

# MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

## SUMMARY REPORT

CHITTOOR -33/2011-12  
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad  
January-2022

**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**

01. STUDY AREA
02. SATELLITE & ANCILLARY DATA INCLUDING DRISHTI STATUS
03. MONITORING IN THE PROJECT AREA : Site wise changes in the project
04. CONCLUSIONS

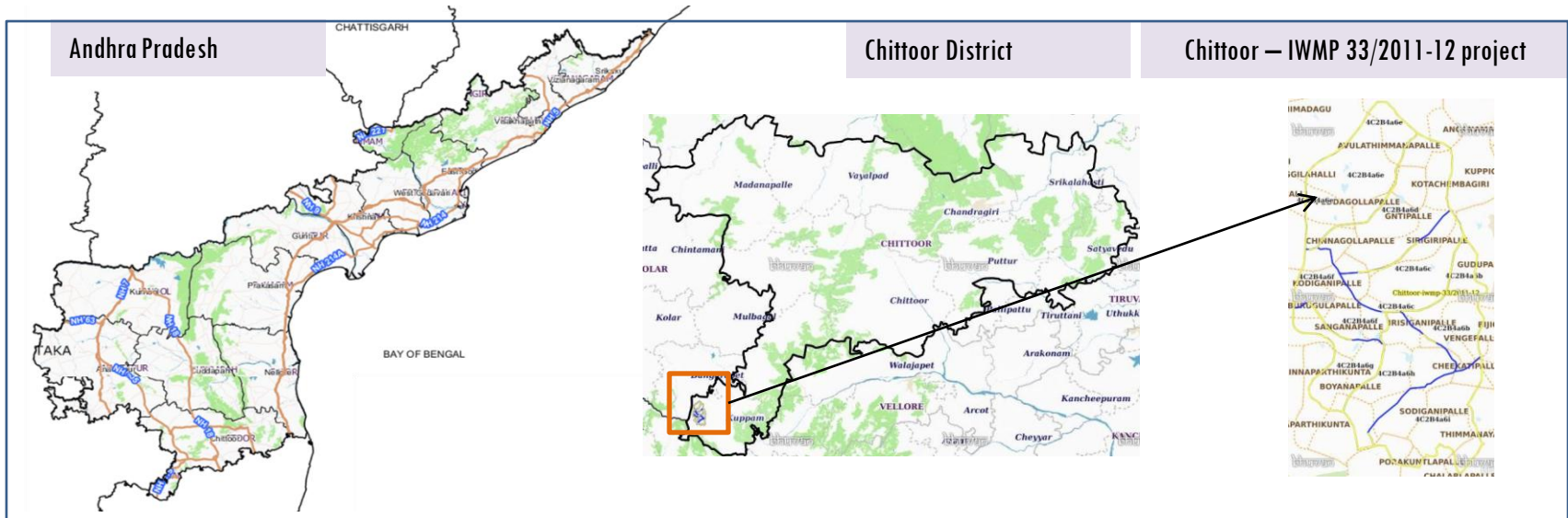
## **E X E C U T I V E   S U M M A R Y**

- Integrated Watersheds Management Project (IWMP) is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development (MRD).
- 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).
- Current summary report gives details of Project- IWMP-33/2011-12, Chittoor District of Andhra Pradesh. The total geographical area of the project is **4229.20** ha. It comprises of 8 micro watersheds.
- In the project area 445 Drishti photos were uploaded showing all water harvesting structures of check dams/Rock fill dam, recharge pits etc,.
- Project area as per image analysis has witnessed distinguishable increase in farm ponds, showing new farm ponds or dug out pits and check dams and drainage treatments with 103 ha increase in the area.
- Major percentage i.e. 60 % is covered by the agriculture, 28 % is covered by scrubland and 7 % is covered by Water body and remaining by other land use classes.

# PROJECT : CHITTOOR – IWMP-33/2011-12

## DISTRICT : CHITTOOR , STATE : ANDHRA PRADESH

- The study area falls in Gudupalle Mandal of Chittoor district of Andhra Pradesh state. The total geographical area of the project is **4229.20** ha. It comprises of 8 micro watersheds. Location Map of the study area is shown in Figure below. Analysis is done for 2011-12 (T0) period (*Batch -1*) projects taking 2019-20 (T5) period satellite images



- The climate of the district is dry and healthy. Out of 66 mandals in the district, 31 are upland mandals which are located in Madanapalle division and are comparatively cooler than the eastern mandals except Chittoor mandal where the climate is moderate. December and January are the coldest months when the mean maximum temperature will be around 26.40 °C, May is the hottest month with the mean daily maximum temperature rising above 40 °C.
- The district receive 83.62 percent of rainfall during South-West monsoon and North-West monsoon period, the rainfall is nominal in summer. On an average the district receives more than 50 percent of rainfall during North- East monsoon.

