BAMBOO PLANTATIONS BY FARMERS AND COMMUNITY IN THE COUNTRY

Document Prepared by Infinite Solutions

Project Title	Bamboo plantations by farmers and community in the country
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The primary goal of this project is to contribute to the removal and reduction of greenhouse gases (GHG) emissions from the atmosphere by planting Bamboo on degraded land owned by individual farmers/communities.

The project is expected to be planted across the country, however initially the plantations were started from districts Raisen and Bhopal of the state Madhya Pradesh, the central part of India and at districts of Nashik and Ahmednagar in the state of Maharashtra.

Reasons why Bamboo is the world's most amazing plant.

1. Bamboo is the fastest growing plant on Earth. Bamboo will constantly reproduce itself, even after harvesting, new shoots will continue to sprout from its extensive root system without having to replant.
2. Bamboo is a highly effective carbon sink. Bamboo absorbs enormous amounts of greenhouse gases, and because of its rapid growth, bamboo is identified as a useful as a tool for high carbon sequestration.

   Therefore, through this project activity there will be overall positive impact on the environment.

Infinite Environmental Solutions LLP is responsible for all activities related to the monitoring and reporting and the farmers participating in the project are responsible for plantation, management, and maintenance of this project activity throughout the crediting period. Before the implementation of the project, the land was barren land owned by individuals and communities. The Project focuses on the contribution of forest cover increase and to improve carbon sequestration and store carbon in form of biomass, thus mitigating climate change and increasing carbon sink.

The project activity will cover the bamboo plantation of **4,500 ha** , with initial plantations carried out for **1,500 ha.** The plantations in the last two years were reduced due to COVID situations and is expected to improve significantly. The project activity will include the harvesting of bamboo in the fourth to fifth year of plantation and then after every year. The project activities are expected to reduce annual removal of **61,126 t/CO2** per year and a total of **1,833,769 t/CO2** during the **30 years** of project lifespan.

1.2 Sectoral Scope and Project Type

The project activity comes under the sectoral scope- 14[1] Agriculture, Forestry, and other Land Use (AFOLU) of Verified Carbon Standard (VCS) under category Afforestation, Reforestation and Revegetation (ARR).

The project activity is a grouped project activity and spread across the multiple locations in India. At present, the project activity covers Madhya Pradesh, and Maharashtra states but in future it will be extended to other states and UTs of India.

1.3 Project Eligibility

The project activity has been initiated and planned as per the VCS eligibility requirements of the VCS framework, as described in the VCS Standard v4.2[2]. The grouped project activities result in GHG emission removals from bamboo plantation as per the rules and requirements of the VCS. The VCS Program defines eligible activities in the Afforestation, Reforestation and Revegetation category as "activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and/or restoring vegetative cover through planting, sowing and/or the human assisted natural regeneration of woody vegetation". The proposed project activities specifically aim to plant some species of bamboo with the specific purpose of increasing the carbon stock through carbon dioxide sequestration in form of bamboo biomass.

The project uses CDM methodology AR-ACM0003, as approved under the scope of the VCS for ARR projects and follows the eligibility requirements as specified by this methodology. The grouped project activities had not resulted in clearance or conversion of any native ecosystems, also they did not include any draining of native ecosystems or degradation of ecological functions.

1.4 Project Design

The project activity includes multiple states of India, the central part of India. The land parcels which have been utilised for plantations were identified as barren land in the baseline. Multiple species of bamboo will be planted under this project activity.

☐ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☒ The project is a grouped project

Eligibility Criteria

[1] https://verra.org/project/vcs-program/projects-and-jnr-programs/vcs-sectoral-scopes/

[2] https://verra.org/wp-content/uploads/2022/02/VCS-Standard_v4.2.pdf

The project consists of plantation of multiple bamboo species, which include Bambusa tulda, Bambusa balcooa, Bambusa bambos species to established green cover in degraded land/community land. The future plantations shall cover all the states of India.

For grouped projects, additional information relevant to the design of the grouped project (e.g., the eligibility criteria for the inclusion of new project activity instances) are described in the table below:

Eligibility conditions	Justification/Description
a) Eligible ARR activities are those that increase carbon sequestration and/or reduce GHG emissions by establishing, increasing or restoring vegetative cover (forest or non-forest) through the planting, sowing or human-assisted natural regeneration of woody vegetation.	The project activity involves the plantation of trees on non-forest land (degraded and low productive land) which will increase the carbon sequestration of the land much higher than in the baseline conditions
b) Eligible ARR projects may include timber harvesting in their management plan.	Not Applicable.
c) The project area shall not be cleared of native ecosystems within 10 years before the project start date.	The project activity has not cleared the native ecosystems. Instead, it will plant agroforestry trees which are suitable for fruit and fodder production and highly adaptive to the native ecosystems of the project area. There was no vegetation in the baseline as the project area is degraded land and not identifies are not suitable for or survival of agroforestry trees without any plantation, management activity [3]. Local stakeholder consultation- Local stakeholder consultation was conducted to identify the baseline scenario and impact of land-use conversion to forestation activity. It is identified that the project activity has no forest or any vegetation in the baseline and is identified as desert land.

[3] https://www.frontiersin.org/articles/10.3389/fpls.2018.01696/full

Eligibility criteria for the new grouped project are discussed below. New project activity instances shall:

Eligibility conditions	Justification/Description
Occur within one of the designated geographic areas specified in the project description.	The new project instances will be within the geographical boundary several states of India.. All the areas are part of the project boundaries and have similarities in geography, meteorology and are identified as deserted land[4].
Comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial compliance with multiple sets of eligibility criteria is insufficient.	The addition of new project instances will be done based on compliance with at least one complete set of eligibility criteria.
Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body	The applicable set of eligibility criteria is mentioned in the relevant section and will follow the same approach for new instances as well, please refer to the monitoring section of this PD.
Be validated at the time of verification against the applicable set of eligibility criteria.	The validation and verification will be done at the same time against the applicable set of eligibility criteria. The DOE is a third-party auditor and is eligible to validate and verify the project.
Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions)	The evidence of project ownership will be held by IESLLP and will remain same during the inclusion of new project instances.
Have a start date that is the same as or later than the grouped project start date	The project start date will be the same as the grouped project start date. The start date of

[4] https://www.worldatlas.com/articles/where-does-the-arabian-desert-lie.html

	the project is when the soil preparation for plantation has begun and is in line with section 3.7 of the project standard version. 4.3.
Be eligible for credit from the start date of the instance through to the end of the project crediting period (only). Note that where a new project activity instance starts in a previous verification period, no credit may be claimed for GHG emission reductions or removals generated during a previous verification period	The project instances later added will have to be credited from the start date of the instance through the end of the project crediting period (only).

