MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

IWMP-Batch-V

GUNTUR -04/2013-14
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
February-2023

T 0 - T 1 - T 2 - T 3 - T 4 - T 5

AGRICULTURE & SOIL DIVISION
Andhra Pradesh Space Applications Centre (APSAC) ITE&C Department Govt. of Andhra Pradesh

RURAL DEVELOPMENT AND WATERSHED MONITORING DIVISION
Land Resources and Land Use Mapping and Monitoring Group, Remote Sensing Application Area, National Remote Sensing Centre, ISRO

DEPARTMENT OF LAND RESOURCES
Ministry of Rural Development Government of India

C O N T E N T S

E X E C U T I V E   S U M M A R Y

EXECUTIVE SUMMARY

1. Integrated Watersheds Management Project (IWMP) is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development (MRD).

2. National Remote Sensing Centre (NRSC), ISRO has designed and developed Bhuvan Geo-ICT Web portal tools namely – Srishti and Drishti for monitoring and evaluation of IWMP watersheds. It uses high spatial and temporal resolution sensors viz., Carto-1/2(2.5 m) , LISS-IV(5.8 m color).

3. Current summary report gives details of Project – IWMP-04/2013-14, Guntur District of   Andhra Pradesh.   The total geographical area of the project is **6,945 ha**. It comprises of 10 micro watersheds.

4. In the project area Drishti points were not uploaded.

5. Water bodies have shown an increased by 7.12 ha , which correspond to the various water bodies that have been converted into other land use classes in this period.

6. Major percentage i.e. 81.09 % is covered by the agriculture, 6.65 % is covered by scrubland, 7.20 % is covered by forest and remaining by other land use classes.

1. STUDY AREA
PROJECT : GURAJALA WATERSHED (IWMP-04/2013-14)
DISTRICT : GUNTUR , STATE : ANDHRA PRADESH

- The study area falls in Gurajala Mandal of Guntur district of Andhra Pradesh state. The total geographical area of the project is **6,945 ha.** It comprises of 10 micro watersheds. Location Map of the study area is shown in Figure 1. Analysis is done for 2013-14 (T0) period (*Batch -1*) projects taking 2021-22 (T5) period satellite images, seen in Table 1 & 2 and Fig 04.
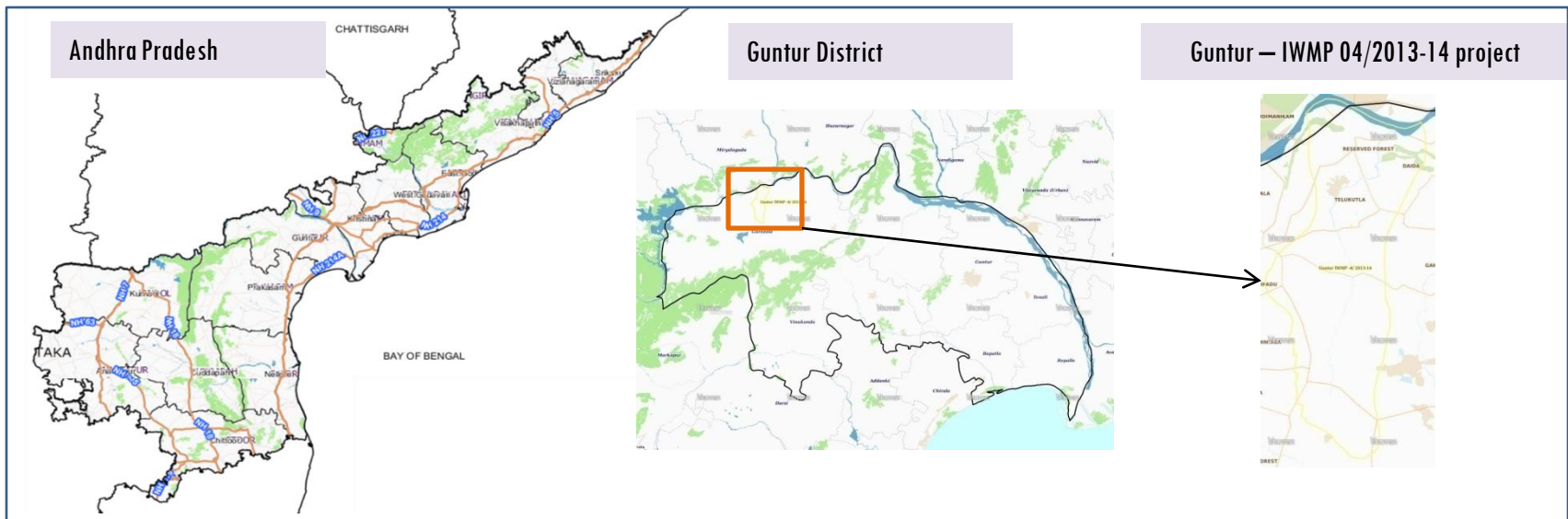
Fig.1. Location map of Gurajala Watershed (IWMP-04/2013-14) in Guntur District, A.P

- Guntur City falls within the hot humid region of the country and it is not more than 40 miles from the Sea. The climate of the district is generally hot is summer. The atmospheric humidity in the region around Guntur ranges from 63% to 81%.
- The average annual temperature is 28.5 C and annual rain fall is about 905 mm. Rain storms and cyclones are common in the region during the rainy season, which starts with the monsoons in early June. Cyclones may occur any time of the year, but occur more commonly between May and November.

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Table 1. Satellite Data and Ancillary Data

Satellite data	T0-A	T0-B	T5
	2013-14	2016-17	2021-22
LISS IV	2013-14		
SCENE 1			28-Jan-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			28-Jan-22
SCENE2			
SCENE 3			
SCENE 4			

Linear Imaging Self Scanning Sensor (LISS)

Table 2.Ancillary Data

	Category	Sub category	Status
1	Thematic maps		
	LULC (1: 10 000)		
		DRAIANGE	YES
		SETTLEMENT	YES
		ROADS/RAILS	No
	LULC (1: 50 000)		
		2005-06	
		2008-09	
2	Activity Plan Maps		
3	Drishti Photographs		
		Total	0
4	Detailed Project Report		

Fig 2. Natural Color Composite overlaid with Project boundaries and high detail stream network

Legend

 Drainage (1:10000 Scale)

 MWS Boundary

 Project Boundary

Fig 3. Natural Color Composite overlaid with Drishti Points

No Drishti Points Uploaded

Drishti Upload Status

Table 3. Classification of the Activities

Sr. No	Activity	Number of Photographs uploaded in Drishti Mobile Application	Visible on satellite in Srishti Geoportal
1	Afforestation	0	0
2	Horticulture	0	0
3	Agriculture	0	0
4	Pasture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Terrace	0	0
8	Checks & Plugs	0	0
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams/Rock fill dam	0	0
12	Nallah Bunds/Drainage treatment	0	0
13	Percolation tanks / Ground water recharge structure	0	0
14	Production System and Micro-Enterprises	0	0
15	Livelihood Activities-Plantation/Horticulture	0	0
16	Capacity Building Activities	0	0
17	Entry Point Activity	0	0
18	Others	0	0
	TOTAL	**0**	**0**

03. MONITORING IN THE PROJECT AREA

3.1 Site Wise Changes in the Project

- Impacts of the activities carried out are presented through combination of Drishti and Srishti captures.

