

# MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

## SUMMARY REPORT

EAST GODAVARI -07/2013-14  
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**

## **EXECUTIVE SUMMARY**

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

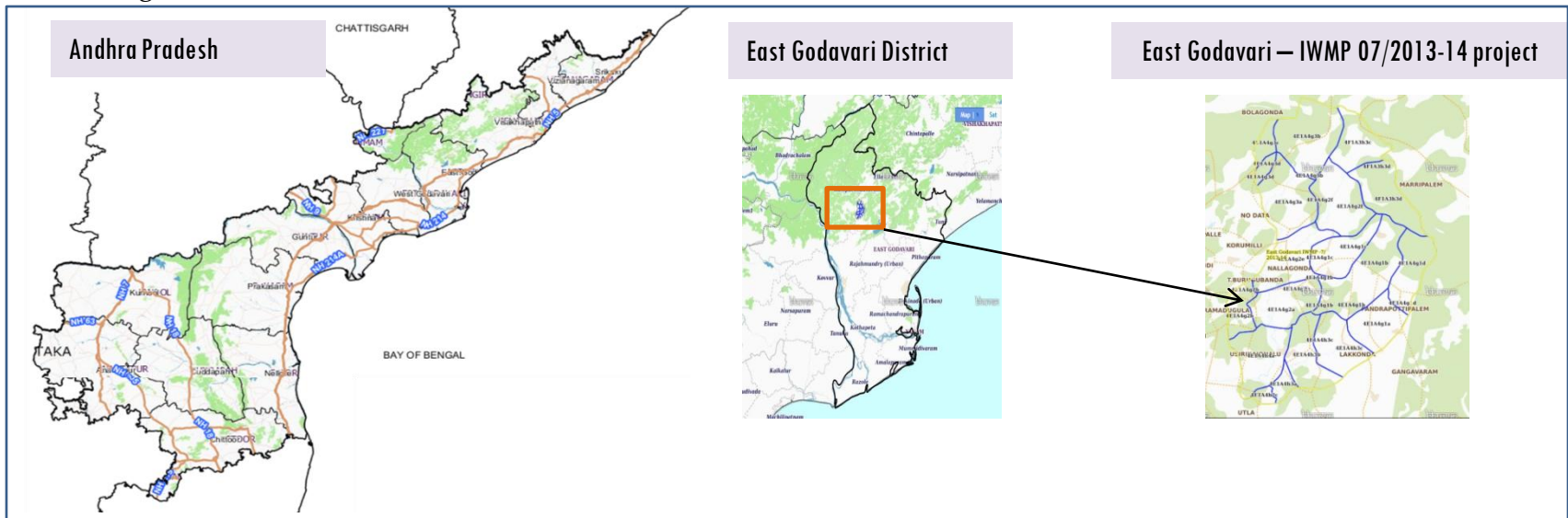
1. Integrated Watersheds Management Project (IWMP) is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development (MRD).
2. National Remote Sensing Centre (NRSC), ISRO has designed and developed Bhuvan Geo-ICT Web portal tools namely - Srishti and Drishti for monitoring 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-07/2013-14, East Godavari District of Andhra Pradesh. The total geographical area of the project is **6,100 ha**. It comprises of 14 micro watersheds.
4. In the project area 70 Drishti photos were uploaded showing check dams/Rock fill dam, livelihood activities, and remaining showing other activities.
5. Water bodies have shown an increased by 18.2 ha, which correspond to the other land use classes that have been converted into various water bodies in this period.
6. Major percentage i.e. 47 % is covered by the agriculture, 29 % is covered by scrubland, 12 % is covered by plantation and remaining by other land use classes.

# 1. STUDY AREA

## PROJECT : LAKKONDA WATERSHED (IWMP-07/2013-14)

### DISTRICT : EAST GODAVARI , STATE : ANDHRA PRADESH

- The study area falls in Maredumilli Mandal of East Godavari district of Andhra Pradesh state. The total geographical area of the project is 6,100 ha. It comprises of 14 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, Fig 04.



**Fig.1. Location map of Lakkonda Watershed (IWMP-07/2013-14) in East Godavari District, A.P**

- The Climate is Comparatively moderate throughout the year except during the months of April to June when the temperature reaches a maximum of 48 deg. Centigrade.
- The normal rainfall of the district is 1280 mm. More than half of the rainfall is brought by south-west monsoon while a large portion of the rest of the district receives rainfall from the North-East Monsoon also, during October and November.

## Table 2. Satellite Data and Ancillary Data

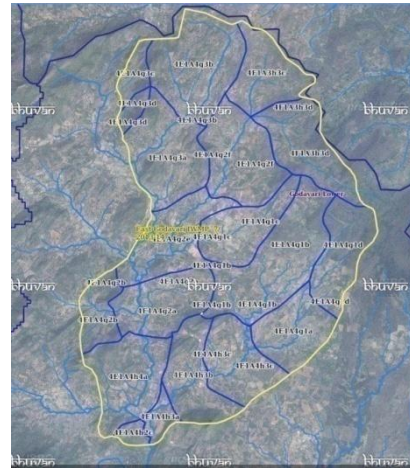
Satellite data	T0-A	T0-B	T5
	2013-14	2011-12	2021-22
LISS IV	2013-14		
SCENE 1			6-Mar-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			6-Mar-22
SCENE2			
SCENE 3			
SCENE 4			

Linear Image Self Scanner (LISS)

## Table 3. 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	Drishiti Photographs		
		Total	70
4	Detailed Project Report		

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



Legend



Drainage (1:10000 Scale)