1.5 Project Proponent

Organization name	Infinite Environmental Solutions LLP
Contact person	Mr. Jimmy Sah
Title	COO (Chief Operating Officer)
Address	Milinda's Manor, 214-215, 2, RNT Marg, Indore, Madhya Pradesh 452001
Telephone	+917314050174
Email	jimmy@infisolutions.org

1.6 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Carbon consultant
Contact person	Mr. Jimmy Sah
Title	COO (Chief Operating Officer)

Address	Milinda's Manor, 214-215, 2, RNT Marg, Indore, Madhya Pradesh 452001
Telephone	+917314050174
Email	jimmy@infisolutions.org

1.7 Ownership

The project proponent meets the ownership requirements of the VCS Program specifications as detailed in section 3.6 of the VCS Standard v4.2[5] The project proponent Infinite Environmental Solutions LLP is the owner of the project. The project proponent has full and uncontested legal rights over the project activity by getting into agreement with individual farmers/land owners who are the legal owners of the land. Another entity is Infinite Solutions which acts as the carbon developer. The land has been owned by locals and the land documents will be available in case of individual landowners at the time of validation and verification to DOE.

The landowners agree to the plantation on their land, their upkeep for proper growth and maintaining survival rate. IESLLP acts as the project proponent on behalf of all the individual farmers/communities.

1.8 Project Start Date

Project start date of implemented AFOLU project activity is the date on which activities that led to the generation of GHG emission reductions or removals are implemented (e.g., preparing land for seeding, planting, changing agricultural or forestry practices, rewetting, restoring hydrological functions, or implementing management or protection plans) and comply with the requirements as per the section 3.7, of the VCS standard Version 4.2,[6]. The start date of Bamboo plantation is 9-July-2019.

1.9 Project Crediting Period

The project activity has renewable crediting period of 30 years and in compliance with the section 3.8, VCS standard Version 4.2,[7] ,

Start date of Crediting Period – 9/07/2019

End date of Crediting Period – 8/07/2048

[5] https://verra.org/wp-content/uploads/2022/02/VCS-Standard_v4.2.pdf

[6] https://verra.org/wp-content/uploads/2022/02/VCS-Standard_v4.2.pdf

[7] https://verra.org/wp-content/uploads/2022/02/VCS-Standard_v4.2.pdf

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☒ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
2019 - 2020	14025
2020 - 2021	45581
2021 - 2022	98175
2022 - 2023	150769
2023 - 2024	147263
2024 - 2025	115706
2025 - 2026	52594
2026 – 2027	52594
2027 - 2028	52594
2028 - 2029	52594
2029 - 2030	52594
2030 - 2031	52594
2031 - 2032	52594
2032 - 2033	52594

2033 - 2034	52594
2034 - 2035	52594
2035 - 2036	52594
2036 - 2037	52594
2037 - 2038	52594
2038 - 2039	52594
2039 - 2040	52594
2040 - 2041	52594
2041 - 2042	52594
2042 - 2043	52594
2043 - 2044	52594
2044 - 2045	52594
2045 - 2046	52594
2046 - 2047	52594
2047 - 2048	52594
2048 - 2049	52594
Total estimated ERs	1833769
Total number of crediting years	30
Average annual ERs	61126

1.11 Description of the Project Activity

The purpose of the project is to reduce atmospheric carbon dioxide through bamboo plantations on the barren land held by community. The objective to utilize the land, which was previously barren, is bamboo plantations. Bamboo is a fast-growing species, and it can store carbon in form of above ground biomass, below ground biomass, SOC and litter. The bamboo plantation will contribute to climate change mitigation by sequestering carbon from the atmosphere through the process of photosynthesis and store carbon in form of biomass thus contributing to the net GHG emission reductions/removals in the project area.

The project activities on the barren land owned by community include initial land preparation, where weeds and other unwanted vegetation were cleared, ensuring minimal disturbance to the soil, planting holes of appropriate size were dug, soil in the prepared hole was loosened, propagule was placed vertically in the planting hole and watered when necessary. The project

proponent's monitoring team does regular monitoring of the plantations and documentation of bamboo's growth rates, type of diseases present in the plantations, yearly replacement of dead bamboo, all factors affecting the survival are keenly assessed.

1.12 Project Location

The community-based Bamboo Project was initated in Raisen and Bhopal districts of the central part of the state of Madhya Pradesh and in Nashik and Ahmednagar districts of the state Maharashtra and is expected to be planted across the country. The project is a grouped project.

The project is located at 23.0150442 latitude and 78.1539958 longitude in Madhya Pradesh. As required the separate KML sheet is also uploaded.

1.13 Conditions Prior to Project Initiation

The land before the implementation of the project activity was degraded owned by farmers and communities. Without the implementation of the project the land would continue to degrade further.

- **Ecosystem type:** *The project area has tropical ecosystem.*

- **Current and historical land-use:** *The project area in the baseline is identified as degraded land.*
- **Has the land been cleared of native ecosystems within 10 years of the project start date?**

☐ Yes ☒ No

MADHYA PRADESH -

Climate –

Madhya Pradesh is one of the warmest region in India with an average daily high temperature of 33 degrees centigrade. It is yearlong warm or hot. Madhya Pradesh also has three major seasons – Summer, Monsoon, and Winter. During summer (March–June), the temperature in the entire state ranges above 34.6 it has increased as it is all time high in Madhya Pradesh. In general, the eastern parts of Madhya Pradesh are hotter than the western parts.

Hydrology –

The Narmada is the longest river in Madhya Pradesh. It flows westward through a rift valley, with the Vindhya ranges sprawling along its northern bank and the Satpura range of mountains along the southern. Its tributaries include the Banjar, the Tawa, the Machna, the Shakkar, the Denwa and the Sonbhadra rivers. The Tapti River runs parallel to Narmada, and also flows through a rift valley. The Narmada–Tapti systems carry an enormous volume of water and provide drainage for almost a quarter of the land area of Madhya Pradesh. It is the main source of water and acts as a lifeline to the state.

Pedology –

Black soil covers maximum area (47%) of Madhya Pradesh. And the water holding capacity in black soil is the highest, due to which the moisture persists for a long time. In international level soil classification, it is called chernorgem. It is found in Malwa plateau, Narmada-Sone valley and Satpura-Maikal range.

Eco-system –

Madhya Pradesh, with 31% of geographical area as forest land, is rich in floral and faunal biodiversity. These forests host 9 National Parks, 25 Wildlife Sanctuaries, 2 Biosphere Reserves, 5 Tiger Reserves and also house a substantial number of villages which are highly dependent on forests for livelihoods. Increasing temperatures and consequent dry spells may increase desertification in western Madhya Pradesh which may, in turn, result in bio-diversity losses and affect economy of the area. Uncontrolled grazing, illegal felling and unsustainable practices of fuel wood collection were mentioned as some of the primary human induced reasons for forest degradation.

MAHARASHTRA –

Climate -

Maharashtra is one of the warmest regions in India with an average daily high temperature of 33 degrees centigrade. The climate is very warm with an annual average of 33 degrees but has few truly tropical and sultry months. It is warm to hot all year round and invites to bathe at average water temperatures of 28 degrees. Due to the lesser rain the best time for traveling is from November to May. Sometimes humidity its unpleasantly high in August. The most rain days occur from June to September.

Hydrology –

The State is mainly covered by the basins of Krishna, Godavari and Tapi except the west-flowing rivers of Konkan strip. A small portion on north comes under Narmada basin. The major rivers, which flow through Maharashtra state are Godavari, Krishna and Tapi. Indravati, Wardha, Mnajira, Penganga and Purna are other important rivers.

