



**Monitoring report form
(Version 03.1)**

Monitoring report

Title of the project activity	Reforestation of degraded land by MTPL in India
Reference number of the project activity	UNFCCC00005016CDMP
Version number of the monitoring report	08, (Identified as MR8)
Completion date of the monitoring report	17/06/2013
Registration date of the project activity	01/08/2011 (<i>Date of registration action 17/10/2011</i>)
Monitoring period number and duration of this monitoring period	First Monitoring Period 25/06/2001 to 24/06/2011 (first and last days included)
Project participant(s)	M/s Mangalam Timber Products Limited
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 14 AR-ACM0001 (Version 04) – Afforestation & Reforestation of degraded land.
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	4,210,087 tCO₂e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	1,764,076 tCO₂e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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1. Purpose of the project activity:

The proposed CDM project activity by Mangalam Timber Products Limited (MTPL) involves carbon sequestration of degraded land through reforestation activities. Small and discrete parcels of degraded land which was lying barren since decades have been reforested under the project activity. The land is owned by poor and illiterate farmers & tribal having no assured source of income to meet even their daily needs. They do not have the capability of growing plantation of their own without any external financial support and technical guidance. They were not able to invest for plantation without any immediate return.

With the reforestation activity the farmers have been able to generate some income from their barren land through sale of harvested timber. MTPL purchased the harvested timber from farmers at prevailing market price at the time of harvest.

Most importantly the revenue earned from trading of carbon credits of the project will also be shared with the participating farmers which will be additional income to them over and above sale proceeds of timber.

The project has not only benefited the participating farmers with sale proceeds of timber but also to the local community in terms of employment generation for associated silviculture activities like site preparation, raising seedling nursery, seedling transportation, planting, fencing, supply of manure and fertilizer etc.

Moreover, in absence of project activity the land would have continued as degraded land or degrading would have continued further. The reforestation activity prevents soil erosion, improves soil stabilization and increase soil organic matter and soil fertility, thus contributing towards environmental well-being of the local area.

Thus the project activity not only helps in carbon sequestration through tree planting but also has resulted into poverty alleviation of the participating farmers & local community, biodiversity conservation and soil erosion control, thus contribute to sustainable development.

2. General description of the project activity:

The reforestation under the project activity was started on 25.06.2001 as per registered PDD. The project was completed when 12437 small & discrete parcels of degraded land owned by 12002 farmers were reforested till 2007. The project area is distributed in seven districts across three states Orissa, Andhra Pradesh and Chattisgarh, majority being in Orissa which constitutes almost 83% area of the project, 14% in Andhra Pradesh and only 3% in Chhatishgarh.

The farmers participating in the reforestation activity are small and marginal farmers mostly owning small parcels of land where almost 92% farmers holding 5 acres or less out of which 60% are having 3 acres or less. Merely 8% farmers are holding more than 5 acres of among which only 1% above 10 acres.

The project was implemented through farm forestry scheme under a tripartite agreement entered into between the farmers investing their land & effort, the bank extending finance to the farmers and MTPL as a facilitator in the scheme on mutually agreed terms wherein the obligations of all the three parties are clearly stated. MTPL agreed to supply good quality of seedlings and fertilizers on competitive price to farmers, ensured free replacement of moratorium and provided technical, assistance and services relating to planting and maintenance. The company also agreed to assist farmers to obtain no objection certificate for plantation, felling, cutting and billeting of trees and transportation of timber from competent authority of the forest department and purchased harvested timber at prevailing market price.

The farmers agreed for tree planting on their degraded land, their upkeep for proper growth and protection form illegal felling. They also agreed to deposit the title deed of the land with bank as security till the entire loan with accrued interest is paid back. For transparency, all loans were disbursed to the farmers through Saving Bank account opened in their name at respective branch of financing banks.

The farmers individually authorized MTPL to claim carbon credit on their behalf and the company agreed to share a part of carbon revenue with them. A separate authorization letter has been signed by all the participating farmers individually.

The species selected for sequestration is Eucalyptus (*E. tereticornis*) which is a fast growing species belonging to Myrtaceae of Angiospermae family. This hybrid manifests good hybrid vigour for growth and volume production. It was selected for its coppicing and drought resistant quality. The species has far greater rooting depth of 3 metres and offers greater capillary action. There is also a considerable increase in the water holding capacity of the soil.

Small pits (40-45 cm in diameter and 30-35 cm in depth) are dug manually for tree planting. Rows are aligned and pits are dug at different spacing of generally 3x1.5m. The plant of 30-45 cm (excluding container height) with girth of 1-2 cm at collar region is used for planting.

The trees are harvested first time normally after 5 years and subsequently thrice at the interval of 4 years. However, harvesting cycle may change depending on growth of the crops, farmers' need and local practices prevailing in the area.

The net anthropogenic GHG removal from the project activity has been 1,764,076 tCO₂e during the current monitoring period.

A.2. Location of project activity

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(a) Host Party(ies)

India (Host)

(b) Region/State/Province etc

Orissa, Andhra Pradesh, Chhatishgarh (India)

(c) City/ Town/ Community etc

The project activity is spread across seven districts in three states of India namely as below:

Orissa - Nabarangpur, Koraput & Malkangiri districts,
Andhra Pradesh - Vishakhapatnam, Vizianagaram & Srikakulam districts and
Chhatishgarh – Bastar district.

Project boundaries are geographically delineated and represented through GIS maps of each discreet parcel. The spread of parcels in each bank area is represented through GIS coordinates of the each area as under:

S No	Bank Area	No of Parcels	Unique ID No of farmers	GIS Coordinates of Bank Area			
				Latitude		Longitude	
				From	To	From	To
1.	NABARANGPUR						
1	Nandahandi	160	NNH001 to 136	19 09 22.2 N	19 17 02.3 N	82 37 01.2 E	82 46 14.8 E
2	Nabarangpur	285	NNP001 to 262	19 09 53.5 N	19 19 33.6 N	82 18 13.4 E	82 40 02.1 E
3	Sindhiguda	139	NSG001 to 130	19 09 25.3 N	19 16 09.0 N	82 31 58.0 E	82 40 26.0 E
4	Rajoda	152	NRJ001 to 148	19 08 43.0 N	19 17 02.8 N	82 09 49.2 E	82 21 23.9 E
5	Tumberla	19	NTB001 to 024	19 19 40.8 N	19 22 21.5 N	82 32 15.0 E	82 37 02.1 E
6	Kosagumuda	138	NKM001 to 136	19 08 56.8 N	19 19 12.5 N	82 08 46.9 E	82 16 48.6 E
7	Jotabal	136	NJB001 to 134	19 20 23.0 N	19 27 00.7 N	82 24 05.1 E	82 30 35.7 E
8	Kathargada	156	NKG001 to 152	19 05 07.0 N	19 10 03.6 N	82 40 59.6 E	82 46 23.8 E
9	Kumuli	207	NKL001 to 192	19 03 19.1 N	19 11 00.1 N	82 38 35.9 E	82 43 40.0 E
10	B Singpur	165	NBS001 to 157	18 58 25.8 N	19 07 43.8 N	82 35 03.9 E	82 42 22.2 E
11	Sanmosigaon	281	NSM001 to 282	19 11 47.2 N	19 19 46.1 N	82 20 26.1 E	82 29 36.7 E
12	Chalanguda	218	NCG001 to 204	19 01 59.3 N	19 12 32.8 N	82 29 51.4 E	82 39 53.7 E
13	Dhamnahandi	64	NDH001 to 061	19 04 47.7 N	19 07 50.5 N	82 16 51.9 E	82 19 13.9 E
14	Raighar	357	NRG001 to 400	19 49 19.9 N	19 58 40.8 N	81 33 01.2 E	82 45 42.8 E
15	Jharigaon	317	NJG001 to 321	19 31 57.2 N	19 45 55.0 N	82 11 26.0 E	82 27 25.2 E
16	Dhodra	207	NDD001 to 211	19 32 38.7 N	19 46 50.8 N	82 10 22.4 E	82 21 13.6 E
17	Kotagaon	183	NKT001 to 187	19 19 16.4 N	19 28 06.2 N	82 09 56.2 E	82 21 26.9 E
18	Umerkote	135	NUK001 to 144	19 37 04.1 N	19 44 07.8 N	82 04 43.3 E	82 17 10.9 E

19	Sosahandi	147	NSH001 to 141	19 00 50.0 N	19 10 23.7 N	82 26 07.1 E	82 33 37.9 E
20	Singsari	68	NSS001 to 069	19 23 01.9 N	19 35 01.4 N	82 03 42.1 E	82 21 26.8 E
21	Turudhi	55	NTD001 to 060	19 53 04.1 N	19 59 23.8 N	81 50 53.3 E	81 56 14.1 E
22	Chandili	53	NCD001 to 053	19 00 26.6 N	19 06 44.6 N	82 12 12.2 E	82 21 38.8 E
23	Kundei	30	NKN001 to 032	20 01 13.0 N	20 04 12.2 N	81 46 55.8 E	81 59 29.1 E
24	Borigumma	24	NBG001 to 025	19 00 07.1 N	19 08 25.5 N	82 34 50.1 E	82 41 41.9 E
25	Kodinga	58	NKD001 to 058	19 14 56.4 N	19 24 09.6 N	82 15 43.0 E	82 22 28.7 E
26	Tentulikuthi	198	NTK001 to 175	19 14 07.1 N	19 19 23.5 N	82 40 45.2 E	82 45 31.7 E
27	Maidalpur	115	NMP001 to 118	19 24 16.1 N	19 33 25.1 N	82 13 15.0 E	82 38 57.3 E
	Total:	4067					
2.	KORAPUT						
1	Boipariguda	317	KBG001 to 314	18 40 33.8 N	18 49 39.4 N	82 16 28.1 E	82 28 16.2 E
2	Ramgiri	287	KRG001 to 291	18 41 57.0 N	18 52 17.5 N	82 10 30.6 E	82 21 08.9 E
3	Kundra	418	KKN001 to 416	18 49 36.8 N	19 00 08.1 N	82 16 56.0 E	82 25 05.6 E
4	Digapur	357	KDG001 to 355	18 46 09.3 N	18 53 03.9 N	82 18 06.2 E	82 30 18.2 E
5	Dongerpaunsi	407	KDP001 to 399	18 50 49.5 N	19 01 00.6 N	82 21 38.3 E	82 27 39.1 E
6	Ambaguda	103	KAG001 to 100	18 56 27.9 N	19 00 22.8 N	82 30 15.1 E	82 37 54.0 E
7	Kusumi	345	KKS001 to 344	18 59 06.1 N	19 06 13.4 N	82 19 39.1 E	82 28 45.8 E
8	Phamphuni	277	KPP001 to 277	18 50 05.7 N	18 57 50.4 N	82 25 01.2 E	82 31 11.4 E
9	Nandapur	586	KNP001 to 575	18 29 03.1 N	18 44 47.9 N	82 29 35.4 E	82 53 01.6 E
10	Padwa	213	KPD001 to 238	18 16 07.2 N	18 37 45.7 N	82 34 47.7 E	82 46 53.3 E
11	Lamtaput	248	KLP001 to 262	18 29 00.4 N	18 46 14.3 N	82 30 33.3 E	82 40 03.1 E
12	Mathalput	129	KMP001 to 136	18 43 22.3 N	18 49 59.8 N	82 53 49.0 E	82 58 58.0 E
13	Jolaput	147	KJP001 to 166	18 25 16.6 N	18 31 42.2 N	82 33 32.1 E	82 39 10.9 E
14	Semiliguda	218	KSG001 to 220	18 33 02.6 N	18 42 56.2 N	82 46 11.4 E	82 56 58.1 E
15	Koraput	48	KKP001 to 057	18 47 10.8 N	18 53 10.3 N	82 38 09.9 E	82 52 43.4 E
16	Podagada	257	KPG001 to 330	18 47 35.0 N	18 56 50.3 N	82 41 00.4 E	82 59 29.8 E
17	Kakiriguma	65	KKG001 to 066	18 52 04.4 N	18 59 58.0 N	82 53 06.2 E	83 04 05.2 E
18	Dasmantpur	208	KDS001 to 223	18 58 07.7 N	19 09 29.6 N	82 49 53.3 E	83 00 05.3 E
19	Pottangi	93	KPT001 to 105	18 27 45.6 N	18 34 19.0 N	82 51 39.1 E	83 00 11.1 E
20	Sunki	141	KSN001 to 178	18 22 38.1 N	18 30 43.4 N	82 55 22.2 E	83 04 05.1 E
21	Jeyapore	82	KJR001 to 081	18 54 04.0 N	18 59 26.7 N	82 29 17.0 E	82 35 40.0 E
22	Sunabeda	43	KSB001 to 043	18 38 34.6 N	18 45 27.0 N	82 45 30.2 E	82 53 37.3 E
23	Onkadili	11	KOD001 to 011	18 30 01.5 N	18 34 29.1 N	82 25 09.0 E	82 27 01.0 E
	Total:	5000					
3.	MALKANGIRI						
1	Pangam	90	MPG001 to 091	18 22 58.1 N	18 33 34.8 N	82 01 43.4 E	82 10 03.2 E
2	Maithili	144	MML001 to 157	18 28 51.0 N	18 36 52.2 N	82 04 29.0 E	82 13 30.2 E
3	Malkangiri	254	MMG001 to 253	18 19 50.8 N	18 29 37.6 N	81 55 17.3 E	82 06 15.2 E
4	Kudumulguma	26	MKG001 to 034	18 15 31.4 N	18 26 22.0 N	82 05 29.6 E	82 11 23.8 E
	Total:	514					
4.	VISAKHAPATNAM						
1	Arkuvalley	746	VSA001 to 1316	18 10 22.6 N	18 23 20.4 N	82 01 28.9 E	83 10 41.2 E
2	Kinchunman da	750	VSK001 to 1099	18 08 34.9 N	18 26 37.8 N	82 39 49.9 E	82 52 49.8 E
3	Paderu	409	VSP001 to 1219	18 01 19.5 N	18 12 43.9 N	82 32 24.7 E	82 50 51.7 E
	Total:	1905					
5.	VIZIANAGARAM						
1	Sallur	54	VZS001 to 096	18 24 58.5 N	18 31 24.8 N	83 00 12.0 E	83 11 48.1 E
2	Gajpatinagar am	2	VZG001 to 002	18 30 54.2 N	18 31 05.6 N	83 07 31.3 E	83 07 39.7 E
	Total:	56					
6.	SRIKAKULAM						
1	Kottur	73	SKT001 to 081	18 37 33.4 N	18 43 23.58 N	83 46 34.9 E	83 49 23.9 E
2	Veergatham	220	SVG001 to 308	18 40 10.4 N	18 46 24.8 N	83 35 56.0 E	83 41 38.0 E
3	Palkonda	53	SPK001 to 058	18 32 06.7 N	18 44 14.7 N	83 41 59.6 E	83 52 00.4 E
4	G L Puram	5	SGL001 to 005	19 02 23.9 N	19 03 11.2 N	83 33 35.4 E	83 39 51.1 E
	Total:	351					
7.	BASTAR						
1	Bastar	351	BBS001 to 351	19 06 17.7 N	19 19 05.5 N	81 45 20.9 E	81 59 45.3 E

2	Lohaniguda	90	BLH001 to 090	19 04 48.3 N	19 16 05.5 N	81 35 01.9 E	81 57 35.2 E
3	Bhanpuri	44	BBH001 to 044	19 17 02.4 N	19 21 07.4 N	81 43 11.5 E	81 48 38.7 E
4	Kesharpal	38	BKP001 to 038	19 20 04.0 N	19 25 25.9 N	81 43 52.9 E	81 54 51.7 E
5	Bokaband	12	BBK001 to 012	19 14 08.7 N	19 14 38.7 N	82 03 29.5 E	82 06 06.5 E
6	Bojawand	9	BBJ001 to 009	19 12 54.6 N	19 13 49.3 N	82 07 07.0 E	82 09 23.6 E
	Total:	544					
	Grand Total:	12437	Parcels				

A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	M/s Mangalam Timber Products Limited (Private Entity)	No

A.4. Reference of applied methodology

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Methodology applied AR-ACM0001 (Version 04) – “Afforestation and reforestation of degraded land.”