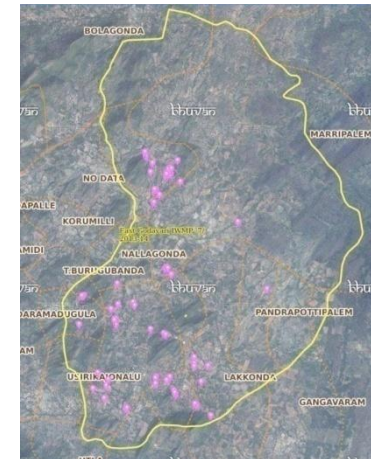


MWS Boundary



Project Boundary

## Fig 3. Natural Color Composite overlaid with Drishiti Points



Drishiti Upload Status

**Table 3. Classification of the Activities**

<b>Sr. No</b>	<b>Activity</b>	<b>Number of Photographs uploaded in Drishti Mobile Application</b>	<b>Visible on satellite in Srishti Geoportal</b>
1	Afforestation	0	0
2	Horticulture	0	0
3	Agriculture	3	3
4	Pasture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Terrace	0	0
8	Checks & Plugs	9	9
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams/Rock fill dam	1	1
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	9	9
18	Others	48	48
	<b>TOTAL</b>	<b>70</b>	<b>70</b>

## 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, figure 05 & 06.

**Fig 4. Lakkonda Watershed (IWMP-07/2013-14) Natural Colour Composite - 2013-14 to 2021-22**

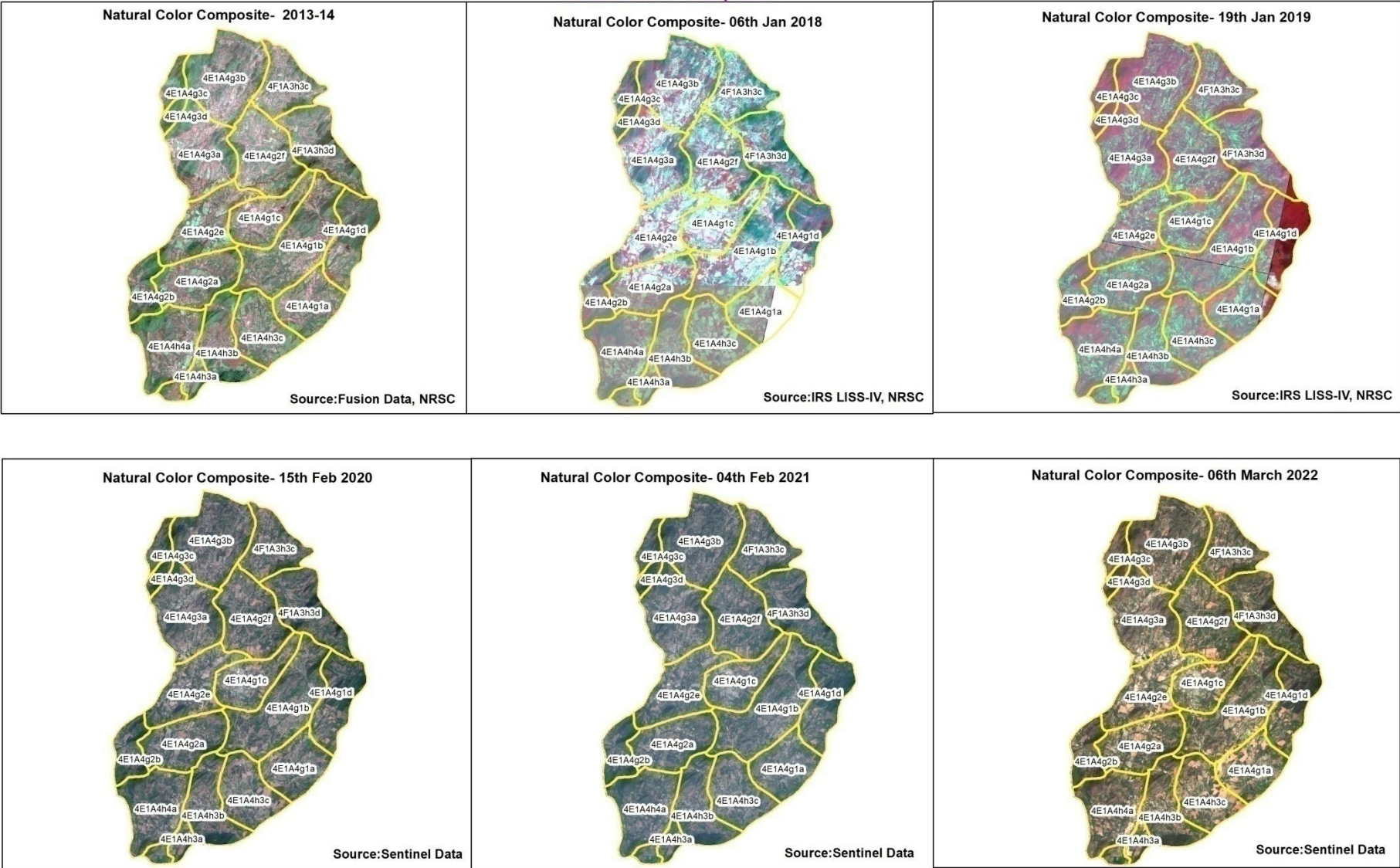
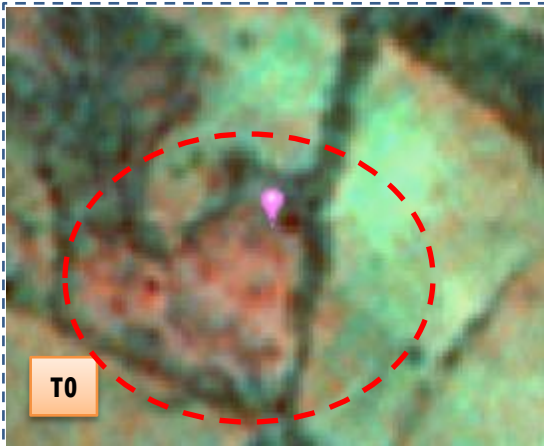




Fig 5. Monitoring of activities in Lakkonda Watershed (IWMP-07/2013-14) East Godavari District, Andhra Pradesh