Pedology –

The soils of Maharashtra are residual, derived from the underlying basalts. In the semi-dry plateau, the regur (black-cotton soil) is clayey, rich in iron, but poor in nitrogen and organic matter; it is moisture-retentive. Where redeposited along the river valleys, those kali soils are deeper and heavier, better suited for rabi crops. Farther away, with a better mixture of lime, the morand soils form the ideal Kharif zone. The higher plateau areas have pather soils, which contain more gravel. In the rainy Konkan, and the Sahyadri Range, the same basalts give rise to the brick-red laterites productive under a forest-cover, but readily stripped into a sterile varkas when the vegetation is removed. By and large, soils of Maharashtra are shallow and somewhat poor.

Ecosystem –

Types of forests such as southern tropical semi-evergreen forests, southern tropical dry deciduous forests, southern tropical moist deciduous forests, southern tropical thorn forests, and littoral and swamp forests can be found. There are various species of trees such as Anjani, Mango Hirda, Jambul Shisan, and Ain, etc.

Different types of animals such as Yellow-footed Green Pigeon, Blackbuck, Indian Giant Squirrel, Sloth bear, Gaur, Python Molurus, Spotted Owlets, and Oriental Garden Lizzard can be seen.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

There are no legally binding laws/ regulations enforcing or preventing the afforestation and reforestation activities in India. The afforestation /reforestation activities therefore are within the relevant, regional laws, statutes and regulatory frameworks.

India is a member of the UNFCCC (United Nations Framework Convention on Climate Change) and an active member of the ITTO (International Tropical Timber Organization). The Project complies with this regulatory framework, because in the AFOLU scope,

Afforestation/Reforestation is one of several mechanisms by which GHG emissions are expected to be reduced.

The project is compliant with the entire applicable national and regional legal framework of the Government of India. The development of the project is based on guidelines included in environmental regulations and laws in force in the country. In addition, the project responds to the Government's desire to promote forest plantations and the development of Bamboo plantations.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has not been registered, nor seeking registration, under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

The GHG emissions removals/reductions generated by the project is neither used for compliance with emissions trading program nor meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

The project has not sought or received any form of environmental credit.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project activities implemented by the project proponent, contributes to achievement of the UN vision 2030 sustainable development goals in the following ways.

No poverty: The benefits accrued from the sale of credits will be used in the development of other community based sustainable programs, which will create more employment opportunities for the youths and women who are the most vulnerable to effects of climate change in the region, this will improve their livelihoods as they will have access to better life and healthcare.

Decent work and Economy growth: The project activity will provide employment to many people including men, women, and young people.

Climate action: The project activities involve afforestation/reforestation practices, these practices will contribute to the reductions/removals of the net GHG emissions from the atmosphere, this will also increase the above ground biomass of the area.

The environmental conditions of the area will improve CO2 sequestration and amount of oxygen thus creating a clean environment, the ecological system of the project area will be also improved due to the increased tree cover, hence improving the microclimate of the area.

Life on Land: The afforestation/reforestation activities will restore barren lands thus helping in combating desertification. The increased forest cover will promote protection of threatened animal/bird species in the area by providing habitat and safe environment for their existence.

1.17.2 Sustainable Development Contributions Activity Monitoring

Tab

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	1.4.2	Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure	Implemented activities to increase	The project will lead to various communities getting access to the plantation activities for non-timber related valued products.	It is expected that tribal areas in the village communities would be beneficiaries. The actual number shall be available at a later stage.
2)	8.3.1	Proportion of informal employment in non-agriculture employment, by sex	Implemented activities to increase	The project will lead to various communities getting access to the plantation activities for non-timber related valued products.	It is expected that tribal areas in the village communities would be beneficiaries. The actual number shall be available at a later stage.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By plantation of 4,500 ha, this project will prevent the release of 61,126 tonnes of carbon into the atmosphere annually.	Absorb the release of 1,833,769 tCO2 of carbon dioxide into the atmosphere over its lifetime of 30 years.

4.	15.1.1	Plantation area as a proportion of total land area	Implemented activities to increase	The project will promote sustainable use of terrestrial ecosystems, combat desertification, and halt and reverse land degradation and halt biodiversity loss by plantation of 4,500 ha.	In total lifetime of the project, it will promote sustainable use of terrestrial ecosystems, combat desertification, and halt and reverse land degradation and halt biodiversity loss by plantation 4,500 ha.

1.18 Additional Information Relevant to the Project

Leakage Management

This project was established mainly to increase forest cover in the region by utilizing barren/community land. The bamboo plantation establishment did not replace any activity that was taking place on the land and neither did it displace people.

The project will economically sustain the community groups around the project region and at the same time contribute to the removals /reductions of the GHG emissions, thus aiding in climate change mitigation of the area.

Therefore, there is no leakage from this project activity.

Commercially Sensitive Information

There is no commercially sensitive information contained within this report.

Further Information

The AR/CDM methodology is applicable for this project as the land at the time of project implementation was not a forest neither a wetland.

According to India's definition of forest under decisions 16/CMP.1 and 5/CMP.1 as communicated by the National CDM Authority (DNA India), for an area to be defined as a forest it must meet the following requirements. The minimum crown cover should be 15%, with 0.05, with the minimum height of the 2 meters at the maturity.

The land was barren and below the forest requirements in terms of the crown cover, tree height at maturity in situ. Therefore, the land was eligible for afforestation /reforestation activities.

The land was not stocked because of anthropogenic influence or natural causes. Also, the land was not covered by young natural stands or plantations, which had the potential to reach forest standards without human intervention, as the land historically had been a low or no productivity lands. The area within the project boundary was barren for ten years prior to the project implementation date. Thus, the project is eligible for ARR project activity as per AFOLU guidelines.

2 SAFEGUARDS

2.1 No Net Harm

According to VCS standards v4.2 section 3.17, project activities should not negatively impact the natural environment or local communities in the project boundary.

The project activity involves bamboo plantation, bamboo's green footprint makes it a plant that could very well shape our future in terms of climate mitigation measures, the species is fast growing and takes in more CO2 and produces more oxygen than average hardwood trees. This makes it a valuable partner in fighting climate change. Therefore, the project is designed to have a positive impact on the environment by improving the ecological, social and biodiversity aspects in the local environment. The ARR activities on the barren land promotes effective utilization of barren/community land, this will open the mindset of local people and bring a shift in the way they plan to utilize their barren/ community lands. The approach used in the plantation ensures minimal disturbance to the soil, no use of pesticides and organic fertilizers which are considered environmental pollutants. The project aims to improve the ecology and biodiversity status of the local environment in the long term.

2.2 Local Stakeholder Consultation

The local stakeholder consultation meetings were organized between 26th May 2018 to 28th May 2018 in Madhya Pradesh and 4th June 2018 to 7th June 2018 in Maharashtra before listing. in Invitation for the meeting was displayed at the gram panchayats as well as circulated with local NGOs. The aim of the meeting held, was to inform local stakeholders (Farmers) about the project and give them an opportunity to discuss and provide feedback on the project. The overall goal was to improve the project design based on stakeholders' comments and suggestions and increase the local awareness and involvement of local people in the project. The meetings were attended by a total of 223 people including both male and female.