Besides above, following methodological tools and EB decisions were applied / referred in the project activity:

S No	Tools used	Version No
1	“Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities”	01
2	“Tools for the identification of degraded or degrading lands for consideration in implementing A/R CDM project activities”	01
3	“Calculation of the number of sample plots for measurements within A/R CDM project activities”	02.1.0
4	“Estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity”	02
5	“Procedure to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities”	01
6	“Estimation of GHG emission due to clearing, burning and decay of existing vegetation attributable to a CDM A/R project activity”	03
7	Estimation of non-CO ₂ GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity	04.0.0
8	“Tool for testing significance of GHG emissions in A/R CDM project activities”	01
9	Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities	01.1.0
10	Tool for “Demonstrating appropriateness of volume equations for estimation of aboveground tree biomass in A/R CDM project activities.” (EB 67, Annex 24)	01.0.1

EB Decisions Referred:

S No	EB meeting	Annex No	Decision	Version No

	No			
1	44	16	Guidance on the application of the definition of project boundary to A/R CDM project activities	1.0
2	54	34	Procedures for requests for issuance of CERs	01.1
3	65	5	Clean Development Mechanism Project Standard	1
4	66	24	Guidelines on accounting of specified types of changes in A/R CDM project activities from the description in registered project design documents.	02.0
5	68	31	Guidelines on application of specified versions of A/R CDM methodologies in verification of registered A/R CDM project activities	1.01

A.5. Crediting period of project activity

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30 years of fixed crediting period starting from 25/06/2001.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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- The project was implemented over a period of 7 years. Plantation activities started on 25/06/2001 and completed in 2007, year wise details of plantation have been delineated below :

Table B.1: Year-wise plantation in different districts (All figures in hectares)

S No	State	District	2001	2002	2003	2004	2005	2006	2007	Total
1	Orissa	Nabarangpur	156.26	465.48	428.80	778.12	819.73	695.95	1115.91	4460.25
2		Koraput	361.95	517.07	723.06	1200.56	1468.48	1541.34	1399.94	7212.40
3		Malkangiri	2.37	18.33	49.48	150.61	169.84	141.34	176.03	708.00
4	Andhra Pradesh	Vishakhapatnam					215.18	734.32	900.88	1850.38
5		Vizianagaram					38.16	20.30	1.39	59.85
6		Srikakulam				34.42	210.11	6.55		251.08
7	Chhatishgarh	Bastar					102.11	260.63	64.76	427.50
		Total:	520.58	1000.88	1201.34	2163.71	3023.61	3400.43	3658.91	14969.46

- The entire reforestation under the project activity has been done using single species of Eucalyptus. 100% Eucalyptus seedlings raised in MTPL's nurseries were supplied to the farmers and planted in the fields; no other species has been used.
- The plants were generally planted at 3x1.5m spacing. However the farmers influenced by local practices, adopted differed spacing also other than the planned spacing of 3x1.5m. They planted seedlings at various other spacings like 2x2m, 2x1.5m, 1.5x1.5m and 1.5x1m. Very few adopted 2.5x1.5m, 2x1m, 1.5x1m & 1x1m also. Changes in spacing adopted are reflected in Section B.4.
- Silviculture practices have been followed to ensure proper growth of the plants. Soil working and round weeding is done after one month of plantation followed by application of fertilizer. After 3months again soil working is done around the plant with strip weeding followed by requisite fertilizer application. Soil working with strip weeding is repeated after completion of one year.
- The plantations are protected by means of live fencing upto maximum one year only to protect the small plants from animal browsing. Eucalyptus trees are not eaten by goats, buffaloes etc, therefore fencing is

not required afterwards. Accordingly the farmers ensure the fencing during first year of plantation.

6. The survival of trees was initially checked after 3 months of plantation and replantation was done where survival was less than 90%. Final survival was checked after three years of plantation.
7. Special event such as harvestation / coppicing is recorded in project data base.. Harvesting in the projected activity started from 2005. The first PSP from Strata 1 was harvested in April, 2005 and a total of 5442 parcels measuring 6597.65 ha harvested during the current monitoring period upto 24.06.2011 as summarized in the table below:

Strata No	Plantati on Year	Number of parcels/ Area harvested in each year								Not Harvstd	Total
		2005	2006	2007	2008	2009	2010	2011	Total		
Strata 1	2001	115	159	90	27	16			407	0	407
Strata 2	2002	5	60	284	272	125	20		766	0	766
Strata 3	2003		5	166	361	375	52	9	968	25	993
Strata 4	2004			9	190	729	573	72	1573	195	1768
Strata 5	2005				25	234	908	314	1481	1106	2587
Strata 6	2006					9	105	107	221	2714	2935
Strata 7	2007						17	9	26	2955	2981
Total:		120	224	549	875	1488	1675	511	5442	6995	12437
Total Area (Ha):		121.34	254.75	680.22	1003.76	1798.86	2125.93	612.78	6597.65	7929.63	14527.27

8. There has been variations in harvesting cycle of the parcels depending on growth of the crops, farmers' own need and local practices prevailing in the area. Changes in harvesting cycle are reflected in Section B.2.6.
9. Monitoring of all relevant activities of the project followed the Monitoring Plan presented in Annex 4 of the registered PDD as elaborated in section C. Records of monitoring like date of plantation, number of seedling planted, survival % and replantation, spacing, details of application of manure, fertilizer & pesticides, weeding and soil working etc have been maintained in "Sample Plot Register".
10. There has been no event or situation during the monitoring period which may impact the applicability of the methodology.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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There are no temporary deviations from registered monitoring plan or applied methodology.

B.2.2. Corrections

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There are no post registration corrections.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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There are no permanent changes from registered monitoring plan or applied methodology.

B.2.4. Changes to project design of registered project activity

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There are no changes to project design of registered project activity.

B.2.5. Changes to start date of crediting period

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There are no changes to start date of crediting period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Primarily there have been five changes from the registered PDD during implementation of the project activity specific to reforestation activity as below:

1. Change in plantation area:

The project boundary has been verified during the current verification in 2011 using GIS technique and the stratum area adjusted accordingly. The total area has reduced by 442.19 hectares compared to last GIS area in 2009 as detailed in the table below:

Table B.3: Strata wise GIS area - 2011 with adjustments						
Strata No	Year of Plantation	No of Parcels	GIS Area 2011 (Ha)	Area in Last GIS 2009 (Ha)	Adjustments (Ha)	Remarks
Strata 1	2001	407	473.29	520.58	-47.29	Reduced
Strata 2	2002	766	931.04	1000.88	-69.84	Reduced
Strata 3	2003	993	1195.85	1201.34	-5.49	Reduced
Strata 4	2004	1768	2150.64	2163.71	-13.07	Reduced
Strata 5	2005	2587	2961.32	3023.61	-62.29	Reduced
Strata 6	2006	2935	3304.89	3400.43	-95.54	Reduced
Strata 7	2007	2981	3510.24	3658.91	-148.67	Reduced
Total:		12437	14527.27	14969.46	-442.19	Reduced

Excel sheet showing the GIS area of 2011 is provided in GIS Map_2011. The project removal has been computed using the current GIS area of each stratum.

2. Change in number of PSPs:

Number of Permanent Sample Plots reduced from 1041 to 48.

The registered PDD envisages 1041 PSPs for ex-post monitoring. In an intermediate calculation during project implementation, number of permanent sample plots reduced to 244 as explained in section C. Subsequently the calculation was found erroneous during current verification since it was based on old volume equation, which was changed during verification, as well as old version of tool. As such the calculation for number of PSPs revised using new volume equation and latest version of methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" version 02.1.0 dt 26.11.10 (Annex 15 of EB 58) that reduced the required number of PSPs to 48, However it was decided to continue monitoring of all 244 PSPs and include them in Project Removal calculation to be more precise and conservative, detailed calculation provided as "Revised calculation for number of PSPs- new tool

Change in number of PSPs is allowed as per para 4, point (m) of EB 66, Annex 24.

3. Change in volume equation:

Volume equation for estimating volume of commercial component of trees changed from

$$\text{Earlier } V = -2.4726 + 0.4354 B \times H \text{ (m}^3\text{/ ha)}$$

$$(n = 125, R^2 = 0.9956)$$

$$\text{To now } V = -0.0001 + 0.31145 \times D^2 \times H \text{ (m}^3\text{)}$$

$$(n = 580, R^2 = 0.9855)$$

The volume equations has been taken from the book titled "Volume Equations for Forests of India, Nepal and Bhutan" published by Forest Survey of India, 1996. Page 226 of the book may be referred for above equations.

The appropriateness of the above volume equation has been examined using A/R Methodological Tool "Demonstrating appropriateness of volume equation for estimation of aboveground tree biomass in A/R CDM project activities", EB 67 Annex 24 . The equation has been derived from data set of n = 580 and coefficient

of determination $R^2 = 0.9855$ that qualifies the criteria laid down in para 5(c) of the tool, hence use of the said equation is fully justified for estimating tree volume.

Further change in volume equation for estimation of tree volume is allowed as per para 4, point (p) of EB 66, Annex 24

4. Change in Plant spacing:

The registered PDD envisages plantation at a spacing of 3x1.5m across the entire project area. But during implementation the farmers, influenced by local practices, adopted different spacings like 2x2m, 2x1.5m, 1.5x1.5m and 1.5x1m. Very few adopted 2.5x1.5m, 2x1m, 1.5x1m & 1x1m also as detailed in Table B.4 below. However change in planned spacing has no impact over the project removal as the same is calculated on the basis of actual count of trees in 20x20m area of sample plot on the day of monitoring.

	3x1.5m	2x1.5m	2x2m	1.5x1.5m	2.5x1.5m	1.5x1m	2x1m	1x1m	Total
Strata 1	14	7	9	4					34
Strata 2	9	9	6	6	4	1			35
Strata 3	10	6	7	9	1			2	35
Strata 4	11	10	6	4	2	2			35
Strata 5	9	9	8	6			2	1	35
Strata 6	3	11	10	10		1			35
Strata 7	6	8	8	11			2		35
Total:	62	60	54	50	7	4	4	3	244
% of Total:	25.4%	24.6%	22.1%	20.5%	2.9%	1.6%	1.6%	1.2%	100%

This is allowed as per para 4, point (c) of EB 66, Annex 24

5. Changes in Harvesting Cycle:

As indicated in the registered PDD the trees are harvested first time normally after 5 years and subsequently thrice at the interval of 4 years. However harvesting cycle varied depending on the growth of crops, farmers' own need and local conditions resulting into early harvesting in few parcels and delayed harvesting in others. The harvesting cycle varied between 3 to 8 years. During the current monitoring period 5442 parcels were harvested out of the total 12437 parcels of the project activity. Actual harvesting events of the parcels tabulated as per various harvesting cycle in Table B.5 below that however indicates majority 2548 parcels (46.82%) were harvested after 5 years.

Strata No	Plantation Year	Number of parcels in each harvesting cycle							Not Harvstd
		3-Year	4-Year	5-Year	6-Year	7-Year	8-Year	Total	
Strata 1	2001		115	159	90	27	16	407	0
Strata 2	2002	5	60	284	272	125	20	766	0
Strata 3	2003	5	166	361	375	52	9	968	25
Strata 4	2004	9	190	729	573	72		1573	195
Strata 5	2005	25	234	908	314			1481	1106
Strata 6	2006	9	105	107				221	2714
Strata 7	2007	17	9					26	2955
Total:		70	879	2548	1624	276	45	5442	6995
% of Total:		1.29%	16.15%	46.82%	29.84%	5.07%	0.83%	100.00%	

This is allowed as per para 4, point (e) of EB 66, Annex 24.

All the post registration changes that took place in the project activity during implementation do not require prior approval of CDM Executive Board as per EB 66, Annex 4.

SECTION C. Description of monitoring system

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The Monitoring Plan designed for A/R-CDM Project (5016) establishes monitoring procedures to calculate net anthropogenic GHG removals by sinks considering the project boundary, changes in the carbon pools, forest establishment and management for project and leakage emissions. The monitoring of all relevant activities for this project followed the Monitoring Plan presented in the PDD.

1. Monitoring of the Project implementation:

To ensure that the planting quality conforms to the practice described in AR-CDM-PDD and is well implemented, the following monitoring activities has been conducted in the first three years after planting:

- Field survey of the boundary of the areas with actual tree planting, site by site.
- Measuring geographical positions (latitude and longitude) using GPS.
- The project boundary, and the planted area, has been monitored periodically using GIS technique in the years 2001, 2006 and 2011.