T0

T0:2013-14



T1

T1: 01 March 2018



Drishti SI no. 7021360 MWS : 4E1A4h4a

Percolation tank



T0

T0:2013-14



T1

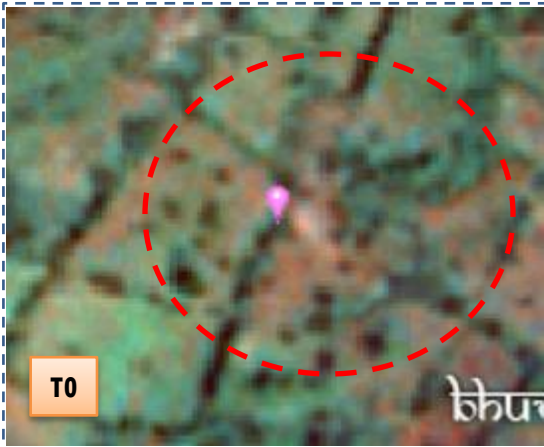
T1: 01 March 2018



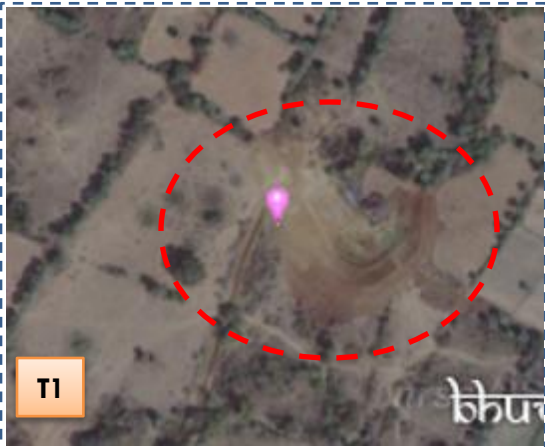
Drishti SI no. 7025077 MWS : 4E1A4h3c

Percolation tank

Fig 6. Monitoring of activities in Lakkonda Watershed (IWMP-07/2013-14) East Godavari District, Andhra Pradesh



T0:2013-14

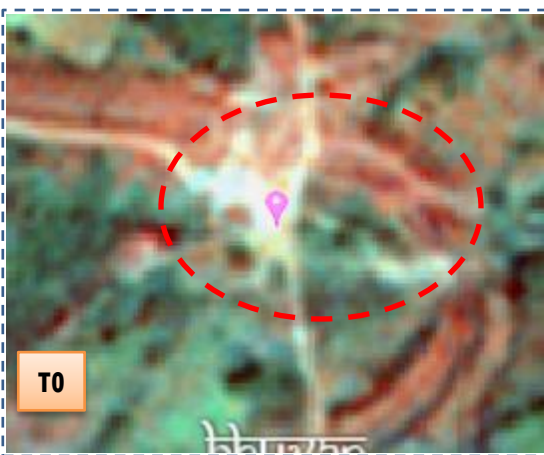


T1: 01 March 2018



Drishti SI no. 2665986 MWS : 4E1A4g1b

**Percolation tank**



T0:2013-14



T1: 01 March 2018



Drishti SI no. 7031126 MWS : 4E1A4g1c

**Percolation tank**

### 03. MONITORING IN THE PROJECT AREA

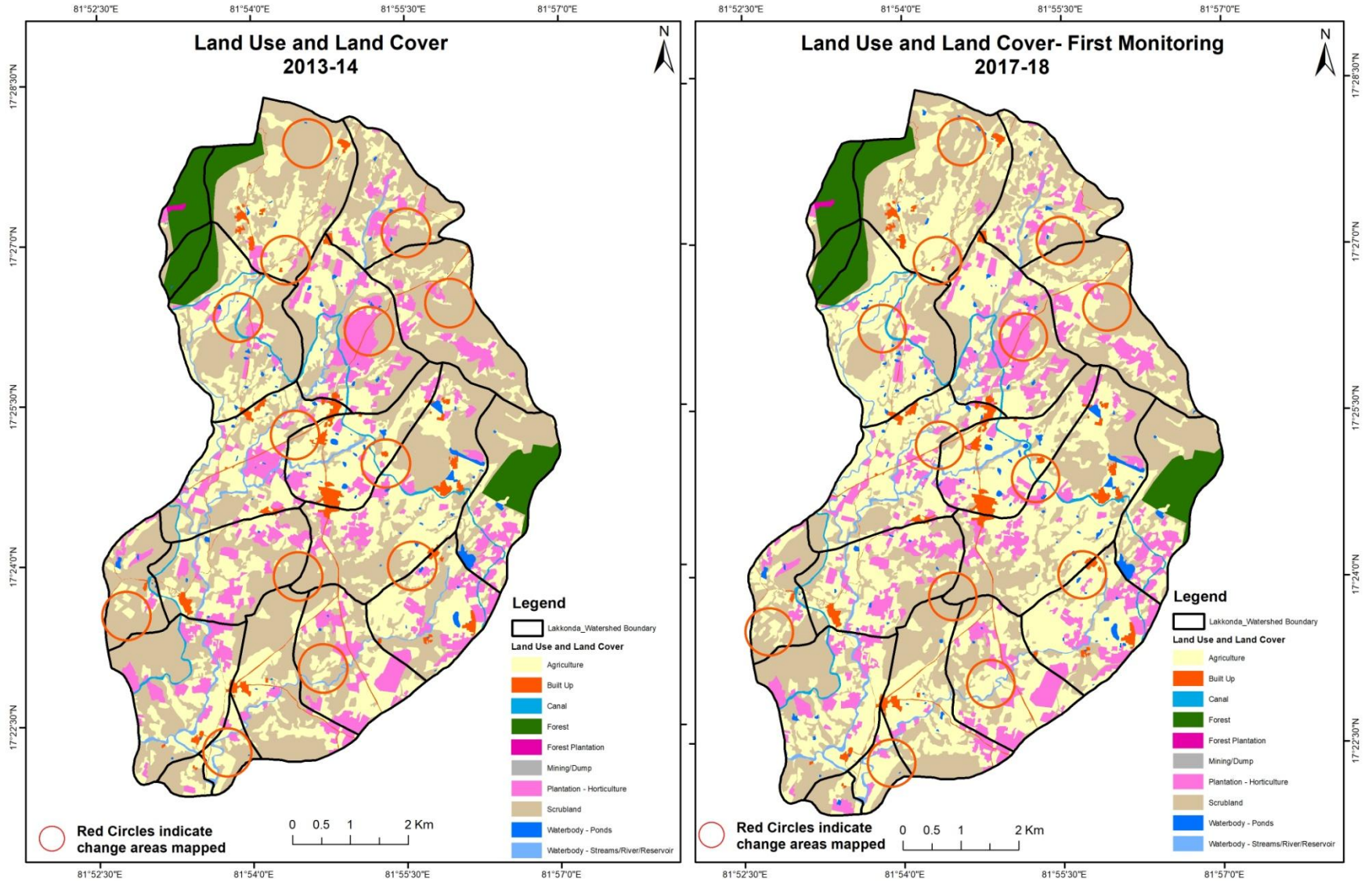
#### 3.2 Land use and Land cover Changes in the Project