Stakeholder identification - Farmers, villagers and local NGOs have been identified as the stakeholder for the project. Also, employees from Infinite Solutions had attended the meeting. The participation of all stakeholders in the project has been inclusive, according to individual and gender-independent capacities, cultural identity, and religion.

Key points from the meetings:

The following agenda was followed:

- Opening of the meeting
- Registration of the participants (signing the attendance sheet)
- About the project and its implementation structure
- Questions for clarification about project
- Discussion on environmental, social, and economic benefits from the project
- Discussion on tree species planted, soil type found in their area
- Explanation of institutional mechanism for carrying out various activities
- Closure of the meeting via suggestions taken up from the stakeholders and feedback

The objective and purpose of the project was explained which is the importance of plantation for our environment and to generate carbon credits by the plantation activities. The participants were

updated with the carbon financing aspects as well as the process of validation and verification by a third party (auditor). Also, the topic of climate change and mitigation potential of trees as carbon sink were discussed. The additional benefits from the project in the form of carbon credits were explained and discussed as well.

The suggestions and comments of the participants were documented through the feedback forms while some of the issues and comments raised by the participants were addressed during the meeting. Few questions related to tree species planted, and soil types, harvesting period of tree species planted were asked by the stakeholder during the stakeholder consultation meetings to be included in the project report. In future many more meetings with the stakeholders shall be organized for much more clarity on the carbon assessment and to take feedback from the stakeholders regarding any negative impact of the project at every stage.

Continuous Engagement:

There is a grievance mechanism established by Infinite Solutions, where all the comments/queries/complaints would be addressed to.

Since the project is implemented in conjunction with the farmers, thus the decision making is the local community and in case of any grievances Infinite Solutions shall take into consideration the best activity for the region.

2.3 Environmental Impact

Ecology: Bamboo forests have many environmental benefits because they function as carbon sinks, produce oxygen, control soil erosion, provide organic matter, regulate water levels in watersheds, conserve biodiversity, beautify the landscape, and essentially contribute to the purification and regulation of the environment.

Biodiversity: The bamboo plantation will provide habitats for all types of terrestrial fauna and flora species. The biodiversity is important for the ecosystem to maintain its basic ecological processes. The presence of the biodiversity will make the plantation more resilient to withstand threats such as climate change and habitat degradation, creating a positive -feedback cycle that will ultimately lead to even more biodiversity increase.

GHG Sequestration: Bamboo absorbs 35% more carbon dioxide and releases more oxygen into the atmosphere than an equivalent stand of hardwood trees, this contributes to net removals/reduction of GHG emissions from the atmosphere.

2.4 Public Comments

Public comments if received shall be addressed by project proponent.

2.5 AFOLU-Specific Safeguards

It can be concluded through the local stakeholder meeting conducted that there are no risks to the local people or communities residing near the project area.

Risks to local population -

There are no risks associated with the local population. The impacts on populations are mainly positive.

Enhancement of soil quality -

Due to deforestation in some areas, the soil gradually gets degraded, which limits the growth of plants and trees. But, with the plantation from the project activity the soils will naturally fertilized with nitrogen and carbon. Improvement in soil fertility improves the quality of plants thereby ensuring enhanced returns.

Increased incomes -

This project will provide an opportunity to the local communities to harvest non-timber related forest produce.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The CDM consolidated methodology **AR-ACM0003:** Afforestation and reforestation of lands except wetlands -Version 02.0 is applied.

In addition, the following tools are applied by the project:

- Combined tool to identify the baseline scenario and demonstrate additionally in A/R CDM project activities (Version 1)
- Tool for estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities (Version 4.2)
- Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities (Version 1.1.0)
- Tool for carbon stocks and change in carbon stocks in dead wood and litter due to the implementation of A/R CDM project activities (Version 3.1)
- VCS AFOLU Non-Permanence Risk Tool (Version 4.0)

3.2 Applicability of Methodology

Methodology/Tools	Applicability
AR - ACM0003 A/R	The project has been implemented on barren lands that are devoid of any significant vegetation cover and have not been used for any productive purpose like agriculture for at least ten years before project start date. Eligible ARR activities are those that increase carbon sequestration and/or reduce GHG emissions by establishing, increasing or restoring vegetative cover (forest or non-forest) through the planting, sowing or human-assisted natural regeneration of woody vegetation. The AR/CDM element methodology is applicable if the project activity is implemented on areas having low existing potential to support living biomass without human intervention, which includes barren lands. Thus, the project meets the applicability conditions.
AR-Tool19 for CDM project. V02.03	The land at the start of the project activity did not contain forest, as defined by forest thresh hold values of the host country. There was no young natural stands and plantations on the land. The land was barren prior to project initiation, therefore was not subject to temporarily unstocked as a result of human intervention (e.g., harvesting) or natural causes, and the land is not expected to revert to forest.
Large-scale AR - ACM0003 A/R CDM Methodology	The small-scale CDM A/R methodology is applicable in VCS ARR project activity provided that the annual average net removals from the project are more than 16000 tons CO2e during the crediting period of the project activity. The estimated carbon removals by a bamboo plantation are 61,126 tons CO2e per year for 4,500 ha. Hence, the net removal from this project has the thresh-hold applicability for the use of large-scale A/R project activities.
AR -Tool 14 V4.2 (Estimated carbon Stocks in trees and shrubs)	The Tool has no internal applicability conditions, it will be used in estimating of carbon stock and change in carbon stock in living biomass of trees and shrubs in baseline scenario of the project, this information will be used to monitor change in carbon in the coming years.
AFOLU-non permanence risk. V4.2	The AFOLU Non-Permanence risk tool is used in setting out the procedures for conducting the non-permanence risk analysis to

	determine the non-permanence risk rating ("risk rating"), which will be used to determine the number of buffer credits that an AFOLU project shall deposit into the AFOLU pooled buffer.

3.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Above Ground Biomass	CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
	Below Ground Biomass	CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
	Soil Organic Carbon	CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored

Source		Gas	Included?	Justification/Explanation
Project	Litter	Other	N/A	
		CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
	Above Ground Biomass	CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
	Below Ground Biomass	CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
		CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
		CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
	Soil Organic Carbon	CH_4	No	GHG emissions in the baseline can be conservatively ignored

Source		Gas	Included?	Justification/Explanation
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	
		CO_2	Yes	Carbon stock in this pool is expected to increase due to the implementation of the project activity
	Litter	CH_4	No	GHG emissions in the baseline can be conservatively ignored
		N_2O	No	GHG emissions in the baseline can be conservatively ignored
		Other	N/A	

3.4 Baseline Scenario

The baseline scenario represents the activities and GHG emissions that would occur in the absence of the project activity.

The baseline field observation for this project indicates that the land was degraded prior to project implementation. No significant agricultural practices would take place due to underlining soil. Also, these farmers are subsistence farmers who have no history of long-term investment in forest and the majority of them live below the minimum daily wage, thus they have no finance to invest in huge plantations. So, the degraded land would have been continuing to be degrade in the absence of the implementation of the project activity. This is the most likely scenario without the project activity.