MTPL hired the services of G-Lution India, a Kolkata based party, who are one of the pioneer agency in the field of GIS mapping. The agency verified the project boundary in the monitoring years 2001, 2006 and 2011 and provided digital boundary of each of 407 parcels planted till 2001, 9456 parcels planted till 2006 and 12437 parcels in 2011, ie. the entire reforested area under the project activity. The GIS maps fixing the project boundary in SHP file and corresponding area of the parcels in excel file alongwith GIS report of each of the three monitoring years are provided in GIS Map_2001, GIS Map_2006 and GIS Map_2011 respectively..

- Confirm that site and soil preparations are implemented based on practice documented in PDD.

Deep repeated ploughing mostly with country plough or tractor ploughing by exceptional farmers is done one month prior to planting. Rows are aligned and pits are dug at generally spacing of 3m x 1.5m. However the farmers influenced by local practices, adopted differed spacing also other than the planned spacing of 3x1.5m. They planted seedlings at various other spacings like 2x2m, 2x1.5m, 1.5x1.5m and 1.5x1m. Very few adopted 2.5x1.5m, 2x1m, 1.5x1m & 1x1m also. Small pits (40-45 cm in diameter and 30-35 cm in depth) are dug manually for tree planting.

- Survival checking:
 - 1) The initial survival rate of planted trees counted three months after the planting, and re-plantation done where survival rate was lower than 90 % as laid down in SOP.
 - 2) Final checking of survival percentage done after three years of planting in permanent sample plots as laid down in SOP.
- Weeding checking: check and confirm that the weeding practice is implemented as described in the PDD;

Soil working and round weeding was done after one month of plantation followed by application of fertilizer. After 3 months again soil working was done around the plant with strip weeding followed by requisite fertilizer application. Soil working with strip weeding was repeated after completion of one year.

- Survey and check that species and planting for each stratum are in line with the PDD;

The entire reforestation under the project activity has been done using single species of Eucalyptus. 100% Eucalyptus seedlings raised in MTPL's nurseries were supplied to the farmers and planted in the fields; no other species has been used.

- Document and justify any deviation from the planned forest establishment.

Changes in registered monitoring plan are given in section B.2.6 above under the heading "Changes specific to afforestation & reforestation project.

Monitoring of Forest Management

Forest management practices are important drivers of the GHG balance of the project, and thus have been monitored. Monitoring Practices include:

- Cleaning and site preparation measures: date, location, area, biomass removed and other measures undertaken;
- Planting: date, location, area, tree species (establishment of the stand models);
- Fertilization: date, location, area, tree species, amount and type of fertilizer applied, etc;
- Harvesting: date, location, area, tree species, volumes or biomass removed;
- Coppicing: date, location, area, check and confirm that the site operation practices are implemented as described in the PDD;
- Monitoring of disturbances: date, location, area (GPS coordinates and remote sensing as applicable), tree species, type of disturbance, biomass lost, implemented corrective measures, change in the boundary of strata and stands.

Records of cleaning and site preparation (weeding, soil working), date & location of plantation, number of seedling supplied, details of application of fertilizer, manure & pesticides, harvestation / coppicing is recorded in "Sample Plot Register".

There has been variation in harvesting cycle of the parcels depending on the growth of the crops, farmers' need and local practices prevailing in the area.

During this current monitoring period there has been no disturbance with regards to GPS coordinates of the plots, tree sp., biomass loss in the boundary of the strata and stands.

2. Sampling Design and stratification

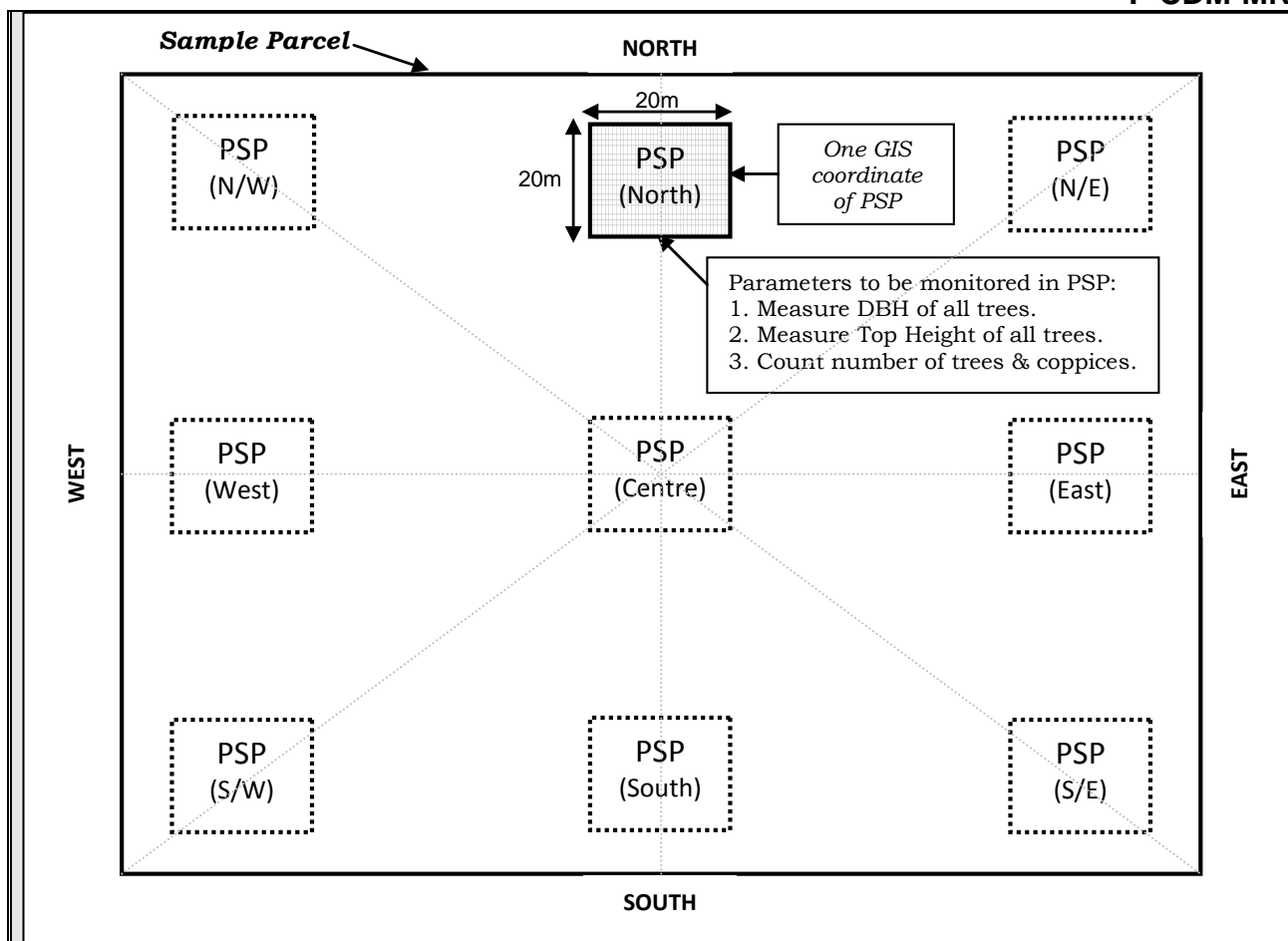
The project stratification initially at the project planning stage was done on the basis of year of plantation and accordingly total number of permanent sample plots of 20m x 20m size (PSPs) calculated was 1041 based on 7 strata. Considering fractions as complete number, total number of sample parcels selected reached to 1305 against the required 1041, sampling plan for ex-post monitoring in Table E.2(b) of registered PDD may be referred). The "Permanent Sample Plot (PSP)" is one where all measurements are done and the parcel containing a PSP is termed a "Sample Parcel" as illustrated in the "Schematic Diagram of PSP & Sample Parcel" below, hence number of PSPs = number of sample parcels.

Location of 400m² size PSPs within each sample parcels were identified in one of the 9 probable directions of the sample parcel, irrespective of parcel size, tree growth and tree count, maintaining a particular order – north, south, east, west, north-east, north-west, south-east, south-west & centre and repeated thereon in the list of sample parcels to avoid any bias, ie in first sample parcel, PSP in north, second south, third east, fourth west, fifth north-east and so on. PSPs were established with GIS coordinates recorded at a point in respective direction of the sample parcels. The location and shape of PSPs other than at centre varied between half way from centre to boundary depending upon shape & size of the sample parcel to ensure 400m² area of PSP which is measured manually.

The sample parcels were first selected through lottery conducted bank area wise each year to ensure randomness. Chits of ID nos of each parcel planted in a bank area each year prepared, all similar in shape, size & colour and folded identically such that the ID no was not visible. The chits were mixed in a basket and a person not associated with the project was asked to pick requisite number of chits to ensure random selection. For example in Nandahandi bank area, 25 chits prepared for 25 parcels planted in 2001 and 2 sample parcels selected out of 25 (ie 8%).

The schematic diagram shows selection of PSP in north direction in one sample parcel and PSPs in other eight directions shown in dotted line for illustration.

Schematic Diagram of PSP & Sample Parcel



Number of PSPs was calculated considering the estimated above ground wood volume per hectare (Q) at 1.993902 m³/ha which was much lower than the actual field values. During project implementation the value of Q was found much higher and accordingly number of PSPs were recalculated using actual value of Q keeping standard deviation (30%), precision level (10%) and confidence level (95%) unchanged that reduced the number of PSPs to 244 as below:

Table C.1: Stratawise Number of PSPs		
Strata No	Plantation Year	No of PSPs
Strata 1	2001	34
Strata 2	2002	35
Strata 3	2003	35
Strata 4	2004	35
Strata 5	2005	35
Strata 6	2006	35
Strata 7	2007	35
Total:		244

But in course of current verification the calculation was found erroneous since it was based on old volume equation, which got changed during verification, as well as old version of tool. As such the calculation for number of PSPs revised using new volume equation and latest version of methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" version 02.1.0 (Annex 15 of EB 58) that reduced the required number of PSPs to 48, much less than the earlier 244. However it was decided to continue with all 244 PSPs and include them in Project Removal calculation to be more precise and conservative, detailed calculation provided as "Revised calculation for number of PSPs- new tool"

Re stratification for project removal calculation

Further in view of variations in harvesting cycle of the parcels during the current monitoring period,

restratification was necessitated for PR calculation. The parcels were restratified on the basis of their age on closing date of monitoring period with respect to date of last harvesting or date of plantation Altogether 17 stratum were identified as RS01 to RS17 and accordingly 244 PSPs were distributed among individual re-strata corresponding to their age as shown in table C.2 below:

Table C.2: Restratiated Area & no of corresponding PSPs						
S No	Re-strata No	Age	No of Parcels	Area (Ha)	No of PSPs required	PSPs Monitor ed
1	RS01	2nd Cop- 4th Year	9	8.34	1	1
2	RS02	2nd Cop- 3rd Year	9	10.68	1	3
3	RS03	2nd Cop- 2nd Year	28	39.53	1	5
4	RS04	2nd Cop- 1st Year	33	37.73	1	5
5	RS05	2nd Cop- 0th Year	43	48.95	0	8
6	RS06	1st Cop- 6th Year	106	108.48	1	8
7	RS07	1st Cop- 5th Year	199	225.14	2	16
8	RS08	1st Cop- 4th Year	514	632.65	2	28
9	RS09	1st Cop- 3rd Year	846	971.31	2	32
10	RS10	1st Cop- 2nd Year	1469	1776.12	1	35
11	RS11	1st Cop- 1st Year	969	1216.97	1	22
12	RS12	1st Cop- 0th Year	1217	1521.73	0	12
13	RS13	Original- 8th yr	25	31.12	1	1
14	RS14	Original- 7th yr	195	234.53	2	2
15	RS15	Original- 6th yr	1106	1125.38	6	6
16	RS16	Original- 5th yr	2714	3062.21	16	26
17	RS17	Original- 4th yr	2955	3476.38	10	34
Total:			12437	14527.27	48	244

Following steps in restratification applied to prevent biasness in selection and ensure conservative approach as far as possible in computing project removal.

1	All the 244 sample parcels for monitoring the project activity were selected from the earlier list of 1305 sample parcels and there has been no new addition. At the same time location of PSPs within the respective sample parcels also remain unchanged. The parcels were selected on lottery basis as explained in this section above to avoid any bias
2	The 244 sample parcels were distributed across 17 restrata depending upon their age of plantation as shown in Table C.1 above. In most of the restrata ie 13 nos, PSPs being monitored are more than the calculated number of PSPs. Only in 4 strata ie RS01, RS13, RS14 & RS15 it equals to calculated number of PSPs.
3	Parcels harvested within a year prior to closing date of monitoring period ie 24.06.2011 were considered having zero tree conservatively assuming that the minimum DBH for measurement is attained on completion of one year. These are "Zero Tree Parcels restratified as "RS05: 2nd Copice-0th year" and RS12: 1st Copice-0th year".
4	While calculating required number of PSPs for individual restrata as per tool, no PSPs were assigned to stratum RS05 & RS12 considering them zero tree parcels. In actual restratification 8 & 12 PSPs belong to restrata RS05 and RS12 respectively and accordingly removal from these stratum made zero in project removal calculations..

3. Monitoring of the baseline net GHG removals by sink

Monitoring of the baseline net GHG removals by sinks is not needed as per the approved methodology AR-

ACM0001 (Version 04) applied.

4. Monitoring of the actual net GHG removals by sinks data

Field measurement of DBH, tree height & number of trees

Method of locating PSPs within sample parcels and tree measurement is detailed in "PSP Measurement Process". Measurement of DBH & top height of all the trees and counting number of trees contained in each of 244 PSPs identified as above were completed as per process from April to June, 2011 before closing date of monitoring period 24.06.2011. The measurements were recorded in measurement sheets and archived in soft copy. Excel sheets of measurement for the PSPs of each re-strata submitted with PR calculation sheet.. Following conservative approach adopted in measurement and PR calculation:

1	Trees having DBH < 1.5 cms and Height < 2 m have not been considered for volume calculation conservatively.
2	It has been conservatively assumed that minimum DBH for measurement is attained on completion of one year. Hence parcels harvested within a year prior to closing date of monitoring period ie 24.06.2011 have been "Zero Tree Parcels".
3	In "Zero Tree Parcels" ie 0th year after 1st / 2nd copice, AGB is zero since there are no trees. Therefore BGB is also zero and accordingly removal in respect of RS05 and RS12, measuring 1570.68 ha, 10.81% of the total area is coservatively shown zero in Project Removal calculation, sheet no 11.

