ADJUSTED WATER MANAGEMENT IN RICE CULTIVATION IN YINGCHENG CITY

Document Prepared by Search Co2(Shanghai) Environmental Science & Technology Co. Ltd

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project changing from continuously flooded to intermittent flooded condition during rice cultivation is conducted in Yingcheng City within Xiaogan City, Hubei Province of China, with a total acreage of 13,540 ha for single-cropping rice. Without the implementation of this project, which provides ditches to conduct intermittently flooded method, the continuously flooded method would be continued, so the scenario that rice was cultivated by continuously flooded method is the baseline scenario. Since the organic matter in rice soil under flooded condition can emit a large amount of methane (CH_4) because of anaerobic decomposition, the intermittent flooded method is more beneficial to water conservation, production increase and methane emission reduction than the continuously flooded.

This project solved the problems of excessive water used during rice cultivation which results in not only large amount of methane (CH_4) emissions but also low rice productivity by replacing the continuously flooded method with intermittent flooded method, which shortens the period of anaerobic decomposition of soil organic matter. In this case, the CH_4 emission can be declined by an average of 48%[1]. Hence, with the proposed project activity, an estimated amount of GHG emission reduction 4.42 tCO_2e/ha for single-cropping rice is expected.

The implementation of the project is expected to reduce the GHG emissions amounting to 419,314 tCO_2e in the first 7 years, with an average annual GHG emission removal of 59,902tCO_2e.

This project aims to:

- Sequester greenhouse gas and mitigate climate changes;
- Increase the rice productivity resulting in higher living standard of local farmers;
- Provide more job opportunities, especially women workers;
- Use a proportion of benefits to improve the local children's education.

1.2 Sectoral Scope and Project Type

The project is developed under VCS scope 14 "Agriculture, Forestry and Other Land Use (AFOLU)" with an activity category of Improved Cropland Management (ICM) under Agricultural Land Management (ALM). Although the AMS-III.AU methodology applied is

[1] Dr. Reiner Wassmann (2016). Coordinator, Climate Change Research. International Rice Research Institute. Available from: r.wassmann@irri.org

approved under sectoral scope 15 (agriculture) of CDM, this project is categorized as sectoral scope 14 (AFOLU) under Verra. This is in accordance with the definitions of eligible AFOLU project categories set out in Appendix 1 of the VCS Standard, 4.1 and can be demonstrated from the following three points.

Requirements	Evidence
Eligible ALM activities are those that reduce net GHG emissions on croplands and grasslands by increasing carbon stocks and woody biomass and/or decreasing CO_2, N_2O and/or CH_4 emissions from soils.	This project reduces CH_4 emissions on croplands by replacing intermittent flooded method by continuously flooded method. So, this project can be categorized as eligible ALM activity.
The project area shall not be cleared of native ecosystems within the 10 years period prior to the project start date.	The project area has not been cleared of native ecosystems since 2005.[2]
Eligible ALM activities include: Improved Cropland Management (ICM): This category includes practices that demonstrably reduce net GHG emissions of cropland systems by increasing soil carbon stocks, reducing soil N_2O emissions, and/or reducing CH_4 emissions.	This project practices intermittent flooded method on croplands, which is demonstrated that can reduce net GHG emissions by reducing CH_4 emissions. So, this project is an eligible ICM activity.

The project is not a grouped project.

1.3 Project Eligibility

According to the Section 2.1.1 of VCS Standard version 4.1, this project activity meets two of the scopes of the VCS program:1) The six Kyoto Protocol greenhouse gases; and 4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval. Accordingly, this project produces methane (CH_4) emission reductions, which is one kind of the six Kyoto Protocol GHGs. Besides, this project activity is supported by the CDM small-scale methodology: *Methane emission reduction by adjusted water management practice in rice cultivation* which is approved under a VCS approved GHG program – United Nations Clean

[2] Evidences on proof of Land History from Xiaogan Agricultural Bureau, and Yingcheng City is directly under the jurisdiction of Xiaogan City.

Development Mechanism and it is not explicitly excluded under the terms of Verra approval. Therefore, this project is eligible under the scope of VCS program.

The project applied a small-scale methodology, according to the KML file of the project boundary and checking the areas within one km of the project boundary, there is no another project exists, hence the project is not a fragmented part of a larger project.

1.4 Project Design

The project is an instance of a single project activity.

Eligibility Criteria

The project is not a grouped project.

1.5 Project Proponent

Organization name	Wuhan Haimingsen Environmental Protection Technology Co., Ltd.
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Wuhan Haimingsen Environmental Protection Technology Co., Ltd. (hereinafter referred to as Wuhan Haimingsen or Haimingsen) is a private entity and its core business involves agricultural technology and agricultural project development.

1.6 Other Entities Involved in the Project

Organization name	Search Co2(Shanghai) Environmental Science & Technology Co. Ltd
Role in the project	Consultant
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Search Co2(Shanghai) Environmental Science & Technology Co. Ltd (hereinafter referred to as Search Co2) is founded in 2018 with a registered capital of 5 million and 20 full-time employees. Search Co2 has developed more than 200 offset projects in China, ranging from wind, solar and forestry, under various standards including VCS, Gold Standard and CCER.

1.7 Ownership

The ownership of the rice paddies of the agricultural land management project belongs to the farmers, which has been confirmed by the local government and agricultural bureau. Since these rice paddies are all legal agricultural fields, and the ownership is clear, there is no dispute over land ownership in the project site.

During the construction period, Yingcheng Agricultural Bureau were the main managers, with the cooperation and participation of Wuhan Haimingsen Environmental Protection Technology Co., Ltd. (hereafter referred to as Wuhan Haimingsen), of the construction of ditches and reservoirs, while the local farmers were hired to build the ditches and reservoirs. During the operation period, Wuhan Haimingsen is responsible for supervising technicians to patrol and maintain the ditches and reservoirs. Furthermore, as the owner of the rice paddies, these farmers have right to authorize Wuhan Haimingsen as a representative of the carbon project owner and Wuhan Haimingsen only has the right to make decisions about the carbon reduction project.[3] Search Co2 was appointed by Wuhan Haimingsen as the developer of rice emission reduction project. Therefore, Search Co2 has played two roles in developing carbon reduction project.