3.5 Additionality

The demonstration and assessment of the additionality of the project is made in accordance with the applied methodology (AR-ACM0003, Version 01.0.0) following the steps of the "Combined tool to identify the baseline scenario and demonstrate additionally in A/R CDM project activities" (Version 01)

STEP 0. Preliminary screening based on the starting date of the A/R project activity

The planting activity was conducted from July 2019, which is before the registration date and after 31 December 1999. The starting date of the A/R project was 2019, which was after 31 December 1999.

The incentive from the planned sale of carbon credits was seriously considered in the decision to proceed with the project activity.

STEP 1. Identification of alternative scenarios

Sub-step 1a. Identify credible alternative land use scenarios to the proposed project activity

According to additionally tool, the alternative land use scenario of the proposed project includes:

The scenario applicable for lands use activity under plantation are as follows;

- Scenario 1: Continuation of existing land use or status quo
- Scenario 2: Proposed project undertaken by the farmer with participation by FPO/Project participant
- Scenario 3: Proposed project undertaken by the farmer with participation by FPO/Project participant but without taking it as a carbon project
- Scenario 4*:* The land used for agricultural practices

The plantation land: The land for the project belongs to the individual small and marginal farmers as well as large community land/large farmers. The ownership lies with the land owner. Currently, this land category is subjected to degradation or usage under other agricultural practices.

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations

The implementation of A/R activity is not a mandatory requirement, the public and private lands would continue to be in the degraded state unless taken action.

Step 2: Barrier analysis

The barrier analysis is used to demonstrate that the alternative use of public and private lands for A/R activity faces investment, technological and ecological barriers.

Investment barrier: No private capital is available due to the risks associated with investments for plantation of degraded lands or agricultural lands. This causes investors to prefer short term investments with high returns. This barrier prevents the alternative land use scenarios 2 and 3

(Afforestation/reforestation of the land within the boundaries of the project activities performed without being registered as the ARR VCS project activity.

No private capital is available from domestic or international capital markets due to risks associated with investments in plantation projects also the banks in India are conservative and have stringent lending guidelines and high-interest rates for this kind of forestry plantation due to environmental risk factors and no returns. As a case, some bank has an interest rate from 7-13 percent for the agriculture segment[8]. The expected financial benefits obtainable through carbon finance will support the project to overcome the obstacle to some extent.

Further, the revenues to the individual farmers are accrued only after the bamboo is sold off and without the intervention of buyback mechanism, the farmer has little or no incentive to make such huge investments. As compared to agricultural activities where they have regular revenue source based on the sale of the crops.

Further the investment by the project developer IESLLP (along with its partners) to invest the amount to offer good quality saplings to the farmers as well as buy back agreement. Without the revenue from carbon credits the company would not make such investments as they can buy bamboo from various state forest departments/markets without any upfront investment with the private plantations.

This barrier prevents the alternative land use scenarios 2,3 and 4 (Afforestation/reforestation of the land within the boundaries of the project activities performed without being registered as the ARR VCS project activity.

Technological barriers

Lack of access to planting materials, constraining in using fertilizers, and breakdown of the agricultural economy (including lack of seeds and agricultural equipment) is among the major technological barriers. These barriers have been identified, for example by NABARD, to be among the main reasons for the decrease in agricultural land use and organic farming[9]. The result of these constraints is to reduce productivity (increase the farm gate cost of fertilizers) and declines the soil organic carbon content with a resultant decline in soil fertility. Due to some regulations and risks associated with agroforestry, the farmers are not having an interest in the plantation[10]. Local communities are committed to planting trees, but without the carbon component, they do not have adequate access to technical and organizational assistance.

Communities need the support of NGOs/FPOs to implement and maintain the project as they are not used to cultivating plants that don't produce immediate output or other parts for nourishment purposes. In fact, at the beginning of the project, it was difficult to receive support and collaboration from the local people. The proposed project activity has anyhow been able to

[8] http://www.aryavart-rrb.com/interest_rates_adv.html

[9] https://www.nabard.org/demo/auth/writereaddata/File/OC%2038.pdf

[10] https://agricoop.nic.in/sites/default/files/National%20Agroforestry%20Policy%202014.pdf

surpass the initial difficulties working together with the local communities and offering local people knowhow and training.

In such cases the participation by the PP leads to access of various seeds, fertilizers and other resources which would not have been accessed to the farmers in case of individual shift to plantations.

Barriers due to local ecological conditions:

Degraded Soil: During the base line carbon stock assessment and PRA exercise it was assessed that the projects sites comprised of degraded soils, and lack organic matter and micronutrients such as N, P, K. The soil organic carbon, which is an indicator of soil fertility is also very low. As mentioned earlier, most of the soil in the division is clay loam, sandy loam and sodic in nature.

Further in case of Bamboo Plantations, the soil gets degraded and no other crop or agriculture could be practiced in near future without reconditioning the soil.

Barriers relating to markets, transport, and storage; -
Unregulated and informal markets for products and services prevent the transmission of effective information to project participants; -

The remoteness of land area and undeveloped roads and infrastructure incur large transportation expenditures, thus eroding the competitiveness and profitability of products from the land use.

Possibilities of large price risk due to the fluctuations in the price's products over the project period in the absence of efficient markets and insurance mechanisms

The absence of facilities to convert, store and add value to products resulting from land-use limits the possibilities of carbon capture is not a common and feasible land-use scenario for these projects.

Delay in income stream from tree growing/management activities: Another aspect relevant to plantation activity is the delay in income from bamboo logs, revenue associated with the long tree-growing period. The delay in revenue translates into large scale non-participation by the communities leading to continued degradation or continued use of the existing practices. There are no institutional mechanisms to support the community for incentive for delayed revenue stream from tree growing/management activity.

Outcome of Step 2a:

- Investment Barrier
- Technological Barrier.
- Barriers related to local tradition
- Barriers due to local ecological conditions:
- Barriers relating to markets, transport, and storage

- Barrier due to delay in income stream

Sub-step 2b: Elimination of land use scenarios that are prevented by the identified barriers:

The alternative scenarios are prevented by at least one of the barriers listed in Step 2a, thus these alternative scenarios are eliminated from further consideration.

Project Alternative	Barrier Faced
Continuation of existing land use or status quo	No Barrier faced
Proposed project undertaken by the farmer with participation by Project proponent and its associates	Investment Barrier
Proposed project undertaken by the farmer with participation by Project proponent and its associates but without taking it as a carbon project	• Investment Barrier • Technological Barrier. • Barriers related to local tradition • Barriers due to local ecological conditions: • Barriers relating to markets, transport, and storage • Barrier due to delay in income stream
The land used for agricultural practices	No Barrier faced

The only alternative scenario not prevented by any barrier is the scenario "The continuation of the current situation or continued agricultural practices, not requiring any investment or expenses to maintain the current situation i.e. continuation of the pre-project land use". In accordance with the applied tool this alternative scenario is identified as the baseline scenario.

Outcome of Sub-step 2b:

List of land use scenarios that are not prevented by any barrier:

- Continuation of pre-project land use which may be left to be degraded or use for agricultural purposes.