- T0 is the baseline period before implementation (2013-14) and T5 is 2021-22 period for monitoring.

- Captures are also provided wherever changes are observed in satellite images, that may match expected activity related impact, even though they don't have Drishti report yet, seen in figure 05.

Fig 4. Gurajala Watershed (IWMP-04/2013-14) Natural Colour Composite- 2013-14 to 2021-22
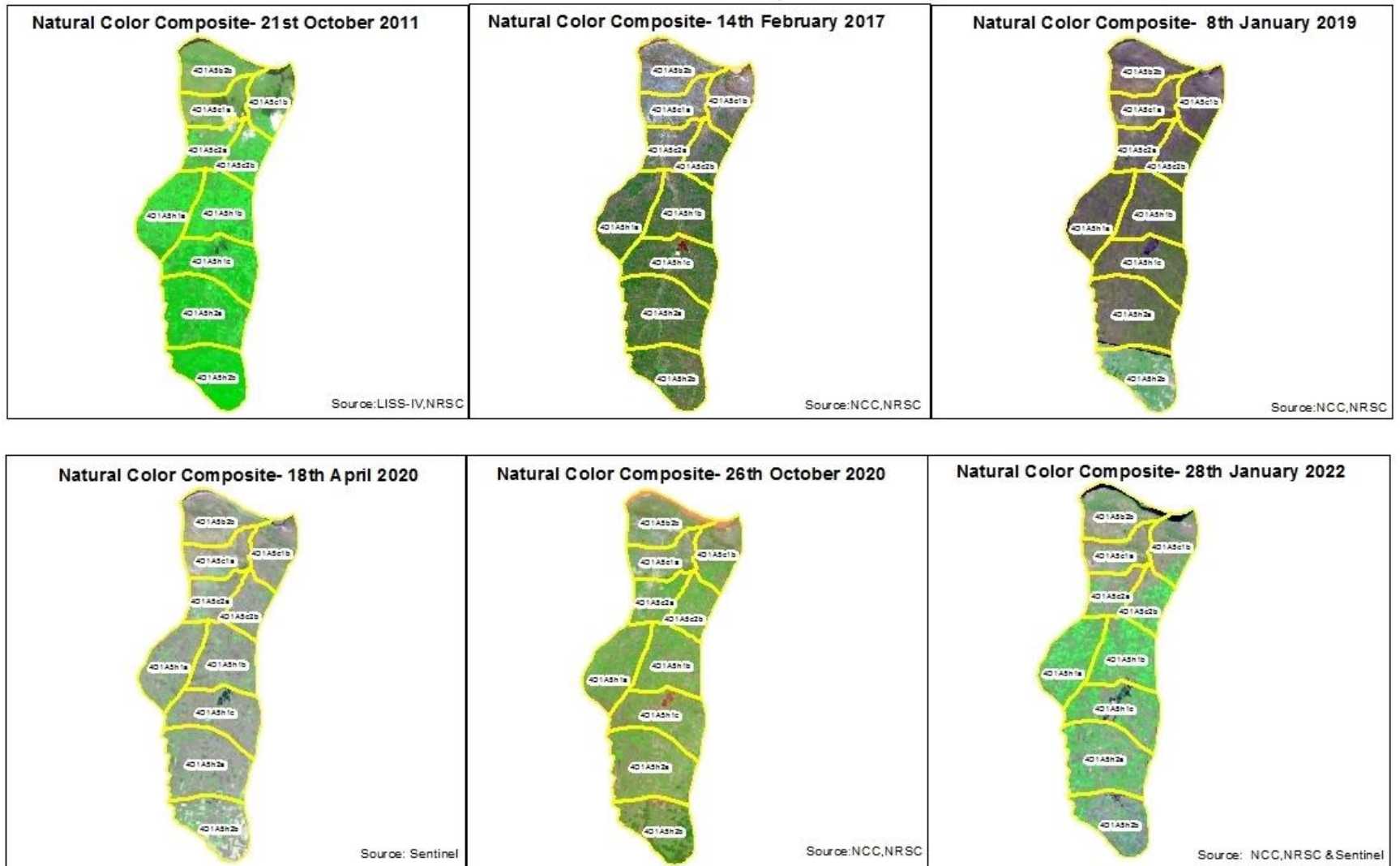
Fig 5. Monitoring of activities, Gurajala watershed (IWMP-04/2013-14 to 2017-18), Guntur District, A.P

T0

T1

T0:

T1:

Drishti Sl no   MWS :
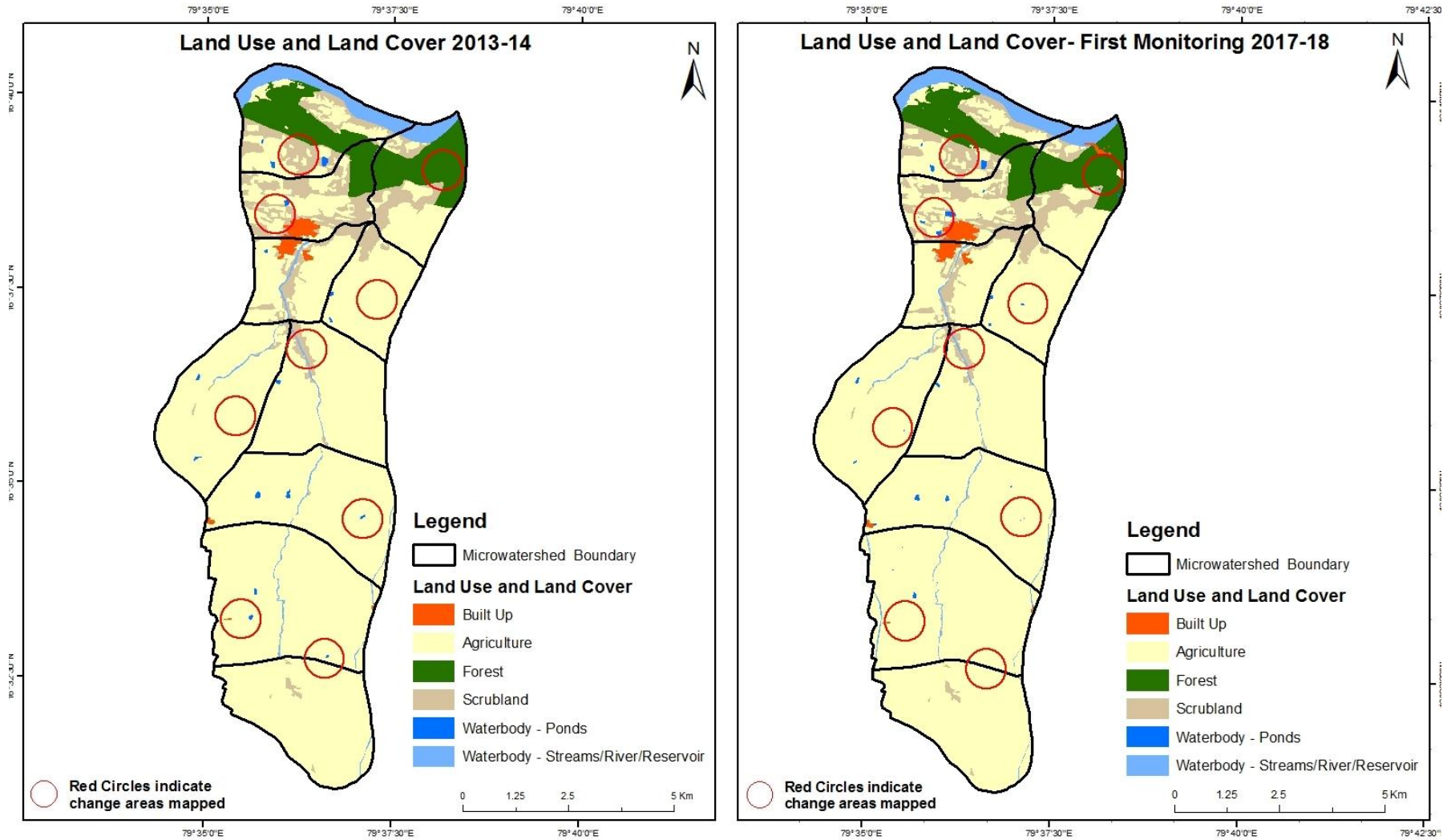
T0

T1

T0:

T1:

Drishti Sl no.   MWS :

3. MONITORING IN THE PROJECT AREA

3.2 Land use and Land cover Changes in the Project

1. Change in land use and land cover form T0 to T5 are analyzed in terms of built up, mining/dump, agriculture, plantation- horticulture, forest, barren rocky waterbody-streams/river/reservoir and waterbody –ponds, seen in figure 06 & 10.

