



**GOVERNMENT OF ODISHA
DEPARTMENT OF WATER RESOURCES**

**CATCHMENT AREA TREATMENT PLAN (CATP)
FOR
BUDHABALANGA BARRAGE PROJECT
IN
KULIANA BLOCK
OF
MAYURBHANJ DISTRICT, ODISHA**

**ASST. EXECUTIVE ENGINEER
MAYURBHANJ INVESTIGATION SUB - DIVISION
UDALA**


Executive Engineer
Mayurbhanj Investigation Division
Udala
**EXECUTIVE ENGINEER
MAYURBHANJ INVESTIGATION DIVISION
UDALA**

1. Introduction:

The Catchment Area Treatment (CAT) of Budhabalanga Barrage Project targets overall improvement in the environmental conditions of the region. All the activities are aimed at treating the degraded and potential areas of severe soil erosion. The plan provides benefits due to biological and engineering measures.

This Plan would cover the following aspects:

- Identification of free draining catchment.
- Assessment of Land Use, Soil, Slope in the Budhabalanga Barrage catchment based on Remote Sensing (RS)/Geographical Information System (GIS) and validation through field survey.
- Erosion levels the watershed and prioritization of water sheds will be done by appropriate methods.
- As per the requirement of Ministry of Environment & Forests and Climate Change, Government of India, the treatment measures will be proposed for the area falling higher priority erosion categories. Both Engineering measures will be proposed for the area falling higher priority erosion categories. Both Engineering measures as well as Biological treatment measures will be proposed in the CAT plan.
- The cost of the administrative set up and mitigative measures will include recommendation from State Forest Department for all forest lands and from the Soil Conservation Department for non-forest land.

2. Need:

Reservoirs formed by dams on rivers are subject to sedimentation. The process of sedimentation embodies the sequential processes of erosion, entertainment, transportation, deposition and compaction of sediment. The study of erosion and sediment yield from catchments is of utmost importance as the deposition of sediment in reservoir reduces its capacity and thus affecting the water availability for the designated use. The eroded sediment from catchment when deposited on streambeds and banks causes threading of river reach. The removal of top fertile soil from catchment adversely affects the agricultural production. Thus a well-designed catchment area treatment plan is essential to ameliorate the above-mentioned adverse process of soil erosion.

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area of a water resource project. The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive measures are thus needed for the treatment of dam for its stabilization against future erosion.

Quantifying soil erosion and reservoir sedimentation is necessary for prioritizing catchments for treatment and development of a suitable treatment mix. It is therefore, also required that the effect of various treatments on controlling soil erosion are quantitatively known. River gauging data are the best information source for undertaking the above activities. As such data are not available for this catchment, so estimation procedure is adopted. At the present level of data availability and also based on the past experience, Sedimentation (Slit) Yield Index (SYI) appears to be an acceptable parameter for use in catchment prioritization work.

SYI is calculated using an empirical formula. Based on the numerical value of SYI, catchments are categorised into five priority classes from very high ($SYI > 1300$) priority to very low ($SYI < 1000$) priority. The method was proposed by **All India Soil Survey and Land Use Planning currently known as Soil and Land Use Survey of India** based on several studies. The method has been used to prioritize catchments in India totalling in area of millions of hectares. It is reported that, the SYI procedure is fairly reliable for determining priority watersheds. The empiricism in this method is manifest in the selection of unit area (mapping unit) and assigning an appropriate value of delivery ratio to it. SYI method is widely used because of the fact that it is easy to use and lesser data requirement. Moreover, it can be applied to larger areas like sub watersheds etc.

3. Methodology Adopted:

Database on natural resources, terrain conditions, soil type of the catchment area is a pre-requisite to prepare CAT Plan. Various thematic maps were prepared and used in preparation of the CAT plan, in Geographic Information System (GIS) platform.

The methodology adopted for development of CAT plan for the project is as under:

- Catchment boundary delineation from Survey of India Topo sheets.
- Watershed boundary from watershed Atlas of India and website of Soil and Land Use Survey of India (SLUSI) and the micro watershed boundary collected from Watershed Mission of Odisha.
- Land Use/Land Cover map preparation from recent 5.8m resolution LISS-III Multi Spectral Satellite Image.
- Contour digitization from Survey of India OSM Topo sheet and generation of slope map.
- Soil Map preparation from National Bureau of Soil Survey and Land Use Planning (NBSS & LUP).
- Assigning weight age value of mapping units based on slope and soil texture and Delivery ratio based on distance from nearest stream.

- Estimation of Soil Loss using Silt Yield Index.
- Selection of locations of treatment and CAT plan.
- Cost Estimate.

Thematic data integration and corrosion index modelling was done using relevant map layers in GIS.

Silt Yield Index (SYI) of various micro watersheds within the free catchment was estimated. Watershed management approach were proposed for optimal use of soil and water resources within the catchment with the broad objective of

- Increasing infiltration into soil.
- Control excessive run off.
- Manage & utilize run off for useful purpose.

4. Salient features of Budhabalanga Barrage Catchments

Budhabalanga River is a major river system of Odisha. The River originates from Similipal hills then passes through Baripada; it later flows through Balasore district and into the Bay of Bengal. The total length of the River is about 175 km has a total catchment area of 4840 Sqkm. The catchment map of Budhabalanga Barrage Project is enclosed at **Plate-I.**

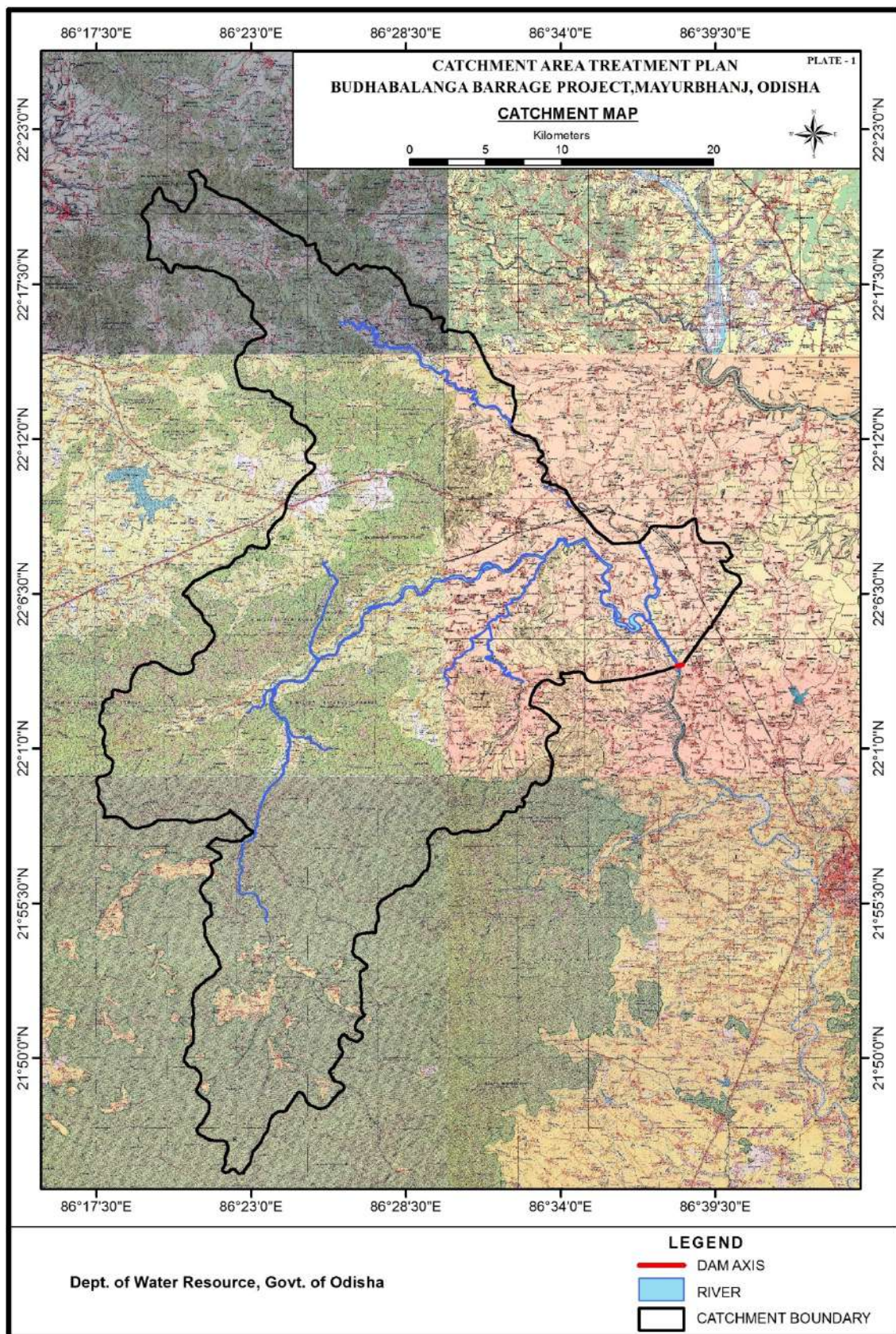
5. Thematic Map Generation

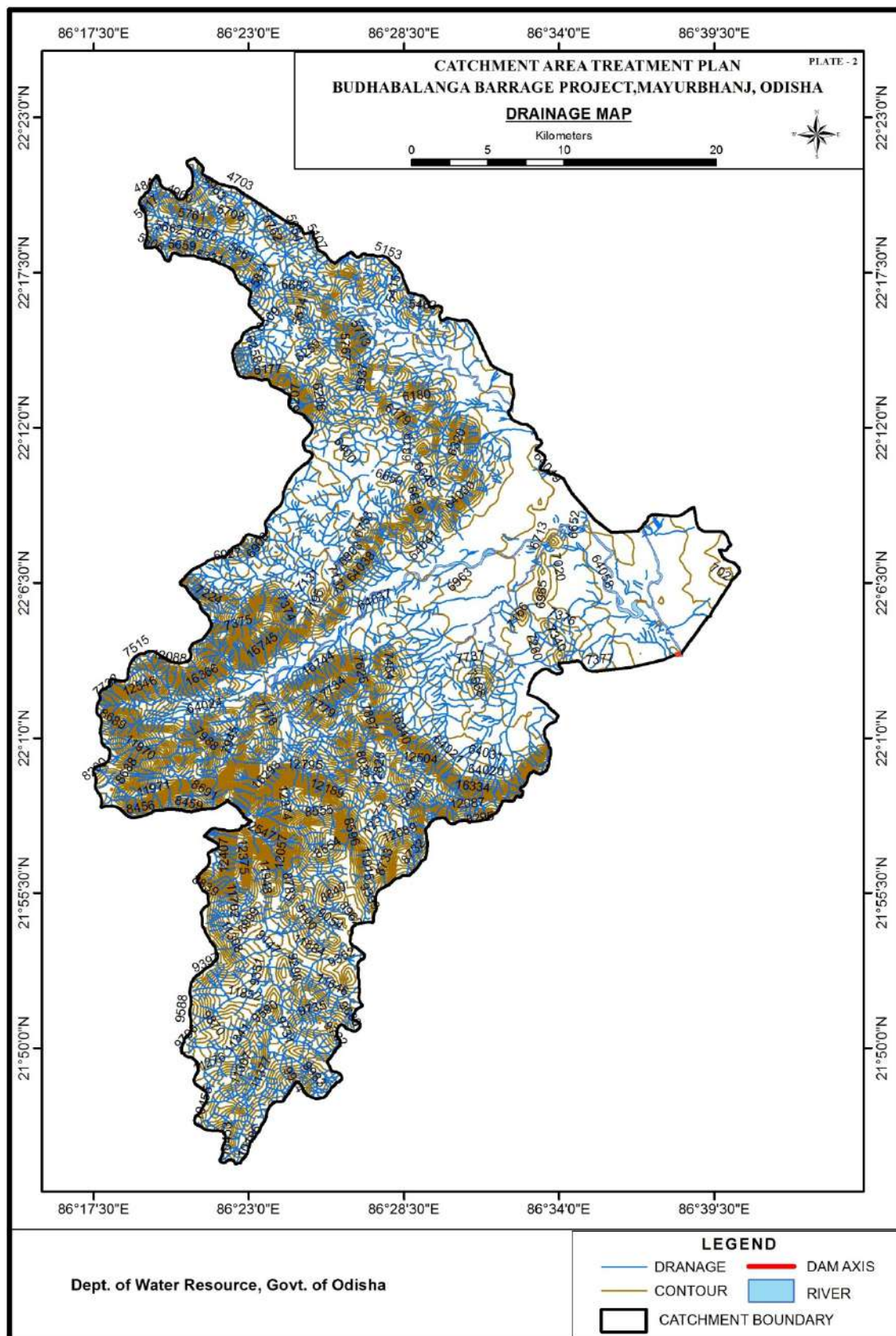
As mentioned in the methodology, various thematic layers like catchment, watershed, drainage, contour, slope, soil were prepared in Geographical Information System (GIS) platform using satellite image, OSM Soil Topo Sheet and other secondary source data. For Seamless integration of different thematic layers and interactive spatial analysis, the themes were generated UTM (Universal Transverse Mercator) projection system. This projection system is used in the recent publication Open Series Map SOI and is also suggested in National map Policy. Datum used for the projection in WGS 1984 and Zone is UTM 45 North.