Firstly, Search Co2 is the consultant which is responsible for helping the project proponent with development and management of the carbon project, including compiling the monitoring plan, organizing the training, etc. Secondly, Search Co2 is the purchaser, so it has right of speech for marketing. Although Wuhan Haimingsen has already sold the carbon emission reduction generated by this project to Search Co2, it does not affect Wuhan Haimingsen rights and obligations as the project proponent.

1.8 Project Start Date

According to VCS standard, the project start date is the date on which activities that lead 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

[3] Source: carbon reduction project cooperation agreement signed between the farmers and Wuhan Haimingsen.

hydrological functions, or implementing management or protection plans). For this project, according to the requirements of the AMS-III.AU methodology applied, an entire cropping season is started from land preparation and the emission reduction calculation is also started this day. So, the project start date is 07-May-2018[4] when the land preparation was started.

1.9 Project Crediting Period

The crediting period of this project will be using a 7-year, twice renewable crediting period, for a combined total project crediting period of 21 years from 07-May-2018 to 06-May-2039, and the project lifetime is 30 years[5] from 13-March-2018[6] to 12-March-2048.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
07-May -2018 to 06-May-2019	59,902
07-May -2019 to 06-May-2020	59,902
07-May -2020 to 06-May-2021	59,902
07-May -2021 to 06-May-2022	59,902
07-May -2022 to 06-May-2023	59,902
07-May -2023 to 06-May-2024	59,902

[4] The earliest start date of the rice cropping season among all farmers recorded in the farmers database.

[5] The Acceptance Report of Xiaogan National Comprehensive Agricultural Development High-standard Farmland Construction Project in 2017

[6] The project lifetime is calculated from the time when ditches and reservoirs, as the major construction, are put into use, while the start dates of the project and of the crediting period are the dates when the project begins to produce emission reductions. According to The Acceptance Report of Xiaogan City National Comprehensive Agricultural Development High-standard Farmland Construction Project in 2017, the ditches and reservoirs were put into use on 13 March 2018. Therefore, the project lifetime starts on 13 March 2018 instead of the project crediting period start date on 07 May 2018.

07-May -2024 to 06-May-2025	59,902
Total estimated ERs	419,314 tCO_2e
Total number of crediting years	7 years
Average annual ERs	59,902tCO_2e

1.11 Description of the Project Activity

The project changing from continuously flooded to intermittent flooded condition during rice cultivation is conducted in Yingcheng City, Xiaogan City, Hubei Province of China. Hubei Province, located in Central China, is one of the major rice-producing provinces in China.

In 2017, the average annual income of each local household in the project area was 10,634 CNY [7], and most of they are used to maintain the survival. In this case, they lacked funds to build ditches for applying intermittently flooded method. So, continuously flooded method was used in rice paddies, which means fields have standing water throughout the rice growing season and may only dry out for harvest. However, the organic matter in rice soil under flooded condition can emit a large amount of methane (CH_4) because of anaerobic decomposition. In contrast, there are at least once aeration period of more than three days, except for end-season drainage, during the cropping season by conducting intermittently flooded method after the cement ditches is built in this project activity. Since the CH_4 in rice paddies is produced by the anaerobic decomposition of organic matter after the flooding, allowing the field to drain halts CH_4 production, which happens in anaerobic condition, reducing the total quantity of CH_4 released during the cropping season. Moreover, the intermittently flooded method is more beneficial to water conservation, production increase and methane emission removal than the continuously flooded. The project aims to replace the traditional cultivation method by intermittent flooded method for GHG removal whilst contributing to Sustainable Development Goals (SDGs) in the project zone. 13,540 ha (203,100 Mu [8]) of rice paddies are changed to apply intermittently flooded method in Yingcheng City where the rice used to be cultivated under continuously flooded condition. The specific farms have been identified in the database[9] set up by the project proponent, and no new farms are expected to be added over the life of project.

[7]Source: The ex-ante investigation report in Yingcheng City in 2017 from Hubei Academy of Social Sciences.

[8] A Chinese metric unit of area, 1ha = 15 Mu.

[9] The database which holds data and information that allow an unambiguous identification of participating rice farms, including the size of field, have been set up by project proponent.

The project is located in Yingcheng City, with a total population of nearly 605,900[10]. All the rice paddies belong to the farmers. During the construction period, Yingcheng City Agricultural Bureau was the main manager of the construction of ditches and reservoirs, while the local farmers were hired to build the ditches and reservoirs. During the operation period, Wuhan Haimingsen is responsible for supervising technicians to patrol and maintain the ditches and reservoirs. Besides, Wuhan Haimingsen has been fully authorized by all the farmers to act as the carbon project proponent. Search Co2 was hired by Wuhan Haimingsen and as the developer of rice emission reduction project. So, Search CO2 is leading the carbon project development and management, including compiling the Monitoring and Quality Control Manual, organizing the training, etc. Moreover, the local agricultural bureau is responsible for technical training. Farmers are the main operators to practice intermittently flooded water regime and supposed to record the cultivation logbooks. The technicians should carry out monthly inspections according to the requirements of Monitoring and Quality Control Manual. The profit from this carbon reduction project is shared with farmers. The implementation of the project activity generates 59,902tCO_2e/year and contributes to 6 SDGs.

This project is not located within a jurisdiction covered by a jurisdictional REDD+ program.

The main objectives of the project are to improve the productivity of rice and contribute to the sustainable development and SDGs, including:

1. Goal 1-No Poverty

   The project increases yield by applying intermittently flooded method during cultivation in rice paddies, so the farmers in impoverished counties can see a higher net return and get out of poverty.

2. Goal 2-Zero Hungry

   The project provides canals, reservoirs and pumps for practicing intermittently flooded method, which helps in increase the rice production.

3. Goal 4-Quality Education

   A part of the profit of this project would be used to buy more books for the local children, which provides them with quality education.