2. Captures are also provided wherever changes are observed in satellite images, that may match expected activity related impact, even though they don't have Drishti report yet, seen in figure 11 & 12

3. The result obtained for the period T0 to T5 are given in the change matrix table.

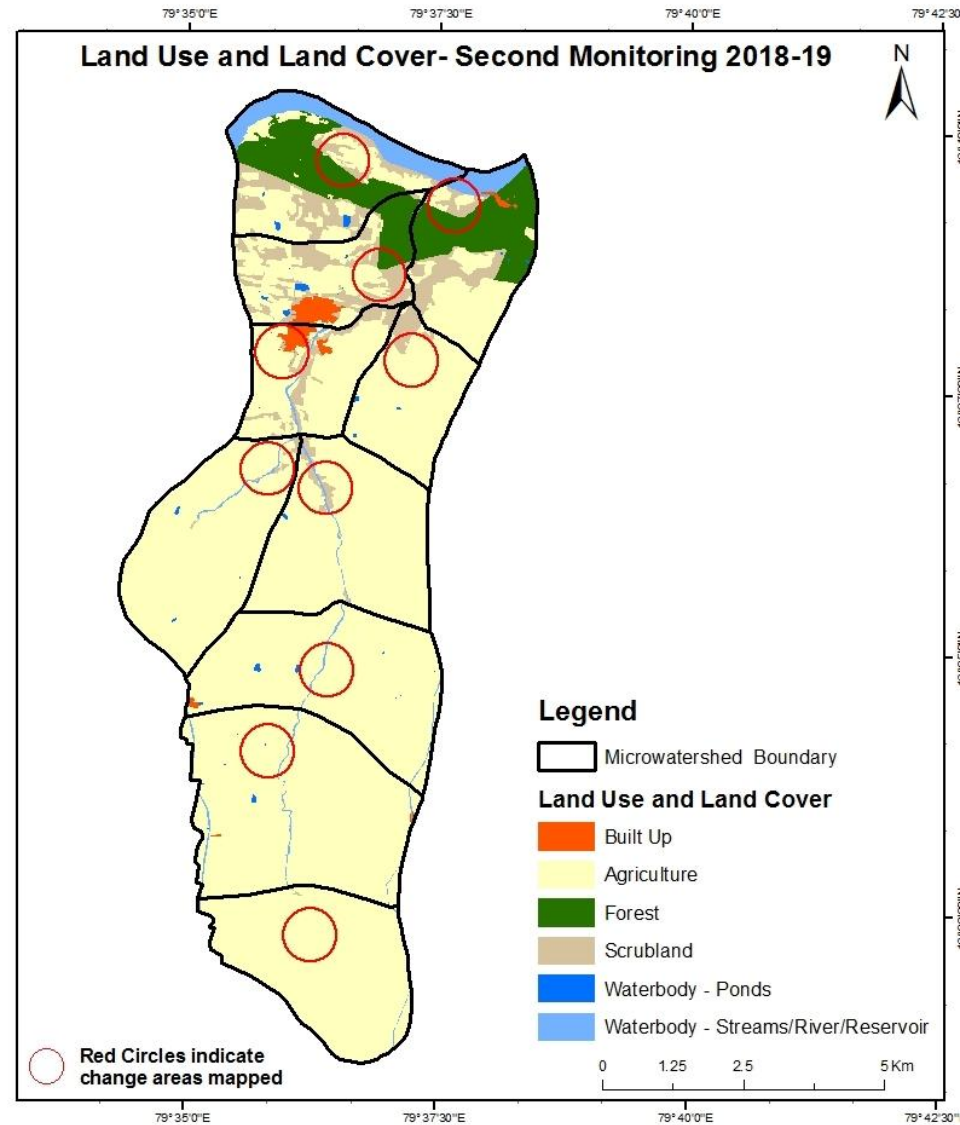4. In matrix table column represents the T0 (2013-14) and row represents the T5 (2021-22)
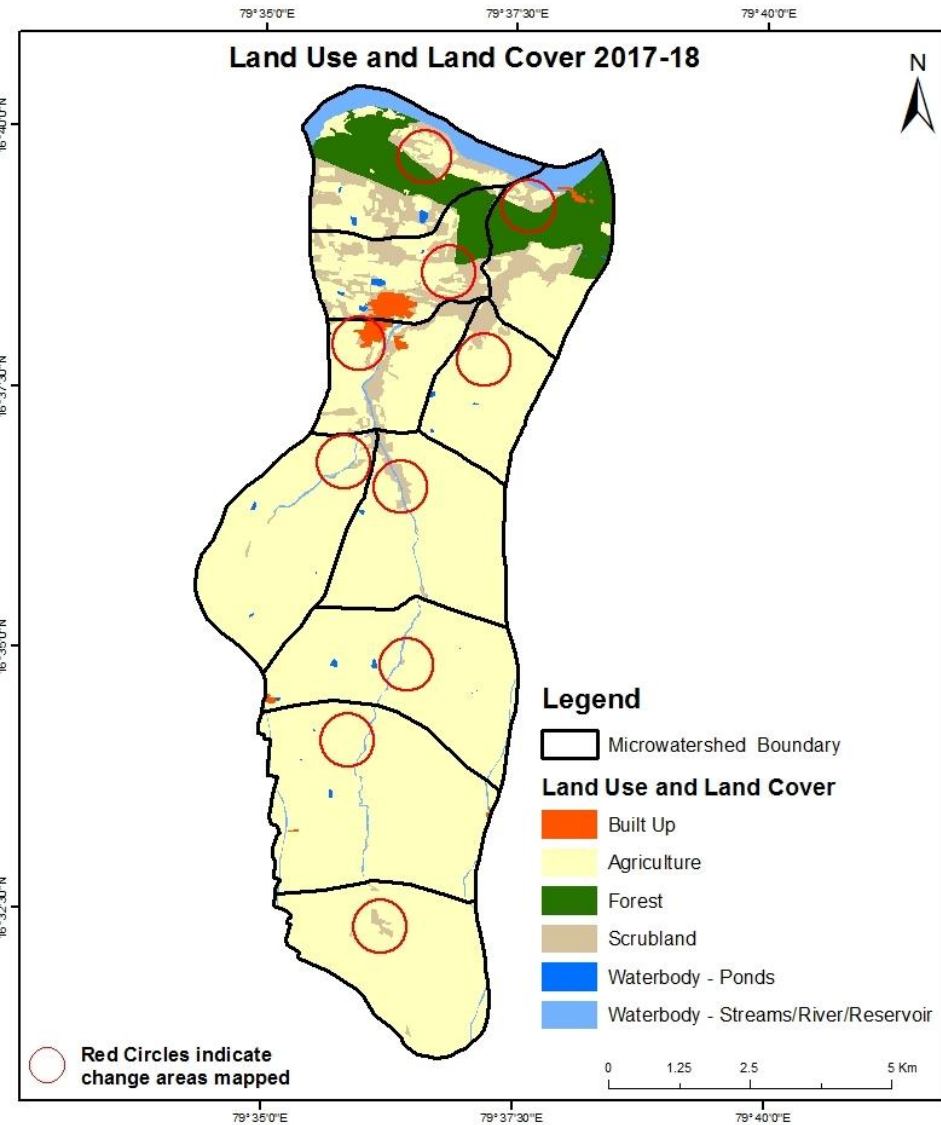
Fig 6. Gurajala Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