Calibration of measuring devices

In order to ensure accuracy in measurement of DBH and tree height, measuring devices duly calibrated were used for project monitoring. A set of master devices were calibrated from external agency having established national and international traceability, record of calibration furnished in the table below. The working devices were calibrated internally with the help of master devices and used for monitoring activity.

Table C.3 : Record of calibration of Measuring Devices used

S No	Date of Calibration	Certificate No	Calibrating Agency	Error	Result of Calibration	Next Calibration due on
A. Abney's (Angle) Level, Make OPTIKA, 0-90°					ID No - MT/AL-01	Yearly
1	14.07.2002	03904/102 dt 14.07.2002	ASKIB Engineers Pvt Ltd, Kolkata	0	Satisfactory	14.07.2003
2	01.07.2003	03903/103 dt 01.07.2003	do	0	do	01.07.2004
3	26.06.2004	03906/104 dt 26.06.2004	do	0	do	26.06.2005
4	19.06.2005	03906/105 dt 19.06.2005	do	0	do	19.06.2006
5	15.06.2006	03900/104 dt 15.06.2006	do	0	do	15.06.2007
6	28.05.2007	03908/107 dt 28.05.2007	do	0	do	28.05.2008
7	20.05.2008	03908/108 dt 20.05.2008	do	0	do	20.05.2009
8	17.04.2009	00433/109 dt 17.04.2009	do	0	do	17.04.2010
9	16.04.2010	06325/107 dt 16.04.2010	do	0	do	16.04.2011
10	16.04.2011	07655/111 dt 16.04.2011	do	0	do	16.04.2012
B. Steel Measuring Tape - FREEMANS 15m					ID No: MT/ST-01	Yearly
1	14.07.2002	03905/102 dt 14.07.2002	ASKIB Engineers Pvt Ltd, Kolkata	-1.2	Ok within ± 2 mm as per Comparision method	14.07.2003

2	01.07.2003	03902/103 dt 01.07.2003	do	-1.2	do	01.07.2004
3	26.06.2004	03906/104 dt 26.06.2004	do	-1.2	do	26.06.2005
4	19.06.2005	03900/105 dt 19.06.2005	do	-1.2	do	19.06.2006
5	15.06.2006	03907/106 dt 15.06.2006	do	-1.2	do	15.06.2007
6	28.05.2007	03901/107 dt 28.05.2007	do	-1.2	do	28.05.2008
7	20.05.2008	03904/108 dt 20.05.2008	do	-1.2	do	20.05.2009
8	18.10.2009	03906/109 dt 18.10.2009	do	-1.2	do	18.10.2010
9	16.10.2010	03903/110 dt 16.10.2010	do	-1.2	do	16.10.2011
10	15.10.2011	07017/111 dt 15.10.2011	do	-1.2	do	15.10.2012
C.	Steel Scale		0-300mm		ID No: MTPL/SS-01	Yearly
1	14.07.2002	03904/102 dt 14.07.2002	ASKIB Engineers Pvt Ltd, Kolkata	0.03	Ok within ± 0.2 mm as per IS1481-1970 & IS 2102	14.07.2003
2	01.07.2003	03903/103 dt 01.07.2003	do	0.04	do	01.07.2004
3	26.06.2004	03906/104 dt 26.06.2004	do	0.02	do	26.06.2005
4	19.06.2005	03906/105 dt 19.06.2005	do	-0.02	do	19.06.2006
5	15.06.2006	03900/104 dt 15.06.2006	do	0.03	do	15.06.2007
6	28.05.2007	03908/107 dt 28.05.2007	do	-0.03	do	28.05.2008
7	20.05.2008	03908/108 dt 20.05.2008	do	0.04	do	20.05.2009
8	17.04.2009	00435/109 dt 17.04.2009	do	-0.03	do	17.04.2010
9	10.02.2010	SIW/1388/F-10/09-10	Sibali Instrument Works, Howrah	0.04	do	10.02.2011
10	05.02.2011	SIW/1236/F-11/10-11	do	0.04	do	05.02.2012

To record the weight of harvested timber, company's weigh bridge installed at the entry was also calibrated regularly on yearly basis from the competent agency, Inspector, Legal Metrology, Nabarangpur as per Orissa Standards of Weights and Measures (Enf.), Rules, 1993. Record of calibration is provided below in table C.3 below. Certificate of verifications in prescribed format, Schedule XI, issued by the authority are available for verification.

Table C.4: Calibration Record of Electronic Weigh Bridge					
Electronic Road Weigh Bridge AVERY - E1210				Capacity: 30,000 Kg	Yearly
S No	Date of Calibration	Certificate No	Authority	Result of Calibration	Next Calibration due on
1	11.06.2005	486179	Inspector, Legal Metrology, Nabarangpur	Satisfactory	11.06.2006
2	25.03.2006	345391	do	do	16.06.2006
3	20.03.2007	124158	do	do	16.06.2007
4	21.06.2007	124433	do	do	21.06.2008
5	17.01.2008	358021	do	do	21.06.2008
6	23.03.2009	158909	do	do	21.06.2009

7	16.02.2010	434299	do	do	16.02.2011
8	26.02.2011	100340	do	do	26.02.2012

Monitoring of Land Title & Carbon Right

Land title and Carbon Right (Farmers' authorization for claiming carbon credit by MTPL) in respect of all 12437 parcels belonging to 12002 individual farmers have been checked by respective Field Officers and confirmed their availability, evidenced in "List of Participating Farmers". Any change in land title is reported by the mates of respective area through their field officer. No change in land title has been noticed or reported by the field officers. Further MTPL has provided a "Declaration" confirming all the 12002 farmers are currently participating in the project activity.

QA/QC for field measurements

All data collected in the field are recorded. In order to ensure consistency in field monitoring and measurements, the team members made aware of all procedures of data collection. The quality of field data collection was verified by undertaking random checks of the plots, including their re-measurement by Manager Plantation and/or CDM Manager from HO.

Collecting reliable field measurements was an important step in the quality assurance plan. Training courses on field data collection and data analyses held for all staff including new entrants involved in the field measurement. The training courses ensure that each task team member is fully aware of all procedures and the importance of collecting data as accurately as requested. To achieve this, both classroom examination and field examination conducted, and only those who pass the required examination joined the task team.

'Hot check' meant tree measurement by field officers in sample plots randomly chosen by CDM Manager in his presence to ensure that the Field Officers and staff are capable enough to take the measurement and that the process of measurement is followed correctly.

"Hot check" of field measurement was conducted by the CDM Manager in 24 PSPs randomly identified in different bank areas covering all Area Incharges as detailed in Table C.5 below. Insignificant variations noticed which had no impact on average DBH and height of the PSPs. CDM Manager demonstrated the correct procedure where field officers departed from the established procedure, on site itself and explained the impact of wrong measurement.

Table C.5: Parcels where Hot Check conducted

S No	Strata	PSP ID	Name of Area Incharge	Date	S No	Strata	PSP ID	Name of Area Incharge	Date
1	Strata 1	NNH001	A D Naidu	28.09.11	13	Strata 4	NRG061	B Das	30.09.11
2		KBG030	D Das	27.09.11	14		KJR032	P K Mishra	26.09.11
3		KKN001	D Das	27.09.11	15		KSB002	D P Purohit	01.10.11
4		KAG001	P K Mishra	26.09.11	16	Strata 5	NUK051	B Das	30.09.11
5	Strata 2	NRJ015	A D Naidu	28.09.11	17		NMP050	A D Naidu	28.09.11
6		NKM024	A D Naidu	28.09.11	18		KDG140	D Das	27.09.11
7		KKS023	P K Mishra	26.09.11	19	Strata 6	NSM238	B Panda	28.09.11
8		KPP023	P K Mishra	26.09.11	20		KDS118	S K Dhall	27.09.11
9	Strata 3	NJG048	B Das	30.09.11	21		NJB096	A D Naidu	28.09.11
10		KPG028	S K Roy	01.10.11	22	Strata 7	NBS114	S K Dhall	26.09.11
11		KNP098	D P Purohit	01.10.11	23		NKG134	S K Dhall	26.09.11
12	Strata 4	NCG038	S K Dhall	27.09.11	24		KDS216	SK Roy	01.10.11

Results of Hot Check: Insignificant variations found in all the PSPs which were within the allowable variation % laid down in SOP no FFS-P-04, limit reproduced in Table C.6 below. However all variations were corrected in the measurement sheet as per the values obtained in hot check.

Similarly 'blind check', to quantify measurement errors, was conducted by Manager (Plantation) in consultation with CDM Manager. Blind check consisted of complete re-measurement of 10% of PSPs randomly selected by CDM Manager as listed in Table C.6 below.

Table C.6: Parcels where Blind Check conducted						
S No	Strata	PSP ID	Name of Area Incharge	Incharge for Blind Chek	Date	Result
1	Strata 1	NSG009	A D Naidu	Mr GVD Prasad	22.09.11	Insignificant variation
2		NRJ008	A D Naidu	do	22.09.11	do
3		KBG034	D Das	do	28.09.11	do
4	Strata 2	NKL029	S K Dhall	do	23.09.11	do
5		NRG004	B Das	do	18.09.11	do
6		KKN045	D Das	do	28.09.11	do
7		KDP019	P K Mishra	do	25.09.11	do
8	Strata 3	NDD013	B Das	do	18.09.11	do
9		NUK018	B Das	do	18.09.11	do
10		KNP097	D P Purohit	do	20.09.11	do
11		KPG034	S K Roy	do	20.09.11	do
12	Strata 4	NNP085	A D Naidu	do	23.09.11	do
13		KDP093	P K Mishra	do	25.09.11	do
14		KPP085	P K Mishra	do	25.09.11	do
15	Strata 5	NNH060	A D Naidu	do	22.09.11	do
16		NSM211	B Panda	do	23.09.11	do
17		KSG073	D P Purohit	do	20.09.11	do
18		VSA131(a)	K Deepak	do	24.09.11	do
19	Strata 6	NCG121	S K Dhall	do	23.09.11	do
20		NKG104	S K Dhall	do	23.09.11	do
21		KDS218	S K Roy	do	20.09.11	do
22	Strata 7	NRG362	B Das	do	18.09.11	do
23		KDG330	D Das	do	28.09.11	do
24		KPP253	P K Mishra	do	25.09.11	do

After measurement a comparison made with the original data and variations identified. Insignificant variations noticed were within the allowable variation % laid down in SOP no FFS-P-04, limit reproduced as below:

Table C.7: Allowable Measurement Variation		
Range of DBH	Range of Height	Allowable Variation %
≤ 5 cms	≤ 5 m	7.5%
> 5 to ≤ 10 cms	> 5 to ≤ 10 m	5%
> 10 cms	> 10 m	2.50%

However all variations were corrected in the measurement sheet as per the values obtained in the blind check.

QA/QC for data entry

To produce reliable carbon estimates the proper entry of data into the data analyses spreadsheets is required. Steps have been taken to ensure that errors are eliminated. Tree measurements are collected by the field officers at plantation sites in their note book and transferred to Measurement Register/ Sheet that

also includes name of farmer, village, bank area, parcel ID no, spacing, date of last harvest, no of trees planted and number of tree available at the time of monitoring. The completed sheet is submitted to CDM Record officer who ensures entry of all data into electronic medium (excel spread sheet). Discrepancies found if any are intimated to concerned field officer and the same is clarified or corrected as the case may be. Entry for number of trees is checked in excel sheet and survival %, average DBH & height are computed for each PSP. The completed excel sheet is audit checked for calculations by Plantation Manager and compared with measurement sheet to identify data entry errors and the same is corrected at this stage.

QA/QC for data archiving

Due to the long-term length of the project activities, data storage and maintenance is very important. All electronic data and reports copied on durable media such as compact discs (CDs) and copies of the CDs stored in multiple locations. The archives included

- Copies of all original field measurement data, laboratory data & data analysis spreadsheets;
- Estimates of the carbon stock changes in all PSPs and corresponding calculation spreadsheets;
- Record of monitoring & measuring devices used with details of their calibration;
- GIS products and
- Copies of the measuring and monitoring reports.

Table C.8: Data Monitored for actual net GHG removals by sinks

S No	Data Parameter	Data Unit	Recording frequency	Monitoring system
1	Stratum ID	Alpha numeric	before the start of project	Unique ID no has been assigned to each strata and being maintained throughout the monitoring period. Plot location is established through GIS coordinates of each plot using satellite remote sensing and GIS techniques.
2	Confidence Level	%	before the start of project	For the purpose of QA/QC and measuring and monitoring precision control
3	Precision Level	%	before the start of project	For the purpose of QA/QC and measuring and monitoring precision control
4	Standard deviation of each stratum	-	before the start of project	Used for estimating numbers of sample plots of each stratum
5	Number of sample plots	-	At start of the project	Number of permanent sample plots 1041 as per registered PDD reduced to 244 as per revised calculation provided.
6	Sample parcel ID	Alpha numeric	At start of the project	Unique ID has been assigned to each sample parcel also like other parcels.
7	Location of Permanent Sample Plot (PSP)	GIS coordinates	As & when PSP identified.	Location of Permanent Sample Plot (PSP) established through GIS coordinates taken within the PSP.
8	Number of Trees	Number	5-yearly	Number of trees are counted manually by field officers in 20m x 20m sample plot
9	Diameter Breast Height (DBH)	Cm	5-yearly	DBH of 100% trees contained in 20mx20m area measured in each sample plot and maintained in Measurement Register.
10	Tree height	M	5-yearly	Tree height of 100% trees contained in 20mx20m area measured in each sample plot and maintained in Measurement Register.
11	Biomass Expansion Factor	Dimensionless	As & when IPCC modify the values.	IPCC GPG for LULUCF Table- 3A.1.10
12	Carbon Fraction	tC(tdm) ⁻¹	As & when IPCC	IPCC default value = 0.5 t C t ⁻¹ d.m.

			modify the values.	
13	Root to shoot ratio	Dimensionless	As & when IPCC modify the values.	IPCC GPG for LULUCF Table- 3A.1.8
14	Area of slash and Burn	ha	As & when incident happen.	During regular visit to sites field officers keep watch for slash & burn. If observed, parcel ID no, area and date shall be recorded by them and reported to CDM Manager.
15	Survival rate	%	Initially after 3 months and final checking after 3 years.	Initial Survival rate is checked after 3 months of planting. If found less than 90%, replantation is done. Final checking after 3 years

Monitoring Frequency

As per registered PDD monitoring frequency of the project activity was 5 years. Accordingly monitoring has been done in the years 2006 and 2011.