4. Goal 5-Gender Equality

   The project provides training to women who wish to participate in and facilitate more ownership of resources and access to economic opportunities.

5. Goal 8-Decent Work and Economic Growth

   Field staff personnel would be hired from the local villages to conduct intermittently flooded water regime in the project area.

6. Goal 13-Climate Action

[10]https://www.ahmhxc.com/tongjigongbao/10592_3.html

The project generates 59,902tCO_2e of emission reductions in rice paddies by practicing intermittently flooded water regime, which makes contribution to the climate problems.

The implementation schedule of this project is listed as follows:

Date	Milestone (s) in the project's development and implementation
13-April-2017	Wuhan Haimingsen Environmental Protection Technology Co., Ltd. held a general meeting of their stockholders and they decided to develop this project as a carbon trading project.
15-August-2017	The ex-ante investigation report in Yingcheng City in 2017 from Hubei Academy of Social Sciences[11]
June-2017	Implementation Plan of Yingcheng National Agricultural Comprehensive Development High Standard Farmland Construction Project in 2017 was completed by Yingcheng Agricultural Bureau
08-October-2017	The Approval of High Standard Farmland Construction Task in 2017 was issued by Xiaogan Agricultural Bureau[12]
19-October-2017	Construction of high standard rice fields was started in Yingcheng City
07-May-2018	The land preparation was started in Yingcheng City, which means the project activity was started.
24-December -2021	The draft PD was completed.

1.12 Project Location

The project is located in Yingcheng City of Xiaogan City in Hubei Province, China. In 2021, Yingcheng City has jurisdiction over 17 towns. The geographical coordinates of the project zone are between 113°19' and 113°45' east longitude and between 30°43' and 31°08' north latitude.

The project is located in Yingcheng City in Xiaogan City, as shown in Figure 1-2. According to VCS standard, Yingcheng City are defined as the project zone, and the rice paddies applied intermittent flooded water regime in Yingcheng City are defined as the project area. Please refer to Section 3.3 for the boundaries of the project area and project zone is shown in Figure 1-2, and the KML file has also been submitted.

[11] The ex-ante investigation report mainly investigated the natural environment, farmers' income, and rice planting status in the project area before the project started, such as rice cultivation system, water management practice, straw utilization, and fertilizer use, etc.

[12] Xiaogan Agricultural Bureau is the superior department in charge of Yingcheng Agricultural Bureau

Figure 1-1 The map of China

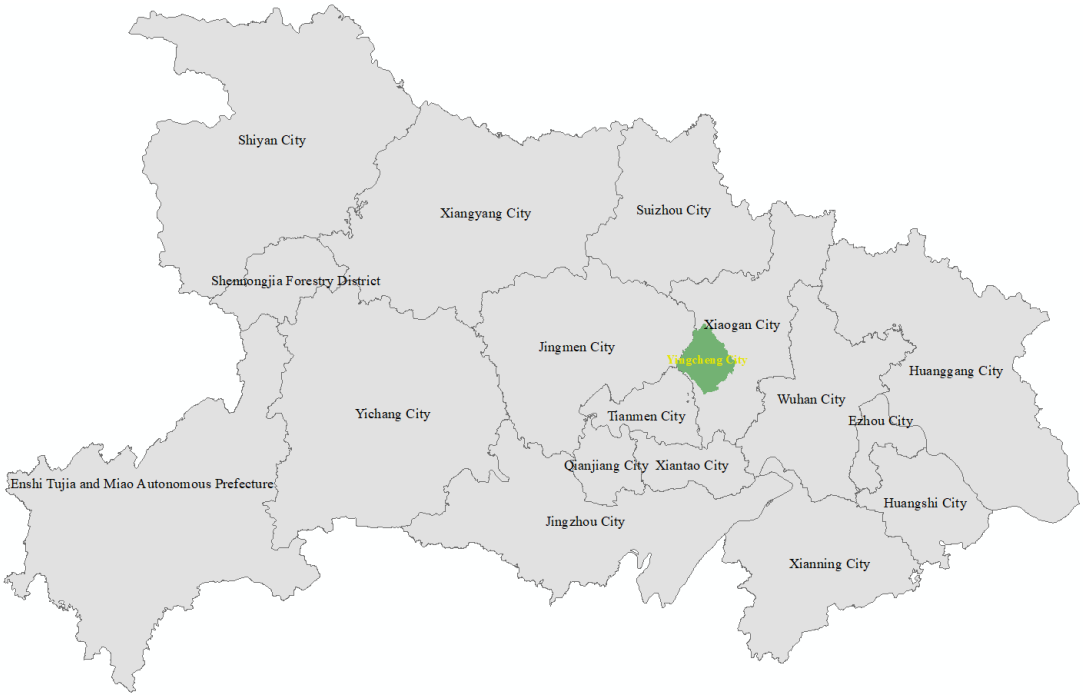

Figure 1-2 The map of project zone-Yingcheng City in Xiaogan City of hubei province

1.13 Conditions Prior to Project Initiation

Prior to the project initiation, economic conditions in the project area are not very good and the level of education is relatively low[13], so farmers lacked advanced irrigation technologies, such as the intermittent flooded water regime. However, intermittent flooded water regime requires that irrigation and drainage can be controlled according to the growth needs of rice during its cultivation. Whereas, the low economic level leads to the low income of farmers, which means that farmers have no additional economic capacity to afford the construction of cement ditches which can practice controllable irrigation and drainage. So, the project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal, or destruction.

Since the conditions existing prior to the project initiation is the same as baseline scenario, please refer to Section 3.4 (Baseline Scenario) to see the detail information. Besides, this project does not affect the environmental conditions, including climate, hydrology, topography, soils, relevant historical conditions, type of vegetation, ecosystems, etc., so, the present and prior environmental conditions of this project are the same, which are listed as follows.