Land Use and Land Cover 2013-14

Land Use and Land Cover- First Monitoring 2017-18

Legend

Microwatershed Boundary

Land Use and Land Cover

Built Up
Agriculture
Forest
Scrubland
Waterbody - Ponds
Waterbody - Streams/River/Reservoir

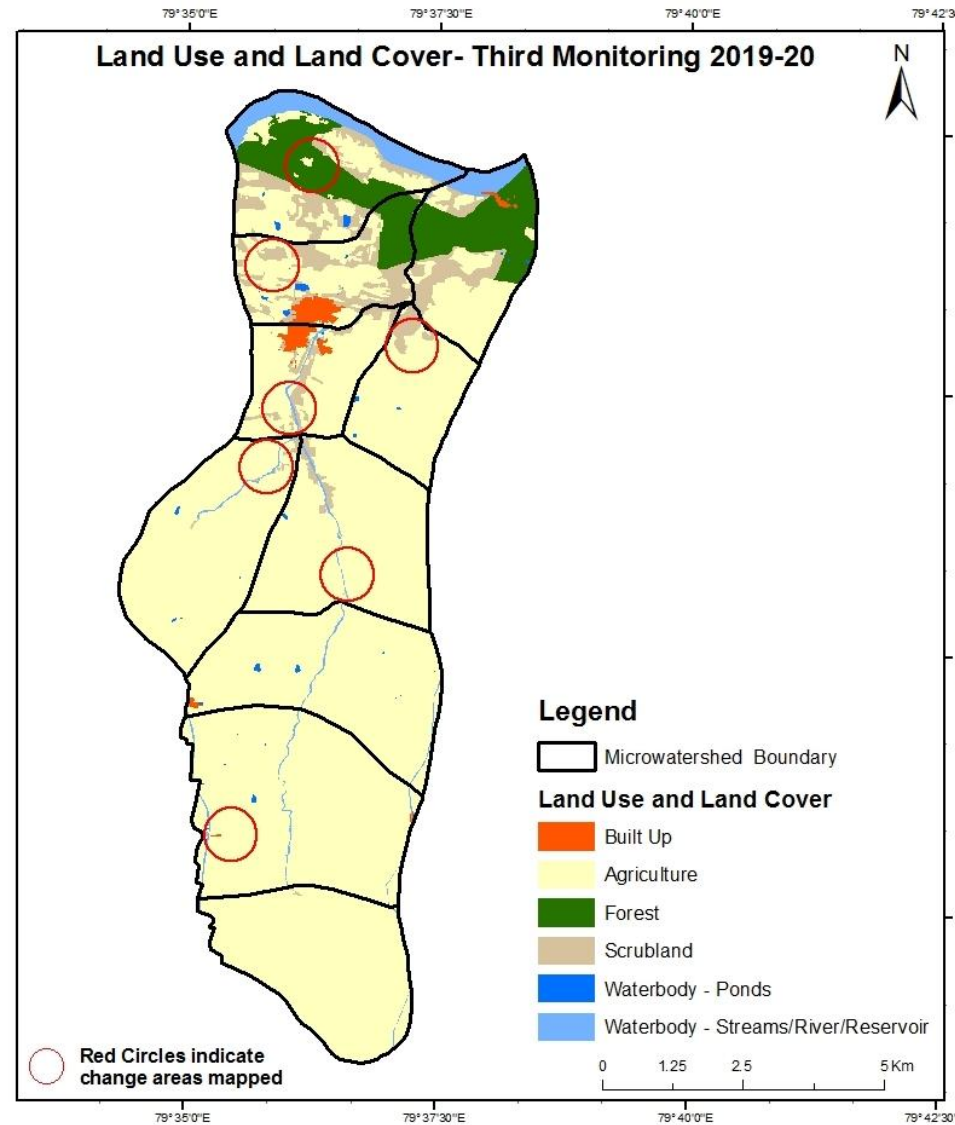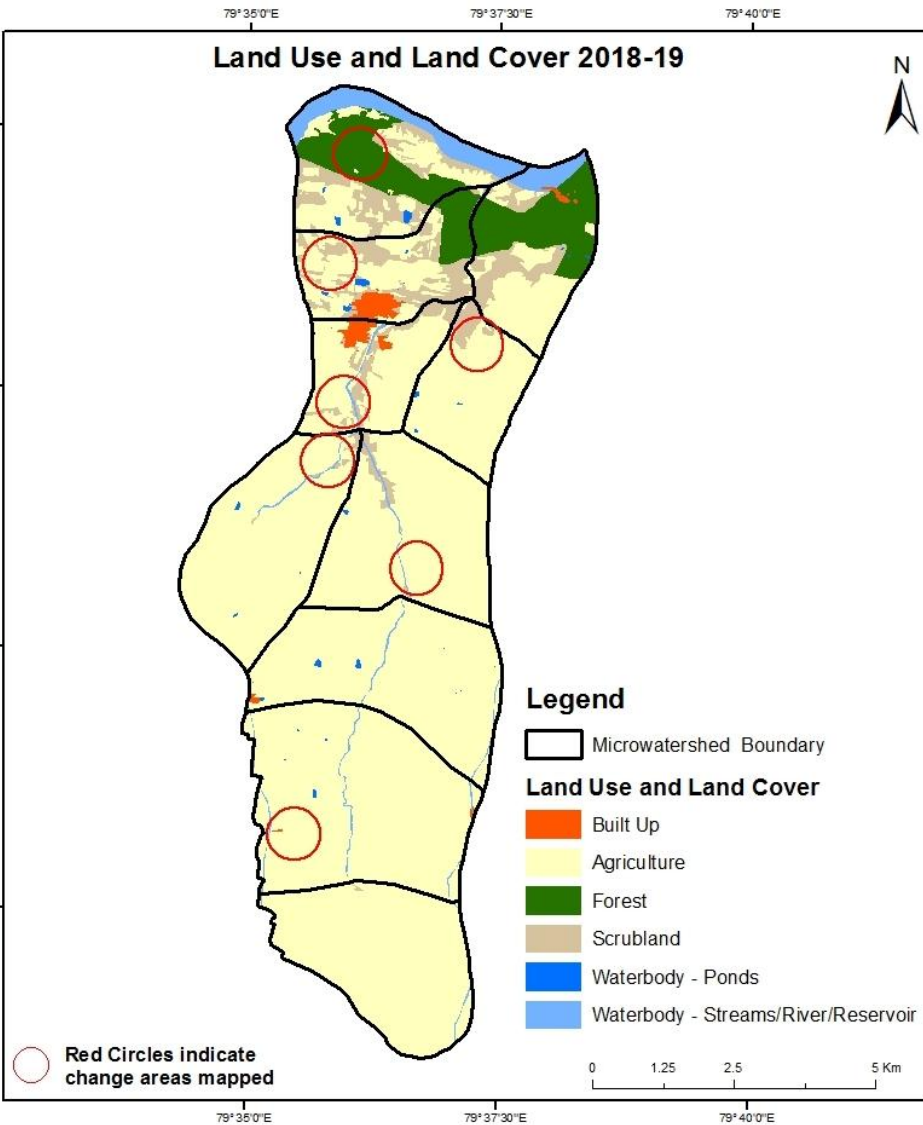Red Circles indicate change areas mapped