- Change in land use and land cover from 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 fig 07 to fig 11.
- 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 fig 12 & 13 .
- The result obtained for the period T0 to T5 are given in the change matrix table, seen in table 04 to table 08.
- In matrix table column represents the T0 (2013-14) and row represents the T5 (2021-22)



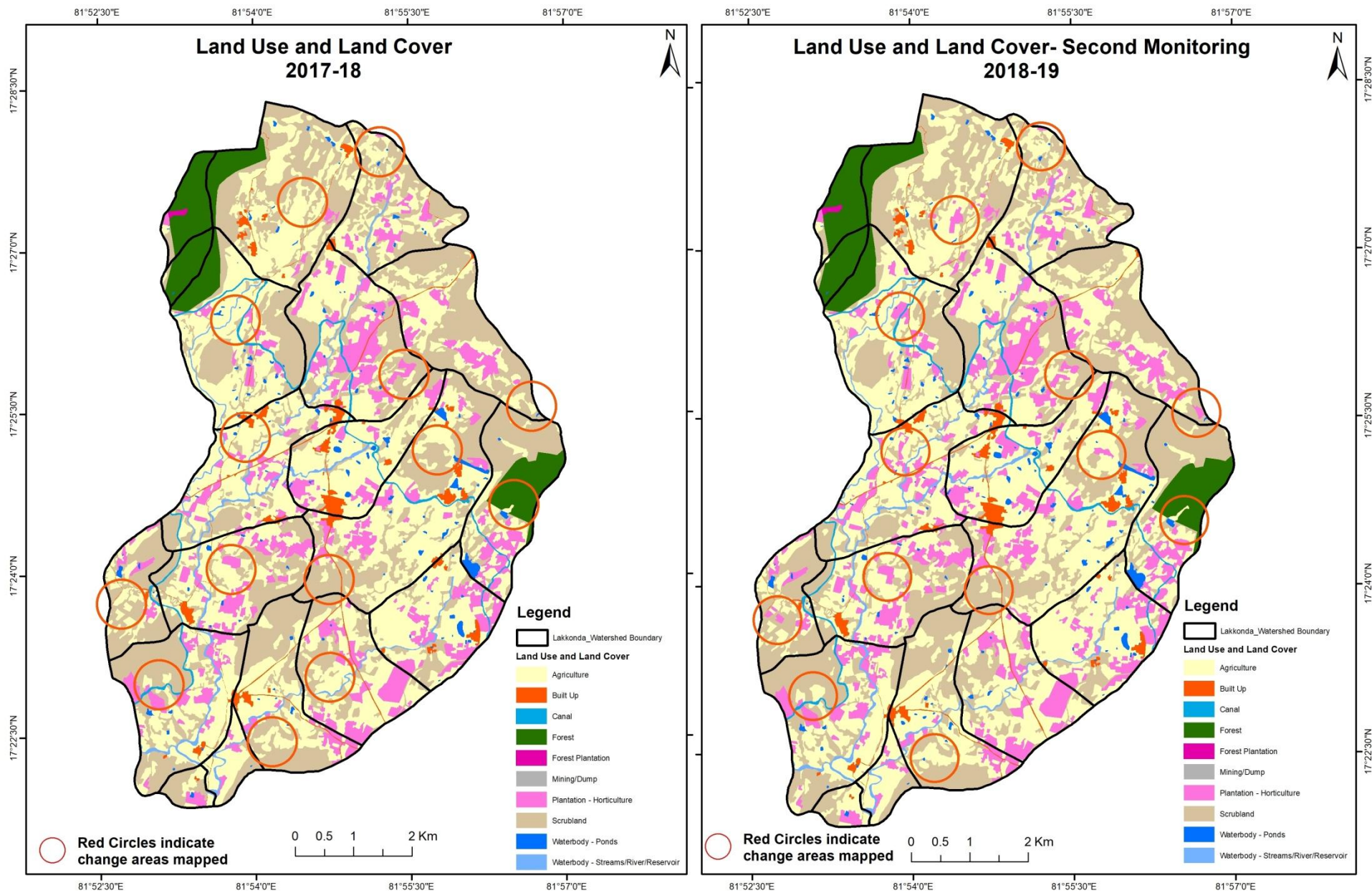
**Fig 7. Lakkonda Watershed (IWMP-07/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)**