Roles & responsibilities of the personnel involved in monitoring activity:

Roles & responsibilities with reporting structure of various personnel engaged in monitoring of CDM project is established as laid down below. In order to ensure that the personnel involved in monitoring are competent to perform monitoring, competency mapping has been done in terms of qualification, experience & training. The personnel are also imparted training from time to time on plantation activity & subsequent monitoring procedures, records of training are available for verification.

Table C.9: Roles & responsibilities of the personnel

Designation	Responsibilities
Head- Plantation & Administration	<ul style="list-style-type: none"> • Planning & resource management of entire plantation activities. • Training on planting & nursery techniques – changes & developments • Planning & development of mist chamber. • Deployment & supervision of all staff & managers of Plantation Deptt. • Soil testing • CDM data and record keeping arrangements • Ensuring availability of trained personnel for CDM data collection
CDM Manager (Head Office)	<ul style="list-style-type: none"> • Entire documentation for CDM activities • Resource management for GIS mapping of plantation sites. • Custodian for all GIS data, maps and satellite images • Quality control of monitoring system • Training on CDM monitoring & measurement procedures like tree height and DBH measurements • Audit check of data • Arranging calibration of measuring devices • Arranging for validation and verification of the project • Liaisoning with all external agencies like DNA, DOE and consultants.
Manager (Plantation)	<ul style="list-style-type: none"> • Execution of Tripartite agreement • Execution of carbon rights (CER authorization contract) • Maintaining record of area planted year wise in plantation register • Updating plantation register • Updating Sample plot register • GPS mapping of the plantation sites • Calibration and maintenance of measuring devices • Quality control of data collection
Area Incharge	<ul style="list-style-type: none"> • Joint verification of plantation sites to ensure fulfilment of eligibility criteria • Identification of sample parcels & permanent sample plots (PSP) • Growth monitoring in sample plots in terms of no of trees, tree height & DBH

	<ul style="list-style-type: none"> • Conducting meeting with the farmers to educate them on the scheme • Train, guide and assist farmers for plantation • Soil sample collection. • Monitoring of land title of the farmers • Obtaining farmers' authorization for claiming carbon credit. • Monitoring any loss of biomass, illegal felling or events of biomass burning.
Field Officers	<ul style="list-style-type: none"> • Assistance in recording GPS coordinates • Measurement of tree height & DBH • Sample plot measurement.
Accounts & CDM Record Officer	<ul style="list-style-type: none"> • Plantation accounts • Compilation of all data received from Area Incharges • Proper upkeep of plantation & CDM records & ensuring their correctness • Sample plot monitoring records.
Mates placed in the villages	<ul style="list-style-type: none"> • Provide link between the farmers and the field officers • Intimation of interested farmers to field officers. • Reporting day to day development in their area • Reporting any loss of biomass, illegal felling and incidents of biomass burning in their respective villages. • Assist the field officers in tree measurement.

Details of competency of the personnel involved in monitoring activity:

Details of competency of the personnel currently involved in monitoring activity in terms of their educational qualification, experience, training & specialization etc are furnished in the table below:

Table C.10: Competency of the personnel currently involved in monitoring the Project					
S No	Name of personnel	Designation	Qualification	Experience in years	Field of experience/ Specialization/ Training
1	Shri D G Hegde	Head-Plantation & Administration	B Sc (Horticulture)	30 years	Entire experience in plantation activity at MTPL, UNILEVER & FINLAYS, Columbia. One month training at Silsoe College of Agriculture, UK.
2	Shri P S Prasad	DGM (QA & Projects) cum CDM Manager	BE (Mechanical)	32 years	4 yrs in AR-CDM Project, 4 yrs in ISO Management Systems and remaining in Steel & Wagon manufacturing. Training in development of CDM projects and Lead Auditor for QMS (ISO 9001) & Social Accountability (SA 8000)
3	Shri G V D Prasad	Manager-Plantation	B Comm (Hons)	24 years	Entire experience in plantation activity at MTPL except 1 year at J K Paper. Training on AR-CDM Sample Plot measurement process.
4	Shri A D Naidu	Area Incharge	BA	11 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
5	Shri B Das	Area Incharge	Matric	26 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
6	Shri S K Dhall	Area Incharge	BA	19 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement

					process.
7	Shri D Das	Area Incharge	Matric	26 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
8	Shri S K Ray	Area Incharge	B.A, LLB	06 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
9	Shri P K Mishra	Area Incharge	M.A, LLB	11 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
10	Shri Brundaban Panda	Area Incharge	HSC	15 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
11	Shri D P Purohit	Area Incharge	HSC	10 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
12	Shri B K Mishra	Supervisor, Mist Chamber	BA	12 years	Entire experience in plantation/nursery activity at MTPL. Training on AR-CDM Sample Plot measurement process.
13	Shri Trishul Santra	Accounts & CDM Record Officer	B Com	06 years	Entire experience in Plantation Accounts and CDM record maintenance. Training on AR-CDM Sample Plot measurement process.
14	Shri K Deepak	Jr. Forester	HSC	14 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
15	Shri K.C.Ratna	Asst. Forester	Matric	26 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.
16	Shri M.K.Nayak	Jr. Forester	HSC	10 years	Entire experience in plantation activity at MTPL. Training on AR-CDM Sample Plot measurement process.

Besides a list of Ex- employees who participated in the project activity since 2001 with their last designation, qualification, experience and period of their service in MTPL is provided as below:

Table C.11: Competency of Ex- employees who participated in the project activity since 2001

S No	Name of personnel	Designation	Qualification	Earlier experience	Period in MTPL	
					From	To
1	Shri C G Singh	DGM (Forest)	Post Graduate	Earlier 10 years in J K Paper Mill	1986	2005
2	Shri Deepak Nandi	AGM (Plantation)	Graduation	Earlier 20 years in plantation in West Coast Paper	2007	2010
3	Shri M S Pareek	Manager (Plantation)/ Jeypore	B.Com	Earlier experience 10 years	1992	2008
4	Shri H. Dwivedi	Manager (Plantation)/ Nabarangpur	B.Sc.	Earlier 20 years in J K Paper Mill	1999	2004

5	Shri V. R. Korosi	Manager (Plantation)/ Vishakhapatnam	M.Sc. (Agriculture)	Earlier 04 years in A P Paper Mill, Rajmundry	2004	2006
6	Shri Sumit Sarkar	Manager (Plantation)/ Bastar	M. Sc.	Earlier experience 03 years	2004	2006
7	Shri Pranab Sur	Manager (Plantation)/ Bastar	M. Sc.	Earlier 10 years in Orient Paper Mill	2006	2007
9	Shri A K Patnaik	Manager (Plantation)/ Nabarangpur	M. Sc. (Agriculture)	Earlier 04 years in J K Paper Mill	2006	2007
10	Shri S K Kushwaha	Manager (Plantation)/ Nabarangpur	B Sc (Agriculture)	Earlier 04 years in Teak Plantation	2008	2009
11	Shri S.K.Padhi	Asst Manager/ Srikakulam	B.Sc.	Earlier 03 years in J K Paper Mill	2005	2006
12	Shri Malikarjun Singh	Area Incharge/ Aruku	B. Sc.	Earlier experience 05 years	2006	2007
13	Shri Pawan Kumar	Asst Manager/ Mist chamber	B. Sc (Agriculture)	Earlier 02 years in BILT, Jeypore	2007	2010

Training details of personnel involved in monitoring activity:

Table C.12: Training details of personnel involved in monitoring activity

S No	Date of Training	Duration	No of Participants	Subject	Trainer	
					Name	Organisation
1	11.06.2002	1 day	10	Planting Techniques	Mr H Dwivedi, Manager (Plantation), Nabarangpur	MTPL
2	23.07.2003	1 day	10	Planting Techniques & Replanting	Mr M S Pareek, Manager (Plantation), Jeypore	MTPL
3	16.09.2004	1 day	10	PoP for Eucalyptus Seedling Nursery	Mr V R Korosi, Manager (Plantation), Vizianagaram	MTPL
4	19 & 20.08.2005	2 days	10	Post plantation activities & silvicultural practices followed by field visit on 20.08.05	Mr V R Korosi, Manager (Plantation), Vizianagaram	MTPL
5	14 & 15.06.2006	2 days	8	CDM Project awareness training	1. Mr A K Perumal 2. Ms Payal Ghosh Sr Associates	Birla Carbon Management & Consulting, Kolkata
6	25 to 26.08.2006	2 days	12	Tree Measurement Process	Mr P S Prasad, CDM Manager & DGM (QA)	MTPL, HO, Kolkata

7	22 & 23.05.2007	2 days	13	CDM requirements, related documentations, various formats & PRA	Ms Tulika Biswas, Sr Associate	Birla Carbon Management & Consulting, Kolkata
8	24 to 26.11.2008	3 days	14	GIS Mapping process and roles & responsibility of MTPL field officers followed by field visits	Dr Chirangibi Pattanaik	Salim Ali Centre for Ornithology & Natural History (SACON), Hyderabad
9	20.04.2009	1 day	15	Training on SOPs and identification of permanent sample plots (PSPs)	1. Mr D Nandy, AGM (Plantation) 2. Mr P S Prasad, CDM Manager, Kolkata	MTPL
10	24.07.2009	1 day	15	PoP for Eucalyptus Seedling Nursery followed by nursery visit	Mr Pawan Kumar, Asst Manager (Plantation)	MTPL
11	16.02.2010	1 day	12	Training on SOPs for plantation	Mr D Nandy, AGM (Plantation)	MTPL
12	24.03.2011	1 day	12	CDM Project Monitoring Procedures	Mr P S Prasad, CDM Manager & DGM (QA & Projects)	MTPL, HO, Kolkata
13	29.09.2011	1 day	10	Training on Sample Plot Measurement Process followed by a written examination	Mr P S Prasad, CDM Manager & DGM (QA & Projects)	MTPL, HO, Kolkata

Training records alongwith examination papers those conducted after training in 2006 & 2011 to test the effectiveness of training are available for verification.

The organisation structure of Plantation department established at MTPL is furnished at the end of this section. Altogether 16 personnel are currently working in the department and involved in monitoring activity of the project with following star marked exceptions:

1. *Mr S K Dhall, Jr Officer, Borigumma has been temporarily given additional charge of Bastar with effect from 18.11.2010 till the appointment of dedicated officer for the area.
2. **Mr D Das, Sr Officer, Baipariguda has been temporarily given additional charge of Malkangiri with effect from 14.01.2011 till the appointment of dedicated officer for the area.

5. Monitoring of Leakage:

Survey was conducted twice in monitoring years 2006 and 2011 by NGO, Maa Samalyi Voluntary Organisation (earlier Maa Syamalay Voluntary Organisation till 2010) on the behest of MTPL to assess presence of animal head, Available Grazing Land (AGL) and incidences of biomass burning in the project area.

Grazing land required for the animals, existing or displaced in the project area has been calculated on the basis of survey report and found that the AGL under the control of farmers is more than required grazing land that can adopt displaced animals.

The reports from Secretary, Maa Samalyi Voluntary Organisation submitted identified as GRZa(Rev01) for 2011 and GRZb(Rev01) for 2006 also confirmed that abundant grazing land is available with the farmers or under their control and there has been no event of biomass burning in the project area. Further the mates

who keep a vigil on biomass loss, biomass burning and forest fire etc in their respective villages have not reported any such incidence of biomass loss during the current monitoring period.

6. Emergency Procedures:

- Procedures to assess the GHG emissions due to fire in the boundary

The project depends on local communities for implementing the fire management plan. The fire prevention measures such as reduction of fuel load, clearance of brushwood and dry vegetation close to the project parcels have been implemented.

In case of accidental fires, the area and carbon stock affected would be assessed using field surveys and measurement. No fire has occurred during the current monitoring period. Occurrence of any fire incidents are reported by the local mates immediately to the field officer or MTPL office directly through phones.