0   1.25   2.5   5 Km

Fig 7. Gurajala Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000

Fig 8. Gurajala Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000

Fig 9. Gurajala Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)
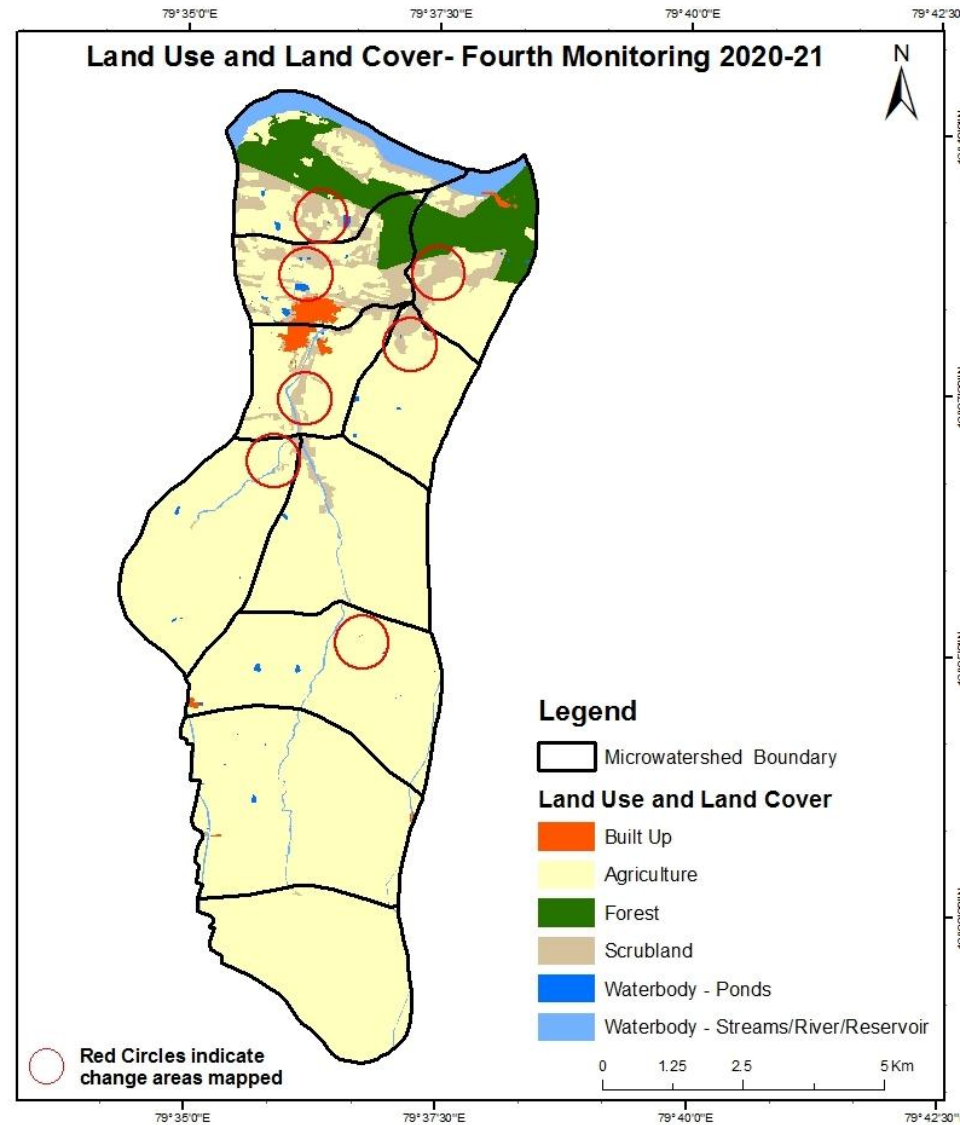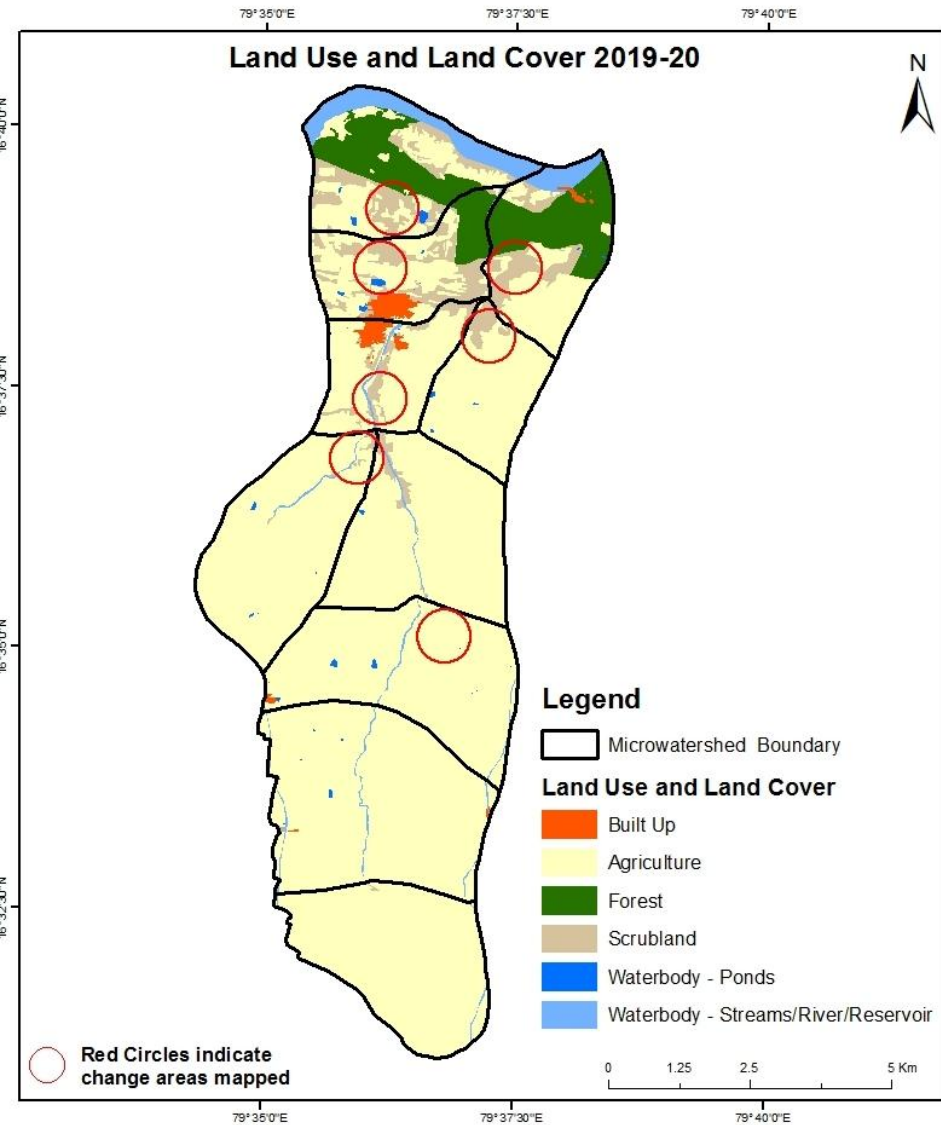
Scale: 1:10000

Fig 10. Gurajala Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)