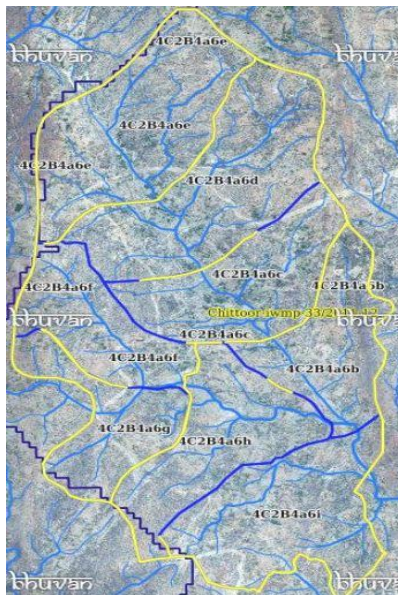
# Satellite Data and Ancillary Data

Satellite data*	T0-A**	T0-B**	T5
	2011-12	2013-14	2019-20
LISS IV	2011-12		
SCENE 1			29-Feb-20
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2011-12		
SCENE 1			29-Feb-20
SCENE2			
SCENE 3			
SCENE 4			

## 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	445
4	Detailed Project Report		

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



### Legend



Drainage (1:10000 Scale)

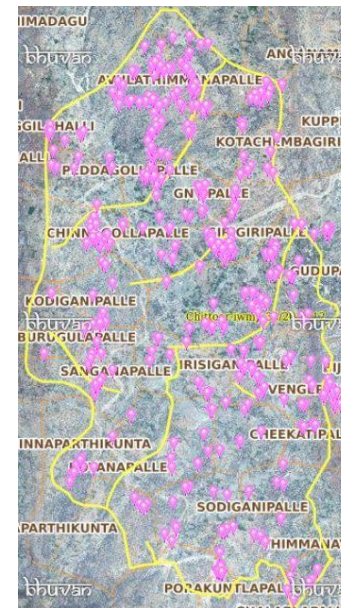


MWS Boundary



Project Boundary

# Natural Color Composite overlaid with Drishti Points



### Drishti Upload Status

## Classification of the Activities

Sr. No	Activity	Drishti Photo	Visible on satellite
1	Afforestation	0	0
2	Horticulture	0	0
3	Agriculture	2	1
4	Pasture	0	0
5	Trench	0	0
6	Field Bunds	1	1
7	Terrace	0	0
8	Checks & Plugs	1	1
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	9	6
11	Civil work-Check dams/Rock fill dam	105	91
12	Nallah Bunds/Drainage treatment	0	0
13	Percolation tanks / Ground water recharge structure	0	0
14	Production System and Micro-Enterprises	8	8
15	Livelihood Activities-Plantation/Horticulture	0	0
16	Capacity Building Activities	0	0
17	Entry Point Activity	1	1
18	Others	353	336
	<b>TOTAL</b>	<b>480</b>	<b>445</b>

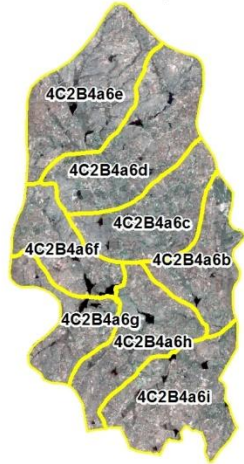
## MONITORING IN THE PROJECT AREA

### 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 (2011-12) and T5 is 2019-20 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.

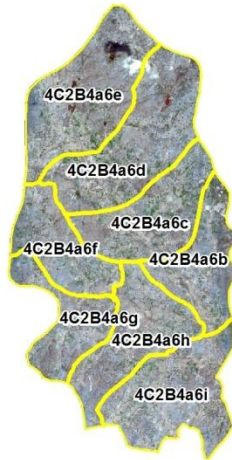
# Natural Color Composite

Natural Color Composite - 2011-12



Source:NCC,NRSC

Natural Color Composite - 12th February 2015



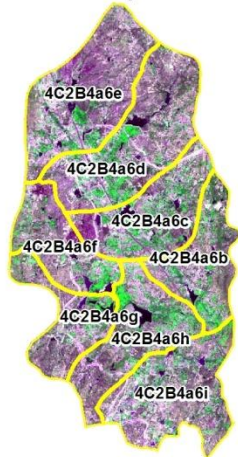
Source:NCC,NRSC

Natural Color Composite - 24th January 2017



Source:LISS-IV,NRSC

Natural Color Composite - 22nd February 2018



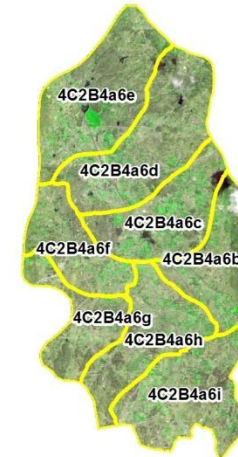
Source:LISS IV,NRSC

Natural Color Composite - 4th January 2019



Source:LISS-IV,NRSC

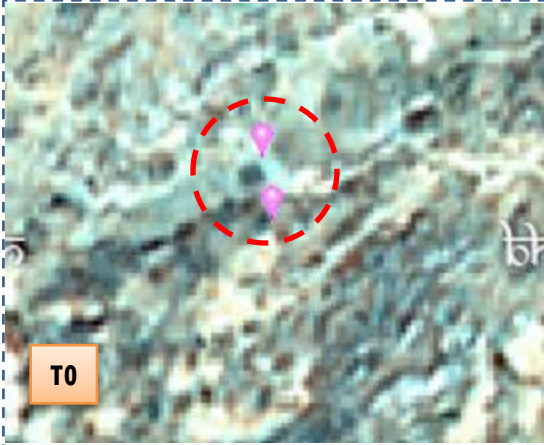
Natural Color Composite - 29th February 2020