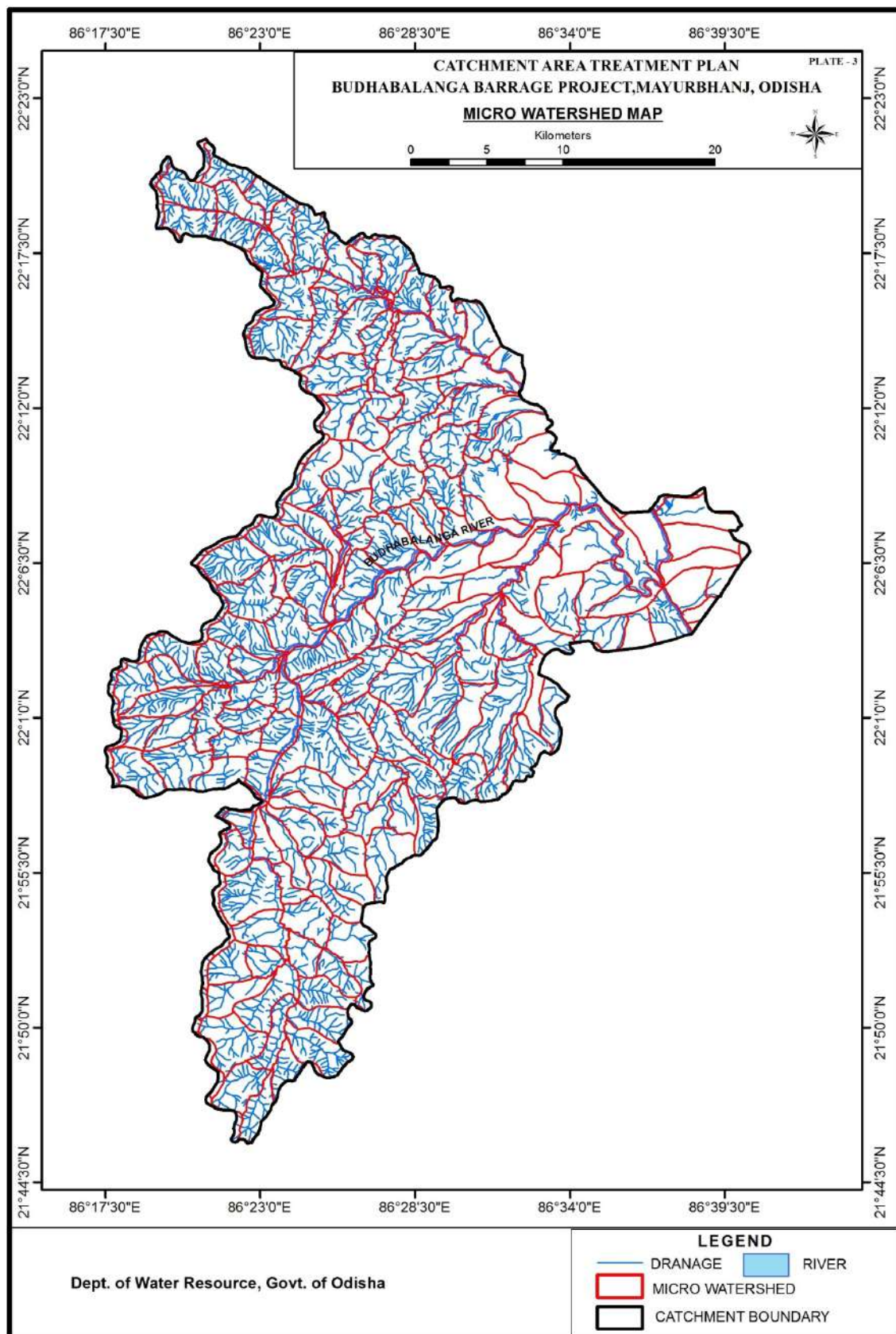
5.1. Catchment Map

The catchment boundary of Budhabalanga Barrage Project was delineated from SOI Topo Sheets (6 Nos) 73J7, 73J8, 73J11, 73J12, 73K5, 73K9 looking at the contours and drainage. The contour and drainage map of the project is enclosed at **Plate-2.**

The entire catchment of Budhabalanga Barrage Project is consist of 212 watersheds as per the watershed Atlas of India published by SLUSI. The total area of the watershed is 103031.7 Ha. . It was decided to prepare the CAT plan at Micro Watershed level instead of Watershed level. The Micro watersheds are prepared using the information available in Watershed Atlas of India, website of Land Use Survey of India (SLUSI) and the micro watershed boundary collected from watershed mission of Odisha. The micro watershed map is enclosed at **Plate-3.**







5.2. Slope Map

The Slope map was derived from contours shown on SOI topo sheet. After marking the catchment area, all the contours and spot heights shown on the topographical maps were mapped with 'Z' value (height above MSL in m). Since the area is mostly flat and contours are wide spaced, the spot heights collected in DGPS (differential GPS) during ground truthing of land use were also used as input.

A surface was created using the elevation values stored in the form of contours or points. A Digital Terrain Model (DTM) of the area was then prepared, which was used to derive a slope map. The slope was divided in classes of slope percentages. The areas falling under various standard slope categories and the slope map is enclosed at **Plate-4**.

5.3. Land Use/Land Cover Map

Land use map was prepared from recent 5.8m resolution LISS-III Multi Spectral satellite image collected from National Data Centre of National Remote Sensing Centre (NRSC), Hyderabad. Details of Satellite Image are given below.

Satellite	: IRS-R2
Sensor	: LISS-III MX
Date of Pass	: 21 st January 2011
Path	: 106
Row	: 57

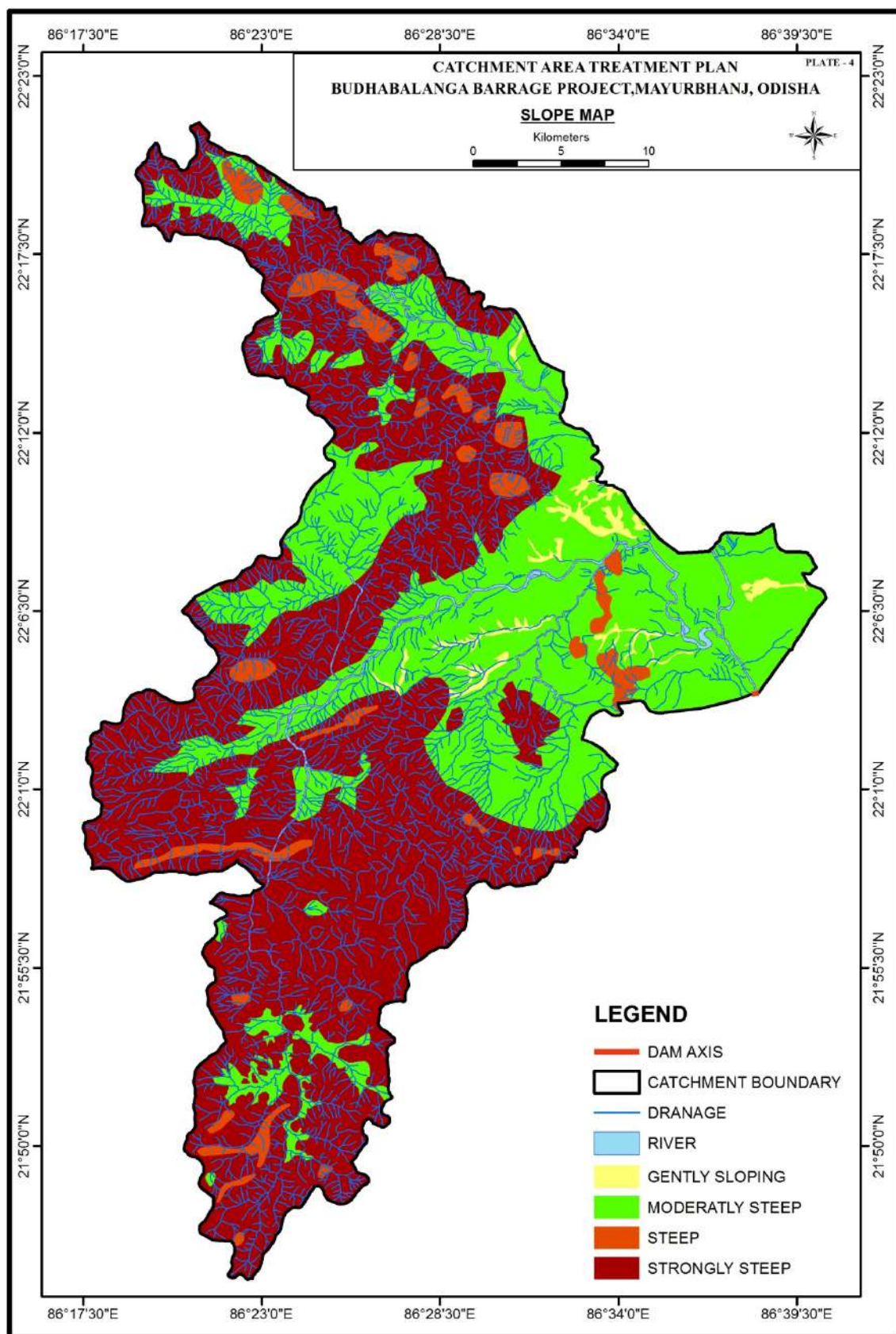
The image was geo-referenced using the common Ground Control Points (GCP) of Survey of India topographical sheets and satellite image with the help of feature registration techniques in standard image processing software. The satellite image map is enclosed at **Plate-5**. As the catchment area is very small, visual interpretation of the geo-referenced satellite data was done by qualified professionals using standard enhancement techniques followed by detail ground truthing to enhance the quality of image interpretation. The classified land use map of the catchment area is depicted in Table-2 and the map is enclosed at **Plate-6**.