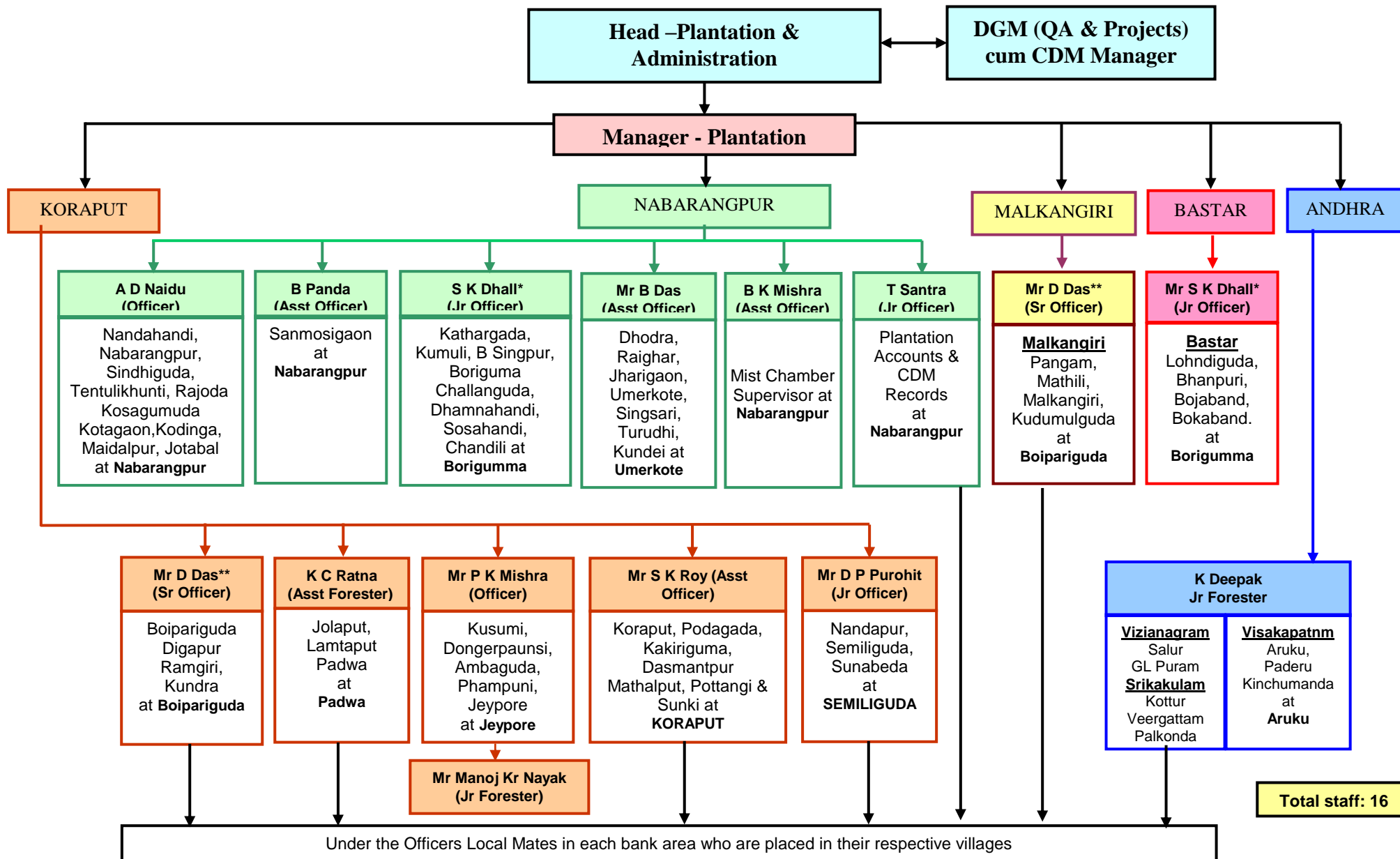
- Procedures to assess the impact of pest infestation on the carbon stock of the project

Pest damage is reported by the local mates / farmer to their respective field officer. The damage is assessed by Manager Plantation along with concerned field officer and farmer. They implement pest management measures to minimize negative impacts on the remaining carbon stock in the project boundary and to prevent the spread of infestation to areas outside project boundary. There have been no major instances of pest infestation under the project during the current monitoring period.

- Impact of weather related disturbances on carbon stocks in the project boundary

Procedures have been implemented to assess the weather related disturbances events such as droughts and floods in the project area and survival of plantations in the affected areas. In case of flood or drought damage on carbon stock will be assessed by the Manager Plantation along with field officers and farmer. No weather related disturbances have been noticed in the project boundary during the current monitoring period.

ORGANIZATION STRUCTURE - PLANTATION & FORESTRY



Total staff: 16

SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

1. Data / Parameter:	Number of Permanent Sample plots (PSPs)
Unit:	Number
Description:	Sample plots are chosen randomly from each stratum who represent the reforestation of respective stratum. Number of PSPs calculated using methodological tool "Calculation of number of sample plots for measurements within A/R CDM project activities, Version 02.1.0. All the project monitoring activity is based on the PSPs.
Source of data :	Sample Plot Register
Value(s) applied :	48
Purpose of data	Project removal
Additional comment:	48 PSPs calculated as per tool but monitored 244 as explained in section C to be more precise.

2. Data / Parameter:	Sample plot ID
Unit:	Alpha Numeric
Description:	Sample plot ID
Source of data :	Sample Plot Register
Value(s) applied :	Numeric series ID has been assigned to each permanent sample plot.
Purpose of data	Project removal
Additional comment:	Numeric series ID assigned to each permanent sample plot

3. Data / Parameter:	Confidence Level
Unit:	%
Description:	Confidence Level
Source of data :	-
Value(s) applied :	95 (The value specified in the methodology AR ACM0001 version 04)
Purpose of data	Calculation of number of PSPs
Additional comment:	Used for estimating numbers of PSPs for each stratum

4. Data / Parameter:	t_{VAL}
Unit:	Dimension less
Description:	Two-sided Student's t-value, at infinite degrees of freedom in the first iteration and at degrees of freedom equal to (n-1) in subsequent iterations, for the required confidence level; dimensionless
Source of data :	Student's t-distribution table given in the tool for calculation of number of PSPs.
Value(s) applied :	1.960
Purpose of data	Calculation of number of PSPs
Additional comment:	Used for estimating numbers of PSPs for each stratum

5. Data / Parameter:	Standard Deviation of each stratum
Unit:	dimensionless
Description:	Standard Deviation of each stratum
Source of data :	-
Value(s) applied :	30
Purpose of data	Calculation of number of PSPs
Additional comment:	Used for estimating numbers of PSPs for each stratum

6. Data / Parameter:	Biomass Expansion Factor (BEF)
Unit:	Dimensionless

Description:	Biomass Expansion Factor
Source of data:	IPCC GPG for LULUCF Table- 3A.1.10
Value(s) applied :	2
Purpose of data	Project removal
Additional comment:	No

7. Data / Parameter:	Carbon Fraction (CF)
Unit:	tC (tdm)-1
Description:	Carbon Fraction
Source of data:	(IPCC default value = 0.5 t C t ⁻¹ d.m.)
Value(s) applied :	0.5
Purpose of data	Project removal
Additional comment	No

8. Data / Parameter:	Root to Shoot Ratio (R)
Unit:	Dimensionless
Description:	Root to Shoot Ratio
Source of data:	IPCC GPG for LULUCF Table- 3A.1.8
Value(s) applied :	0.27
Purpose of data	Project removal
Additional comment	No

D.2. Data and parameters monitored

1. Data / Parameter:	Area of stratum i (A_i)																											
Unit:	Ha																											
Description:	The area of each stratum is obtained by measuring actual area of all the discrete parcels in the stratum using GIS technique.																											
Measured /Calculated /Default:	Measured																											
Source of data:	GIS data																											
Value(s) of monitored parameter:	<p>Project stratification is based on year of plantation. Strata wise total area as per 2011 measurement using GIS technique is given in the table below:</p> <table border="1"> <thead> <tr> <th>Strata no</th> <th>Year of Plantation</th> <th>GIS Area 2011 (Ha)</th> </tr> </thead> <tbody> <tr> <td>Strata 1</td> <td>2001</td> <td>473.29</td> </tr> <tr> <td>Strata 2</td> <td>2002</td> <td>931.04</td> </tr> <tr> <td>Strata 3</td> <td>2003</td> <td>1195.85</td> </tr> <tr> <td>Strata 4</td> <td>2004</td> <td>2150.64</td> </tr> <tr> <td>Strata 5</td> <td>2005</td> <td>2961.32</td> </tr> <tr> <td>Strata 6</td> <td>2006</td> <td>3304.89</td> </tr> <tr> <td>Strata 7</td> <td>2007</td> <td>3510.24</td> </tr> <tr> <td></td> <td>Total:</td> <td>14527.27</td> </tr> </tbody> </table> <p>Strata wise area provided in Project Removal in excel sheet identified as GIS Area_2011.</p>	Strata no	Year of Plantation	GIS Area 2011 (Ha)	Strata 1	2001	473.29	Strata 2	2002	931.04	Strata 3	2003	1195.85	Strata 4	2004	2150.64	Strata 5	2005	2961.32	Strata 6	2006	3304.89	Strata 7	2007	3510.24		Total:	14527.27
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Strata 7	2007	3510.24																										
	Total:	14527.27																										
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: GPS machines - <i>eTrex Vista(Garmin make)</i> GPS Accuracy: Position <15 meters, 95% typical.																											
Measuring/ Reading/ Recording frequency:	At start of project activity and adjusted thereafter every five years.																											
Calculation method (if applicable):	NA																											
QA/QC procedures	Review of measured data carried out by CDM Manager as and when data are collected.																											

Purpose of data	Project removal																																																																																															
Additional comment																																																																																																
2. Data / Parameter:	Area of all sample plots in stratum i ($A_{sp,i}$)																																																																																															
Unit:	ha																																																																																															
Description:	As per registered PDD the size of PSPs remain constant as 0.04 ha for all strata. An area of 20m x 20m size (measuring 0.04 ha) is measured and marked within each sample parcel in the direction mentioned in sample plot register																																																																																															
Measured /Calculated /Default:	Measured																																																																																															
Source of data:	Field measurement																																																																																															
Value(s) of monitored parameter:	Total area of PSPs in each stratum is given in the table below: <table border="1" data-bbox="730 622 1390 1323"> <thead> <tr> <th>S No</th> <th>Re-strata No</th> <th>Age</th> <th>No of PSPs</th> <th>Area @ 0.04 ha per PSP</th> </tr> </thead> <tbody> <tr><td>1</td><td>RS01</td><td>2nd Cop- 4th Year</td><td>1</td><td>0.04</td></tr> <tr><td>2</td><td>RS02</td><td>2nd Cop- 3rd Year</td><td>1</td><td>0.04</td></tr> <tr><td>3</td><td>RS03</td><td>2nd Cop- 2nd Year</td><td>1</td><td>0.04</td></tr> <tr><td>4</td><td>RS04</td><td>2nd Cop- 1st Year</td><td>1</td><td>0.04</td></tr> <tr><td>5</td><td>RS05</td><td>2nd Cop- 0th Year</td><td>0</td><td>0</td></tr> <tr><td>6</td><td>RS06</td><td>1st Cop- 6th Year</td><td>1</td><td>0.04</td></tr> <tr><td>7</td><td>RS07</td><td>1st Cop- 5th Year</td><td>2</td><td>0.08</td></tr> <tr><td>8</td><td>RS08</td><td>1st Cop- 4th Year</td><td>2</td><td>0.08</td></tr> <tr><td>9</td><td>RS09</td><td>1st Cop- 3rd Year</td><td>2</td><td>0.08</td></tr> <tr><td>10</td><td>RS10</td><td>1st Cop- 2nd Year</td><td>1</td><td>0.04</td></tr> <tr><td>11</td><td>RS11</td><td>1st Cop- 1st Year</td><td>1</td><td>0.04</td></tr> <tr><td>12</td><td>RS12</td><td>1st Cop- 0th Year</td><td>0</td><td>0</td></tr> <tr><td>13</td><td>RS13</td><td>Original- 8th yr</td><td>1</td><td>0.04</td></tr> <tr><td>14</td><td>RS14</td><td>Original- 7th yr</td><td>2</td><td>0.08</td></tr> <tr><td>15</td><td>RS15</td><td>Original- 6th yr</td><td>6</td><td>0.24</td></tr> <tr><td>16</td><td>RS16</td><td>Original- 5th yr</td><td>16</td><td>0.64</td></tr> <tr><td>17</td><td>RS17</td><td>Original- 4th yr</td><td>10</td><td>0.4</td></tr> <tr> <td colspan="3" style="text-align: center;">Total:</td> <td>48</td> <td>1.92</td> </tr> </tbody> </table>	S No	Re-strata No	Age	No of PSPs	Area @ 0.04 ha per PSP	1	RS01	2nd Cop- 4th Year	1	0.04	2	RS02	2nd Cop- 3rd Year	1	0.04	3	RS03	2nd Cop- 2nd Year	1	0.04	4	RS04	2nd Cop- 1st Year	1	0.04	5	RS05	2nd Cop- 0th Year	0	0	6	RS06	1st Cop- 6th Year	1	0.04	7	RS07	1st Cop- 5th Year	2	0.08	8	RS08	1st Cop- 4th Year	2	0.08	9	RS09	1st Cop- 3rd Year	2	0.08	10	RS10	1st Cop- 2nd Year	1	0.04	11	RS11	1st Cop- 1st Year	1	0.04	12	RS12	1st Cop- 0th Year	0	0	13	RS13	Original- 8th yr	1	0.04	14	RS14	Original- 7th yr	2	0.08	15	RS15	Original- 6th yr	6	0.24	16	RS16	Original- 5th yr	16	0.64	17	RS17	Original- 4th yr	10	0.4	Total:			48	1.92
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17	RS17	Original- 4th yr	10	0.4																																																																																												
Total:			48	1.92																																																																																												
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Measuring Tape ID no: MT/ST/01 Calibration frequency – Annually, Date of last calibration: 15.10.2011, Validity – One year till 14.10.2012,																																																																																															
Measuring/ Reading/ Recording frequency:	Five years.																																																																																															
Calculation method (if applicable):	NA																																																																																															
QA/QC procedures	Review of measured data carried out by CDM Manager as and when data are collected.																																																																																															
Purpose of data	Project removal																																																																																															
Additional comment																																																																																																
3. Data / Parameter:	Diameter at breast height (DBH)																																																																																															
Unit:	Cm																																																																																															
Description:	Diameter of 100% tree at breast height (DBH) contained in each PSP is measured using steel scale and outside calliper and recorded. Measurement is taken at standard breast height of 1.37m and not at individual's breast height for which a stick with 1.37m marking is used.																																																																																															
Measured /Calculated /Default:	Measured																																																																																															
Source of data:	Field measurement																																																																																															