Conditions	Description
Climate	Yingcheng City is a humid mid-latitude area with a subtropical monsoon climate. The four seasons change significantly, with peaks of rain and heat appearing in the same season. There is plenty of sunshine, plenty of rain, and a long frost-free period. There are very few geographical differences in light, heat, and water. The city's annual average temperature is normally high, not cold in winter and hot in summer.
Hydrology	There are mainly four rivers in the territory: Laoshui, Zhanghe, Dafushui and Hanbei River, all of which are crossing rivers. Among them, Rushui is an independent water system that directly enters the Yangtze River, and Zhang River is a tributary; Dafushui belongs to the Hanbei River system in the Hanshui River Basin, with a length of 114.7 kilometers.
Topography	Yingcheng is located in the transitional zone between the hills of central Hubei and the Jianghan Plain. It is dominated by low hills and also has plains. The entire terrain slopes from the northwest to the southeast. The northwest is a low-level area, accounting for about 66.4% of the total area of the territory. The surviving veins of Dahong Mountain in the low hill system in the territory generally have a slope of less than 10 degrees and gentle fluctuations; the elevation is between 41-80 meters, and the highest point is 111.6 meters above sea level.

[13] The ex-ante investigation report of Yingcheng City in 2017 from Hubei Academy of Social Sciences

Soils	The soil types of arable land in Yingcheng are divided into paddy soil types (including 5 subtypes, 11 soil genera, 40 soil types, submerged type, fertile type, gall type, swamp type, and lateral infiltration type), fluvo-aquic soil type (Divided into two subtypes of fluvo-aquic soil and gray fluvo-aquic soil, 5 genus soils, 20 soil species), yellow brown soil (1 subtype of yellow brown soil, 3 soil genera, 16 soil species).
Relevant historical conditions	In August 1944, Yingcheng County and Yingxi County were established in Yingcheng County. In March of the following year, the two counties merged and remained Yingcheng County. In April 1949, the whole county of Yingcheng was liberated and belonged to Hubei Prefecture; in 1959, it was under the jurisdiction of Wuhan City; in 1961, it belonged to Xiaogan Prefecture (later Xiaogan area). On May 27, 1986, with the approval of the State Council, Yingcheng County was abolished and Yingcheng (county-level city) was established. Now escrow in Xiaogan City
Type of vegetation	There are about 100 species of trees in Yingcheng, divided into two types: timber forest and economic forest. Timber forest trees include masson pine, fir, maple poplar, dry willow, Italian poplar, pond fir, metasequoia, white poplar, phalaenopsis, slash pine, etc.; economic forest tree species include pear, olive, citrus, apple, peach, etc.
Ecosystems	In Yingcheng, wild animals include hares, otters, hedgehogs, dog badgers, etc.; wild birds include geese, swallows, mallards, pheasants, turtledoves, and sharks. There are about 100 species of trees, divided into timber forest and economic forest. There are 6 types of flowers and more than 140 varieties; there are also aquatic plants such as lotus root, water chestnut, water chestnut, gorgon, water chestnut, etc.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project conforms to all kinds of regulations, which are listed as below:

PRC Constitution, *PRC Agricultural Law*, *Law of the PRC on Land Administration*, *Implementing Regulations of the Law of the PRC on Land Administration*, *Law of the PRC on Rural Land Contracting*, *PRC Production Safety Law*, and *PRC Labour Law*.

- National Master Plan for High Standard Farmland Construction
- National Plan for the Construction of High Standard Farmland for Comprehensive Agricultural Development
- Guidance on the National Demonstration Project of High Standard Farmland Construction Comprehensive Agricultural Development

- Construction Standard of National Agricultural Comprehensive Development of High Standard Farmland Construction Demonstration Project (Trial) (National Agricultural Office [2009] No.163)
- Design Specification for Irrigation and Drainage Engineering (GB50288-1999)
- Technical Specification for Water-saving Irrigation Engineering (GB/T50363-2006)

According to the Inspection and Acceptance Report of the project, during the construction of cement ditches, the requirements of Design Specification for Irrigation and Drainage Engineering (GB50288-1999) and Technical Specification for Water-saving Irrigation Engineering (GB/T50363-2006) have been followed, which requires no harm to the surrounding soils. Besides, the construction of high standard farmland also followed the requirements of PRC Agricultural Law, National Master Plan for High Standard Farmland Construction, National Plan for the Construction of High Standard Farmland for Comprehensive Agricultural Development, and Guidance on the National Demonstration Project of High Standard Farmland Construction Comprehensive Agricultural Development, without causing negative impact on the local ecological environment. Besides, the project will be subject to regular inspection by local government during the implementation period to ensure continuous compliance.

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 or is 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

The project is not involved in an emission trading program or any other mechanism that includes GHG allowance trading and has not been rejected by other GHG program. GHG emission reductions and removals generated by the project will not be used for compliance under any programs or mechanisms.

1.16.2 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit.

1.17 Additional Information Relevant to the Project

Leakage Management

According to the applied methodology: *Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation*, any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not have to be considered under this methodology. So, leakage does not need to be considered.

Commercially Sensitive Information

None of the project documents will be considered as commercially sensitive information, and all the documentation is available to any stakeholders.

Sustainable Development

The Project provides many benefits that will help achieve China's Sustainable Development Goals, a set of 17 universal goals covering the thematic areas of environmental, economic and social development.

The project contributes to achieving sustainable development as following:

- High yield brings extra income and improves the living standard of local farmers (Goal 1 mentioned as Section 1.11);
- Increase the rice productivity alleviates hunger problem (Goal 2 mentioned as Section 1.11);
- Use a proportion of benefits to improve the local children's education (Goal 4 mentioned as Section 1.11);
- Women are given priority for employment and their social status is raised (Goal 5 mentioned as Section 1.11);

- Provide more job opportunities for local farmers (Goal 8 mentioned as Section 1.11);
- Sequester greenhouse gas and mitigate climate changes (Goal 13 mentioned as Section 1.11).

Goal 1	Higher income
Type of Impact	The impact is a positive impact as increasing yield and new job opportunities created by the change of rice cultivation method.
Provisions for monitoring and reporting the Goal	Payroll of the workers who worked as technicians related to the project, and the questionnaires on the increase of farmers' income.
Affected Stakeholder Group(s)	A total number of 3,223 households is 11,120 farmers who are involved in this project.
Expected achievement	Agricultural farming is a major source of income for the farmers in the project zone. Therefore, the increase of yield is of great importance for them, which can increase their income. The construction of the project will provide new job opportunities for farmers involved in this project, as well as provision of technicians during the operation of the project, which could help them increase income.