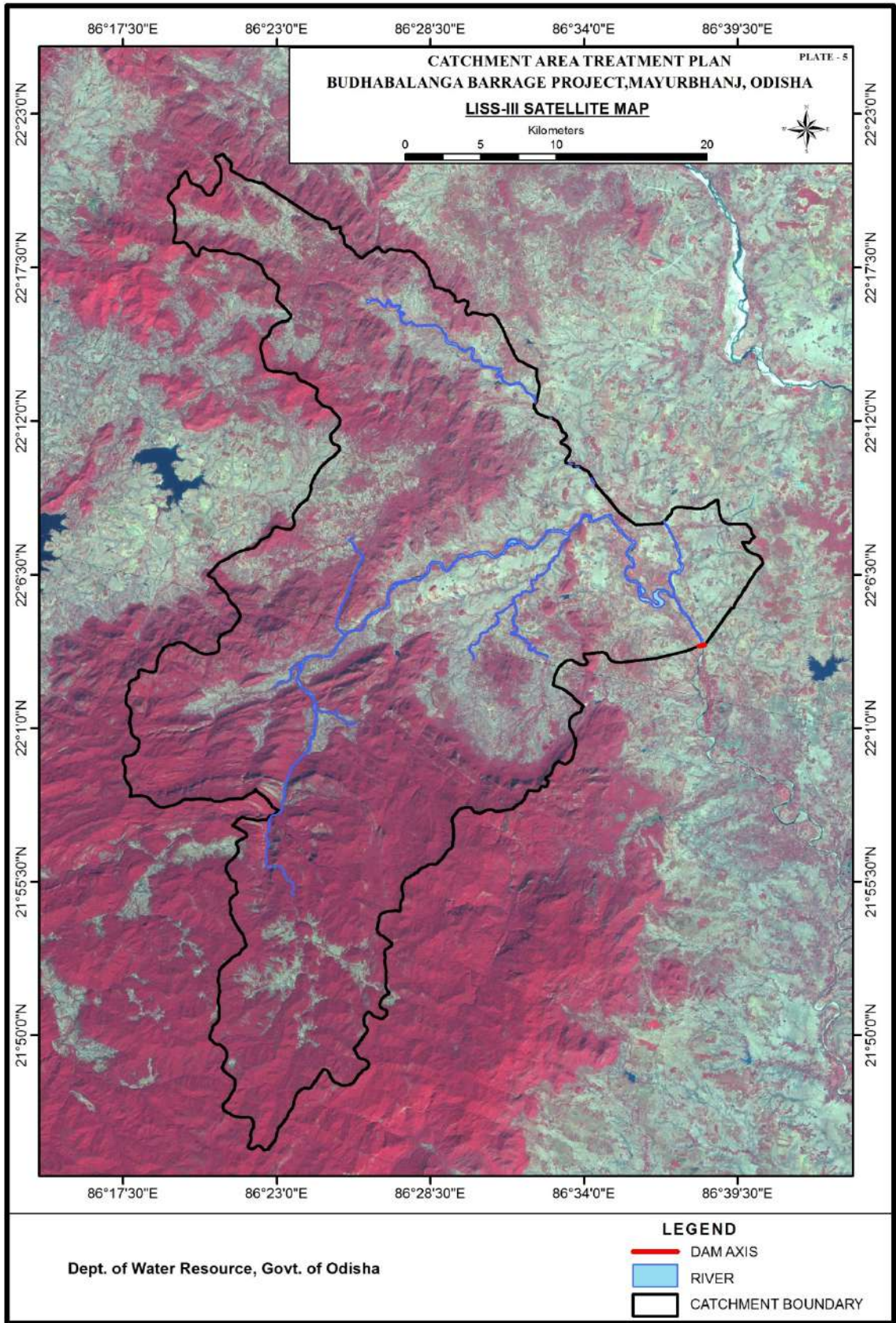
5.4. Soil map

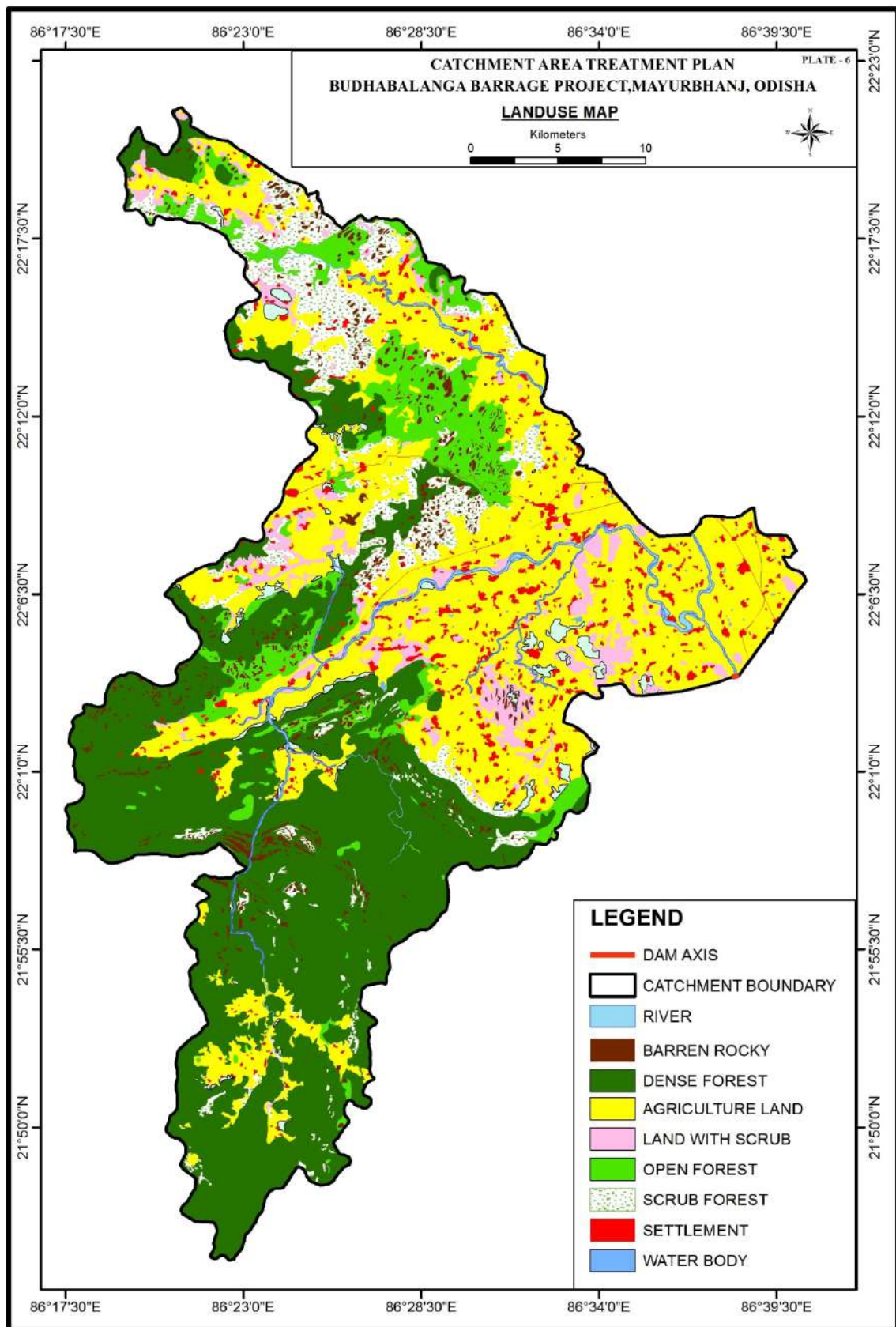
Soil map was prepared by digitalizing the soil map collected from National Bureau of Soil Survey and Land Use Planning (NBSS & LUP) for Odisha and undivided Madhya Pradesh. The soil map is depicted at **Plate-7**.

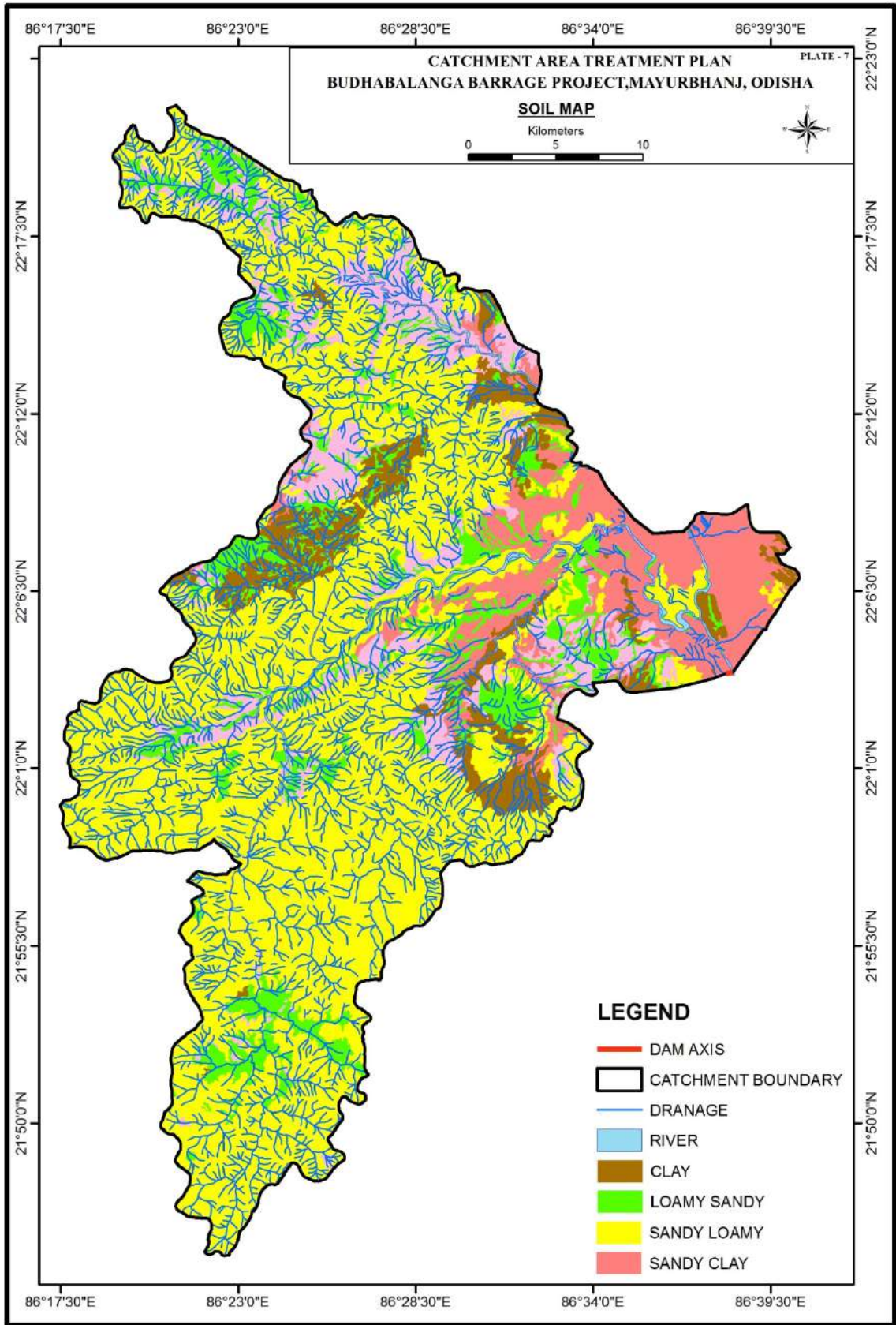
6. Estimate of Soil Intensity Using Silt Yield Index (SYI) method

The sedimentation (silt) Yield Index Model (SYI), considering sedimentation as product of erosivity, erodibility and arial extent was conceptualized in the AISLUS, as early as 1969 and has been in operational use since then to meet the requirements of prioritization of smaller hydrologic units. The erosivity determinants are the climatic factors and soil and land attributes that have direct or reciprocal bearing on the unit of the detached soil material.









The Silt Yield Index (SYI) is defined as the Yield per unit area and SYI value for hydrologic unit is obtained by taking the weighted arithmetic mean over the entire area of the hydrologic unit by using suitable empirical equation.

In SYI methodology, each Erosion Intensity Unit (EIU) is assigned a weightage value. When considered collectively, the weightage value represents approximately the relative comparative erosion intensity. The slope, soil and land use theme of the catchment were combined using union tool in GIS and EIU were formed using different combination of soil, slope and land use categories.

SYI was calculated using following empirical formula:

$$SYI = \frac{\sum (A_i \times W_i) \times D_i \times 100}{A_w} \quad [\text{Where } i = 1 \text{ to } n \text{ (n is the No. (EIU))}]$$

A_i = Area of i^{th} unit (EIU)

D_i = delivery Ratio of the i^{th} unit EIU

W_i = Weightage value of the i^{th} unit EIU

A_w = Total area of Micro - Watershed

Weightage Value (W)

Weightage Value is a combination of two factors K and X. A basic Factor of $k=10$ was used in determining the weightage values. The value of 10 indicates a static condition of equilibrium between erosion and deposition. Any addition to the factor of K ($10+X$) is suggestive of erosion in ascending order whereas subtraction, i.e. ($10-X$) is indicative of deposition possibilities.

Delivery Ratio (D)

Delivery ratio was assigned to all erosion intensity units depending upon their distance from the nearest stream. The criteria adopted for assigning the delivery ratio are as follows:

Nearest stream	Delivery Ratio
0– 0.9	1.00
1.0-2.0	0.95
2.1-5.0	0.90
5.1-15.0	0.80
15.1-30.0	0.70

1.0km, 2.0 km, 5.0 km, 15.0 km and 30.0 km buffers were created around the main stream and reservoir using GIS. EIUs falling in different buffer zone were assigned the delivery ratio of the respective buffer zone.

Prioritization of Micro Watershed based on SYI findings.

The objective of the SYI method is to prioritize micro watershed in a catchment area for treatment. For prioritizing the micro watersheds, these are to be divided in to different categorized based on their SYI. The SYI values for classification of various categories of erosion intensity rates are depicted below

Priority Categories	SYI Values
Very High	>1300
High	1200-1299
Medium	1100-1199
Low	1000-1099
Very Low	<1000

The micro watershed wise SI and category of erosion is depicted in **Table-4** and **Plate-8**.