Sub-step 2c. Determination of baseline scenario: Scenario 1, continuation of pre-project use, remains the possible baseline scenario.

According to the tool: Is Plantation without being registered as an A/R CDM project activity included in the list of land use scenarios that are not prevented by any barrier? NO

→ If no, then:

Does the list contain only one land use scenario? YES

→ If yes, then the remaining land use is the baseline scenario.

STEP 3. Investment analysis (if needed) Scenario 1 remains the only possible baseline scenario, which makes investment analysis not necessary.

STEP 4. Common practice analysis In the project area, i.e. Plantation activities as carried by Project proponent and its associates have not been implemented previously, which is similar to this VCS project. Therefore, the plantation in degraded/agricultural lands without intervention by PP is not a common practice in the project area.

Outcome: The proposed ARR group project activity is not the baseline scenario and, hence, it is additional.

3.6 Methodology Deviations

There are no methodological deviations.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The AR-ACM0003 methodology applied for this project activity uses AR-Tool 14 in the calculation of Baseline Emission of the project activity. As indicated the project area in the baseline was a barren land and did not have any land management activities ongoing before the implementation of the project activities. According to AR- Tool 14, changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero for those lands for such lands, in this case the community Based bamboo project baseline emission will be accounted as zero, for future reference in monitoring the change in carbon stock after the project implementation. According to this tool, the baseline net GHG removals by sinks are estimated as mentioned below: Baseline net GHG removals by sinks 13. The baseline net GHG removals by sinks shall be calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t} + \Delta C_{DW\_BSL,t} + \Delta C_{LI\_BSL,t}$$

Where:

$\Delta C_{BSL,t}$	=	Baseline net GHG removals by sinks in year t; t CO2-e
$\Delta C_{TREE\_BSL,t}$	=	Change in carbon stock in baseline tree biomass within the project boundary in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e
$\Delta C_{SHRUB\_BSL,t}$	=	Change in carbon stock in baseline shrub biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e
$\Delta C_{DW\_BSL,t}$	=	Change in carbon stock in baseline dead wood biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e
$\Delta C_{LI\_BSL,t}$	=	Change in carbon stock in baseline litter biomass within the project boundary, in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e

The community lands where the project is established were degraded prior to project implementation. According to the AR-Tool 14, Changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero for such lands.

Thus, for the purpose of ex-ante estimation of carbon stock and change in carbon stock in the project scenario, change in carbon stock of shrubs may be estimated as zero.

4.2 Project Emissions

The actual net GHG removals by sinks are estimated using the equation 2 of the methodology AR ACM0003 (Version 02.0).

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t} \quad \text{Equation (2)}$$

Where:

$\Delta C_{ACTUAL,t}$ = Annual actual net GHG removals by sinks at time t; t CO2-e yr-1

$\Delta C_{P,t}$ = Change in carbon stocks in project, occurring in the selected carbon pools, at time t; t CO2-e yr-1

$GHG_{E,t}$ = Increase of non-CO2 GHG emissions within the project boundary as a result of the implementation of the A/R project activity, in year t; t CO2-e

As

Change in the carbon stocks in project, occurring in the selected carbon pools in year t shall be calculated as follows:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta C_{SOC\_AL,t}$$

Where:

$\Delta C_{P,t}$ = Change in the carbon stocks in project, occurring in the selected carbon pools, in year t; t CO2-e

$\Delta C_{TREE\_PROJ,t}$ = Change in carbon stock in tree biomass in project in year t, as estimated in the tool " Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e

$\Delta C_{SHRUB\_PROJ,t}$ = Change in carbon stock in shrub biomass in project in year t, as estimated in the tool " Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; t CO2-e

$\Delta C_{DW\_PROJ,t}$ = Change in carbon stock in dead wood in project in year t, as estimated in the tool " Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e

$\Delta C_{LI\_PROJ,t}$ = Change in carbon stock in litter in project in year t, as estimated in the tool "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"; t CO2-e

$\Delta C_{SOC\_AL,t}$ = Change in carbon stock in SOC in project, in year t, in areas of land meeting the applicability conditions of the tool "Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities", as estimated in the same tool; t CO2e

4.3 Leakage

The calculations for leakage are determined through

Tool AR0015: Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity.

$$LK_{AGRIC,t} = (44/12) \times (\Delta C_{BIOMASS,t} + \Delta SOC_{LUC,t})$$

$$\Delta C_{BIOMASS,t} = [1.1 \times b_{TREE} \times (1+R_{TREE}) + b_{SHRUB} \times (1+ RS)] \times CF \times A_{DISP,t}$$

$$\Delta_{SOCLUC,t} = SOC_{REF} \times (f_{LUP} \times f_{MGP} \times f_{INP} - f_{LUD} \times f_{MGD} \times f_{IND}) \times A_{DISP,t}$$

Where:

$LK_{AGRIC,t}$ = Leakage emission resulting from displacement of agricultural activities in year t; t CO2e

$\Delta C_{BIOMASS,t}$ = Decrease in carbon stock in the carbon pools of the land receiving the activity displaced in year t; t d.m.

CF = Carbon fraction of woody biomass; dimensionless.

$A_{DISP,t}$ = Area of land from which agricultural activity is being displaced in year t; ha.

b_{TREE} = Mean above-ground tree biomass in land receiving the displaced activity; t d.m. ha-1.

R_{TREE} = Root-shoot ratio for trees in the land receiving the displaced activity; dimensionless.

b_{SHRUB} = Mean above-ground shrub biomass in land receiving the displaced activity; t d.m. ha-1.

RS = Root-shoot ratio for shrubs in the land receiving the displaced activity; dimensionless.

$\Delta SOC_{LUC,t}$ = Change in soil organic carbon (SOC) stock due to land-use change in the land receiving the displaced activity in year t; tC ha-1.

SOC_{REF} = SOC stock corresponding to the reference condition in native lands by climate region and soil type applicable to the land receiving the displaced activity; t C ha-1.

f_{LUP}, f_{MGP}, f_{INP} = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land before the displaced activity is received; dimensionless.

f_{LUD}, f_{MGD}, f_{IND} = Relative SOC stock change factors for land-use, management practices, and inputs respectively, applicable to the receiving land after the displaced activity has been received; dimensionless.

t = 1, 2, 3 ...years elapsed since the start of the A/R CDM project activity.

As there is no displacement of agricultural production within the project boundary as a result of the project activities, leakage emissions are considered to be zero for the life of the project.

project activities, leakage emissions are considered to be zero for the life of the project.