Source:LISS-IV,NRSC



# Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-33/2011-12



T0:2009-10



T1: 28 March 2017



Drishti Sl no. 1911049 MWS :4C2B2d1c

Check dam



T0:2009-10



T1: 28 March 2017



Drishti Sl no. 1789100 MWS :4C2B4a6d

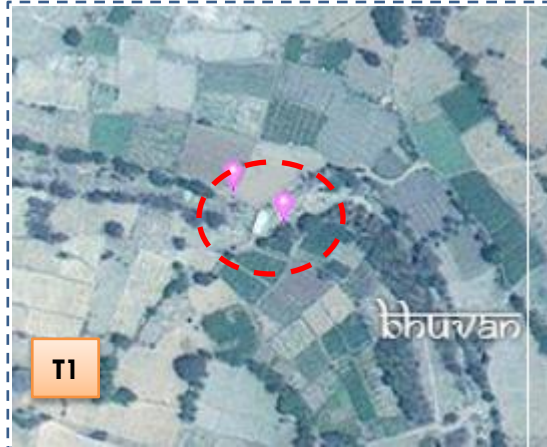
Check dam

Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-33/2011-12



T0

T0: 2009-10



T1

T1: 28 March 2017



Drishti SI no. 2422620 MWS :4C2B4a6b

Check dam



T0

T0: 2009-10



T1

T1: 28 March 2017



Drishti SI no. 7013154 MWS :4C2B4a6e

Check dam

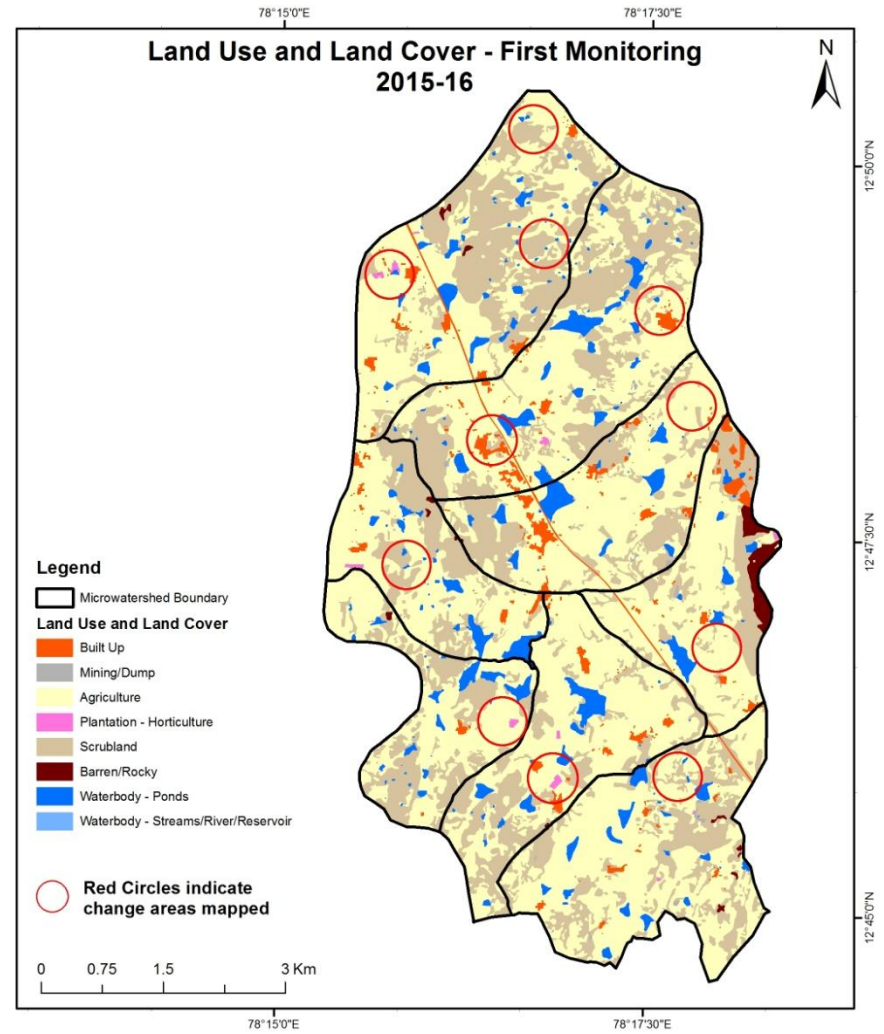
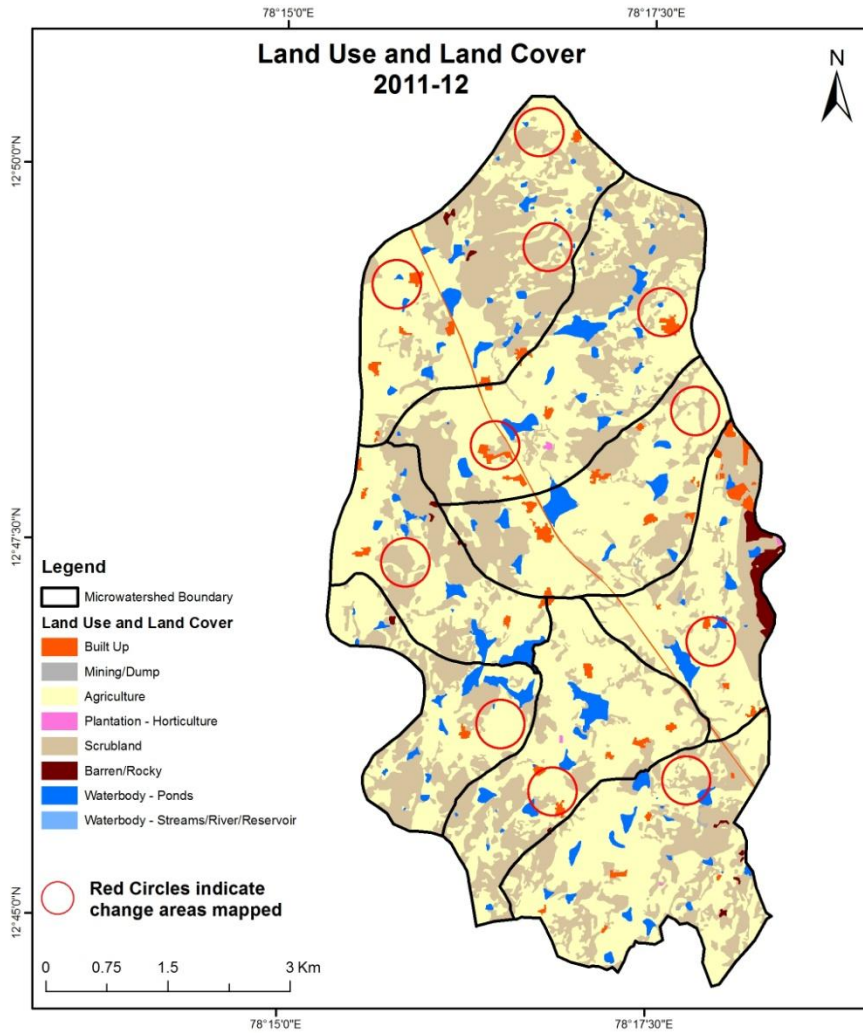
## MONITORING IN THE PROJECT AREA