Value(s) of monitored parameter:	For values refer to Measurement Sheets contained in Project Removal Calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Type: Steel scale – 30 cm, ID no: MTPL/SS-01 Calibration frequency: Annually, Last calibration: 30.01.12, Validity: One year till 30.01.13,
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	PSP Measurement Process (Procedure no: FFS-P-04), Clause no 5.2 Procedure for measuring DBH
Purpose of data	Project removal
Additional comment	
4. Data / Parameter:	Tree height (H)
Unit:	M
Description:	Top Tree height of 100% trees contained in each PSP is measured using Abney's Level (Angle Level) and measuring tape. However shorter trees upto 2m height are measured directly with measuring tape.
Measured /Calculated /Default:	Measured
Source of data:	Field measurement
Value(s) of monitored parameter:	For values refer to Measurement Sheets contained in Project Removal Calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	1. Type: Angle Level (Abney's Level) ID no: MT/AL-01 Calibration frequency – Annually, Date of last calibration: 16.04.2011, Validity – One year till 15.04.2012, 2. Type: Measuring Tape ID no: MT/ST/01 Calibration frequency – Annually, Date of last calibration: 15.10.2011, Validity – One year till 14.10.2012,
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	Method of calculation is given in PSP Measurement Process (Procedure no: FFS-P-04).
QA/QC procedures applied:	PSP Measurement Process (Procedure no: FFS-P-04), Clause no 5.1 Procedure for measuring tree height
Purpose of data	Project removal
Additional comment	
5. Data / Parameter:	Years of monitoring activity (t_2 and t_1)
Unit:	yr
Description:	Years of the monitoring activity
Measured /Calculated /Default:	Default
Source of data:	Recorded data
Value(s) of monitored parameter:	2006 and 2011
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration,	NA

validity)	
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA
Purpose of data	Project removal
Additional comment	
6. Data / Parameter:	Land title
Unit:	NA
Description:	Land ownership of the farmers is ensured through availability of Land Patta or Passbook in respect of individual farmers at the time of each monitoring.
Measured /Calculated /Default:	Document: Land Patta/ Passbook
Source of data:	Individual farmer
Value(s) of monitored parameter:	Copy of land patta/ pass book in respect of all 12437 parcels owned by 12002 farmers are available. None of them opted out from the project activity.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	Review of measured data is carried out by Manager (Plantation)
Purpose of data	-
Additional comment	Results of patta verification is evidenced in "List of Participating Farmers" and "Declaration by MTPL".
7. Data / Parameter:	Carbon Right
Unit:	-
Description:	Availability of "Authorization of farmers for claiming Carbon Credit" from individual farmer is ensured at the time of each monitoring.
Measured /Calculated /Default:	Document: "Authorization letter for claiming carbon Credit"
Source of data:	Individual farmer
Value(s) of monitored parameter:	Carbon Right in respect of all 12437 parcels owned by 12002 farmers are available. None of them opted out from the project activity.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	Review of measured data is carried out by Manager (Plantation)
Purpose of data	-
Additional comment	Results of verification is evidenced in "List of Participating Farmers" and "Declaration by MTPL".
8. Data / Parameter:	Available Grazing Land (AGL)
Unit:	Acre
Description:	Land available for grazing under the control of PP
Measured /Calculated /Default:	Calculated

Source of data:	Survey in 2006 and 2011 by Maa Samalyi Voluntary Organization
Value(s) of monitored parameter:	Available grazing land under the control of PP is 2840.30 acres as against the required area of 2673.38 acres as per current survey of 2011.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA
Purpose of data	Leakage emission
Additional comment	

9. Data / Parameter:	No of existing animals ($H_{Existing,g,k,t}$)
Unit:	Head
Description:	Number of head of animal type g existing on parcel k and / or being fed by fodder produced on parcel k before displacement of animals in year t
Measured /Calculated /Default:	Estimated in displacement plan and monitored
Source of data:	Survey in 2006 and 2011 by Maa Samalyi Voluntary Organization
Value(s) of monitored parameter:	Animals within project boundary as per 2011 report: Cows/ Bufallos = 756 nos Goats = 696 nos
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA
Purpose of data	Leakage emission
Additional comment	

10. Data / Parameter:	No of displaced animals ($H_{d,k,t}$)
Unit:	Head
Description:	Number of head of animal type g displaced and/or the number of animals of type g fed by fodder for which production is displaced to parcel k in year t.
Measured /Calculated /Default:	Estimated in displacement plan and monitored
Source of data:	Survey in 2006 and 2011 by Maa Samalyi Voluntary Organization
Value(s) of monitored parameter:	Animals displaced as per 2011 report: Cows/ Bufallos = 2062 nos Goats = 3374 nos
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA
Purpose of data	Leakage emission
Additional comment	Please refer Project Removal calculation

11. Data / Parameter:	Biomass Burning ($E_{\text{BiomassBurn,t}}$)
Unit:	t C/yr
Description:	Loss of above ground biomass carbon due to biomass burning
Measured /Calculated /Default:	Calculated
Source of data:	Survey in 2006 and 2011 by Maa Samalyi Voluntary Organization
Value(s) of monitored parameter:	Nil
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Five Years
Calculation method (if applicable):	ER Sheet
QA/QC procedures applied:	NA
Purpose of data	Leakage emission
Additional comment	Please refer Project Removal calculation

12. Data / Parameter:	Survival Rate
Unit:	%
Description:	Number of trees counted in each sample parcel initially after 3 months of planting and survival rate is computed. Replantation done where survival is < 90%. Final survival checking is done after 3 years of planting for plantation management. At the time of monitoring number of trees contained in each PSP are counted manually and recorded. In case of harvested parcels, number of coppices in each tree are also counted and recorded.
Measured /Calculated /Default:	Calculated
Source of data:	Field measurement
Value(s) of monitored parameter:	For values refer to Sample Plot Register and Measurement Sheets contained in Project Removal.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Initial survival checking after 3 months of planting. Final survival checking after 3 years of planting and subsequently at each monitoring event.
Calculation method (if applicable):	$\frac{\text{No of trees available} \times 100}{\text{No of trees planted}} \%$
QA/QC procedures applied:	PSP Measurement Process (Procedure no: FFS-P-04)
Purpose of data	Plantation Management & Project Removal calculation
Additional comment	

D.3. Implementation of sampling plan

>>

In course of implementation of the project activity, total number of PSPs reduced to 244 as against 1041 as per registered PDD which is permitted as per board decision contained in para 4, point (m) of EB 66, Annex 4. Bank area wise revised number of PSPs identified in each strata is detailed in Table D.1 below:

Table D.1: Bank area wise Permanent Sample Plots (PSPs) identified in each strata

S No	Bank Area	ID	Number of Permanent Sample Plots identified Stratwise							Total Nos
			Strata 1 (2001)	Strata 2 (2002)	Strata 3 (2003)	Strata 4 (2004)	Strata 5 (2005)	Strata 6 (2006)	Strata 7 (2007)	
1	B Singhpur	NBS	1	1	1	1	1	1	1	7
2	Challanguda	NCG	1	1	1	1	1	1	1	7
3	Dhodra	NDD		1	1	1	2	1	1	7
4	Jotabal	NJB	0	1	1	1	1	1	1	6
5	Jharigaon	NJG		2	1	1	1	1	1	7
6	Kodinga	NKD			0	1	0		1	2
7	Katharguda	NKG	1	2	1	1	1	1	1	8
8	Kumuli	NKL	1	2	1	1	1	1	1	8
9	Kosagumuda	NKM	1	1	1	1	1	1	1	7
10	Maidalpur	NMP				0	1	1	1	3
11	Nandahandi	NNH	2	0	1	1	1	1	1	7
12	Nabarangpur	NNP	1	0	1	1	1	1	1	6
13	Raighar	NRG		2	1	1	1	1	1	7
14	Rajoda	NRJ	1	2	1	1	1	1	1	8
15	Sindhiguda	NSG	1	1	1	1	1	1	1	7
16	Sanmosigaon	NSM	1	1	1	1	1	1	1	7
17	Tentulikuthi	NTK				0	1	0	0	1
18	Umerkote	NUK		0	2	1	1	1	1	6
19	Ambaguda	KAG	1	1	2	1	1	1		7
20	Boipariguda	KBG	7	3	2	1	1	1	1	16
21	Digapur	KDG	2	2	1	2	1	3	2	13
22	Dongerpausi	KDP	1	2	2	2	0	1	3	11
23	Dasmantpur	KDS		1	1	1	0	1	2	6
24	Jeypore	KJR				1	0	1		2
25	Kundra	KKN	3	2	2	2	3	3	2	17
26	Koraput	KKP	1	1	1	1	1	1		6
27	Kusumi	KKS	1	1	1	2	2	0	1	8
28	Nandpur	KNP	3	1	2	2	1	1	2	12
29	Podagada	KPG	1	1	1	1	1	1	2	8
30	Phamphuni	KPP	2	2	1	1	1	0	1	8
31	Sunabeda	KSB				1	1	1	0	3
32	Semiliguda	KSG	1	1	2	1	1	1	2	9
33	Malkangiri	MMG			0	0	0	1	0	1
34	Maithili	MML		0	1	0	0	0	0	1
35	Arkuvley	VSA					1	0	0	1
36	Kinchunmanda	VSK					1	0	0	1
37	Paderu	VSP					0	1	0	1
38	Veergatham	SVG					1			1
	Bastar	BBS					0	1	0	1
Total:			34	35	35	35	35	35	35	244
: Grey colour indicates no plantation in the area during that particular year										

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

The baseline net greenhouse gas removal by sink is calculated by using the equation given in the methodology. The baseline net GHG removal by sink is determined as follows:

$\Delta C_{BSL} = \Delta C_{BSL,tree}$	
ΔC_{BSL}	Baseline net greenhouse gas removable by sinks, tCO ₂ -e
$\Delta C_{BSL,tree}$	Sum of the carbon changes in above ground and below ground biomass of trees in the baseline; tCO ₂ -e

For those strata without growing trees the methodology conservatively assumes that, $\Delta C_{BSL,tree}$, baseline = 0. For those strata with a few growing trees, baseline, is estimated using stock change method.

$$\Delta C_{BSL,AG/BG,i,t} = \sum_{j=1}^J (C_{j,i,t2} - C_{j,i,t1}) / T \quad \dots\dots\dots (7)$$

$$C_{i,i,t} = C_{AB_tree,i,i,t} + C_{BB_tree,i,i,t} \quad \dots\dots\dots (8)$$

$$C_{AB_tree,i,i,t} = A_{BSL,i} * V_{tree,i,i,t} * D_j * BEF_{2,i} * CF_j \quad \dots\dots\dots (9)$$

$$C_{BB_tree,i,i,t} = C_{AB_tree,i,i,t} * R_j \quad \dots\dots\dots (10)$$

$\Delta C_{BSL,AG/BG,i,t}$	Annual carbon stock change in above-ground and below-ground tree biomass for stratum <i>i</i> , time <i>t</i> ; t C yr-1
$C_{j,i,t2}$	Total carbon stock in living biomass of trees of species <i>j</i> in stratum <i>i</i> , calculated at time <i>t2</i> ; t C
$C_{j,i,t1}$	Total carbon stock in living biomass of trees of species <i>j</i> in stratum <i>i</i> , calculated at time <i>t1</i> ; t C
T	Number of years between times <i>t2</i> and <i>t1</i> ; yr
$C_{AB_tree,j,i,t}$	Carbon stock in above-ground tree biomass of species <i>j</i> in stratum <i>i</i> , at time <i>t</i> ; t C
$C_{BB_tree,j,i,t}$	Carbon stock in below-ground tree biomass of species <i>j</i> in stratum <i>i</i> , at time <i>t</i> ; t C
$A_{BSL,i}$	Area of baseline stratum <i>i</i> ; ha
$V_{tree,j,i,t}$	Pre-project tree stem volume for species <i>j</i> , stratum <i>i</i> , at time <i>t</i> ; m ³ ha-1
D_j	Basic wood density for species <i>j</i> ; t d.m. m ⁻³
$BEF_{2,j}$	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for tree species <i>j</i> ; t d.m t-1 d.m
R_j	Root-shoot ratio appropriate for biomass stock, for species <i>j</i> ; t C t-1 C
<i>i</i>	1, 2, 3, ... MB strata in the baseline scenario
<i>j</i>	1, 2, 3, ... J tree species in the baseline scenario
<i>t</i>	1, 2, 3, ... t* years elapsed since the start of the A/R CDM project activity

The carbon stock in living biomass of pre-project growing trees is expected to increase in the absence of the proposed A/R CDM project activity, due to continuous growth of the living trees. The carbon stock in the living biomass of pre-project trees has been predicted using equation from Brown et al.¹ (1989) for dry forest in India.

$$\text{Dry matter (kg)} = \exp(-1.996 + 2.32 * \ln(\text{dbh cm}))$$

From the dry matter, the carbon stocks have been estimated using the formulae from the applied methodology. The BEF of 3.4 has been taken from the table 3A.1.10 of the IPCC good practice guidance for LULUCF. The BEF has been chosen from the default values in the absence of any national data in this regard. The default value is that of a tropical broadleaf forest having a range of BEF from 2.0 to 9.0.

¹ Brown, S. 1997. Estimating biomass and biomass change of tropical forests: a primer. FAO Forestry Paper 134, Rome, Italy

E.1: Estimation of Baseline net GHG removals by Sinks (tonnes of CO ₂)								
Year	2001	2002	2003	2004	2005	2006	2007	Total
2001	0	0	0	0	0	0	0	0
2002	2.93	0	0	0	0	0	0	2.93
2003	2.94	4.74	0	0	0	0	0	7.68
2004	2.95	4.75	6.42	0	0	0	0	14.12
2005	2.96	4.76	6.44	10.39	0	0	0	24.55
2006	2.97	4.78	6.46	10.42	11.72	0	0	36.35
2007	2.98	4.79	6.48	10.45	11.77	14.18	0	50.64
2008	2.99	4.81	6.49	10.49	11.81	14.22	16.98	67.79
2009	3.00	4.82	6.51	10.52	11.85	14.27	17.04	68.01
2010	3.01	4.83	6.53	10.55	11.90	14.32	17.09	68.23
2011	3.02	4.85	6.55	10.59	11.94	14.37	17.14	68.45
							Total:	408.75

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

Project removal has been calculated considering three carbon pools as below mentioned in section C.3 of registered PDD:

1. Above-ground biomass
2. Below-ground biomass
3. Soil organic Carbon

Formulae for estimation of actual net GHG removals by sinks:

The Actual net greenhouse gas removals by sinks represent the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in GHG emissions measured in CO₂ equivalents by the sources that are increased as a result of the implementation of an A/R CDM project activity, while avoiding double counting, within the project boundary, attributable to the A/R CDM project activity. Therefore,

$$\Delta C_{\text{ACTUAL}} = \Delta C_{\text{p}} - \text{GHG}_{\text{E}} \quad \text{.....(12)}$$

where	
ΔC_{ACTUAL}	Actual net greenhouse gas removals by sinks; t CO ₂ -e.
ΔC_{p}	Sum of the changes in above-ground and below-ground biomass, dead wood, litter and soil organic carbon stocks in the project scenario; t CO ₂ -e.
GHG_{E}	Increases in GHG emissions as a result of the implementation of the proposed AR CDM project activity within the project boundary; t CO ₂ -e.

Based on the approved methodology applied, the aboveground biomass and belowground biomass are the pools to be accounted for.

Estimates of carbon stock changes in living biomass of planted trees

BEF method as presented in Section II.5.1 of the approved methodology applied is used. Above ground biomass shall be estimated through the following steps:

Step 1: Measuring the diameter at breast height (DBH) at 1.37 m above ground and height of all the trees contained in 20m x 20m area of each of 244 permanent sample plots spread across the entire project area.