Goal 2	Increase in rice yield
Type of Impact	The impact is a positive impact as the rice grown using the intermittently flooded method can increase its production.
Provisions for monitoring and reporting the Goal	The percentage of increase in rice yield was monitored by questionnaires and interviews from farmers for achieving this Goal 2.
Affected Stakeholder Group(s)	Farmers participated in the project
Expected achievement	Rice is an important staple for local farmers and even the whole country, so higher yields could solve the hunger problem to some extent.

Goal 4	Help in quality education
Type of Impact	The impact is a positive impact as the project will help to improve the local education.
Provisions for monitoring and reporting the Goal	The photos of actions that contribute to improving the quality of education for local children need to be taken for achieving this Goal 4. And the questionnaires on whether the quality of education was improved from farmers.
Affected Stakeholder Group(s)	Farmers participated in the project
Expected achievement	A part of the profit of this project shall be used to buy some books and stationery for the local children, which provides them with quality education.

Goal 5	Help in gender equality
Type of Impact	The impact is a positive impact as the project provides training to women who wish to participate in and facilitates more ownership of resources and access to economic opportunities.
Provisions for monitoring and reporting the Goal	The payroll of female workers.
Affected Stakeholder Group(s)	Female workers within the project area.
Expected achievement	21 new occupations for the technicians would be created by this project, and the women shall be given priority for employment which improves their social status.

Goal 8	More job opportunities and growth of local economy

Type of Impact	The impact is a positive impact as the project provides more job opportunities for practicing the intermittently flooded method. At the same time, higher rice production could bring growth in local economy.
Provisions for monitoring and reporting the Goal	Payroll of the workers who worked as technicians related to the project, and the questionnaires and interviews on the increase of farmers' income.
Affected Stakeholder Group(s)	A total number of 3,223 households is 11,120 farmers who are involved in this project.
Expected achievement	In order to practice the intermittently flooded method, some better irrigation and drainage facilities should be provided, such as cement ditches and reservoirs. In this case, a large number of job occupations could be created for the farmers involved in this project, including building the ditches and reservoirs, working as technicians, etc. Therefore, the male adults working outside the county would come back to make contribution to their hometown.

Goal 13	CH_4 emission reduction
Type of Impact	The impact is a positive impact as CH_4 emissions generated by soil organic matter under anaerobic conditions is reduced. The impact is an actual impact which is a direct consequence of the project activity.
Provisions for monitoring and reporting the Goal	The Report of Measuring Methane Emission Rate of Paddy Fields by Closed Chamber in Yingcheng City from Huazhong Agricultural University was used to prove the amount of net GHG emission reduction.
Affected Stakeholder Group(s)	Farmers within the project area
Expected achievement	It is expected to reduce 59,902tCO_2e every year by conducting this project, because the duration of anaerobic decomposition of soil organic matters in rice paddies is shorten by replacing continuously flooded with intermittently flooded.

Further Information

There is no further information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS

2.1 No Net Harm

The potential negative environmental and socio-economic impacts and steps to mitigate them have been summarized in the following table:

Environmental		Socio-Economic	
Potential Negative Impacts	Actions	Potential Negative Impacts	Actions
During the construction, a large amount of construction waste could be generated, which has a negative impact on water resources, air quality and soil quality.	During the construction process of the project, the construction waste should be uniformly classified and collected according to the requirements of Xiaogan City Construction Waste Management Interim Measures. The construction entity shall provide personnel in charge of the discharge of construction wastes at the construction site, supervise the standard shipment of construction wastes at the construction site, and ensure that the transport vehicles are washed clean before leaving.	The construction of the project needs to be jointly by local farmers and the government, so it would put economic pressure on them, especially farmers	Project proponent provided a part of funds as subsidies to farmers involved in this project to ease their economic pressure[14]

[14] Carbon reduction project cooperation agreement signed between the farmers and Wuhan Haimingsen.

During the construction, the construction dust could be produced, which could form haze and harm the air quality.	During the construction, water should be sprayed frequently to reduce the negative impacts brought by the dust.	If the intermittently flooded method cannot be conducted strictly during rice cultivation within the project area, then the yield would not be great and the income will not be increased.	The relevant training should be conducted every year and the technician should also give timely guidance during every monthly inspection.

2.2 Local Stakeholder Consultation

Stakeholder consultations include an ex-ante surveys and stakeholder meetings, requiring stakeholders to present their opinions on project design and their willingness to participate.

Before the project started, Hubei Academy of Social Sciences conducted stakeholder meetings to ask their willingness of participation. Hubei Academy of Social Sciences organized a team of people to interview the village representatives, relevant governmental officials and distribute the questionnaires to gather local farmers' opinions. A total of 100 questionnaires were distributed, and 100 were collected. The background information of these 100 stakeholders is summarized as follows (see Table 2-1). The surveys took 1 week and completed on 14 August 2017. The feedback collected is summarized below:

- Most farmers are aware of the benefits of adjusted water management during rice cultivation. They understand that the intermittently flooded method can reduce methane emissions, save water resource, and increase the rice productivity.
- Prior to the meeting, most local farmers had never heard of carbon trading, VCS or carbon credits. After the introduction, they strongly agreed that the project should be registered as a carbon reduction project and participate in the carbon trading market.
- Local farmers believe that the project can 1) create jobs; 2) get more benefits from selling carbon credits; 3) reduce methane emissions, save water resource, and increase the rice productivity; 4) improve the quality of local education by donating books; and 5) improve the social status of women by hiring them to be technicians.
- The local agricultural bureau is very clear about the benefits of the intermittently flooded cultivation method and understands that carbon trading can make projects more sustainable.