**Scale: 1:10000**



**Fig 8. Lakkonda Watershed (IWMP-07/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)**

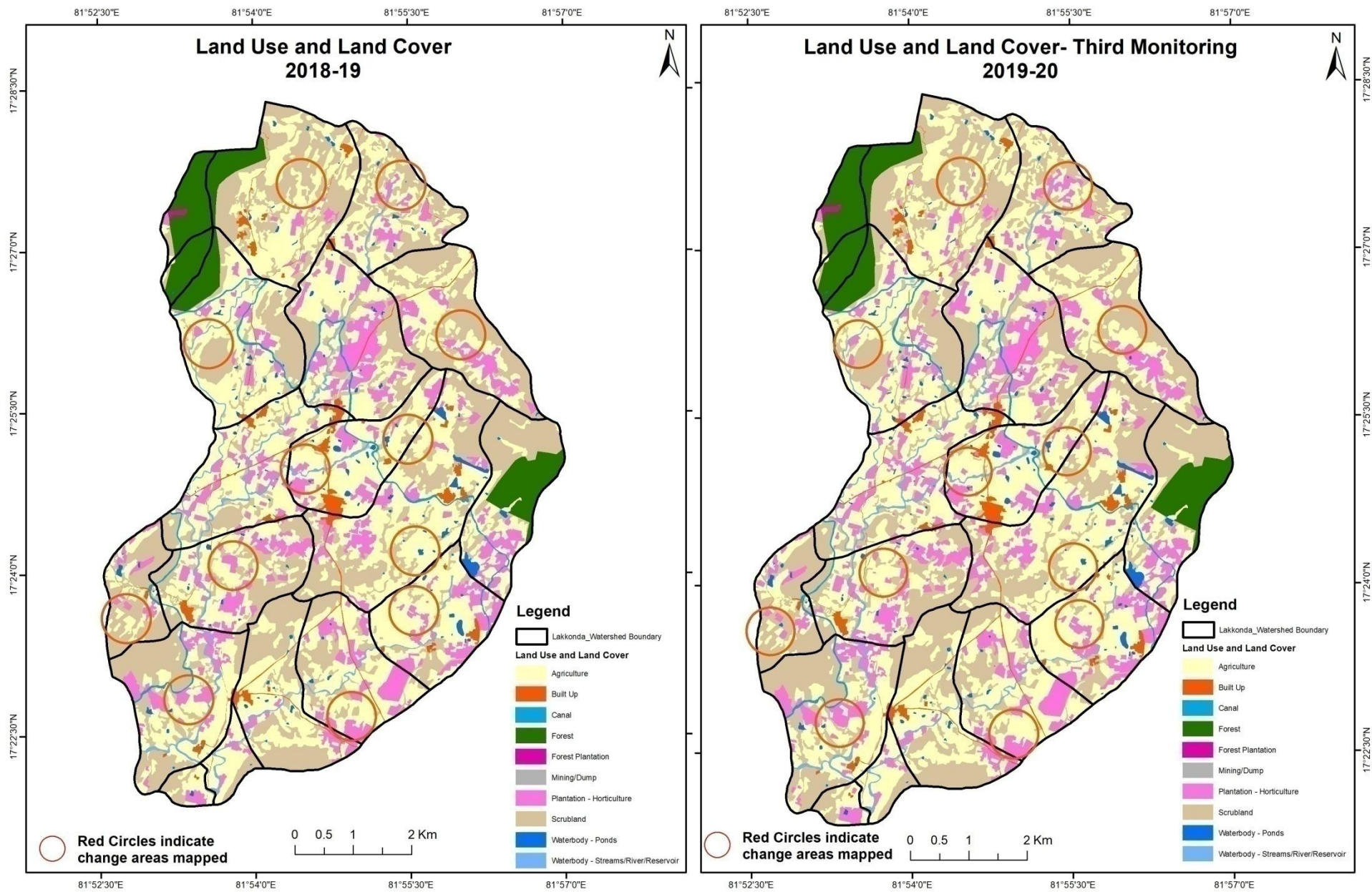
**Scale: 1:10000**





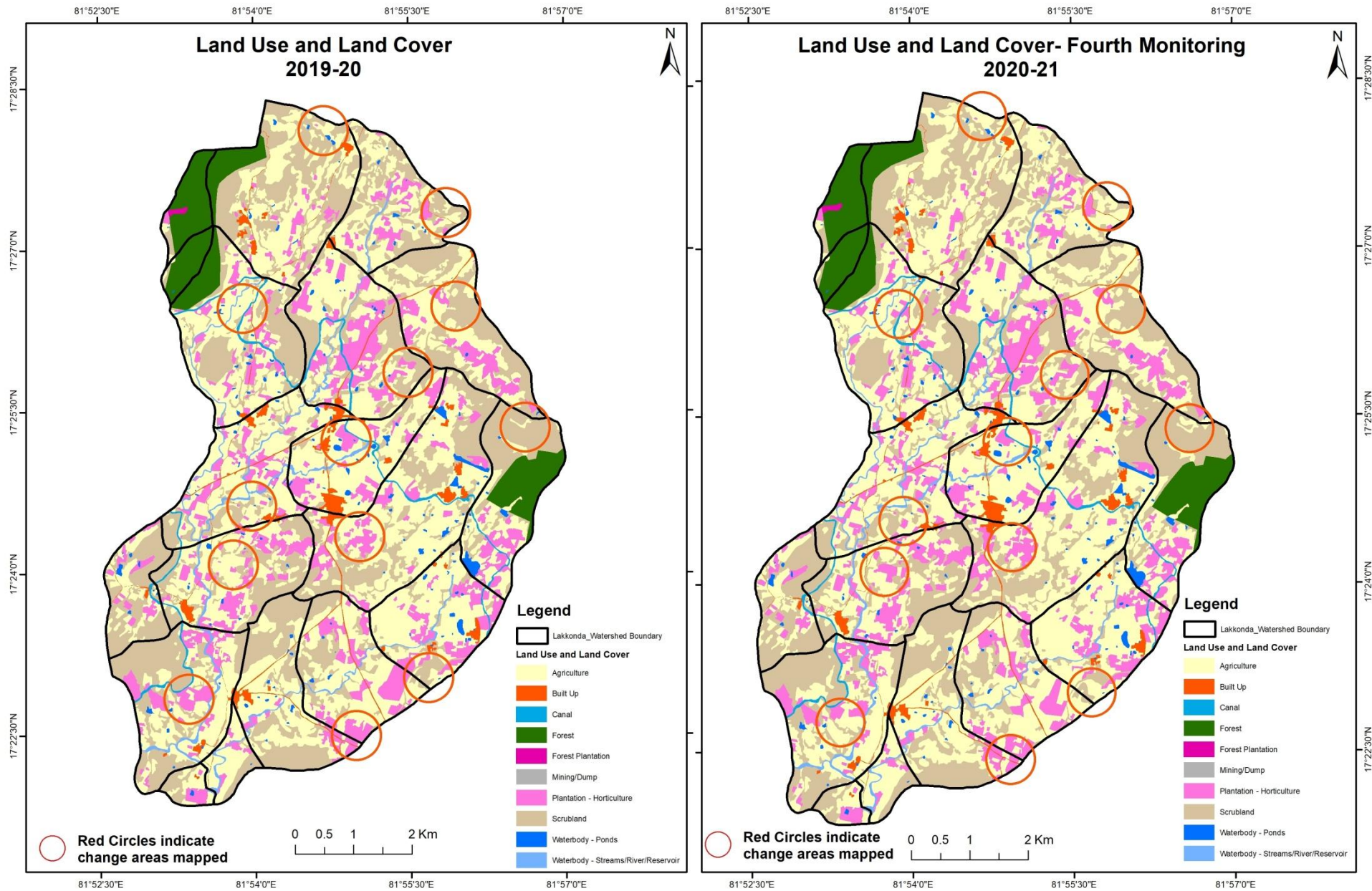
**Fig 9. Lakkonda Watershed (IWMP-07/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)**