Table-4: Soil Erosion Priority Category of Watersheds

SL NO	WS LCODE	SYI	PRIORITY
1	408030204390202	1055	Low
2	408020306070101	956	Very Low
3	408020307040102	950	Very Low
4	408030106040201	1039	Low
5	408020307040202	948	Very Low
6	408020202180201	958	Very Low
7	408030106040203	1035	Low
8	408030106020101	1031	Low
9	408020306010101	952	Very Low
10	408020306040103	954	Very Low
11	408020307060101	1179	Medium
12	408030204400202	943	Very Low
13	408020202130101	980	Very Low
14	408020307050202	1193	Medium
15	408020306080102	1035	Low
16	408030106040202	1043	Low
17	408030106030103	1030	Low
18	408030204390101	1051	Low
19	408020202170104	962	Very Low
20	408020304300102	1030	Low
21	408030204440102	940	Very Low
22	408030204350103	945	Very Low
23	408020306330102	1187	Medium
24	408020202160104	938	Very Low
25	408030106030101	1027	Low
26	408030204390203	1059	Low
27	408020202130103	973	Very Low
28	408030204410202	942	Very Low
29	408030204400201	944	Very Low

30	408030204350104	946	Very Low
31	408030204510204	937	Very Low
32	408030204510205	938	Very Low
33	408020307050201	1183	Medium
34	408020307070102	1185	Medium
35	408030204520203	936	Very Low
36	408020202150203	945	Very Low
37	408020202170202	960	Very Low
38	408020202130104	1025	Low
39	408030204520204	935	Very Low
40	408020202150202	952	Very Low
41	408030204350201	1047	Low
42	408020307170202	895	Very Low
43	408030204440103	939	Very Low
44	408020202130202	966	Very Low
45	408030106010101	947	Very Low
46	408020202140101	959	Very Low
47	408030204430102	1067	Low
48	408020202170103	931	Very Low
49	408030204430201	1185	Medium
50	408020306330201	1193	Medium
51	408030204430202	1181	Medium
52	408030204400101	1063	Low
53	408030204440202	941	Very Low
54	408020307250102	1057	Low
55	408020307180101	865	Very Low
56	408020307250202	938	Very Low
57	408020307210201	1039	Low
58	408020306330203	1199	Medium
59	408020307220102	957	Very Low
60	408020307120102	1175	Medium
61	408020307040101	1171	Medium
62	408020307100101	1095	Low
63	408020307220101	870	Very Low
64	408020307010202	1183	Medium
65	408020307300202	1169	Medium
66	408020307190102	1177	Medium
67	408020307200103	950	Very Low
68	408020307170101	1054	Low
69	408020307100202	1096	Low
70	408020307120203	1071	Low
71	408020307160202	950	Very Low
72	408020307020103	1085	Low
73	408020307270101	1183	Medium
74	408020306080202	1191	Medium

75	408020307250101	1056	Low
76	408020307140103	1173	Medium
77	408020307020202	1086	Low
78	408020307140203	944	Very Low
79	408020307090201	1177	Medium
80	408020307240104	900	Very Low
81	408020307180102	855	Very Low
82	408020307210103	1042	Low
83	408020307010203	1040	Low
84	408020307220201	958	Very Low
85	408020307010201	1050	Low
86	408020307210102	956	Very Low
87	408020307100103	1195	Medium
88	408020307240201	885	Very Low
89	408020307200102	948	Very Low
90	408020307170201	1057	Low
91	408020307150102	945	Very Low
92	408020307260202	1192	Medium
93	408020307150201	1061	Low
94	408020307130202	1063	Low
95	408020307100104	1173	Medium
96	408020307010103	1065	Low
97	408020307020102	1075	Low
98	408020307010104	1181	Medium
99	408020306080101	1185	Medium
100	408020307010105	1070	Low
101	408020307160201	934	Very Low
102	408020307240202	920	Very Low
103	408020307290102	1091	Low
104	408020307290201	1186	Medium
105	408020307090102	1078	Low
106	408020307230101	890	Very Low
107	408020307200104	954	Very Low
108	408020307170102	1062	Low
109	408020307300204	1063	Low
110	408020307110102	1083	Low
111	408020307150202	1055	Low
112	408020307070203	1167	Medium
113	408020307100102	1093	Low
114	408020307030102	1090	Low
115	408020307150101	915	Very Low
116	408020307210101	955	Very Low
117	408020307140202	946	Very Low
118	408020307250203	955	Very Low
119	408020307060201	1171	Medium

120	408020307190101	1045	Low
121	408020307160103	940	Very Low
122	408020307010102	1060	Low
123	408020306080201	1189	Medium
124	408020307270202	1161	Medium
125	408020306330202	1197	Medium
126	408020307140201	1050	Low
127	408020307030201	1084	Low
128	408020307300101	1176	Medium
129	408020307140204	942	Very Low
130	408020307220104	875	Very Low
131	408020307270102	1165	Medium
132	408020306080203	1195	Medium
133	408020307240102	905	Very Low
134	408020307120202	1099	Low
135	408020307260103	1166	Medium
136	408020307190103	1033	Low
137	408020307300104	930	Very Low
138	408020307130103	1087	Low
139	408020307220203	880	Very Low
140	408020307030202	1179	Medium
141	408020307200201	953	Very Low
142	408020307220202	961	Very Low
143	408020307210202	1048	Low
144	408020307080101	1078	Low
145	408020307220103	960	Very Low
146	408020307090203	1081	Low
147	408020307270103	1156	Medium
148	408020307260102	1049	Low
149	408020307300203	1060	Low
150	408020307010101	1045	Low
151	408020307070101	1171	Medium
152	408020307080202	1169	Medium
153	408020307180202	1051	Low
154	408020307070201	1197	Medium
155	408020307080203	1076	Low
156	408020307260101	1051	Low
157	408020307200101	949	Very Low
158	408020307160101	935	Very Low
159	408020307210203	1054	Low
160	408020307240103	925	Very Low
161	408020307300201	1171	Medium
162	408020307250201	936	Very Low
163	408020307060202	1186	Medium
164	408020307290202	1168	Medium

165	408020307160203	1059	Low
166	408020307060102	1177	Medium
167	408020307260201	1177	Medium
168	408020307100201	1187	Medium
169	408020307080201	1072	Low
170	408020307030101	1080	Low
171	408020307090101	1175	Medium
172	408020307290101	1174	Medium
173	408020307120101	1195	Medium
174	408020307230102	910	Very Low
175	408020307020204	1082	Low
176	408020307130102	1075	Low
177	408020307080102	1087	Low
178	408020307140102	1048	Low
179	408020307200202	951	Very Low
180	408020307140101	1047	Low
181	408020307020101	1055	Low
182	408020307090103	1075	Low
183	408020307020201	1088	Low
184	408020307020203	1080	Low
185	408020307110202	1067	Low
186	408020307190201	1036	Low
187	408020307130203	1055	Low
188	408020307280202	1051	Low
189	408020307080103	1084	Low
190	408020307120201	1191	Medium
191	408020307070202	1165	Medium
192	408020307260104	1162	Medium
193	408020307110101	1090	Low
194	408020307280201	1058	Low
195	408020307130101	1180	Medium
196	408020307240101	860	Very Low
197	408020307090202	1074	Low
198	408020307160102	940	Very Low
199	408020307110201	1079	Low
200	408020307020205	1173	Medium
201	408020307290103	1189	Medium
202	408020307130201	1059	Low
203	408020307290203	1159	Medium
204	408020307100203	1181	Medium
205	408020307270201	1181	Medium
206	408020307190202	952	Very Low
207	408020307280101	1052	Low
208	408020307180201	959	Very Low
209	408020307100105	1189	Medium

210	408020307280102	1053	Low
211	408020307300103	1165	Medium
212	408020307230202	1060	Low

Area under very high categories is proposed to be treated at the project proponent's cost. A base map showing land use reserve forest boundary, slop, major drains and priority watershed is enclosed at **Plate-9** for micro planning of the catchment area treatment plan as the steep areas are more prone to soil erosion, looking at the land use was finally selected for catchment area treatment plan which is directly draining to the Budhabalanga River. The topographic map, drainage and contour map and land use and slope map of the sub watershed is enclosed at **Plate-10, 11, and 12** respectively.

6.1. Demography of the watershed

Sl. No.	Village Name	Male	Female	Total Population
1	Bangiriposi	51880	52000	103880
2	Bijatola	31684	32509	64193
3	Bisoi	36357	38215	74572
4	Jashipur	49862	51196	101058
5	Kuliana (Koliana)	50722	50429	101151
6	Rairangpur	29715	30850	60565
7	Saraskana	50904	49912	100816
8	Shamakhunta	39892	39991	79883

The demography of the villages as per Census 2011 is depicted below.

7. Catchment Area Treatment (CAT) Plan

Following Engineering and Biological measures are planned for the catchment area treatment depending upon the requirement and suitability.