### 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.
- 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.
- The result obtained for the period T0 to T5 are given in the change matrix table.
- In matrix table column represents the T0 (2011-12) and row represents the T5 (2019-20)

# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2011-12 to 2015-16)

Scale: 1:10000

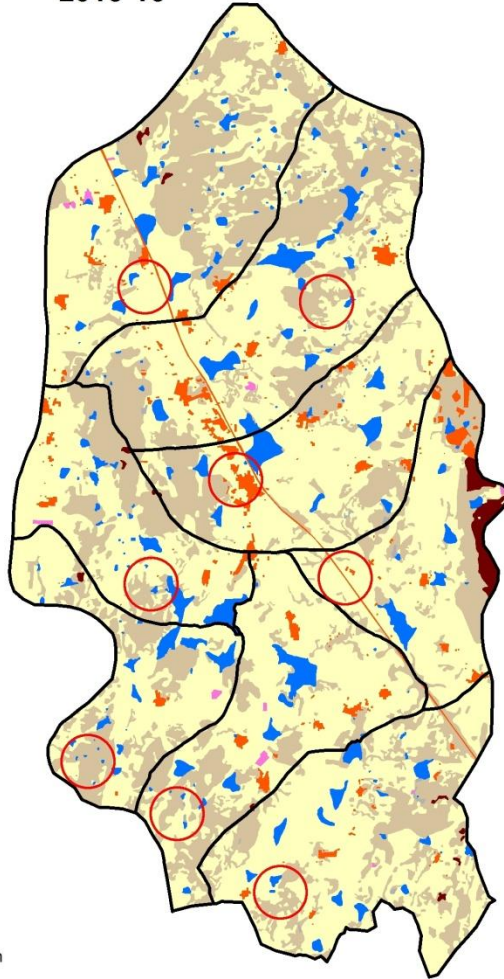


# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2015-16 to 2016-17)