**Scale: 1:10000**



**Fig 10. Lakkonda Watershed (IWMP-07/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)**

**Scale: 1:10000**





**Fig 11. Lakkonda Watershed (IWMP-07/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)**

**Scale: 1:10000**

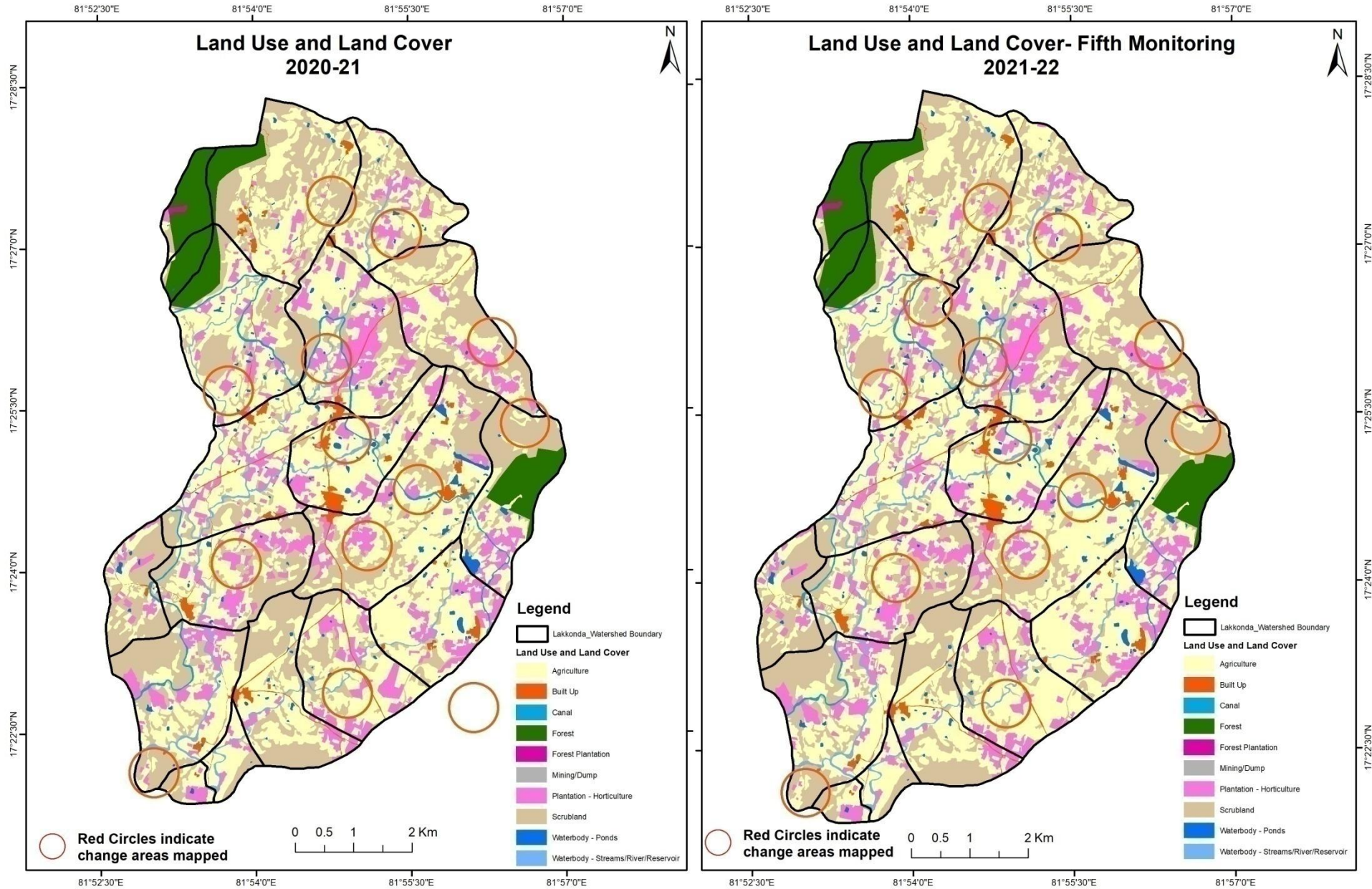
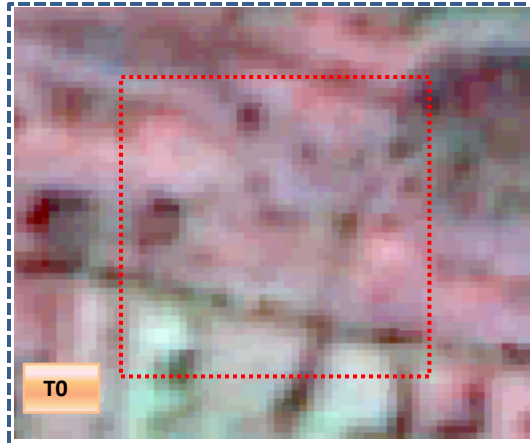