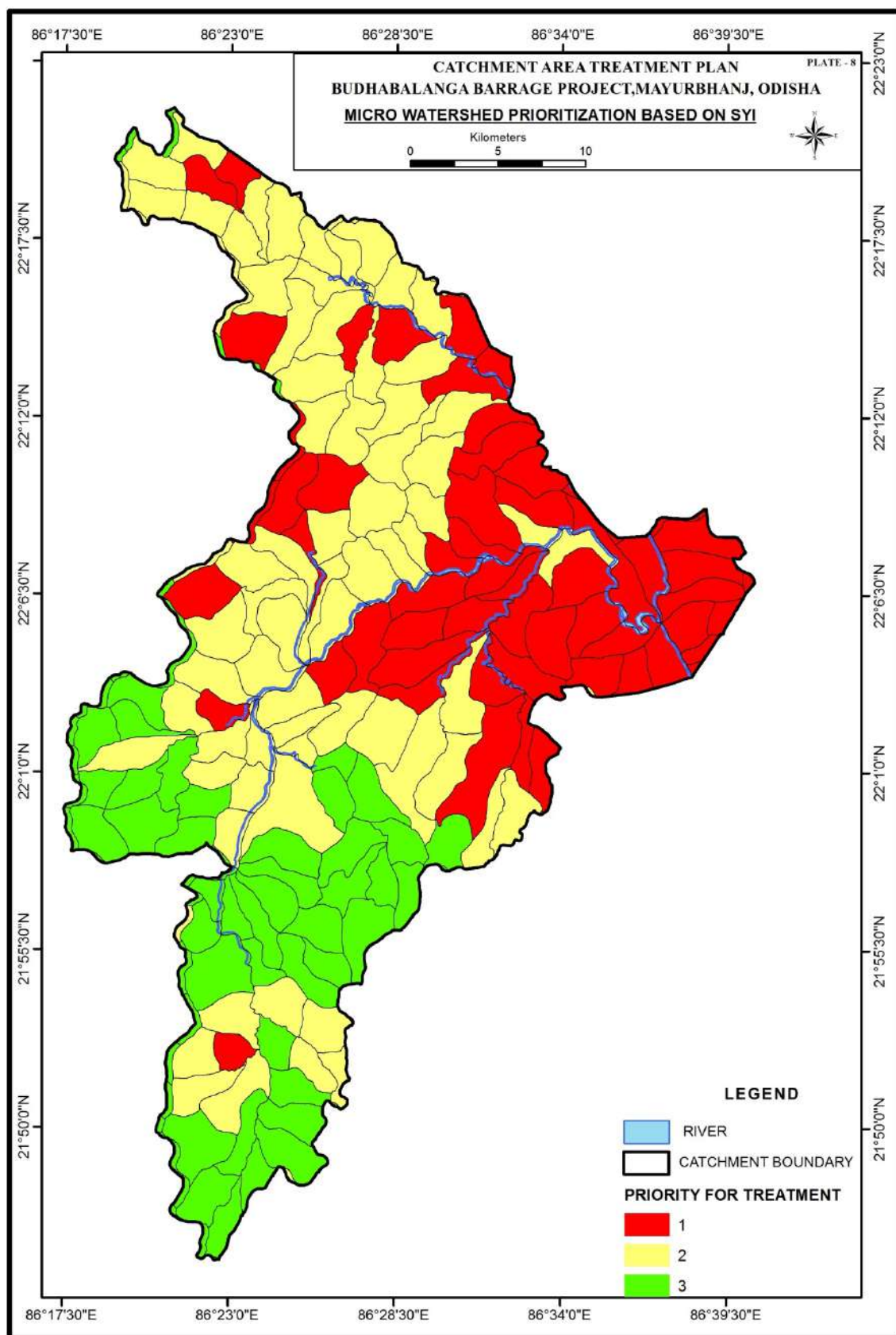
a. Biological Measures

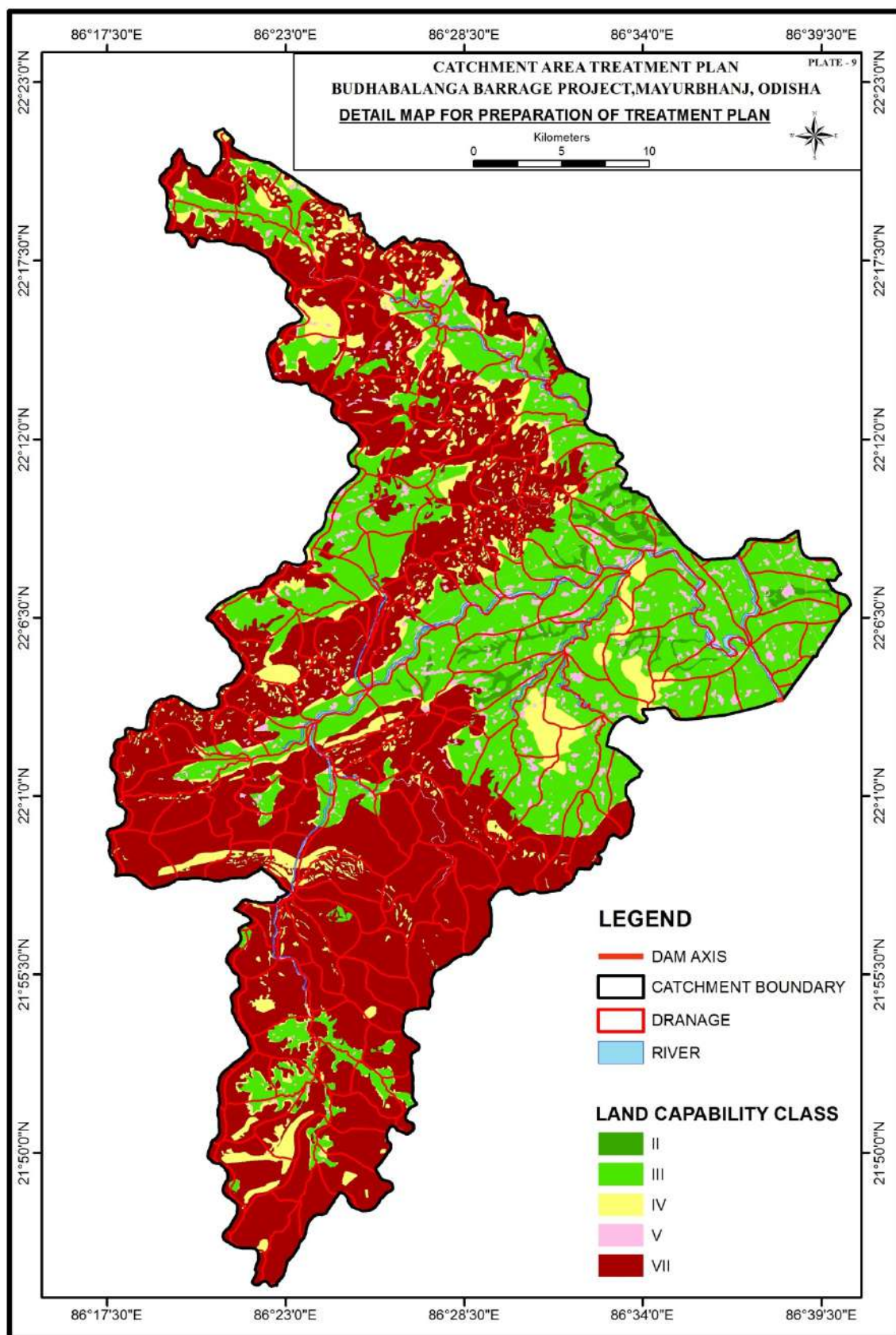
- Assisted Natural Regeneration
- Block Plantation /Afforestation
- Fodder land Development

b. Engineering Measures

- Loose boulder wall-gully plugging in small hilly streams
- Stone masonry check dams – in major drains

As the majority of the area is agricultural land (81.92%),awareness campaign will be done for farm management (negative of burning farm residuals, adoption of proper cropping pattern etc), digging of farm pond, controlled grazing in graze land ,etc.





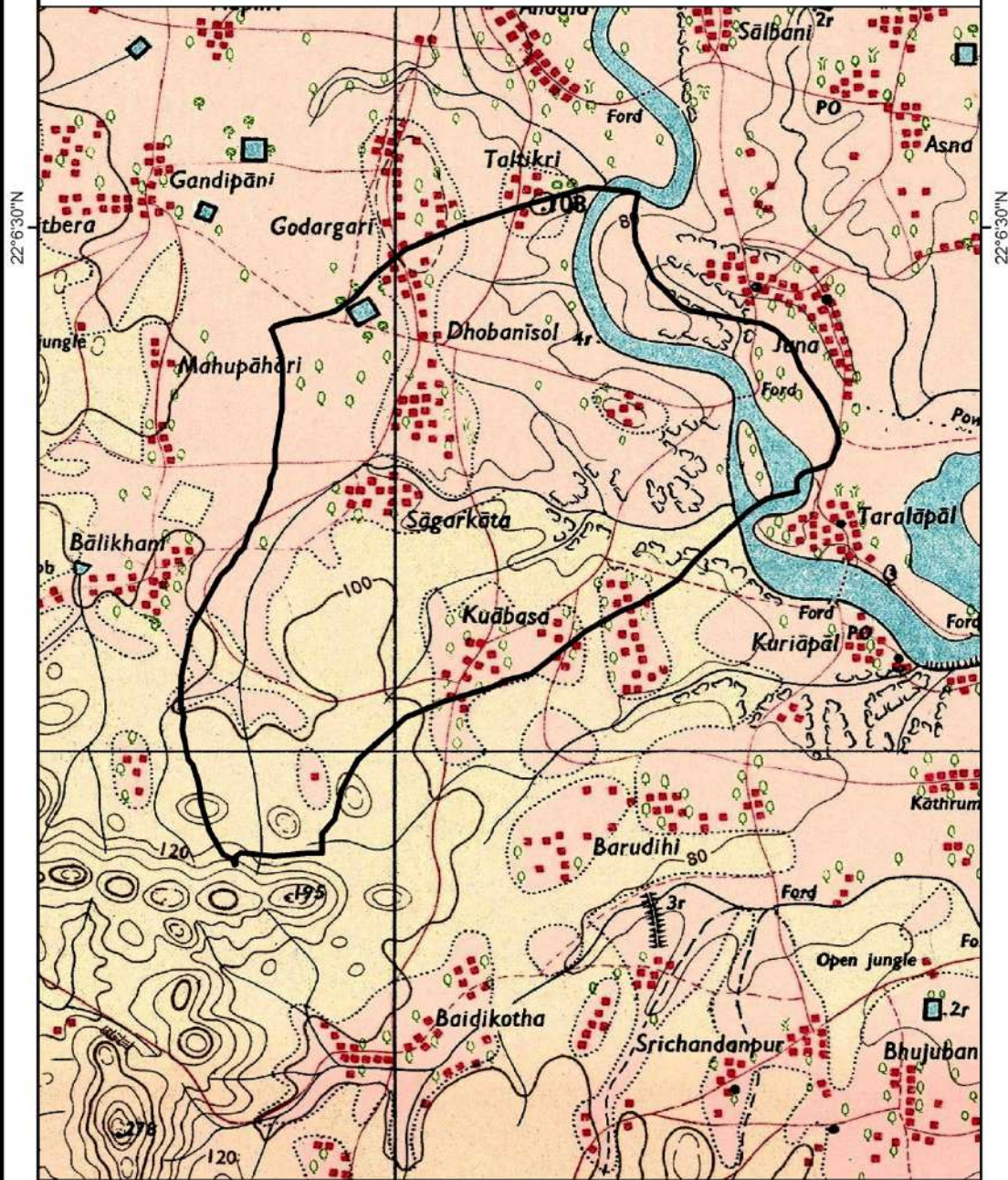
86°34'0"E

CATCHMENT AREA TREATMENT PLAN
BUDHABALANGA BARRAGE PROJECT, MAYURBHANJ, ODISHA
TOPOGRAPHIC MAP OF THE PRIORITY WATERSHED



PLATE - 10

Meters
0 250 500



86°34'0"E

LEGEND

Dept. of Water Resource, Govt. of Odisha

 CATCHMENT BOUNDARY

86°34'0"E

**CATCHMENT AREA TREATMENT PLAN
BUDHABALANGA BARRAGE PROJECT, MAYURBHANJ, ODISHA
DRAINAGE & CONTOUR MAP OF PRIORITY WATERSHED**

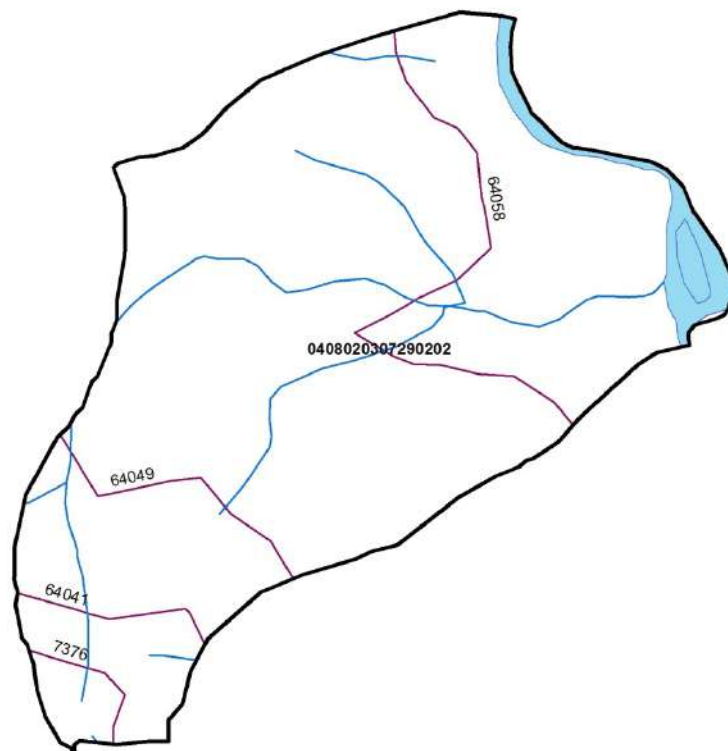
PLATE - 11



Meters
0 250 500 1,000

22°6'30"N

22°6'30"N



86°34'0"E

Dept. of Water Resource, Govt. of Odisha

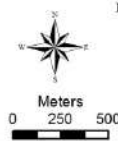
LEGEND

- DRAINAGE
- CONTOUR
- PRIORITY WATERSHADE

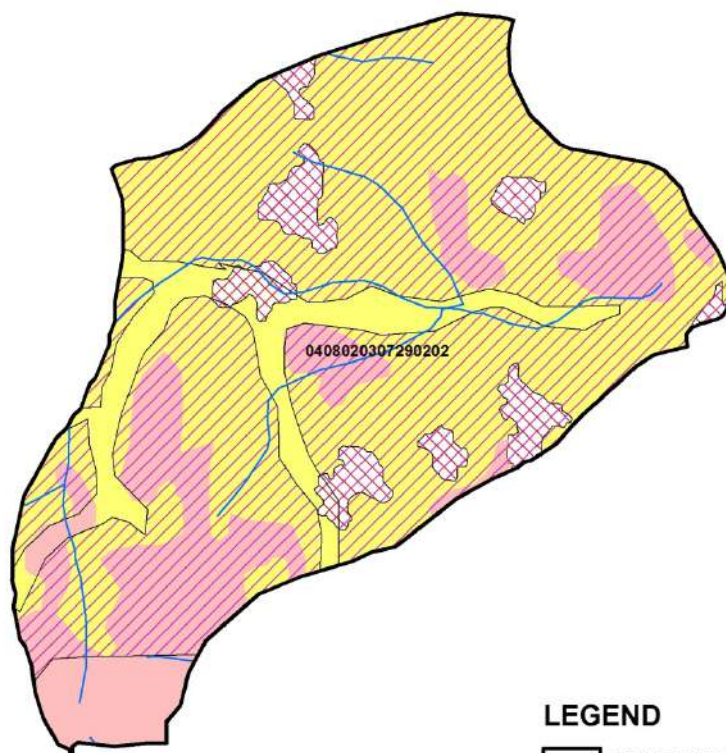
86°34'0"E

CATCHMENT AREA TREATMENT PLAN
BUDHABALANGA BARRAGE PROJECT, MAYURBHANJ, ODISHA
LANDUSE & SLOPE MAP OF THE PRIORITY WATERSHED

PLATE - 12



22°6'30"N



22°6'30"N

LEGEND

- PRIORITY WATERSHADE
- DRANAGE
- MODERATLY STEEP
- STRONGLY STEEP
- BARREN ROCKY
- DENSE FOREST
- KHARIF
- LAND WITH SCRUB
- OPEN FOREST
- SCRUB FOREST
- SETTLEMENT

86°34'0"E

7.1. Assisted Natural Regeneration

Assisted Natural Regeneration is suggested in the 8065.8 ha of open forest available within the open forests. The detail estimate is depicted at **Annexure-1.**

7.2 Block Plantation/ Afforestation-1

The village wise revenue forest and govt. land is depicted in the table below.

All areas are in Ha.