4.4 Estimated Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2019 - 2020	0	14025	0	14025
2020 - 2021	0	45581	0	45581
2021 - 2022	0	98175	0	98175

2022 - 2023	0	150769	0	150769
2023 - 2024	0	147263	0	147263
2024 - 2025	0	115706	0	115706
2025 - 2026	0	52594	0	52594
2026- 2027	0	52594	0	52594
2027 - 2028	0	52594	0	52594
2028 - 2029	0	52594	0	52594
2029 - 2030	0	52594	0	52594
2030 - 2031	0	52594	0	52594
2031 - 2032	0	52594	0	52594
2032 - 2033	0	52594	0	52594
2033 - 2034	0	52594	0	52594
2034 - 2035	0	52594	0	52594
2035 - 2036	0	52594	0	52594
2036 - 2037	0	52594	0	52594
2037 - 2038	0	52594	0	52594
2038 - 2039	0	52594	0	52594
2039 - 2040	0	52594	0	52594
2040 - 2041	0	52594	0	52594
2041 - 2042	0	52594	0	52594
2042 - 2043	0	52594	0	52594

2043 - 2044	0	52594	0	52594
2044 - 2045	0	52594	0	52594
2045 - 2046	0	52594	0	52594
2046 - 2047	0	52594	0	52594
2047 - 2048	0	52594	0	52594
2048 - 2049	0	52594	0	52594
Total	0	1833769	0	1833769

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	Location of project area
Data unit	Latitude and longitude
Description	Single point location of a discrete project area
Source of data	GPS
Value applied:	As per Work Sheet, field data
Justification of choice of data or description of measurement methods and procedures applied	Direct measurement of latitude and longitude of a point within a project area using a GPS. Used to provide a simple location of a discrete project area.
Purpose of Data	Calculation of project emissions
Comments	None

Data / Parameter	Total area of project
Data unit	Hectares
Description	Size of the area where the project activity has been implemented
Source of data	Field Data
Value applied:	4500
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Calculation for emission reduction both estimated and actual
Comments	None

Data / Parameter	Soil Organic Carbon (SOC)
Data unit	Tonnes/ hectares
Description	Soil organic carbon (SOC) refers only to the carbon component of organic compounds
Source of data	Laboratory testing of soil sample to calculate percentage organic carbon
Value applied:	Default value of 0.6
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of estimated emissions reduction
Comments	None

Data / Parameter	Carbon Fraction (CFtree)
Data unit	tC/t.d.m
Description	Carbon fraction of bamboo biomass
Source of data	This carbon fraction was taken from IPCC (2006), Guidelines for National Greenhouse Gas Inventories-Volume 4 Agriculture, Forestry and Other Land Use, Forestry, Table 4.3, tropical/subtropical wood
Value applied:	0 .49
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Calculation of project emissions
Comments	None

Data / Parameter	Wood density
Data unit	T dm/m3
Description	Weight to volume equation for bamboo species selected for project
Source of data	
Value applied:	Default Value according to the tree species 0.67
Justification of choice of data or description of measurement methods and procedures applied	
Purpose of Data	Calculation of project emissions removals
Comments	None

Data / Parameter	Carbon fraction
Data unit	tCO_2/tC
Description	Factor applied to convert the bamboo carbon sequestered to bamboo CO2e sequestered
Source of data	IPCC default value
Value applied:	44/12=3.67
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of project emission removals
Comments	None

Data / Parameter	Root-to-Shoot Ratio
Data unit	Dimensionless
Description	Root-shoot ratio appropriate for biomass stock
Source of data	Values from IPCC Good Practice Guidance for LULUCF (2003) Table 3A.1.8 average belowground to aboveground biomass ratio (root-shoot ratio, r) in natural regeneration by broad category (tonnes dry matter/tonne dry matter)
Value applied:	0.27
Justification of choice of data or description of measurement methods and procedures applied	The ratios of belowground to aboveground biomass (root-to-shoot ratio) is used to account for belowground biomass in living biomass estimations as it is not possible to estimate BGB through measurement for a living tree species.
Purpose of Data	Calculation of project emission removals
Comments	None

5.2 Data and Parameters Monitored

Data / Parameter	DBH
Data unit	meters
Description	Diameter at breast height of tree
Source of data	Field measurements
Description of measurement methods and procedures applied	Measurements will be performed by Infinite Solutions team, following the monitoring plan described in section 5.3.
Frequency of monitoring/recording	At the time of verification
Value applied:	To be applied at monitoring
Monitoring equipment	Diameter tape
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of actual project emissions
Calculation method	-
Comments	None

Data / Parameter	Vtree
Data unit	m3

Description	Stem volume of trees of species in sample plot of stratum at time t calculated using volume equations
Source of data	Volume equations of each species were taken from India State of Forest Report, 2019 and Volume Equations for Forests of India, (1996)
Description of measurement methods and procedures applied	As per the FSI/ peer review
Frequency of monitoring/recording	At the start of the project activity and every five years since the initial verification and certification of an A/R project activity
Value applied:	It will be calculated
Monitoring equipment	N/A
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of actual project emissions
Calculation method	Every bamboo has defined equations to calculate volume
Comments	None

Data / Parameter	Rs
Data unit	t.d.m/ha
Description	The root-shoot ratio used to determine the proportion of belowground biomass in relation to the aboveground biomass
Source of data	Field measurements
Description of measurement methods and procedures applied	Measurements will be performed by Infinite Solutions team, following the monitoring plan described in section 5.3
Frequency of monitoring/recording	-

Value applied:	It will be calculated
Monitoring equipment	-
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of project emissions
Calculation method	BGB= 0.27* AGB (IPCC, 2006)
Comments	None

Data / Parameter	Standard Deviation
Data unit	t d.m. (or t d.m. ha-1)
Description	Estimated standard deviation of biomass stock in stratum i
Source of data	Calculated
Description of measurement methods and procedures applied	N/A
Frequency of monitoring/recording	At the start of the project activity during pilot survey
Value applied:	
Monitoring equipment	It is calculated for every strata
QA/QC procedures applied	N/A
Purpose of data	Calculation of uncertainty of project emissions/removals
Calculation method	N/A
Comments	None

Data / Parameter	AGB_{tree}
Data unit	t.d.m/ha
Description	Above ground Biomass of trees planted under
Source of data	Field measurements
Description of measurement methods and procedures applied	Measurements will be performed by the Infinite Solutions team, following the monitoring plan described in section 5.3.
Frequency of monitoring/recording	-
Value applied:	It will be calculated
Monitoring equipment	N/A
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of actual project emissions
Calculation method	AGB= Volume* Wood density* BEF
Comments	None

Data / Parameter	d_{SOC}
Data unit	tC/ha/yr
Description	The rate of SOC changes within the project boundary under baseline conditions
Source of data	N/A
Description of measurement methods and procedures applied	Value of the calculation model “Tool for estimation of changes in soil organic carbon stocks due to the implementation of A/R CDM project activities”.