Table 2-1 Background information of these 100 stakeholders

Categories	Proportion
Nationality	2% of them are Hui, 2% of them are Tujia, 1% of them are Miao, rest of them are Han.
Educational Level	16% and 10% are at the primary and high school levels, respectively, with the rest are all at the junior high school level.
Career	95% are farmers, only 2% work for factories and 3% are village officials.
Gender	59% are female and 41% are male.
Age-bracket	31~66 years old

Table 2-1 Survey Results Summary Sheet

Question	**Survey Result**
How many people in your family? How much is the annual income? What are the main economic sources?	The average number of people is 3.45 in one family and the average annual income is CNY 10,634. The main economic source is planting rice.
Do you think the intermittently flooded water regime is good for rice cultivation?	It is favourable.
What do you know about the benefits of the intermittently flooded water regime?	Reduce methane emissions, save water resource and increase the rice productivity
What industries does your family member work in?	Labor and farming
What kind of production activities does your family do?	Crop farming
What is your educational level?	74% are middle school level, 10% are high school level and the rest are primary school level.
Is the land ownership involved in the project clear?	Yes.

Did you know carbon trading before?	Most people had never known.
Through the staff's introduction to carbon trading, do you support this project's application for development as a carbon reduction project?	Most people had never known.
If this project is successfully applied for development as a carbon reduction project, what benefits do you think can be brought?	Create more job opportunities for economic benefits, improve the local environment, reduce methane emissions, save water resource, and increase the rice productivity.
Do you support hiring women to participate in rice cultivation and management in this project?	Yes.
Do you think there is anything that needs to be improved in the design or implementation of this project? Please provide your valuable comments.	There are some comments came up from farmers: 1. They worried that they cannot afford the self-raised part of construction funds. 2. They worried that they cannot conduct the intermittent flooded water regime well. Firstly, during the stakeholders meeting, the representatives of Wuhan Haimingsen and local agricultural bureaus explained that the government and Wuhan Haimingsen would jointly fund the construction of high standard farmland to reduce the economic burden on farmers. For the second problem, experts from local agricultural bureau train the technicians every year, and the technicians also train farmers every February to master their skills of practicing intermittent flooded water regime. Lastly, the farmers represent that they have no comments.

Therefore, the stakeholders have no opinions on the project implementation, and there is no need to change the project design.

The project proponent has formulated a series of plans to ensure continuous communication with stakeholders to protect the interests of local stakeholders and ensure the good operation of the project.

The mechanism for on-going communication with local stakeholders

Firstly, the technicians are required to patrol the fields every week, and communicate with the farmers and collect their opinions when patrolling the fields. Secondly, the villages are adjacent to each other. If the farmers have any opinions, they can directly report to the local agricultural bureau. Thirdly, there will be a training for farmers once a year, and they can also express their opinions to technicians during the training period. Finally, the telephone number of the contact person of the project should be posted on the bulletin board in each village during the operation of the project, and farmers can also communicate directly with the project proponent by telephone.

- As mentioned above, during the stakeholders meeting before the implementation of this project, the project proponent and local agricultural bureaus had explained all the designs of the high standard farmland construction and the development process of the carbon reduction project. During the operation phase, all the stakeholders have been and will be communicated about the results of monitoring through villagers' meetings.
- Besides, during the stakeholders meeting, all the risks, costs and benefits the project may bring to local stakeholders had been discussed and the corresponding resolutions were also proposed by the project proponent. All the stakeholders had expressed the view that they were informed and accepted.
- Also, the representative of Wuhan Haimingsen, under the supervision of the local agricultural bureau and government, has also informed farmers of all relevant laws and regulations covering workers' rights in the host country.
- The process of VCS Program validation and verification and the validation/verification body's site visit are required to inform the farmers by publishing it on the notice board also with the contact person's information. If there is any negative feedback, a meeting will be immediately held in the village.

2.3 Environmental Impact

According to the Environmental Impact Assessment Law of the People's Republic of China, this project does not require any environmental impact assessments. The environmental impacts, both positive and negative, produced during construction and operation of this project activity and the mitigation of negative impact are summarized as follows.

Stages	Positive impact	Negative impact	Mitigation of negative impact
Construction period	In the process of construction, the soil has been turned from a deep	During the construction, a small amount of wastewater could be generated	Build a sewage sedimentation tank, and the water after sedimentation can be

	level, which can improve the soil structure to a certain extent.		used for sprinkling on the construction site to reduce dust.
		Construction noise. During the construction period, construction machinery generated noise	Construction activities should avoid rest time.
		Construction waste. During the construction, a large amount of construction waste could be generated.	During the construction process of the project, the construction waste should be collected by classification and recycled.
		Construction dust. During the construction, the construction dust could be produced.	During the construction, water should be sprayed frequently to reduce the negative impacts brought by the dust.
Operation period	Drainage and irrigation can be controlled, so water resources could be saved compared to the original continuously flooded method.	In the course of drainage, if the ditches are damaged, the discharged water may not be discharged into the reservoir in accordance with the set route and contaminate other water resources	Since each technician is in charge of several villages, farmers would immediately call the technician if a ditch broke down in their fields. If it is a minor problem, including a blocked water outlet, the technician shall be on site within an hour to solve it. If the technician cannot solve the problem, they should immediately inform Wuhan Haimingsen and contact the local agricultural bureau to activate the emergency

			mechanism and take corresponding measures. For example, if the ditch is broken or leaking, the repair shall be arranged within 24 hours.
	Drainage and irrigation can be controlled, so methane emissions from soil organic matter under flooded conditions during rice cultivation can be reduced.		

2.4 Public Comments

The public comments period will be updated after the project is announced.

2.5 AFOLU-Specific Safeguards

1. Stakeholder Identification

This stakeholder's identification starts by listing all the people or groups who might have an influence over or be impacted by a project. The local village committees and village officials were considered as the key informants and focus groups who know best about the local farmers. In August 2017, the project proponent and Hubei Academy of Social Sciences held a consultant meeting with local village committees before the project start, and the main purpose of the meeting was to identify the stakeholders in the project.