SI No	Village Name	Forest	Govt	Total
1	Adapal	-	586.4	586.4
2	Alapani	35645.2	589.8	36235.0
3	Ambadiha	124.4	154.8	279.1
4	Ambua	-	605.0	605.0
5	Amdapani	-	602.8	602.8
6	Andola	-	586.7	586.7
7	Anlagunja	-	580.7	580.7
8	Anlajodi	-	-	0.0
9	Anlatoda	-	580.7	580.7
10	Argalbindha	4863.6	62.0	4925.6
11	Asana	-	585.4	585.4
12	Asanbani	-	636.4	636.4
13	Asansikar	-	193.9	193.9
14	Asansikhar	293.6	513.9	807.5
15	Asna	-	5.9	5.9
16	Astabeda	84.4	705.9	790.3
17	Astakuanr	35660.9	13.4	35674.3
18	Badamtalia	-	-	0.0
19	Badgan	368.5	33.1	401.5
20	Badhunja	-	593.8	593.8
21	Badmakabadi	35655.0	-	35655.0
22	Badnedam	-	190.3	190.3
23	Badpatharakham	233.7	2.9	236.6
24	Baghiabeda	222.0	-	222.0
25	Baidikotha	-	421.7	421.7
26	Bakua	35649.7	-	35649.7
27	Balarampur	36759.1	640.5	37399.6
28	Baliadhipa	35645.2	-	35645.2
29	Baliajoka	-	130.8	130.8
30	Baliam	1576.4	0.3	1576.7
31	Balikhani	-	521.7	521.7
32	Balimundali	-	580.7	580.7
33	Balipalmundhakata	-	580.7	580.7
34	Banakati	-	598.2	598.2

35	Bangriposi	-	1.2	1.2
36	Bankadunguri	3425.0	114.0	3539.0
37	Bareipani	-	-	0.0
38	Baribeda	35645.2	580.7	36225.9
39	Barudihi	-	387.1	387.1
40	Barundapahadihill	3425.0	-	3425.0
41	Basantpur	-	669.1	669.1
42	Basilakacha	35645.2	619.2	36264.4
43	Basukitala	1275.9	615.0	1890.9
44	Baunsabudi	-	-	0.0
45	Baunsapahadi	35645.2	727.4	36372.6
46	Bautia	36608.0	639.8	37247.8
47	Beguniabandh	36523.6	37.3	36560.9
48	Beguniadiha	-	582.3	582.3
49	Betjharan	-	677.5	677.5
50	Bhadiari	-	580.7	580.7
51	Bhadua	3291.4	134.0	3425.4
52	Bhadua Samil Bachhuribandh	1100.4	180.6	1281.0
53	Bhaduabeda	-	-	0.0
54	Bhaduakacha	35645.2	580.7	36225.9
55	Bhagirathipur	37005.5	41.6	37047.1
56	Bhaliadaha	-	-	0.0
57	Bhalupahadi (Hill block)	-	38.0	38.0
58	Bhejidihi	3425.0	11.9	3436.9
59	Bhimkhanda	3561.7	228.5	3790.2
60	Bholagadia	1275.9	604.1	1880.0
61	Bhuasuni	-	387.7	387.7
62	Bhulanpur	-	-	0.0
63	Binjhabani	-	6.9	6.9
64	Bisoi	-	-	0.0
65	Bisoihill	408.4	514.9	923.3
66	Brahmangan	878.4	1167.4	2045.7
67	Budamara	4589.9	244.8	4834.6
68	Budhabalanga	35653.4	22.8	35676.2
69	Budhikhamari	-	-	0.0
70	Chadeipahadi	3425.0	148.5	3573.5
71	Chadheipahadi	-	384.4	384.4
72	Chakdar	-	654.2	654.2
73	Chakidi	35645.2	604.0	36249.3
74	Champabeda	-	-	0.0
75	Chandanpur	-	134.9	134.9
76	Chandbil	-	634.8	634.8
77	Charabandh	35645.2	-	35645.2
78	Chaulgheri	-	583.0	583.0
79	Chhatramandal	3454.3	213.7	3668.0

80	Chuakankar	449.4	94.9	544.3
81	Chuapani	-	633.8	633.8
82	Dahisahi	-	627.2	627.2
83	Daleidihi	3425.0	190.8	3615.8
84	Dambeda hill	3425.0	14.7	3439.7
85	Damsole	-	580.7	580.7
86	Danadar	-	160.5	160.5
87	Dantiakacha	35645.2	-	35645.2
88	Dantuani	36094.6	156.8	36251.4
89	Darakantia	300.5	137.2	437.6
90	Dasisul	1275.9	6.1	1282.0
91	Deolipal	-	586.7	586.7
92	Deopata	36105.1	2.2	36107.2
93	Dhadangri	-	-	0.0
94	Dhadipani	35648.9	-	35648.9
95	Dhana	17.3	514.5	531.8
96	Dhangidisol	-	-	0.0
97	Dhantangar	4445.7	28.6	4474.3
98	Dhantangarhill	3425.0	64.8	3489.8
99	Dhobanijoda	-	574.0	574.0
100	Dhobanisul	-	615.2	615.2
101	Dhuduruchampa	35710.5	2.4	35712.8
102	Diabaghia	-	-	0.0
103	Digarisol	1165.1	180.6	1345.7
104	Dighi	300.5	3.6	304.1
105	Duarsuni	4742.4	12.5	4754.9
106	Dudhakundi	4863.6	-	4863.6
107	Dumuhani	878.4	589.8	1468.2
108	Dumuria	-	130.8	130.8
109	Dumurikudar	3734.7	167.5	3902.3
110	Ektali	35746.6	637.4	36384.0
111	FOREST	158721.1	4902.8	163623.9
112	Fulbadia	754.0	22.2	776.2
113	Fulbadiahill	754.0	22.2	776.2
114	Fuljhara	35645.2	599.9	36245.1
115	Fuljharan	1410.8	78.8	1489.6
116	Gamhapur	-	46.7	46.7
117	Gandipani	-	1.6	1.6
118	Garudpani	754.0	0.6	754.5
119	Gauddiha	-	-	0.0
120	Gendapokhari	-	85.3	85.3
121	Ghatiduba	-	709.2	709.2
122	Ghatkuanri	878.4	580.7	1459.1
123	Ghodabandha	35736.3	632.2	36368.5
124	Ghuma	3815.1	136.2	3951.3

125	Gobindpur	153.6	25.8	179.4
126	Godargadi	-	-	0.0
127	Gohalhill	14.8	-	14.8
128	Gohirapal	1275.9	677.3	1953.2
129	Golamundhakata	-	582.5	582.5
130	Gopalpur	-	50.7	50.7
131	Gopinathpur	35710.5	2.4	35712.8
132	Gosanipal	-	9.4	9.4
133	Gothanida	335.6	-	335.6
134	Gurandia	35645.2	-	35645.2
135	Handa	-	2.7	2.7
136	Hatibari	878.4	633.9	1512.2
137	Hatichhad	8167.4	6.6	8174.0
138	Hatisal	3432.9	-	3432.9
139	Henselgoda	3425.0	323.2	3748.2
140	Hijili	-	632.8	632.8
141	Hill -2	8181.0	47.1	8228.0
142	Hill Block	1263.6	125.4	1389.0
143	Hill block-1	4835.8	289.0	5124.8
144	Hillblock	36610.7	1425.5	38036.3
145	Jaganathkhunta	-	49.6	49.6
146	Jagannathpur	-	585.0	585.0
147	Jaladiha	36013.7	63.5	36077.2
148	Jamadapal	-	610.0	610.0
149	Jamtalia	35650.4	5.8	35656.2
150	Jamugadia	-	16.8	16.8
151	Jamunagarh	35668.3	-	35668.3
152	Jamupani	292.5	104.5	397.0
153	Jarihill	756.6	216.8	973.4
154	Jenabil	35645.2	-	35645.2
155	Jerkani	35645.2	609.1	36254.3
156	Jerki	68.7	133.9	202.6
157	Jhilidam	-	1065.2	1065.2
158	Jhinkpahadi	-	777.9	777.9
159	Jhumukapahadi	3425.0	270.6	3695.6
160	Jodajam	3222.7	130.8	3353.5
161	Jogibandh	-	-	0.0
162	Joka	36032.7	301.5	36334.2
163	Jualikata	-	587.8	587.8
164	Juha	368.5	98.1	466.6
165	Juna	-	581.4	581.4
166	Jurunda	35645.2	-	35645.2
167	Kadadiha	-	3.7	3.7
168	Kadamdiha	35645.2	-	35645.2
169	Kadapani	12.9	-	12.9

170	Kadatamak	4944.7	11.4	4956.1
171	Kalabadia	-	-	0.0
172	Kalapathar	-	0.7	0.7
173	Kalasibhanga	4179.0	213.7	4392.7
174	Kalliami	-	582.1	582.1
175	Kamalpur	-	634.8	634.8
176	Kanchhinda	84.4	753.4	837.8
177	Kandalia	-	865.5	865.5
178	Kanimahuli	-	71.4	71.4
179	Kanjiasol	-	1.6	1.6
180	Kankadabeda	3425.0	70.6	3495.6
181	Kankadabeda hill	3425.0	41.0	3466.0
182	Kantapal	-	580.7	580.7
183	Kantasala	-	129.5	129.5
184	Kapadiha	196.6	0.0	196.6
185	Karanjiapal	-	583.6	583.6
186	Karkachia	35645.2	-	35645.2
187	Kasiabeda	1711.3	262.3	1973.5
188	Kasipani	153.6	56.1	209.7
189	Kasipanihillblock	924.7	78.4	1003.1
190	Kathruma	-	56.7	56.7
191	Kendudiha	-	-	0.0
192	Keshargadia	1559.8	11.1	1570.8
193	Ketabeda	754.0	22.2	776.2
194	Khadambeda	305.6	16.4	322.0
195	Khadighati	35660.3	-	35660.3
196	Khadikasul	-	666.6	666.6
197	Khadkei	35651.5	-	35651.5
198	Khairabani	-	580.7	580.7
199	Khandipal	-	580.7	580.7
200	Khejurijharan	-	-	0.0
201	Kitabeda	36210.3	140.7	36351.0
202	Koilisuta	-	-	0.0
203	Kripaduma	-	722.7	722.7
204	Krushnachandrapur	-	580.7	580.7
205	Kudiapal	-	976.5	976.5
206	Kukudaanda	3425.0	130.8	3555.8
207	Kukurbhuka	35771.2	636.1	36407.4
208	Kulapathar	4835.8	130.8	4966.6
209	Kulgidihi	377.1	513.9	891.0
210	Kumbharmundha	-	66.8	66.8
211	Kumbhirmundi	878.4	661.3	1539.6
212	Kundalbani	398.4	69.6	468.0
213	Kurukutia	-	170.7	170.7
214	Kusumbandha	-	744.1	744.1

215	Kusumtota	35645.2	24.2	35669.4
216	Labania	-	15.0	15.0
217	Lado	3495.4	-	3495.4
218	Ladohill	3425.0	-	3425.0
219	Lakhanchhatar	3425.0	119.5	3544.5
220	Laxmiposi	-	733.3	733.3
221	Lembujharan	35645.2	-	35645.2
222	Mahespur	1183.9	20.2	1204.0
223	Mahilalpur	-	580.7	580.7
224	Mahiralpur	-	-	0.0
225	Mahulbarei	300.5	2.1	302.6
226	Mahuli	-	38.0	38.0
227	Mahulisul	-	-	0.0
228	Mahupahadi	-	252.0	252.0
229	Majhigan	-	648.3	648.3
230	Makabadi	35710.5	11.7	35722.1
231	Makhuna	101.4	554.9	656.3
232	Malidihi	-	-	0.0
233	Manda	-	130.8	130.8
234	Manikpur Hill	1533.3	-	1533.3
235	Mankadkenda	35645.2	1.0	35646.2
236	Manoharpur	-	583.6	583.6
237	Masinabila	35984.6	70.7	36055.4
238	Matikhani	-	31.5	31.5
239	Mohanala	-	-	0.0
240	Mohanpur	36523.6	-	36523.6
241	Mundhabani	-	174.3	174.3
242	Mundhakata	3523.2	0.0	3523.2
243	Musamari	-	-	0.0
244	Naana	35760.6	580.7	36341.3
245	Nafri	-	993.0	993.0
246	Naikali	-	-	0.0
247	Nakhura	-	580.7	580.7
248	Nalhua	-	637.4	637.4
249	Nangalkatapokharia	49.5	545.8	595.4
250	Nayabasan	-	580.7	580.7
251	Nayadasisul	1275.9	3.0	1278.8
252	Nikhirda	35820.1	-	35820.1
253	Nischinta	1275.9	669.1	1945.0
254	Nitai	3222.7	130.8	3353.5
255	Nuagan	-	16.3	16.3
256	Osadala	35826.9	581.5	36408.3
257	Pahadpur	3519.7	114.0	3633.7
258	Paktia	1020.7	-	1020.7
259	Palasbani	-	264.2	264.2