Frequency of monitoring/recording	At the start of the project activity and every five year since the initial verification and certification of an A/R project activity
Value applied:	It will be calculated
Monitoring equipment	N/A
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of carbon stock density of soil organic carbon (SOC)
Calculation method	
Comments	None

Data / Parameter	Wi
Data unit	Dimensionless
Description	Relative weight of the area of stratum I, the area of the stratum i divided by the project area
Source of data	Calculated
Description of measurement methods and procedures applied	N/A
Frequency of monitoring/recording	Measured at each verification event
Value applied:	Summation of Wi is 1
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions

Calculation method	The area of the stratum i divided by the project area
Comments	None

Data / Parameter	Htree
Data unit	meters
Description	Height of tree
Source of data	Field measurements
Description of measurement methods and procedures applied	Measurements will be performed by Infinite Solutions following the monitoring plan described in section 5.3.
Frequency of monitoring/recording	At the start of the project activity and every five years since the initial verification and certification of an A/R project activity
Value applied:	Height of all project trees will be measured
Monitoring equipment	Altimeter
QA/QC procedures applied	Standard operating procedures are made to ensure the correct and validating data collection for each of the monitoring parameters
Purpose of data	Calculation of project emissions
Calculation method	Measured height of all bamboo within the sample plot with the help of Ravi altimeter (A height measurement instrument). Measured data is initially recorded in the survey sheets which will be later entered in to Excel format for CER calculation
Comments	None

Data / Parameter	Ai
Data unit	Ha

Description	Area of stratum i
Source of data	As per data Sheet
Description of measurement methods and procedures applied	
Frequency of monitoring/recording	Measured at start of the project and at each verification event
Value applied:	
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline and project emissions
Calculation method	Calculation of actual net GHG removals by sinks
Comments	None

Data / Parameter	Biomass Expansion Factor (BEF)
Data unit	Dimensionless
Description	Biomass expansion factor, expressing the additional biomass of a tree when only stem volume is known
Source of data	Values from IPCC Good Practice Guidance for LULUCF (2003) Table 3A.1.1012. Default values of biomass expansion factors (BEFs).
Description of measurement methods and procedures applied	Value is taken according to the plantation models (canopy density cover)
Frequency of monitoring/recording	
Value applied:	3.4

Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of project emission removals
Calculation method	
Comments	None

5.3 Monitoring Plan

In accordance with Section 6.1 of Methodology AR-ACM0003 (version 2.0), the purpose of this monitoring plan is to collect all relevant data necessary for:

(a) Verification that the applicability conditions listed under paragraphs 3 and 4 has been met;

(b) Verification of changes in carbon stocks in the pools selected.

(c) Verification of project emissions and leakage emissions.

The methods for calculating biomass consist of multiple unit measurements that follow allometric calculations.

Major eligible carbon pools are

- Above Ground Biomass (AGB)
- Below Ground Biomass (BGB)
- Soil Organic Carbon (SOC)
- Litter

The steps involved in the process of assessing Carbon Stock are:

1 As per the requirements of VCS Standard Ver_4.2, each project activity instance to be added to this Grouped Project will describe the process and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters set out in Section 5.2 (data and parameters monitored) above. The following details should be included

• The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities.

• The methods for measuring, recording, storing, aggregating and reporting data and parameters, where relevant, also include the procedure for calibrating monitoring equipment.

- The policies for oversight and accountability of monitoring activities.
- The procedures for internal auditing and QA/QC.
- The procedures for handling non-conformances with the validated monitoring plan.
- Any sampling approaches used, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures.

In accordance with Methodology AR-ACM0003, the purpose of this monitoring plan is to collect all relevant data necessary to:

- Verify that the applicability conditions of the methodology have been met.
- Verify the changes in carbon stocks in the pools selected.
- Verify project and leakage emissions.

Sampling plan

Fixed area plots of 10m X 10m will be established in the plantation and the DBH of those plants will be measured. Using the allometric equation presented in the Project Description, the biomass related to the species will be calculated.

Measuring tape will be used to measure the diameter at breast height. Breast Height is quantified as 1.36 m and everyone working on the monitoring will use a meter stick which will be marked at 1.36 m to ensure that measurements are taken at the right height. Every plant is separately recorded on a field data sheet and a separate page for each plant will be allotted for the recording of the relevant DBH.

Data will be recorded on field sheets and then transcribed to electronic media. Database searches will be made following data entry to identify any anomalous values that require clarification or correction.

The project will develop and maintain an electronic database of GIS coverages that will be archived in both digital and hard copy form. Original datasheets from field monitoring will be archived. All project data will be archived for a minimum of 2 years beyond the project crediting period. Monitoring will take place every 5 years or within the subsequent verification.

Responsibilities of plantation owner: Ensure that monitoring will take place in 5 years or within the subsequent verification and that data is transcribed into electronic media. The plantation owner will furthermore ensure that the hard copy data is stored appropriately and will check quality control by looking for outliers and conducting random checking during monitoring.

Responsibilities of plantation manager: To ensure that all farm employees are trained to conduct monitoring. The plantation manager will keep oversight of the monitoring and take random samples as a form of quality control. The plantation manager is furthermore responsible for the

transcribing of data into electronic media. The plantation manager will continuously monitor whether fires occur and capture information on the area impacted by fire, supported by photographs. The plantation manager is responsible for the replacement of dead samplings.

Responsibilities of monitoring staff: Staff will count the number of plants and measure the diameter at breast height. For this, they will use a measuring tape, a measuring stick to ensure accurate repeated measures of the breast height and data sheets on which the data can be recorded.

Because of the long-term objective of the monitoring plan, data archiving is essential. Field measurement data will be recorded on field sheets, while original data sheets are archived as well as scanned and saved electronically, field data will be entered in an electronic database. All original field data sheets, GIS data layers, reports of analyses and supporting spreadsheets will be stored in both hard copy and digital form for at least 2 years beyond the project crediting period.

- The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters. Where relevant, include the procedures for calibrating monitoring equipment.
- The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities.
- The policies for oversight and accountability of monitoring activities.
- The procedures for internal auditing and QA/QC.
- The procedures for handling non-conformances with the validated monitoring plan.
- Any sampling approaches used, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures.

Estimates of carbon stock changes in living biomass of planted trees.

Above-ground biomass shall be estimated through the following steps:

Step 1:

Measuring the diameter at breast height (DBH) at 1.36 meters above ground and height of all the trees contained in 20m x 20m area of each of sample plots spread across the entire project area.

Step 2:

Estimating the volume of the commercial component of trees based on a locally derived equation, expressed as volume per unit area, m^3/ha

The volume of each tree measured is calculated using the volume equation below and multiplied by the number of trees per hectare in the PSPs which gives the volume per unit area, m3/ha:

The calculation for plantation using equations- As per the FSI.

However, in volume calculation trees having DBH < 2 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 the wood density database

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:

AGB tree= V * Dj * BEF * CF

Where-	
AGB tree	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	Stem volume of tree l of species j in plot sp in stratum i at time t; m3 tree-1
BEF	Basic wood density of species j; t d.m. m–3 Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for species j; dimensionless
Carbon fraction	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.)
N	The sequence number of trees on plot
S	1, 2, 3, … MPS strata in the project scenario
Species	1, 2, 3, … SPS tree species in the project scenario
Year	1, 2, 3, … t* years elapsed since the start of the 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:

BGB= AGB* Rj

Where	
BGB	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

AGB	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/S Tree	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.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

To be updated later

Data / Parameter	
Data unit	*Indicate the unit of measure*
Description	*Provide a brief description of the data/parameter*
Value applied:	*Provide the monitored value for the data/parameter*
Comments	*Provide any additional comments*

6.2 Baseline Emissions

To be updated later.

6.3 Project Emissions

To be updated later.

6.4 Leakage

To be updated later.

6.5 Net GHG Emission Reductions and Removals

To be updated later.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation	VCUs eligible for Issuance
Year A						
Year...						
Total						

APPENDIX X: <TITLE OF APPENDIX>

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.