1) Village residents: (including 11,120 local farmers within 3,223 households of which 7,143 are females, accounting for about 60.7percent)

In Yingcheng City, a total of 11,120 farmers have been directly affected by the activities of the project. In addition, the rice paddies in the project area belong to these farmers. Hence, the village committees collected the opinions and consent of the farmers in respective villages through face-to-face meetings before deciding to apply to the local governments'

and agricultural bureaus for using intermittently flooded method through participation in the Plan of High Standard Farmland Construction[15] (hereinafter referred to as HSFC). These farmers were also responsible for signing the cooperation agreements with the project proponents to ensure the proper development of the project.

Since June 2017, before the project started, the village committees conducted a survey of the local farmers' willingness to participating in the Plan of HSFC for applying the intermittently flooded method during rice cultivation. This was done through meetings and interviews with farmers. All the farmers agreed to use this advanced cultivation method in the end.

The meeting held on August 2017 was attended by the representatives of Yingcheng Agricultural Bureau, the representatives of Wuhan Haimingsen, the representatives of farmers, and the representatives of the village committee. The representatives of Yingcheng Agricultural Bureau also organized a meeting to solicit suggestions from farmers for the implementation of project activities and their willingness to participate in rice cultivation.

This project activity has greatly benefited the local farmers and could only carry out with the farmers' consent. Hence, all the farmers within the project area are recognized to be stakeholders in the project.

2) Agricultural Bureau of Yingcheng City

The techniques of intermittently flooded method are provided by the local agricultural bureau, which inspects successful rice cultivation. In this respect, the farmers, the committees, the local governments granting permission and local agricultural bureau providing advice and inspections, are all identifies as relevant stakeholders in this project.

3) Local governments of Yingcheng City

The local administration is responsible for the local social and environmental management. They are responsible and accountable to all local farmers for any violation of their rights.

4) Village committees of Yingcheng City

They are responsible for collecting opinions from the respective locals and villages with the project proponent or agricultural bureaus.

The results of identified stakeholders will be publicly announced on VCS website as part of the draft PD which can be accessed by everyone, in case there is any other person who may consider themselves as one of the project's stakeholders, they can directly contact the project proponent for consultation.

[15] This Plan is government-led, involving the construction of ditches and the leveling of rice paddies, and voluntary participation is applied for by farmers

2. Potential Risks and Measures

Potential risks to stakeholders	During the implementation of the project, since it is necessary to go to the field every day to observe the growth of rice and the change of water level, drainage and irrigation are carried out from time to time, which increases the chances of farmers encountering dangers, such as slipping while checking the rice in the field.
Measures to mitigate it	All these potential risks should be told to the stakeholders in advance and some simple first aid measures also need to be communicated to farmers during training to reduce the injuries.

Prior to the project implementation, the original simple ditches in the project area could not achieve controllable irrigation and drainage, which caused the rice to be in a flooded state for a long time. Therefore, the rice yield was low and the farmers' income was less. After the construction of the cement ditches, farmers volunteered to conduct intermittent flooded water regime, because it allowed them to irrigate and drain the rice according to its growth needs, resulting in higher yields.

Besides, the 13,540 ha of construction land within the project has been agricultural land since 2005, which has been proved by Xiaogan Agricultural Bureau. In addition, this project activity only adjusts the water regime during rice cultivation but not changes the type of land use, therefore, the project would not impact local stakeholder’s property rights without the free, prior and informed consent.

Feedback and Grievance Redress Procedure

Throughout the implementation of the project, an anonymous opinion collection box was set up and a commissioner appointed by the project proponent with the phone number was publicized in bulletin in each village. Therefore, if there are any conflicts came up between the local communities and individual villagers, they can contact the commissioner directly. The commissioner shall record and summarize all the conflicts collected and then submit it to the relevant management unit. The management unit should communicate with all the relevant communities and stakeholders to solve the conflict within 5 days. Afterwards, the solution should be proposed within 10 days and the conflicts should be solved within one month.

At the annual stakeholders meeting, parties can appeal directly to the agricultural bureau. In addition, the project proponent shall also conduct a stakeholders satisfaction survey at the meeting.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The small-scale methodology AMS-Ⅲ.AU: *Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation/version 4.0* is used. Also, the project proponent shall apply the "General guidelines for SSC CDM methodologies/version 23.1".

In addition, since the reporting and verification shall be done on the basis of samples of the log-books from the farmers, the *Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities/version 9.0* and the Guideline for *Sampling and Surveys for CDM Project Activities and Programme of Activities/version 4.0* are used.

The TOOL 21"Demonstration of Additionality of Small-scale Project Activities (version 13.1)" is used to demonstrate the additionality.

3.2 Applicability of Methodology

1) As mentioned in Section 3.1, the methodology applied in this project is AMS-Ⅲ.AU (version 4.0) which is applicable under the following conditions:

Conditions required by methodology	Applicability of this project
2. The methodology comprises technology/measures that result in reduced anaerobic decomposition of organic matter in rice cropping soils and thus reduced generation of methane. The methodology includes projects such as: a) Rice farms that change the water regime during the cultivation period from continuously to intermittent flooded conditions and/or a shortened period of flooded conditions; b) Alternate wetting and drying method and aerobic rice cultivation methods; c) Rice farms that change their rice cultivation practice from transplanted to direct seeded rice.	This project activity realized the type (a), changing the water regime during the cultivation period from continuously to intermittent flooded conditions, through the construction of cement ditches for controllable irrigation and drainage.
3. This methodology is applicable under the following conditions:	According to the result of the ex-ante investigation report of Yingcheng City in