Scale: 1:10000

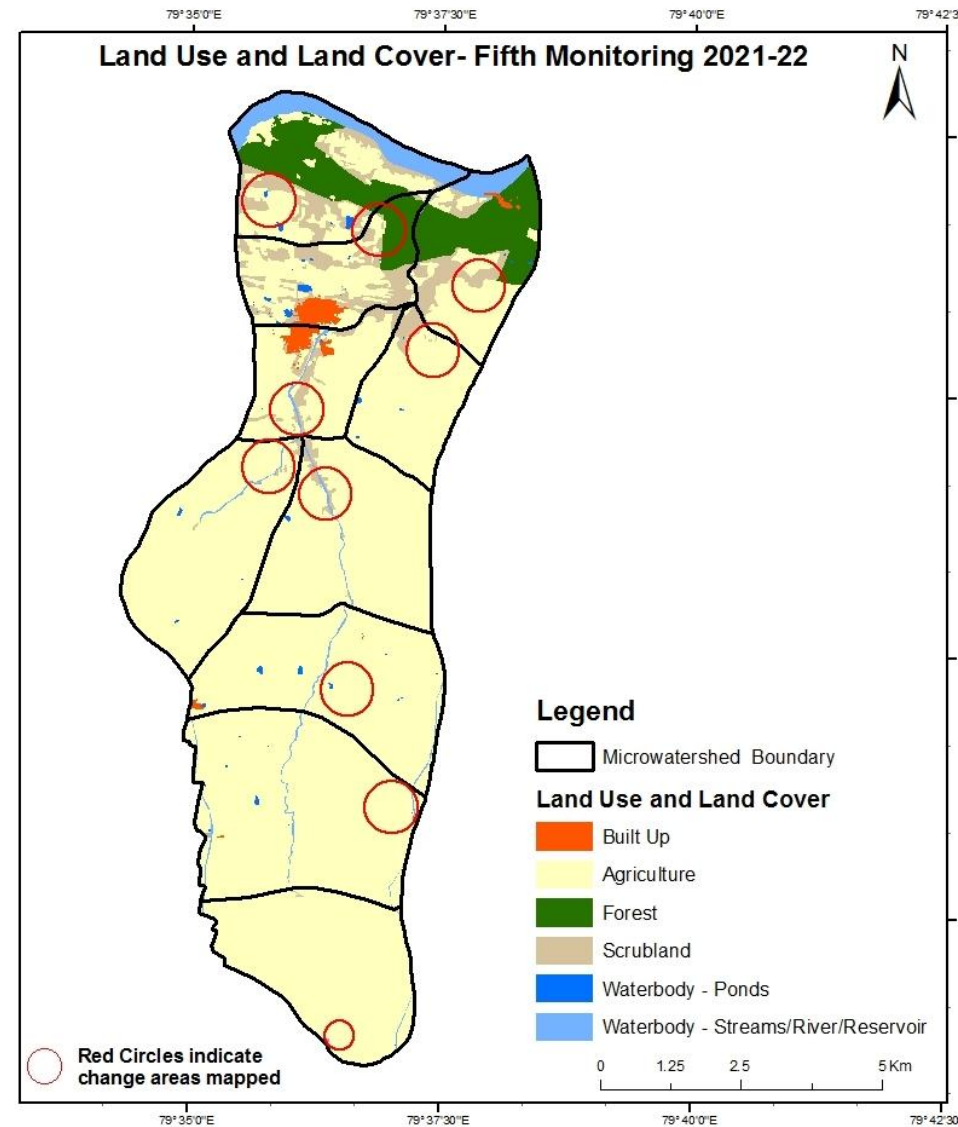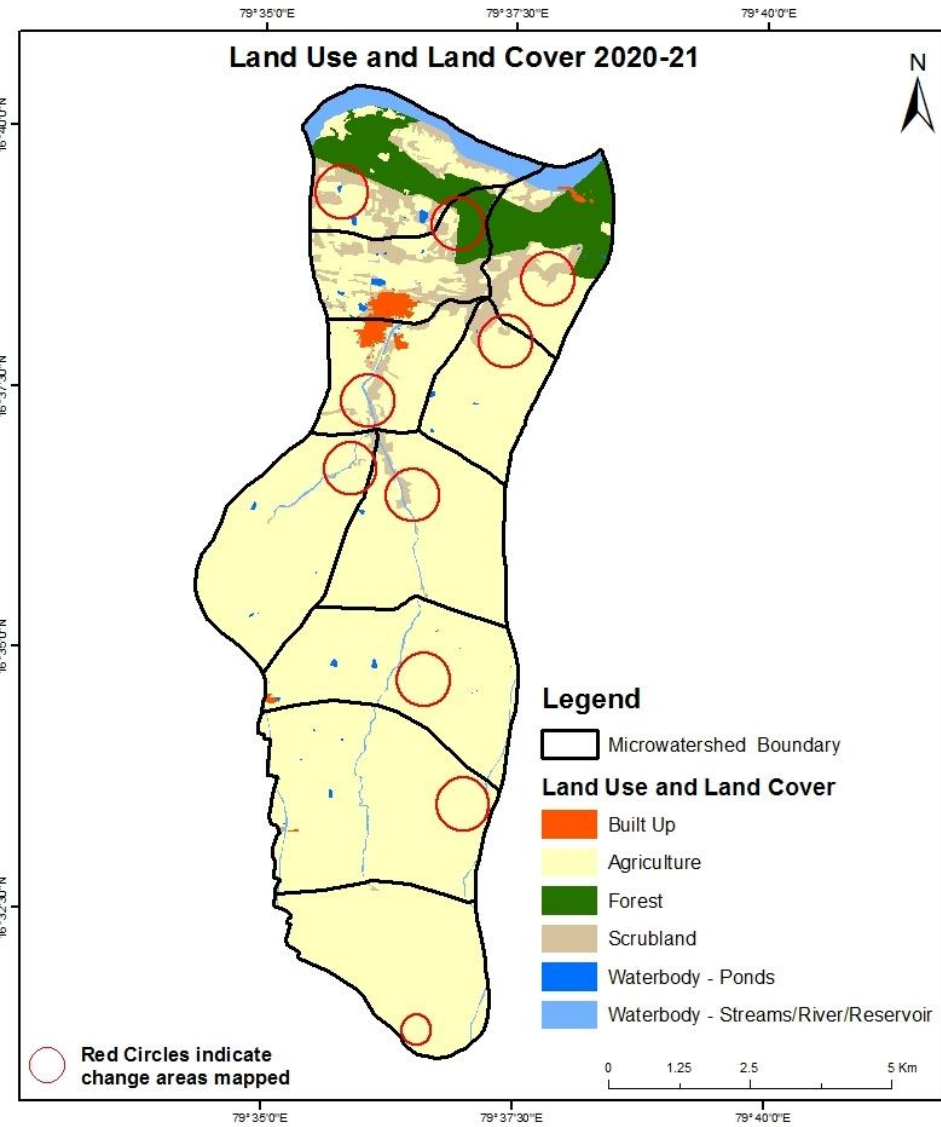# Fig 11. Gurajala Watershed (IWMP-04/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Scrub To Agriculture
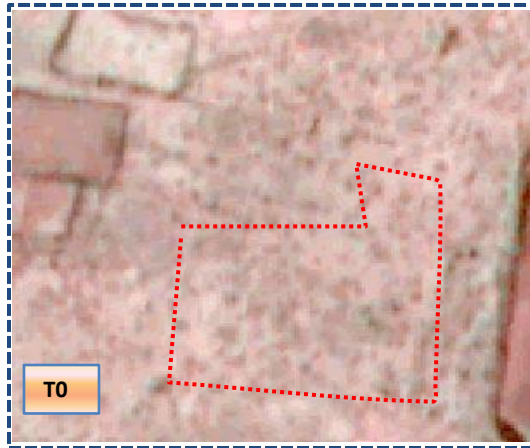
T0: 2013-14 (79°36'16.753"E 16°38'54.631"N)

T1: 14 February 2017

Agriculture To Waterbody

T0: 2013-14 (79°35'33.961"E 16°38'38.847"N)
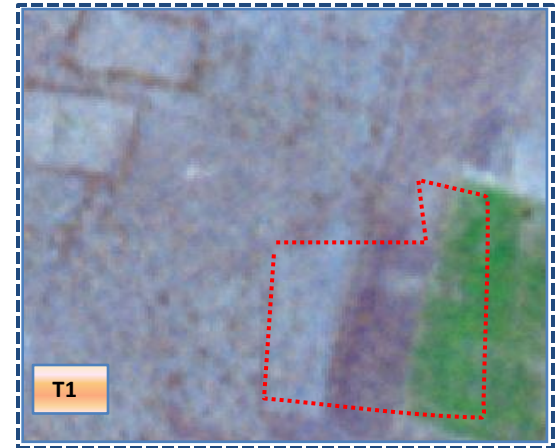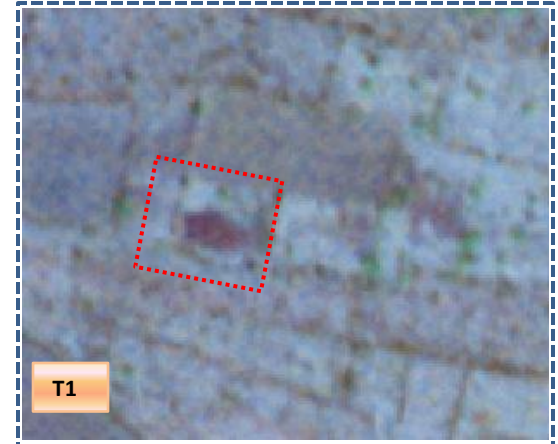
T1: 14 February 2017