260	Panasdiha	-	1254.1	1254.1
261	Panchudahan	35645.4	-	35645.4
262	Pandrabandha	-	-	0.0
263	Pandubadi	-	-	0.0
264	Panduda	132.6	22.4	155.0
265	Pandupani	4376.4	21.3	4397.7
266	Panisiali	-	5.6	5.6
267	Pankhi	127.6	513.9	641.5
268	Patbeda	-	240.1	240.1
269	Patharghera	-	92.9	92.9
270	Pathuri	-	584.1	584.1
271	Patihinja	-	59.9	59.9
272	Pimpudijharan	1020.7	53.9	1074.6
273	Pindargadia	1275.9	597.3	1873.2
274	Pokharia	124.4	-	124.4
275	Pratappur	-	24.3	24.3
276	Punasia	-	38.0	38.0
277	Purunabalichua	35981.9	10.5	35992.4
278	Purunapani	35645.2	628.7	36273.9
279	Purusotampur	-	500.1	500.1
280	Rajabasa	39499.5	9.2	39508.7
281	Ramharipur	-	50.6	50.6
282	Ranasul	-	-	0.0
283	Randasahi	-	-	0.0
284	Rangamatia	3425.0	863.7	4288.7
285	Rayan	-	-	0.0
286	Rengalbeda	35645.2	145.1	35790.3
287	Sadheikala	-	649.0	649.0
288	Sagunasul	-	40.6	40.6
289	Salabani	-	582.5	582.5
290	Salghati	-	41.4	41.4
291	Sanbalichua	36125.9	-	36125.9
292	Sandim	-	-	0.0
293	Sankhabhanga	3222.7	132.3	3355.0
294	Sankucha	-	1.7	1.7
295	Sannedam	35645.2	182.6	35827.8
296	Sanpatharakham	233.7	0.6	234.3
297	Sapaghera	1533.3	-	1533.3
298	Saragchhida	-	1.0	1.0
299	Saranda	3425.0	190.8	3615.8
300	Saranda Bisoi Hill	4984.7	22.1	5006.9
301	Saranda Bisoihill	4966.8	603.6	5570.3
302	Sarasposi	-	19.0	19.0
303	Sarbania	878.4	651.7	1530.1
304	Sargoda	79.8	191.7	271.5

305	Saripada	-	587.8	587.8
306	Sarlihill	3487.4	253.6	3741.0
307	Sarpankha	-	637.4	637.4
308	Saruda	35645.2	20.0	35665.2
309	Sasadapal	-	633.8	633.8
310	Satbhaya	-	7.5	7.5
311	Shyamsundarpur	-	582.5	582.5
312	Sialjodi	-	580.7	580.7
313	Sikarbhangha	-	-	0.0
314	Silphodi	-	-	0.0
315	Silpunji	-	601.1	601.1
316	Simila	-	1.6	1.6
317	Similipal	35723.3	20.9	35744.2
318	Sirasahi	1275.9	-	1275.9
319	Sitaldhar	-	-	0.0
320	Sorisapal	-	704.5	704.5
321	Srichandanpur	-	137.0	137.0
322	Sukhuapara	-	605.0	605.0
323	Sunamuhin	-	606.7	606.7
324	Sunaposi	-	642.6	642.6
325	Sundhisahi	1275.9	678.0	1953.9
326	Talabharadasol	-	242.1	242.1
327	Talatikiri	-	130.8	130.8
328	Talbandh	35645.2	0.6	35645.8
329	Taltikiri	-	-	0.0
330	Tambahill	754.0	2.0	756.0
331	Tangiabasa	-	650.7	650.7
332	Tanguru	1519.7	-	1519.7
333	Taradapal	-	604.8	604.8
334	Tarana	3222.7	-	3222.7
335	Tiakati	4472.3	130.8	4603.1
336	Tiakati hill	4445.7	13.0	4458.7
337	Tila	-	39.1	39.1
338	Tilow	-	130.8	130.8
339	Titiri	-	605.0	605.0
340	Tulasibani	136.7	217.1	353.8
341	Uania	-	580.7	580.7
342	Udali	-	683.3	683.3
343	Unchadiha	-	-	0.0
344	Uperbeda	124.4	130.8	255.1
345	Uperbharadasul	-	243.1	243.1

As 39499.5 ha of forest land is available in Rajabasa village but there is no forest growth, it is proposed to block plantation of 50 Ha in this village. The detailed estimate is enclosed at **Annexure-2.**

7.3 Fodder land development

To minimize the pressure on forest for grazing, it is suggested to develop fodder land in the Watershed. Looking at the availability of Gochar land and population, it is proposed to develop Gochar land for fodder development. The detail estimate is given at **Annexure-3.**

7.4 Loose Boulder Wall-gully plugging In Small Hilly Streams

Gully Erosion, including ephemeral gully erosion, refers to the cutting of narrow channels resulting from concentration of sheet and rill flow of runoff water. Ephemeral gullies are small channels of approximately 3 to 12 inches deep. Gullies may be one to several feet deep. Gully erosion occurs when rill erosion is neglected. The tiny grooves develop into wider and deeper channels, which may assume a huge size. This state is called 'gully' erosion. Gullies are the most widen with every heavy rainfall.

Gully plugging work is required for reduction of runoff velocities within permissible limits and for controlling gully erosion of micro-watershed.

Appropriate gully plugging work would be selected from bush/wood check dam, Pall-siding works, gabion, structure, sunken pits etc.

A provision is kept for three numbers of gully plugging in the hilly streams. Estimate at **Annexure-4.**

7.5 Stone masonry check dams – in major drains

Check dams range in size, shape and cost. It is possible to build them out of easily available materials and even at a very little cost. Decision of building such a dam depends on its location. Essentially a check dam has an earthen dam and masonry spillway.

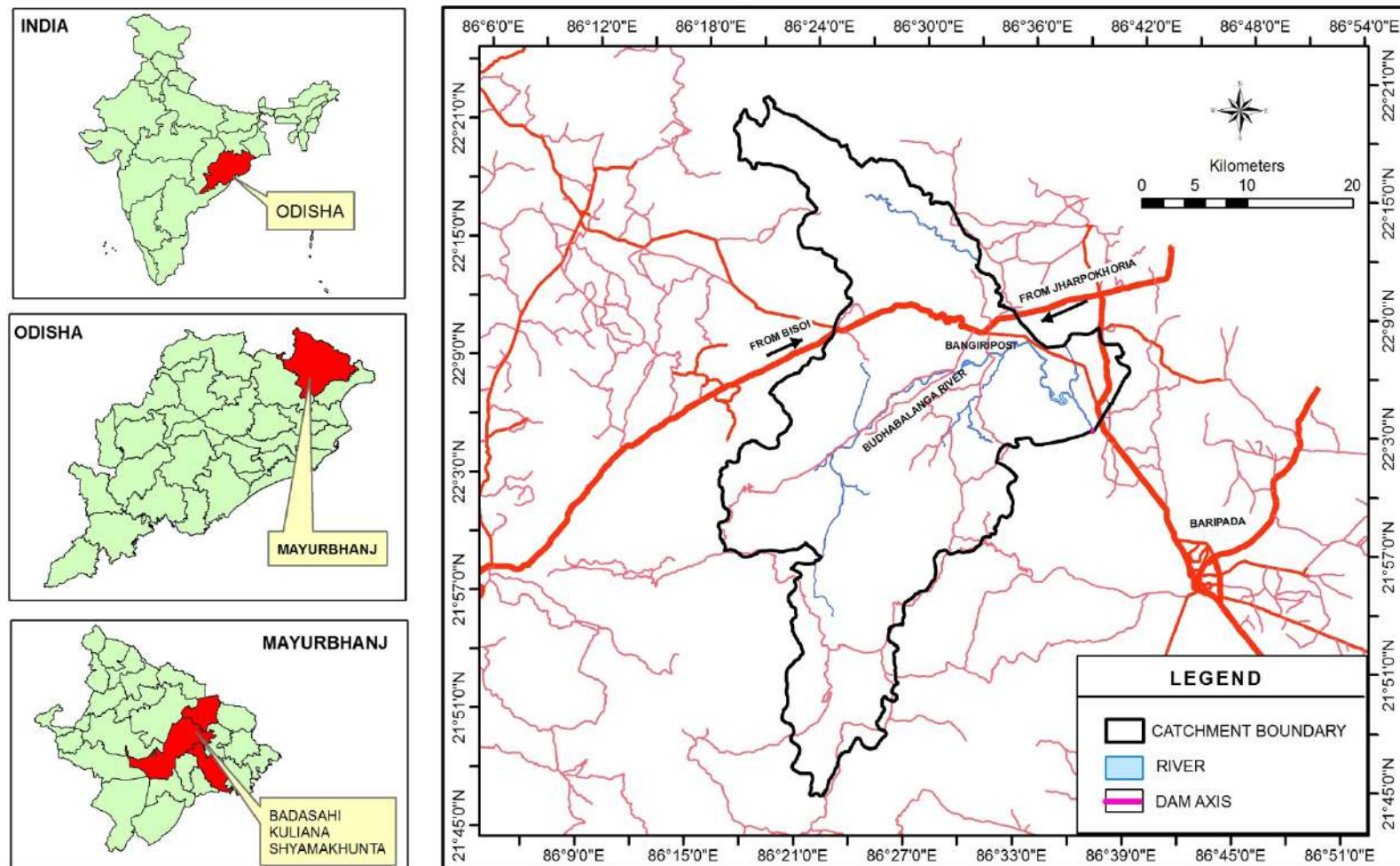
It cuts the velocity and reduces erosive activity. The stored water improves soil moisture of the adjoining area and allows percolation to recharge the aquifers Spacing between the check dams should be such that water spread of one should be beyond the water spread of the other Height depends on the bank height, varies from 1 meter to 3 meter and length varies from less than 3m to 10 m.

The typical Estimate of earthen check dam with concrete core is depicted at **Annexure-5.**

The location of proposals for all treatments other than ANR activities are depicted in **Plate-13.** The detail year wise cash flow estimate is depicted at **Annexure-6.**

**CATCHMENT AREA TREATMENT PLAN
BUDHABALANGA BARRAGE PROJECT, MAYURBHANJ, ODISHA
LOCATION MAP**

PLATE - 13



Cost Estimate

Sl No	Item	Rate in Rs.	Unit	Physical	Cost (Rs. In Lakh)
Biological Measure					
1	Afforestation including maintenance	85,824	Ha	50	42.91
2	Enrichment of plantation / Re-densification	29,170	Ha	50	14.59
3	Fodder land development per 10 ha	15,05,000	Ha	40	60.20
Engineering Measure					
4	Loose Boulder wall gully plugging	3,318	No	5	0.17
5	Masonry stone Check Dam	2,14,650	No	5	10.73
	Total				128.60

Total cost of Biological, Engineering measure an site observation at site = Rs 128.60 lakh

Micro Planning Cost @ 5% = Rs 6.43 Lakh

Sub Total = **Rs 135.03 Lakh**

Contingency cost @ 5% = Rs 6.75 Lakh

Sub Total = **Rs 141.78 lakh**

Administrative Expenditure @ 12% = Rs 17.01 Lakh

Total = **Rs 158.79 Lakh**

Annexure-1

**COST NORM FOR AIDED NATURAL REGENERATION (ANR) @ 200 PLANTS PER
HECTRE WAGE RATE Rs.311/- PER DAY**

SL NO	Items of work	Person days	Labour (Rs.)	Material (Rs.)	Total (Rs.)
1	2	3	4	5	6
0th YEAR					
1	Survey, Demarcation & Pillar posting ,GPS reading with mapping	2	622	0	622
2	Site preparation	2	622	0	622
3	Silvicultural Operation including clearance of weed, climber cutting, high stump cutting, singling of shoots etc.	5	1555	0	1555
4	Nursery cost (6 months old seedling) part @ Rs.9.45/- seedling (Rs. 6.67 in 0 th year + Rs.2.78 in 1 st year) for 220 seedlings(200+20)	5.5	1710.5	367	2077.5
5	Contingency and Unforeseen Expenditures	0	0	133	133
TOTAL		14.5	4509.5	500	5009.5
1st YEAR OPERATION					
1	Nursery cost(6 month old seedling)Balance @ Rs.2.78 for 220 seedlings	2.5	777.5	112	889.5
2	Pitting 30 cm cube size	6	1866	0	1866
3	Carriage & Planting including Casualty Replacement	5	1555	0	1555
4	Complete weeding, Soil working, Manuring	6	1866	0	1866
5	Cost of vermin compost@ 200gms/plant @Rs.20/-per Kg= Rs. 800.00 and Granular Insecticide % gms/Plant @ Rs.80/-per Kg=Rs.80.00	0	0	880	880
6	Cost of Chemical Fertilizer	0	0	324	324
	(a) Urea 70 gms/plant in two subsequent doses @Rs. 6/-per Kg= Rs.84.00				
7	Silvicultural Operation involving clearance of weeds, climber cutting, singling of shoots etc.	15	4665	0	4665
8	Soil Conservation Measures (Staggered Trenches of Dimension 2m× 0.5 m ×0.5 m @60 nos per ha)or its equivalent.	20	6220	0	6220