Step 2: Estimating the volume of the commercial component of trees based on locally derived equation, expressed as volume per unit area, m³/ha:

The volume of each tree measured is calculated using volume equation as below and multiplied by number of

trees per hectare in the PSPs which gives the volume per unit area, m³/ha:

$$V = -0.0001 + 0.31145 D^2 \times H$$

(n = 580, R² = 0.9855)

(For volume equation refer page 226 of the book titled “Volume Equations for Forests of India, Nepal and Bhutan” published by Forest Survey of India, 1996)

However in volume calculation trees having DBH< 1.5 cms and height < 2m are not considered in the project removal conservatively for being very small in values.

Step 3: Choosing BEF, root-shoot ratio, wood density and other parameters:

The wood density has been taken from project data base which is the average density of Eucalyptus species computed on the basis of actual field measurement. Values of BEF and Root-shoot ratio for Eucalyptus are taken from table 3A.1.10 of IPCC GPG for LULUCF:

Species	Wood density	BEF	Root to shoot ratio
Eucalyptus sp.	0.60672	2	0.27
Reference	Project data base	IPCC GPG for LULUCF Table- 3A.1.10	IPCC GPG for LULUCF Table- 3A.1.8

Step 4: Converting the volume of the commercial component of trees into carbon stock in aboveground biomass via basic wood density, BEF root-shoot ratio and carbon fraction, given by:

$$C_{AB_tree,l,i,j,sp,t} = V_{l,i,j,sp,t} * D_j * BEF_{2j} * CF_j \dots\dots\dots(15)$$

where	
C _{AB_tree,l,i,j,sp,t}	Carbon stock in above-ground biomass of tree l of species j in plot sp in stratum i at time t; t C tree ⁻¹
V _{l,i,j,sp,t}	Stem volume of tree l of species j in plot sp in stratum i at time t; m ³ tree ⁻¹
D _j	Basic wood density of species j; t d.m. m ⁻³
BEF _{2j}	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for species j; dimensionless
CF _j	Carbon fraction of biomass for tree species j; t C t ⁻¹ d.m. (IPCC default value = 0.5 t C t ⁻¹ d.m.)
l	Sequence number of trees on plot sp
i	1, 2, 3, ... MPS strata in the project scenario
J	1, 2, 3, ... SPS tree species in the project scenario
t	1, 2, 3, ... t* years elapsed since the start of the A/R CDM project activity

Step 5: Converting the volume of the commercial component of trees into carbon stock in belowground biomass via basic wood density, BEF root-shoot ratio and carbon fraction, given by:

$$C_{BB_tree,l,i,j,sp,t} = C_{AB_tree,l,i,j,sp,t} * R_j \dots\dots\dots(16)$$

where	
C _{BB_tree,l,i,j,sp,t}	Carbon stock in below-ground biomass of tree l of species j in plot sp in stratum i at time t; t C tree ⁻¹
C _{AB_tree,l,i,j,sp,t}	Carbon stock in above-ground biomass of tree l of species j in plot sp in stratum i at time t; t C tree ⁻¹
R _j	Root-shoot ratio appropriate for biomass stock, for species j; dimensionless

Step 6: Calculate carbon stock in above-ground and below-ground biomass of all trees present in plot sp in stratum i at time t

$$C_{tree,i,sp,t} = \sum_{j=1}^{S_{SP}} \sum_{l=1}^{N_{i,j,sp,t}} (C_{AB_tree,l,i,j,sp,t} + C_{BB_tree,l,i,j,sp,t}) \dots\dots\dots(17)$$

where	
$C_{tree,i,sp,t}$	Carbon stock in trees on plot <i>sp</i> of stratum <i>i</i> at time <i>t</i> ; t C
$C_{AB_tree,l,j,i,sp,t}$	Carbon stock in above-ground biomass of tree <i>l</i> of species <i>j</i> in plot <i>sp</i> in stratum <i>i</i> at time <i>t</i> ; t C tree ⁻¹
$C_{BB_tree,l,j,i,sp,t}$	Carbon stock in below-ground biomass of tree <i>l</i> of species <i>j</i> in plot <i>sp</i> in stratum <i>i</i> at time <i>t</i> ; t C tree ⁻¹
$N_{j,i,sp,t}$	Number of trees of species <i>j</i> on plot <i>sp</i> of stratum <i>i</i> at time <i>t</i>
<i>l</i>	Sequence number of trees on plot <i>sp</i>
<i>i</i>	1, 2, 3, ... MPS strata in the project scenario
<i>j</i>	1, 2, 3, ... SPS tree species in the project scenario
<i>t</i>	1, 2, 3, ... t* years elapsed since the start of the A/R CDM project activity

Soil Organic Carbon:

As the project activity satisfies all applicability conditions listed in paragraph 5.1.4 under the heading “Soil Organic Carbon of the methodology AR-ACM0001 (version 04), the default method has been used to account for soil organic carbon considering default values of ΔC = 0.5tC/hectare/year. The following formula has been used.

$$\Delta C_{d,SOCT} = A_i * \Delta C \text{ for } 0 < t \leq t_{equilibrium} \dots\dots\dots (29)$$

where	
$\Delta C_{d,SOCT}$	Annual change in carbon stock in soil organic matter for area of land <i>i</i> , for year <i>t</i> ; t C yr ⁻¹
A_i	Area of land <i>i</i> that satisfies all conditions (i)-(iv) listed for soil organic carbon ; hectare (ha)
ΔC	Default annual increase in carbon stock in soil organic carbon; t C ha ⁻¹ yr ⁻¹
$t_{equilibrium}$	Time until a new equilibrium in carbon stock in soil organic matter is reached in area of land <i>i</i> ; years

Calculation provided in sheet no 12 of Project Removal calculations.

PROJECT EMISSION CALCULATION:

Estimation of GHG emissions within the project boundary

The increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary can be estimated as:

$$GHG_E = \sum_{t=1}^{t^*} E_{BiomassBurn,t} \dots\dots\dots (30)$$

where	
GHG_E	Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; t CO2-e
$E_{BiomassBurn,t}$	Non-CO2 emissions due to biomass burning of existing woody vegetation as part of site preparation during the year <i>t</i> ; t CO2-e
<i>t</i>	1, 2, 3, ... t* years elapsed since the start of the A/R CDM project activity

There will be no biomass burning during site preparation, thus there will be no GHG emissions from biomass burning, i.e., $E_{BiomassBurn,t} = 0$;

So, $GHG_E = 0$

As per vegetation survey few trees along with scattered herbs & shrubs have been found in almost 1483 parcels spreading across 2938 hectares of the project area. Because of degraded nature of land majority of parcels are barren without any woody vegetation. Herbs and shrubs that grow during rains, dries and disappear automatically with the onset of summer. During site preparation at the best these herbs and shrubs are cleared which is maximum 5% of the total area. Existing woody biomass are essentially not removed at all. So, $E_{biomassLoss} = 0$

E.3. Calculation of leakage

>>

“Leakage (LK) represents the increase in GHGs emissions by sources which occurs outside the boundary of an AR CDM project activity which is measurable and attributable to the AR CDM project activity”.

Based on the applied approved consolidated afforestation and reforestation baseline and monitoring methodology AR-ACM001 (Version 4) following potential sources of leakage (LK) are identified:

- GHG emission due to activity displacement
- GHG emission due to increase in use of wood posts for fencing

Estimation of leakage :

$$LK = LK_{ActivityDisplacement} \dots\dots\dots(31)$$

Where	
LK	Total GHG emissions due to leakage; t CO ₂ -e
LK _{ActivityDisplacement}	Leakage due to activity displacement; t CO ₂ -e

a. Estimation of LK_{ActivityDisplacement}

Some lands planted in the proposed A/R CDM project activity had grazing animals. Thus, as the result of the project activity, grazing may be temporarily or permanently displaced from the project sites to other locations. The displacement may result in leakage if the new grazing areas are obtained by converting stocked areas, particularly forests, to grazing land, results in degradation or deforestation of other forests and loss of vegetation on other lands.

Leakage due to activity displacement (LK_{ActivityDisplacement}) is estimated as follows:

$$LK_{ActivityDisplacement} = LK_{conversion} \dots\dots\dots (32)$$

LK _{ActivityDisplacement}	Leakage due to activity displacement; t CO ₂ -e
LK _{conversion}	Leakage due to conversion of land to grazing land; t CO ₂ -e

a.1 Estimation of LK_{Conversion} (Leakage due to conversion of land to grazing land)

The project animal population and the number of months of grazing of different livestock groups on lands, both within the project boundary and outside the project boundary that are under the control of the project participants, have been currently surveyed by Maa Samalyi Voluntary Organization using Participatory Rural Appraisal (PRA). Altogether 2062 (756+1306) cows & buffalos and 3374 (696+2678) goats were found within and outside the project boundary those are likely to be displaced by project activity. Grazing land outside the project boundary, well under the control of animal owners, for displaced animals has been found 2840.3 acres against the required area of 2673.4 acres calculated on the basis of dry matter intake. Leakage calculation sheet ensure sufficient AGL with all individual animal owners. A summary of district wise land available for grazing and land required for displacement due to grazing is presented in the table below:

Table: E.2: Summary of calculation for Required Grazing Land							
S No	Districts	No of animals likely to be displaced by the project activity				Required Grazing Land (Acres)	Available Grazing Land (AGL) outside the project boundary under the control of the animal owners (Acres)
		Animals within project boundary		Animals outside project boundary			
		Cows/ Bufallo	Goats	Cows/ Bufallo	Goats		
1	Nabarangpur	206	208	365	677	730.20	787.9
2	Koraput	265	244	531	1028	1025.77	1080.5
3	Malkangiri	46	45	78	148	158.74	172.0
4	Vishakhapatnam	177	136	260	658	582.74	613.7

5	Vizianagaram	5	6	8	18	17.41	18.0
6	Srikakulam	16	12	22	45	48.21	50.0
7	Bastar	41	45	42	104	110.31	118.2
Total:		756	696	1306	2678	2673.38	2840.3

The annual biomass intake of the animals over the project lands and existing grasslands is estimated using equation (4) in the A/R methodological tool “Estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity” and the required area to accept displaced animals is estimated using equation (5) of the methodological tool.

$$DMI_{TOTAL,k,t} = \frac{\sum DMI_g * (H_{existing,g,k,t} + H_{g,k,t})}{1000} * 365$$

DMI _{TOTAL,k,t}	Total dry matter intake of grazing animal on parcel k in year t ; tdm /year
DMI _g	Daily dry matter intake per grazing animal of animal type g ; kg d.m./head/day
H _{existing,g,k,t}	Number of head of animal type g existing on parcel k and/or being fed by fodder produces on parcel k before displacement of animals in year t; head
H _{g,k,t}	Number of head of animal type g displaced and/or the number of animals of type g fed by fodder for which production is displaced to parcel k in year t; head

DMIG is taken from Table 3 in methodological tool.

$$Area_{required,k,t} = \frac{DMI_{TOTAL,k,t}}{ANPP_k}$$

Area _{required,k,t}	Total area of land required for year t to sustain the grazing activities displaced to parcel k; (ha)
DMI _{TOTAL,k,t}	Total dry matter intake of grazing animals on parcel k in year t ;td.m/yr
ANPP _k	Above ground net primary productivity of parcel k in tones dry matter, td.m./ha/yr

The default value for annual net primary production (ANPP) i.e. 8.2 tonnes d.m. ha⁻¹ from Table 3.4.2 of IPCC good practice guidance LULUCF was used as in the calculation. Daily Dry matter intake has been taken as 21.6 kg/head/day for cows/buffalos and 4.6 kg/head/day for goat from Table 3 of A/R methodological tool “Estimation of GHG emissions related to displacement of grazing activities in A/R CDM project activity” (version 02).

Leakage calculation indicates that sufficient grassland land exists under the control of the project participants that can adopt displaced animals even if all pre-project animals are displaced to existing grasslands outside the project boundary. Therefore, LK_{Conversion}= 0.

As per EB42, monitoring of leakage associated with the use of fencing posts is not required as it is considered insignificant.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Net anthropogenic GHG removals by sinks

The net anthropogenic GHG removals by sinks is the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage, therefore, the following formula used to calculate the net anthropogenic GHG removals by sinks.

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - LK \dots\dots\dots (33)$$

C _{AR-CDM}	Net anthropogenic GHG removals by sinks; t CO2-e
ΔC _{ACTUAL}	Actual net GHG removals by sinks; t CO2-e
ΔC _{BSL}	Baseline net GHG removals by sinks; t CO2-e
LK	Total GHG emissions due to leakage; t CO2-e

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
25.06.2001 to 24.06.2011	408.755	1764485.264	0	1,764,076
Total	408.755	1764485.264	0	1,764,076

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

The estimated net anthropogenic GHG removal by sinks as per registered PDD corresponding to the current monitoring period has been furnished in Table E.4 below for comparison with the actual project removal:

Table E.4: Estimated Net Anthropogenic GHG removals as per registered PDD					
Year		Estimated baseline net GHG Removals by sinks (tCO ₂ e)	Estimated actual net GHG removals by sinks (tCO ₂ e)	Estimated leakage (tCO ₂ e)	Estimation of net anthropogenic GHG Removals by sinks (tCO ₂ e)
1 st year	2001	0	3862.37	0	3862
2 nd year	2002	2.93	28667.04	0	28664
3 rd year	2003	7.68	97471.37	0	97464
4 th year	2004	14.12	261234.66	0	261221
5 th year	2005	24.55	618873.65	0	618849
6 th year	2006	36.35	736103.63	0	736067
7 th year	2007	50.64	1021486.61	0	1021436
8 th year	2008	67.79	1616039.06	0	1615971
9 th year	2009	68.01	-385670.24	0	-385738
10 th year	2010	68.23	365863.64	0	365795
11 th year	2011	68.45	-153435.72	0	-153504
Total estimated GHG removals upto 2011 (tCO₂e):		408.75	4,210,496.08	0	4,210,087

Comparison of estimated GHG removal with actual removal:

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	4,210,087	1,764,076

E.6. Remarks on difference from estimated value in registered PDD

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The actual emission reduction is much less than the estimated one because of growth pattern of the trees.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO ₂ e)	1,764,076	Nil

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
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