Fig 12. Gurajala Watershed (IWMP-04/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates
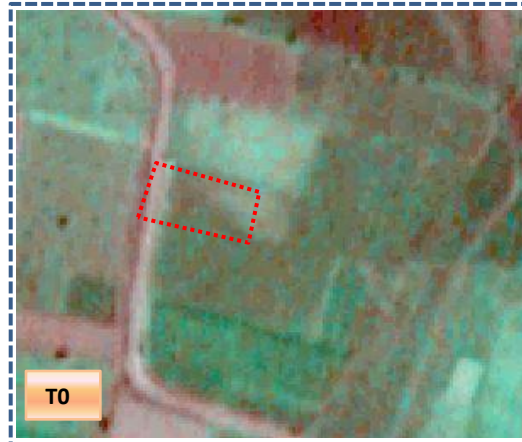
Scrub to Agriculture

T0: 2013-14 (79°36'13.468"E 16°37'1.022"N)

T1: 14 February 2017

Agriculture to Water body

T0: 2013-14 (79°37'5.471"E 16°37'21.333"N)

T1: 14 February 2017

Table 4. showing change matrix depicting Land cover transitions for Gurajala Watershed (IWMP-04/2013-14) during study period - 2013-14 to 2017-18

Land cover	Monitoring period (T1)									Units in Hectares	
T0	Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	58.12										58.12
Mining/dump											
Agriculture	1.5		5492.69						8.54	2.86	5505.59
Plantation Horticulture											
Forest	3.94		8.04		503.88					0.49	516.35
Forest Plantation											
Barren Rocky											
Scrub	1.28		35.67					553.68		3.62	594.25
Waterbody-Streams/River	1.47		4.65						248.07		254.19
Waterbody – Ponds			6.04							10.79	16.83
Grand Total	66.31		5547.09		503.88			553.68	256.61	17.76	6945.33

Interpretation: The example of "Agriculture" Land cover for the period 2013-14 to 2017-18

1. In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents the changes in between the classes.

2. In T0 12 ha of the agriculture area has decreased and it is converted into Built-up (1.50 ha) and water body (11.4 ha) in T1.

3. In T1 54 ha of the agriculture area has increased from forest (8.04 ha), scrubland (35.6 ha) and water body (10.6) of T0.

Table 5. showing change matrix depicting Land cover transitions for Gurajala Watershed (IWMP-04/2013-14) during study period - 2017-18 to 2018-19

Land cover / T1	Monitoring period (T2) Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	66.31										66.31
Mining/dump											
Agriculture	0.83		5545.82							0.44	5547.09
Plantation Horticulture											
Forest					503.88						503.88
Forest Plantation											
Barren Rocky											
Scrub	1.48		46.35					505.85			553.68
Waterbody-Streams/River									256.61		256.61
Waterbody – Ponds										17.76	17.76
Grand Total	68.62		5592.17		503.88			505.85	256.61	18.2	6945.33

4. In T1 1.2 ha of the agriculture area has decreased and it is converted into Built-up (0.8 ha) and water body (0.44

5. In T2 46.3 ha of the agriculture area has increased from scrubland (46.3 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Gurajala Watershed (IWMP-04/2013-14) during study period - 2018-19 to 2019-20

Land cover	Monitoring period (T3)										Units in Hectares
T2	Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	68.62										68.62
Mining/dump											
Agriculture	0.96	0.85	5590.17							0.19	5592.17
Plantation Horticulture											
Forest			3.78		500.1						503.88
Forest Plantation											
Barren Rocky											
Scrub	0.69		23.19					481.8		0.17	505.85
Waterbody-Streams/River									256.61		256.61
Waterbody – Ponds										18.2	18.2
Grand Total	70.27	0.85	5617.14		500.1			481.8	256.61	18.56	6945.33

6. In T2 2.0 ha of the agriculture area has decreased and it is converted into Built-up (0.9 ha), mining/dump (0.8 ha) and water body (0.19 ha) in T3.

7. In T3 26.9 ha of the agriculture area has increased from forest (3.7 ha) and scrubland (23.1 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Gurajala Watershed (IWMP-04/2013-14) during study period-2019-20 to 2020-21

T3	Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	70.27										70.27
Mining/dump		0.85									0.85
Agriculture	0.72		5614.83							1.59	5617.14
Plantation Horticulture											
Forest					500.1						500.1
Forest Plantation											
Barren Rocky											
Scrub	0.33		5					475.68		0.79	481.8
Waterbody-Streams/River									256.61		256.61
Waterbody – Ponds										18.56	18.56
Grand Total	71.32	0.85	5619.83		500.1			475.68	256.61	20.94	6945.33

Units in Hectares

8. In T3 2.3 ha of the agriculture area has decreased and it is converted into built-up (0.7 ha) and water body (1.5 ha) in T4.

9. In T4 5.0 ha of the agriculture area has increased from scrubland (5.0 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Gurajala Watershed (IWMP-04/2013-14) during study period - 2020-21 to 2021-22

Land cover	Monitoring period (T5)										Units in Hectares
T4	Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	71.32										71.32
Mining/dump		0.85									0.85
Agriculture	0.48		5618.23	0.53						0.59	5619.83
Plantation Horticulture											
Forest					500.1						500.1
Forest Plantation											
Barren Rocky											
Scrub			13.49					462.19			475.68
Waterbody-Streams/River									256.61		256.61
Waterbody – Ponds										20.94	20.94
Grand Total	71.8	0.85	5631.72	0.53	500.1			462.19	256.61	21.53	6945.33

10. In T3 1.07 ha of the agriculture area has decreased and it is converted into built-up (0.4 ha), plantations/horticulture (0.5 ha)and water body (0.5 ha) in T4.

11. In T4 13.4 ha of the agriculture area has increased from scrubland (13.4 ha) of T3.

4. Conclusion

1. The Land Use/Land Cover shows that there is an increase in Crop land, Built up area, Reservoir / Tanks & decrease in Scrubland as presented in the change matrix for different years.

2. There is an increase of 7.1 Hectares in Reservoir / Tanks area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.

3. There is an increase of 41, 45, 24, 2.6 & 11.8 Hectares from T0-T1, T1-T2, T2-T3, T3-T4 & T4-T5 respectively and overall increase of 126 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.

4. There is a decrease of 132 Hectares in Scrubland area as compared between 2013-14 (T0) & 2021-22 (T5) years.

5. Farm ponds (09) is visible on IWMP (Integrated Watershed Management Programme) Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (09) verified from the portal.

Abbreviations :

➢ IWMP -Integrated Watershed Management Programme

➢ LU/LC-Land Use/Land Cover

➢ DRISHTI- a mobile based android application

➢ SHRISTI- a web GIS interface on Bhuvan

➢ LISS – Linear Image Self Scanner

➢ PAN - Panchromatic Image

➢ FCC – False Colour Composite

➢ NCC – Natural Colour Composite

➢ NRSC – National Remote Sensing Centre

➢ DoLR – Department of Land Records