9	Fire line Tracing & Inspection Path	3	933	0	933
10	Watch & ward	7	2177	0	2177
11		0	0	304	304
TOTAL		64.5	20059.5	1620	21679.5
2nd YEAR MAINTENANCE					
1	Casualty Replacement including cost of seedling, carriage and planting	1	311	189	500
2	Completing weeding and cultural operations	2	622	0	622
3	Soil working and manuring	2	622	0	622
4	Cost of fertilizer and insecticide	0	0	800	800
	(a) Vermi compost 200 gms/plant @200 nos of plants/per Kg = 40 Kg @Rs.20.00= Rs.800.00				
	(b) Granular Insecticide 5 gms/plant for 200 plants 1000 gms @ Rs.80/-per Kg= Rs.80.80				
5	Soil Conservation Measures (Renovation of staggered trenches etc.)	8	2488	0	2488
6	Fire line Tracking and Inspection Path	1	311	0	311
7	Watch & Ward(whole year)	7	2177	0	2177
8	Contingency and Unforeseen Expenditures	0	0	181	181
TOTAL		21	6531	1170	7701
3rd YEAR MAINTENANCE					
1	Complete weeding and Cultural operations	1	311	0	311
2	Soil working	1	311	0	311
3	Fire line Tracing and Inspection Path	1	311	0	311
4	Watch & Ward(whole year)	7	2177	0	2177
5	Contingency and Unforeseen Expenditures	0	0	200	200
TOTAL		10	3110	200	3310
4th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection Path	1	311	0	311
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933
5th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection	1	311	0	311

	Path				
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933
6th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection Path	1	311	0	311
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933
7th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection Path	1	311	0	311
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933
8th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection Path	1	311	0	311
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933
9th YEAR MAINTENANCE					
1	Fire line Tracking and Inspection Path	1	311	0	311
2	Watch & Ward and Cultural Operations	2	622	0	622
TOTAL		3	933	0	933

ABSTRACT

SL NO	Item of work	Person days	Labour (Rs.)	Material (Rs.)	Total Cost (Rs.)
1	0 th Year	14.5	4509.5	500	5009.5
2	1 st Year	64.5	20059.5	1620	21679.5
3	2 nd Year	21	6531	1170	7701
4	3 rd Year	10	3110	200	3310
5	4 th Year	3	933	0	933
6	5 th Year	3	933	0	933
7	6 th Year	3	933	0	933
8	7 th Year	3	933	0	933
9	8 th Year	3	933	0	933
10	9 th Year	3	933	0	933
Total		128	39808	3490	43298

COST NORM FOR BLOCK PLANTATION@1600 PLANTS PER HECTRE
WAGE RATE Rs.311/-PER DAY

SL NO	Items of work	Person days	Labour (Rs.)	Material (Rs.)	Total (Rs.)
1	2	3	4	5	6
0th YEAR (advance work) PRE-PLANTING OPERATION					
1	Survey, Demarcation & Pillar posting	2	622	0	622
2	Site preparation	8	2488	0	2488
3	Alignment & Stacking of pits	2	622	0	622
4	Digging of pits(30 cm cube)	40	12440	0	12440
5	Nursery cost(6 month old seedling)part @Rs.9.45/-seedling (Rs.6.67 in 0 th year +Rs.2.78 in 1 st year) for 1760 seedlings(1600+160)	44	13684	2939	16623
TOTAL		96	29856	2939	32795
1st YEAR OPERATION					
6	Nursery cost(6 month old seedling)Balance @ Rs.2.78 for 1260 seedlings	21.5	6686.5	593	7279.5
7	Carriage & Planting including Casualty Replacement and application of insecticide, manure etc.	21	6531	0	6531
8	Cost of insecticide & fertilizer	0	0	3232	3232
	(a) NPK @ 50 gms/plant as basal dose = 80 Kg @ Rs. 24/-per Kg= Rs. 1920.00				
	(b) Ureas @ 70 gms/plant in two subsequent doses @ Rs. 6/- per Kg= Rs. 672.00				
	(c) Granular insecticide (Themet, foeate etc.)@ 5 gms/plant @ Rs. 80/-per Kg= Rs.640				
9	1 st weeding (complete wedding)	7	2177	0	2177
10	Manuring Urea 35 gms	5	1555	0	1555
11	2 nd weeding (complete wedding)	5	1555	0	1555
12	Soil working (50 cms. Radius around plants) & manuring Urea 35 gms per plant	7	2177	0	2177
13	Soil Conservation Measures in the form of Staggered Trenches of size 2m× 0.5 m ×0.5 m @30 nos per ha	10	3110	0	3110
14	Fire line Tracing & Inspection	3	933	0	933

	Path				
15	Watch & ward	7	2177	0	2177
TOTAL		86.5	26901.5	3825	30726.5
2nd YEAR MAINTENANCE					
16	Casualty Replacement (10%) with nursery cost	4	1244	1512	2756
17	Weeding Complete weeding	6	1866	0	1866
18	Cost of fertilizer (NPK @70 gms/plant)for 1600 plants = 112 Kg @Rs.24/per Kg and	0	0	3328	3328
	Insecticide@ 5 gms/plant for 1600 plants 8Kg@ Rs.80/per Kg		0		0
19	Soil working(50 Cms. Radius around plants)	7	2177	0	2177
20	Application of fertilizer & Insecticide	4	1244	0	1244
21	Fire line Tracing (2 m, Wide fire line over 400 m long)	3	933	0	933
22	Watch &Ward(whole year)	15	4665	0	4665
TOTAL		39	12129	4840	16969
3rd YEAR MAINTENANCE					
23	Weeding and Application fertilizer	7	2177	0	2177
24	Cost of fertilizer (NPK @50 gms/plant)@ Rs.24/- per Kg	0	0	1920	1920
25	Soil working(50 Cms. Radius around plants) & Application of fertilizer	7	2177	0	2177
26	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
27	Watch &Ward	15	4665	0	4665
TOTAL		32	9952	1920	11872
4th YEAR MAINTENANCE					
28	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
29	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598
5th YEAR MAINTENANCE					
30	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
31	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598
6th YEAR MAINTENANCE					

32	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
33	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598
7th YEAR MAINTENANCE					
34	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
35	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598
8th YEAR MAINTENANCE					
36	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
37	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598
9th YEAR MAINTENANCE					
38	Fire line Tracing (2 m, Wide fire line over 400 m long)and cultural operation	3	933	0	933
39	Watch &Ward	15	4665	0	4665
TOTAL		18	5598	0	5598

ABSTRACT

SL NO	Year	Person days	Labour Cost @ Rs.311/- Per Day	Material Cost (Rs.)	Total Cost (Rs.)
1	0 th Year	96	29856	2939	32795
2	1 st Year	86.5	26901.5	3825	30726.5
3	2 nd Year	39	12129	4840	16969
4	3 rd Year	32	9952	1920	11872
5	4 th Year	18	5598	0	5598
6	5 th Year	18	5598	0	5598
7	6 th Year	18	5598	0	5598
8	7 th Year	18	5598	0	5598
9	8 th Year	18	5598	0	5598
10	9 th Year	18	5598	0	5598
Total		361.5	112426.5	13524	125950.5

Annexure-3

Cost estimates of Grassland Development Including Grass for one unit (10 Hectare) Rupees in Lakh

As per Guideline of Dept. of Animal Husbandry and Dairying (2007)

SL	Item	CPR, Gochar land/community land/Waste land which does not need treatment of soil
1. Capital Investment		
A	Demarcation of boundary, fencing/trench/brushwood/barbed wire	0.75
B	Land Development(10 hectares)@10 lakhs pr ha.(including soil treatment and weeding)	1
C	Farms sheds- for equipment, seed , manure, and office	1.5
D	Purchase of agriculture implements	0.5
E	Creation of Irrigation facilities: wells, pumps, power line, water tank, pump room, pipelines etc	3
	Sub Total	6.75
2. Recurring Expenditure		
A	Wages of supervisory staff	0.24
B	Seeds, fertilizer/manure, insecticides	0.4
C	Cultivation charges	0.5
D	Irrigation electricity/fuel charges	0.3
E	Maintenance of store/dead stock	0.3
F	Maintenance of store/dead stock	0.3
	Sub Total	2
	Grand Total	8.75
	Add for inflation of 9 years @8% per annum = $8.7.7 \times 9 \times 8\%$	6.3
	Total	15.05

Annexure-4

(Gully with 1.3 m width, 0.6 m bottom width and depth 0.6m)

**As per manual on land and water management of Orissa Tribal Empowerment &
Livelihoods Program 2010**

SI No	Details of work	Man Days	RATE	AMOUNT IN Rs.
1	Survey, alignment, demarcation	1	311	311
2	Earth work excavation in stony earth mixed with gravel within initial lead and lift	1.747	311	543.317
	Edging out of gully $2 \times 0.5 \times 0.85 \times 2.25 \times 0.6 = 1.15$			
	Foundation for stone packing $1 \times 2.33 \times 1.8 \times 0.3 = 1.24$			
	D/S guard wall $1 \times 1.3 \times 0.5 \times 0.6 = 0.39$			
	Side wall $2 \times 2.13 \times 0.5 \times 0.3 = 0.64$			
	Total = 3.42			
3	a. Dry stone packing in the foundation of structure	2.6 MD	311	808.6
	U/S dumping (deflected by 45 deg.)	Material	900*	1800
	$1 \times \{(1.3 + 2.2)/2\} \times 0.45 \times 0.3 = 0.24$ Head wall and D/S	2		
	Dumping $1 \times 1.3 \times 0.9 \times 0.3 = 0.35$ Apron	Tractor		
	$1 \times 1.3 \times 0.9 \times 0.3 = 0.35$ side walls	load		
	$2 \times 3.95 \times 0.5 \times 0.33 = 1.19$ D/S guard wall			
	$1 \times 1.3 \times 0.5 \times 0.6 = 0.39$			
	b. Dry stone packing in super structure			
	U/S dumping $1 \times \{(3.2 + 2.3)/2\} \times 0.45 (0.45 + 0)/2 = 0.27$ D/S			
	dumping $1 \times 2.3 \times 0.45 \times (0.45 + 0.2)/2 = 0.333$ Head wall			
	$1 \times 2.3 \times 0.45 \times 0.45 = 0.47$ Apron $1 \times 0.9 \times 1.3 \times 0.15 = 0.18$ side walls $2 \times 3.954 \times 0.5 \times 0.3 = 1.30$			
	Total(a+b)=5.07			
4	Earth work in hard soil for side bund of 10m length in both side of structure $2 \times 10 \times \{(1.05 + 0.45)/2\} \times 0.3 = 4.5 - 3.42 = 1.08$ i.e excavated earth in the foundation will be adjusted for the side bund	0.6	311	186.6
5	Fine dressing and turfing locally available grass within initial lead and lift both side slopes $2 \times 10 \times 0.42 = 8.40$ Top $1 \times 10 \times 0.45 = 4.50$ for no. bunds $2 \times 12.90 = 25.80$ sq m	0.8	311	248.8
6	Vetiver plantation with locally collected vetiver sleeves in D/S of the structure with spacing (0.23×0.23) sq m over .3 mt span and 1.0 mt width of 3 rows including foliar spraying with Urea. No .of sleeves required $= (0.23 \times 0.23) \times 3 = 330$ nos.	0.2	311	62.2
7	Contingency and unforeseen charges			130
	Total			4090.517

Note: Labour rate revised from 280 to 298 and tractor load rate increased by 50% for inflation rate of 8%? For 6 years

Earthen Check Dam, 10 m with Concrete Core Wall**As per Manual on Land and Water Management of Odisha Tribal Empowerment &****Livelihoods Program 2010**

Labour Cost (A)			
Ordinary Labour	310 Mandays	Rs. 311.00	Rs. 96,410.00
Skilled Labour (Mason etc)	15 Mandays	Rs. 338.00	Rs. 5,070.00
Total			Rs. 97,450.00
Material Cost (B)			
Cement	230 Bags	Rs. 360.00	Rs. 82,800.00
Sand	15 Truck	Rs. 1,370.00	Rs. 20,550.00
Brick	2500 Nos	Rs. 15.00	Rs. 37,500.00
Aggregate (40mm)	5 Truck	Rs. 6,000.00	Rs. 30,000.00
Bamboo	60 Nos	Rs. 160.00	Rs. 9,600.00
Total			Rs. 1,80,450.00
Grand Total (A+B)			Rs. 2,81,930.00

Note: Material rate increased by 50% for inflation rate of 8% for 6 years

Annexure-6

Year wise Cash Flow

[illegible]