Scale: 1:10000

78°15'0"E 78°17'30"E

## Land Use and Land Cover 2015-16



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

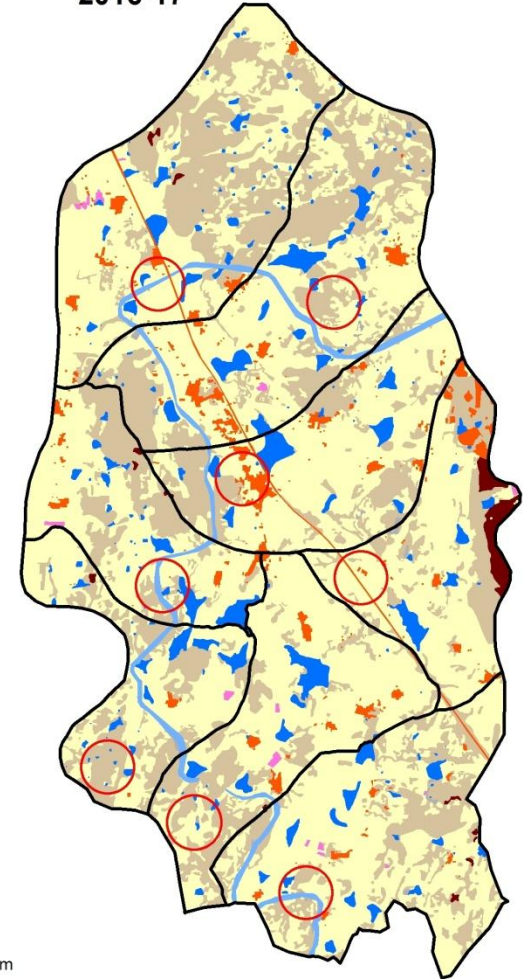
0 0.75 1.5 3 Km

78°15'0"E

78°17'30"E

78°15'0"E 78°17'30"E

## Land Use and Land Cover - Second Monitoring 2016-17



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 0.75 1.5 3 Km

78°15'0"E

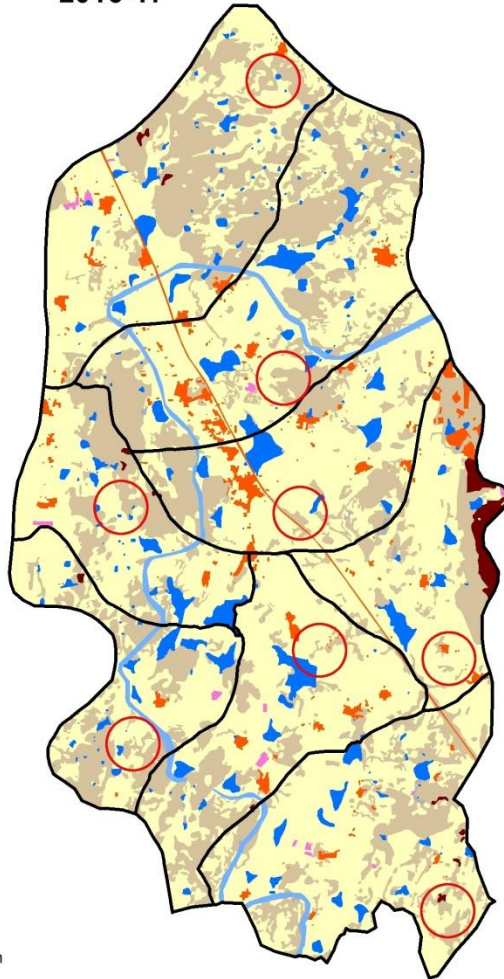
78°17'30"E

# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)

