption - KLU (Litres)										**58,262.40**
Daily Water Consumption - KLU(Litres)										**115,382.40**
Annual Water Consumtion - KLU(Kilo Litres)										**25,499.51**

MONTHLY WATER USE - BASE CASE											
Project: KL UNIVERSITY, VIJAYAWADA											
S.No	Month	No. of Days	No. of working days	Campus Occupancy	KLU WATER DEMAND	Potable water use per day	Treated water use per day	Monthly Treated water use - Campus		Monthly Potable water use - Campus	Total water use per month - Campus
		per month	per month	%	Litres	Litres	Litres	Kilo litres		Kilo litres	Kilo litres
1	July	31	23	100%				1,340.04		1,313.76	2,653.80
2	August	31	21	100%				1,223.51		1,199.52	2,423.03
3	September	30	22	100%				1,281.77		1,256.64	2,538.41
4	October	31	23	100%				1,340.04		1,313.76	2,653.80
5	November	30	20	100%				1,165.25		1,142.40	2,307.65
6	December	31	26	100%	115,382.40	57,120.00	58,262.40	1,514.82		1,485.12	2,999.94
7	January	31	23	100%				1,340.04		1,313.76	2,653.80
8	February	28	20	100%				1,165.25		1,142.40	2,307.65
9	March	31	21	100%				1,223.51		1,199.52	2,423.03
10	April	30	22	100%				1,281.77		1,256.64	2,538.41
11	May	31	0	100%				-		-	-
12	June	30	0	100%				-		-	-
Total		**365**	**221**					**12,875.99**		**12,623.52**	**25,499.51**

Status	
Annual roof water harvest (Cu.M)	3,832.71
Annual non-roof water harvest (Cu.M)	1,730.56
Annual water demand (Cu.M)	20,751.26
Reusable water quantity annually (Cu.M)	10,528.36
Water reuse achieved	51%
Amount of surplus rainwater recharged (Cu.M)	5,563.27

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