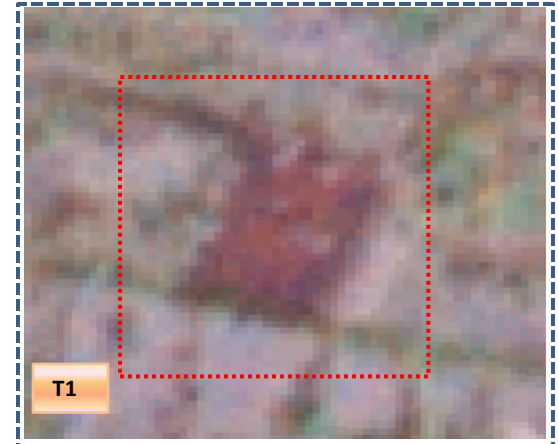


Fig 12. Lakkonda Watershed (IWMP-07/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Agriculture to Water body

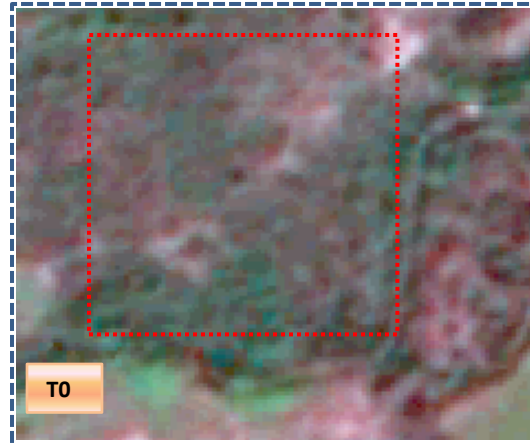


T0: 2013-14 (81°54'12.912"E 17°28'10.869"N)



T1: 06 January 2018

Scrubland to Agriculture



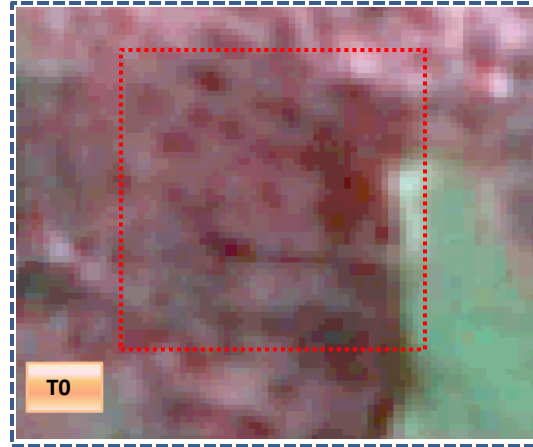
T0: 2013-14 (81°55'12.864"E 17°23'53.718"N)



T1: 06 January 2018

**Fig 13. Lakkonda Watershed (IWMP-07/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates**

Scrubland to Agriculture



T0

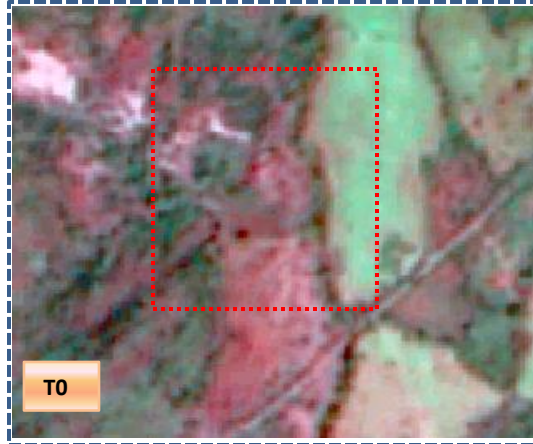
T0: 2013-14 (81°55'19.774"E 17°23'14.146"N)



T1

T1: 06 January 2018

Scrubland to Water body



T0

T0: 2013-14 (81°54'20.62"E 17°23'24.846"N)



T1

T1: 06 January 2018

**Table 4. showing change matrix depicting Land cover transitions for Lakkonda Watershed (IWMP-07/2013-14) during study period-2013-14 to 2017-18**

Land cover	Monitoring period (T1)										Units in Hectares	
	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody- Streams/River	Water body Ponds	Grand Total	
<b>Built up</b>	121.24		0.34								<b>121.58</b>	
<b>Mining/dump</b>		0.37								0.14	<b>0.51</b>	
<b>Agriculture</b>	1.61	0.12	1963.62	53.39						4.58	<b>2023.32</b>	
<b>Plantation Horticulture</b>	0.29		97.44	621.96						0.09	<b>719.78</b>	
<b>Forest</b>					308.84						<b>308.84</b>	
<b>Forest Plantation</b>						3.02					<b>3.02</b>	
<b>Barren Rocky</b>												
<b>Scrub</b>		0.13	547.86	8.92				2181.35		5.41	<b>2743.67</b>	
<b>Waterbody- Streams/River</b>								135.82			<b>135.82</b>	
<b>Waterbody – Ponds</b>			0.21							43.35	<b>43.56</b>	
<b>Grand Total</b>	<b>123.14</b>	<b>0.62</b>	<b>2609.47</b>	<b>684.27</b>	<b>308.84</b>	<b>3.02</b>		<b>2181.35</b>	<b>135.82</b>	<b>53.57</b>	<b>6100.1</b>	

**Interpretation: The example of “Agriculture” Land cover for the period 2013-14 to 2021-22**

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 59 ha of the agriculture area has decreased and it is converted into Built-up(1.6 ha), plantation/horticulture (53 ha) and water body (4.5 ha) in T1.
3. In T1 645 ha of the agriculture area has increased from built-up (0.3 ha), plantations/horticulture (97.4 ha) and scrubland (547 ha) of T0.