Scale: 1:10000

78°15'0"E 78°17'30"E

## Land Use and Land Cover 2016-17



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

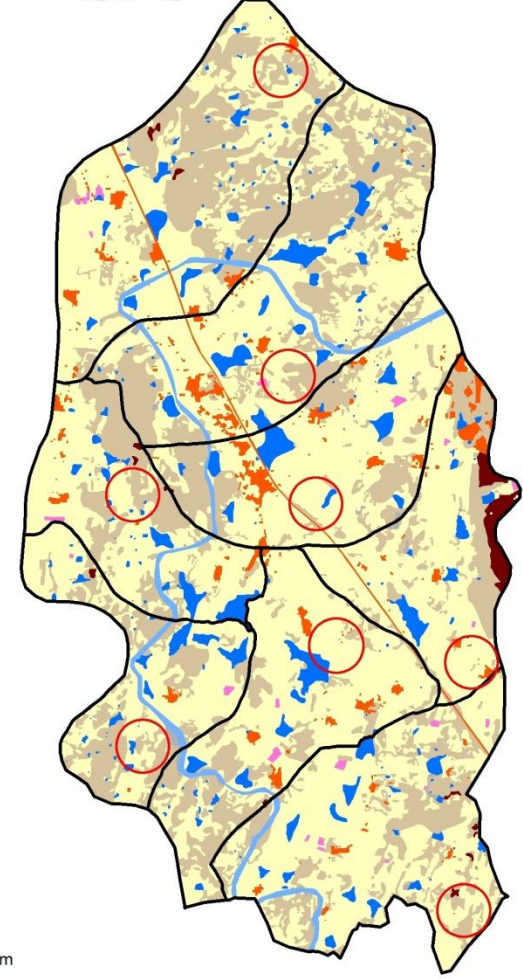
0 0.75 1.5 3 Km

78°15'0"E

78°17'30"E

78°15'0"E 78°17'30"E

## Land Use and Land Cover - Third Monitoring 2017-18



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 0.75 1.5 3 Km

78°15'0"E

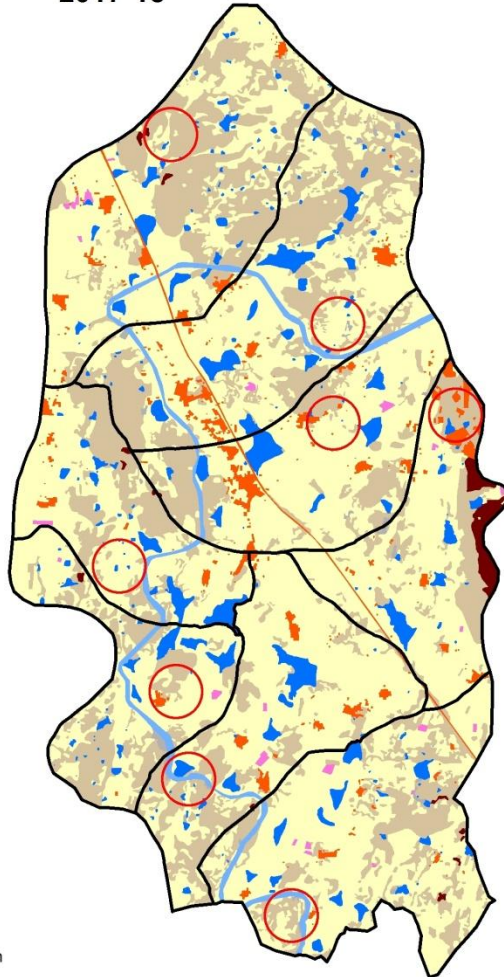
78°17'30"E

# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000

78°15'0"E 78°17'30"E

## Land Use and Land Cover 2017-18



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

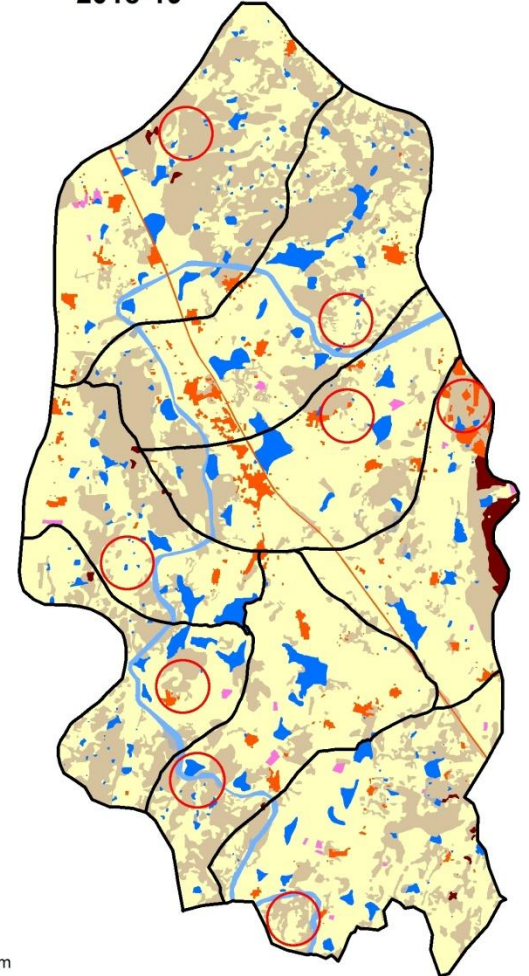
0 0.75 1.5 3 Km

78°15'0"E

78°17'30"E

78°15'0"E 78°17'30"E

## Land Use and Land Cover - Fourth Monitoring 2018-19



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 0.75 1.5 3 Km

78°15'0"E

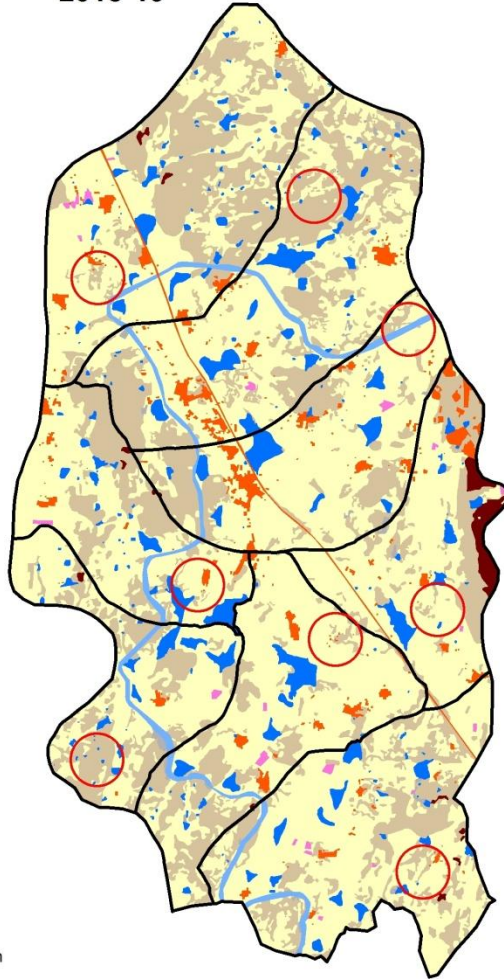
78°17'30"E

# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000

78°15'0"E 78°17'30"E

## Land Use and Land Cover 2018-19



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

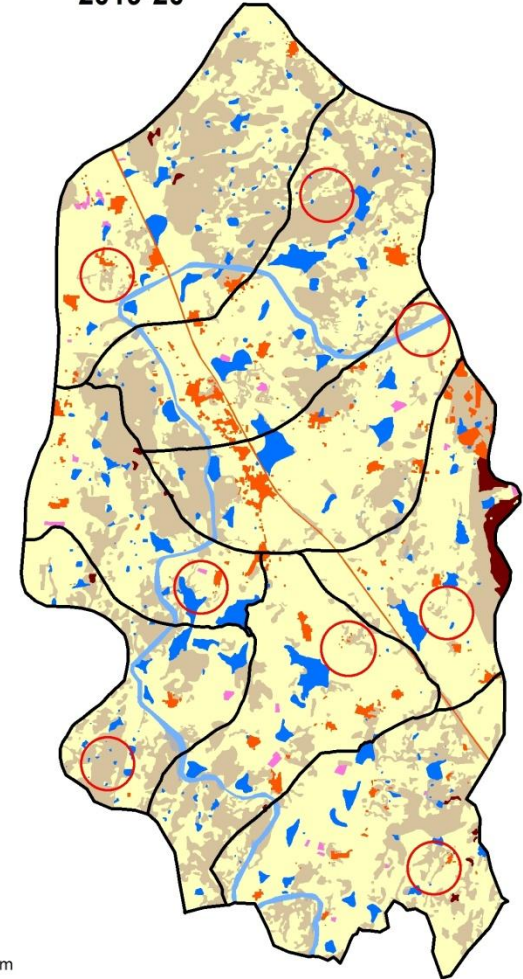
0 0.75 1.5 3 Km

78°15'0"E

78°17'30"E

78°15'0"E 78°17'30"E

## Land Use and Land Cover - Fifth Monitoring 2019-20



### Legend

- Microwatershed Boundary
- Land Use and Land Cover**
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Scrubland
- Barren/Rocky
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 0.75 1.5 3 Km

78°15'0"E

78°17'30"E

12°50'0"N

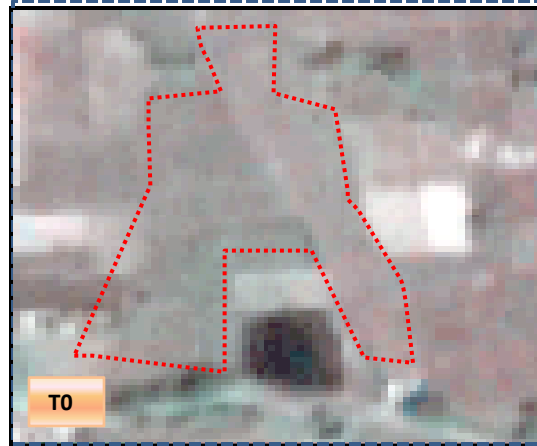
12°47'30"N

12°45'0"N



## Land Use and Land Cover changes for Pre and Post treatment dates

### Agriculture to Plantation



T0: 2009-10(78°15'45.845"E 12°49'18.139"N )



T1: 12 Feb 2015

### Scrub to water body



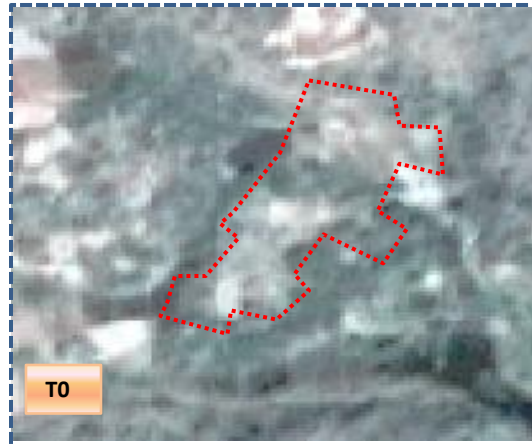
T0: 2012-13 (78°16'31.835"E 12°45'37.146"N )



T1: 12 Feb 2015

## Land Use and Land Cover changes for Pre and Post treatment dates

Scrub to Agriculture



T0: 2009-10(78°17'18.294"E 12°49'24.13"N )



T1: 12 Feb 2015

Agriculture to Water body



T0: 2009-10(78°15'56.465"E 12°48'37.631"N )



T1: 12 Feb 2015

**Table showing change matrix depicting Land cover transitions during study period-2011-12 to 2015-16**

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		
T0													
<b>Built up</b>	84.78												<b>84.78</b>
<b>Mining/dump</b>		4.95											<b>4.95</b>
<b>Agriculture</b>	30.23	0.63	2398.02	5.29						9.86			<b>2444.02</b>
<b>Plantation Horticulture</b>				2.15									<b>2.15</b>
<b>Forest</b>													
<b>Forest Plantation</b>													
<b>Barren Rocky</b>							31.48						<b>31.48</b>
<b>Scrub</b>	4.55	1.24	127.70					1329.24		5.86			<b>1468.60</b>
<b>Waterbody- Streams/River</b>													
<b>Waterbody – Ponds</b>			2.60							190.61			<b>193.22</b>
<b>Grand Total</b>	<b>119.56</b>	<b>6.83</b>	<b>2528.32</b>	<b>7.44</b>			<b>31.48</b>	<b>1329.24</b>		<b>206.33</b>			<b>4229.20</b>

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T0 46 ha of the agriculture area has decreased and it is converted into Built-up, plantation and water body in T1.
- In T1 127 ha of the agriculture area has increased from scrubland and water body of T0.
- The additional agriculture are coming from waterbody in T1 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions during study period-2015-16 to 2016-17**

Land cover	Monitoring period (T2)										
	Units in Hectares										
T1	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody- Streams/River	Water body Ponds	Grand Total
Built up	119.56										119.56
Mining/dump		6.83									6.83
Agriculture	1.47	0.93	2472.31	1.41					50.10	2.10	2528.32
Plantation Horticulture				7.44							7.44
Forest											
Forest Plantation											
Barren Rocky							31.48				31.48
Scrub	1.31	1.92	29.94					1267.98	27.64	0.45	1329.24
Waterbody- Streams/River											
Waterbody – Ponds									0.41	205.92	206.33
<b>Grand Total</b>	<b>122.34</b>	<b>9.68</b>	<b>2502.26</b>	<b>8.84</b>			<b>31.48</b>	<b>1267.98</b>	<b>78.15</b>	<b>208.47</b>	<b>4229.20</b>