**Table 5. showing change matrix depicting Land cover transitions for Lakkonda Watershed (IWMP-07/2013-14) during study period-2017-18 to 2018-19**

Land cover	Monitoring period (T2)										Units in Hectares		
	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody- Streams/River	Water body Ponds	Grand Total		
<b>Built up</b>	121.02		2.12										<b>123.14</b>
<b>Mining/dump</b>		0.62											<b>0.62</b>
<b>Agriculture</b>	0.39		2556.24	49.76							3.08		<b>2609.47</b>
<b>Plantation Horticulture</b>			12.01	672.26									<b>684.27</b>
<b>Forest</b>			1		307.84								<b>308.84</b>
<b>Forest Plantation</b>						3.02							<b>3.02</b>
<b>Barren Rocky</b>													
<b>Scrub</b>			145.16	24.96				2010.31			0.92		<b>2181.35</b>
<b>Waterbody- Streams/River</b>									135.82				<b>135.82</b>
<b>Waterbody – Ponds</b>											53.57		<b>53.57</b>
<b>Grand Total</b>	<b>121.41</b>	<b>0.62</b>	<b>2716.53</b>	<b>746.98</b>	<b>307.84</b>	<b>3.02</b>		<b>2010.31</b>	<b>135.82</b>		<b>57.57</b>		<b>6100.1</b>

4. In T1 53 ha of the agriculture area has decreased and it is converted into Built-up 90.3 ha), plantations/horticulture (49.7 ha) and water body (3ha) in T2.

5. In T2 160 ha of the agriculture area has increased from built-up (2.1 ha), plantations/horticulture (12 ha) and scrubland (145 ha) of T1.

**Table 6. showing change matrix depicting Land cover transitions for Lakkonda Watershed (IWMP-07/2013-14) during study period-2018-19 to 2019-20**

Land cover	Monitoring period (T3)										Units in Hectares		
	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody- Streams/River	Water body Ponds	Grand Total		
<b>Built up</b>	121.12			0.29									<b>121.41</b>
<b>Mining/dump</b>		0.62											<b>0.62</b>
<b>Agriculture</b>	0.67		2642.17	73.03							0.66		<b>2716.53</b>
<b>Plantation Horticulture</b>			27.03	719.48							0.47		<b>746.98</b>
<b>Forest</b>					307.84								<b>307.84</b>
<b>Forest Plantation</b>						3.02							<b>3.02</b>
<b>Barren Rocky</b>													
<b>Scrub</b>			30.4	21.38				1957.14			1.39		<b>2010.31</b>
<b>Waterbody- Streams/River</b>									135.82				<b>135.82</b>
<b>Waterbody – Ponds</b>											57.57		<b>57.57</b>
<b>Grand Total</b>	<b>121.79</b>	<b>0.62</b>	<b>2699.6</b>	<b>814.18</b>	<b>307.84</b>	<b>3.02</b>		<b>1957.14</b>	<b>135.82</b>		<b>60.09</b>		<b>6100.1</b>

6. In T2 74 ha of the agriculture area has decreased and it is converted into Built-up (06 ha), plantations/horticulture (73 ha) and water body (0.6 ha) in T3.

7. In T3 57 ha of the agriculture area has increased from plantations /horticulture (27 ha) and scrubland (30 ha) of T2.

**Table 7. showing change matrix depicting Land cover transitions for Lakkonda Watershed (IWMP-07/2013-14) during study period-2019-20 to 2020-21**

Land cover	Monitoring period (T4)										Units in Hectares		
	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody- Streams/River	Water body Ponds	Grand Total		
<b>T3</b>													
<b>Built up</b>	121.79												<b>121.79</b>
<b>Mining/dump</b>		0.62											<b>0.62</b>
<b>Agriculture</b>			2671.69	27.37							0.54		<b>2699.6</b>
<b>Plantation Horticulture</b>			43.37	770.5							0.31		<b>814.18</b>
<b>Forest</b>					307.84								<b>307.84</b>
<b>Forest Plantation</b>						3.02							<b>3.02</b>
<b>Barren Rocky</b>													
<b>Scrub</b>			94.56					1861.72			0.86		<b>1957.14</b>
<b>Waterbody- Streams/River</b>										60.09			<b>60.09</b>
<b>Waterbody – Ponds</b>									135.82				<b>135.82</b>
<b>Grand Total</b>	<b>121.79</b>	<b>0.62</b>	<b>2809.62</b>	<b>797.87</b>	<b>307.84</b>	<b>3.02</b>		<b>1861.72</b>	<b>135.82</b>	<b>61.8</b>			<b>6100.1</b>

8. In T3 27 ha of the agriculture area has decreased and it is converted into plantations/horticulture (27.3 ha) and water body (0.5 ha) in T4.

9. In T4 137 ha of the agriculture area has increased from plantations/horticulture (43 ha) and scrubland (94 ha) of T3.

**Table 8. showing change matrix depicting Land cover transitions for Lakkonda Watershed (IWMP-07/2013-14) 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	121.79										121.79
Mining/dump		0.62									0.62
Agriculture			2780.07	29.55							2809.62
Plantation Horticulture			49.22	748.65							797.87
Forest					307.84						307.84
Forest Plantation						3.02					3.02
Barren Rocky											
Scrub			57.52					1804.2			1861.72
Waterbody- Streams/River										61.8	61.8
Waterbody – Ponds									135.82		135.82
<b>Grand Total</b>	<b>121.79</b>	<b>0.62</b>	<b>2886.81</b>	<b>778.2</b>	<b>307.84</b>	<b>3.02</b>		<b>1804.2</b>	<b>135.82</b>	<b>61.8</b>	<b>6100.1</b>

10. In T4 29.5 ha of the agriculture area has decreased and it is converted into plantations/horticulture (29.5 ha) in T5.

11. In T5 106 ha of the agriculture area has increased from plantations/horticulture (49.2 ha) and scrubland (57.5 ha) of T4.

# Conclusion

1. DPR of the project is uploaded on to Bhuvan Portal.
2. 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.
3. There is an increase of 18 Hectares in Reservoir / Tanks area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
4. There is an increase of 586, 107, 110 & 77 Hectares from T0-T1, T1-T2, T3-T4 & T4-T5 respectively and overall increase of 863 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
5. About **58 ha of the plantation/horticulture area has been increased** in during the monitoring period of 2013-14 (T0) to 2021-22 (T5) years.
6. There is a decrease of 939 Hectares in Scrubland area as compared between 2013-14 (T0) & 2021-22 (T5) years.
7. 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