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T1 56 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantation and water body in T2.
- In T2 29 ha of the agriculture area has increased from scrubland area of T1. The additional agriculture are coming from waterbody in T2 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions during study period-2016-17 to 2017-18**

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>	122.34										<b>122.34</b>	
<b>Mining/dump</b>		9.68									<b>9.68</b>	
<b>Agriculture</b>	2.40	0.79	2489.69	3.21					0.44	5.74	<b>2502.26</b>	
<b>Plantation Horticulture</b>				8.84							<b>8.84</b>	
<b>Forest</b>												
<b>Forest Plantation</b>												
<b>Barren Rocky</b>							31.48				<b>31.48</b>	
<b>Scrub</b>	0.64	1.74	33.25	1.22				1228.63	1.45	1.04	<b>1267.98</b>	
<b>Waterbody- Streams/River</b>									78.15		<b>78.15</b>	
<b>Waterbody – Ponds</b>										208.47	<b>208.47</b>	
<b>Grand Total</b>	<b>125.38</b>	<b>12.20</b>	<b>2522.94</b>	<b>13.27</b>			<b>31.48</b>	<b>1228.63</b>	<b>80.05</b>	<b>215.25</b>	<b>4229.20</b>	

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T2 12 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantations and water body in T3.
- In T3 33 ha of the agriculture area has increased from scrubland of T2.
- The additional agriculture are coming from waterbody in T3 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions during study period-2017-18 to 2018-19**

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>	125.38										<b>125.38</b>	
<b>Mining/dump</b>		12.20									<b>12.20</b>	
<b>Agriculture</b>	0.16		2522.54	0.24							<b>2522.94</b>	
<b>Plantation Horticulture</b>			0.89	12.38							<b>13.27</b>	
<b>Forest</b>												
<b>Forest Plantation</b>												
<b>Barren Rocky</b>							31.48				<b>31.48</b>	
<b>Scrub</b>	0.07		3.94					1224.63			<b>1228.63</b>	
<b>Waterbody- Streams/River</b>									80.05		<b>80.05</b>	
<b>Waterbody – Ponds</b>										215.25	<b>215.25</b>	
<b>Grand Total</b>	<b>125.61</b>	<b>12.20</b>	<b>2527.36</b>	<b>12.62</b>			<b>31.48</b>	<b>1224.63</b>	<b>80.05</b>	<b>215.25</b>	<b>4229.20</b>	

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T3 0.40 ha of the agriculture area has decreased and it is converted into Built-up, plantations area in T4.
- In T4 4.8 ha of the agriculture area has increased from plantations and scrubland of T3.
- The additional agriculture are coming from waterbody in T4 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions during study period-2018-19 to 2019-20**

Land cover	Monitoring period (T5)										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>T4</b>												
<b>Built up</b>	125.61										<b>125.61</b>	
<b>Mining/dump</b>		12.20									<b>12.20</b>	
<b>Agriculture</b>	0.84		2523.68	2.21						0.63	<b>2527.36</b>	
<b>Plantation Horticulture</b>			1.06	11.56							<b>12.62</b>	
<b>Forest</b>												
<b>Forest Plantation</b>												
<b>Barren Rocky</b>							31.48				<b>31.48</b>	
<b>Scrub</b>	0.12		8.78					1215.44		0.29	<b>1224.63</b>	
<b>Waterbody- Streams/River</b>									80.05		<b>80.05</b>	
<b>Waterbody – Ponds</b>										215.25	<b>215.25</b>	
<b>Grand Total</b>	<b>126.56</b>	<b>12.20</b>	<b>2533.52</b>	<b>13.77</b>			<b>31.48</b>	<b>1215.44</b>	<b>80.05</b>	<b>216.17</b>	<b>4229.20</b>	

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T4 3.6 ha of the agriculture area has decreased and it is converted into Built-up, plantations and water body in T5.
- In T5 9.8 ha of the agriculture area has increased from plantations and scrubland of T4.
- The additional agriculture are coming from waterbody in T5 represents seasonal agriculture.

# Conclusion

1. DPR of the project is uploaded on to Bhuvan Portal.
2. The LULC 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 103 Hectares in Reservoir / Tanks area as compared between baseline LU/LC data 2011-12 (T0) & 2019-20 (T5) years.
4. There is an increase of 84, 20, 04 & 06 Hectares from T0 to T1, T2-T3, T3 to T4 & T4-T5 respectively and overall increase of 89 Hectares in Crop land area as compared between baseline LU/LC data 2011-12 (T0) & 2019-20 (T5) years.
5. There is an increase of 11 ha of the Plantation/Horticulture area has been increased between 2011-12 (T0) & 2019-20 (T5) years.
6. There is a decrease of 253 Hectares in Scrubland area as compared between 2011-12 (T0) & 2019-20 (T5) years.
7. Farm ponds (6) is visible on IWMP Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (9) verified from the portal.