a) Rice cultivation in the project area is predominantly characterized by irrigated, flooded fields for an extended period during the growing season, i.e. farms whose water regimes can be classified as upland or rainfed and deep water are not eligible to apply this methodology. This shall be shown from a representative survey conducted in the geographical region of the proposed project or by using national data. This project area characterization shall also include information on pre-season water regime and applied organic amendments, so that all dynamic parameters as shown in Table 3-1 below are covered by the baseline study.	2017[16], rice cultivation in the project area is predominantly characterized by irrigated, flooded fields for an extended period during the growing season. And the pre-season water regime is mainly continuously flooded with no any organic amendments.
b) The project rice fields are equipped with controlled irrigation and drainage facilities such that both during dry and wet season, appropriate dry/flooded conditions can be established on the fields;	With the project, the rice fields are equipped with controlled irrigation and drainage facilities such that intermittently flooded method can be conducted.
c) The project activity does not lead to a decrease in rice yield. Likewise, it does not require the farm to switch to a cultivar that does not been grown before;	The type of rice planted in this project is very common and the project activity is not subject to any local regulatory restrictions, so it will not lead to a decrease in rice yield.
d) Training and technical support during the cropping season that delivers appropriate knowledge in field preparation, irrigation, drainage and use of fertilizer to the farmer is part of the project activity and is to be documented in a verifiable manner (e.g.	By now since the project activity was started in 2018, experts from Huazhong Agricultural University will train technicians in intermittent irrigation, requiring correct drainage and irrigation at the corresponding stages during rice planting. Every April from 2018 to 2021, farmers are

[16] The ex-ante investigation report in Yingcheng City in 2017 from Hubei Academy of Social Sciences

	protocol of trainings, documentation of on-site visits). In particular, the project proponent is able to ensure that the farmer by himself or through experienced assistance is able to determine the crop's supplemental N fertilization need. The applied method shall assess the fertilizer needs using for example a leaf colour chart or photo sensor or testing stripes. Alternatively, a procedure to ensure efficient fertilization considering the specific cultivation conditions in the project area backed by scientific literature or official recommendations shall be used;	also trained intensively. During the training, it will be emphasized that the application amount of fertilizer should not exceed the recommended amount for Yingcheng City by Agricultural Bureau, which is 10-12kg/mu[17].
e)	Project proponents shall assure that the introduced cultivation practice, including the specific cultivation elements, technologies and use of crop protection products, is not subject to any local regulatory restrictions;	The intermittent flooded water regime, the optimal amount of nitrogen utilization and the high standard farmland construction introduced in the project area are legal.
f)	Except the case where the default value approach indicated as follows, "Emission reductions using IPCC tier 1 approach or default values" is chosen for emission reductions calculations, project proponents have access to infrastructure to measure CH_4 emissions from reference fields using closed chamber method and laboratory analysis;	For the ex-ante emission reduction calculation, project proponent made measurements by using the closed chamber to determine baseline emission factors for continuously flooded field and project emission factors for intermittent flooded field[18]. For the post-emission reduction calculation, project proponent has already set the closed chamber in baseline and project reference fields respectively, and made the plan of monitoring.

[17] The Technical Guidelines for Intermittently Flooded Rice Cultivation Method in Hubei Province, issued by Agricultural Bureau, also emphasized that the optimal amount of nitrogen fertilizer used in Hubei rice paddy fields is 10-12kg/ Mu.

[18] The Report of Measuring Methane Emission Rate of Paddy Fields by Closed Chamber in Yingcheng City

g) Aggregated annual emission reductions of all fields included under one project activity shall be less than or equal to 60 kt CO_2 equivalent.	Those rice paddies belong to the local farmers, covering a total of 13,540 hectares, and 59,902tCO_2e is expected to be generated every year, which is below 60 kt CO_2e. If the emission reductions monitored during the verification excesses the threshold, the project proponent will only claim gap of 60,000 tons according to the Applicability of small-scale methodology.

Table 3-1 Parameters for the definition of cultivation patterns

Nr.	Parameter	Type	Values/categories	Source/method
1	Water regime – on-season	Dynamic	Continuously flooded	Baseline: Farmer's information Project: Monitoring
			Single drainage	
			Multiple drainage	
2	Water regime – pre-season		Flooded	
			Short drainage (<180d)	
			Multiple drainage (>180d)	
3	Organic amendment		Straw on-season	
			Green manure	
			Straw off-season	
			Farm yard manure	
			Compost	
			No organic amendment	
4	Soil pH	Static	<4.5	ISRIC-WISE soil property database or national data
			4.5-5.5	
			>5.5	
5	Soil organic carbon		<1%	

			1-3%	
			>3%	
6	Climate		[AEZ][19]	Rice Almanac, HarvestChoice[f]

As described above, this small-scale methodology AMS-III.AU (version 4.0) is applicable to the proposed activity.

2) The Tool 21 "Demonstration of Additionality of Small-scale Project Activities (version 13.1) applied in this project is applicable under the following conditions:

Conditions required by methodology	Applicability of this project
4. The use of the methodological tool "Demonstration of additionality of small-scale project activities" is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	For this project activity, this methodological tool is decided to be used. Besides, Wuhan Haimingsen (as the project proponent) and Search Co2 (as the project managing entities) do not plan to propose alternative methods.
5. Project participants and coordinating/managing entities may also apply "TOOL 19: Demonstration of additionality of microscale project activities" as applicable.	This project activity is expected to generate 59,902tCO_2e/ha emission reductions per year which is greatly more than 20 tCO_2e/ha defined under microscale project activities, so it is not applicable to "TOOL 19".

3.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	The rice paddies where water regimes	CO_2	No	Not included in this project
		CH_4	Yes	Baseline emissions consist of the CH_4 emissions.
		N_2O	No	Due to the optimized N fertilization practice regulated by the methodology, N_2O emissions

[19] Climate zone: use agroecological zone as shown in the Rice Almanac (Third Edition, 2002), or by HarvestChoice.

Source		Gas	Included?	Justification/Explanation
	are changed			do not significantly deviate from the baseline emissions and hence are not considered.
		Other	No	Not included in this project
Project	The rice paddies where water regimes are changed	CO_2	No	Not included in this project
		CH_4	Yes	Project emissions consist of the CH_4 emissions, which will still be emitted under the changed water regime.
		N_2O	No	Due to the optimized N fertilization practice regulated by the methodology, N_2O emissions do not significantly deviate from the baseline emissions and hence are not considered.
		Other	No	Not included in this project

The rice paddies applied intermittently flooded water regime in Yingcheng City are defined as the project area, also the project boundary where the cultivation method and water regime are changed. The map of the project boundary is provided as the Figure 3-1.

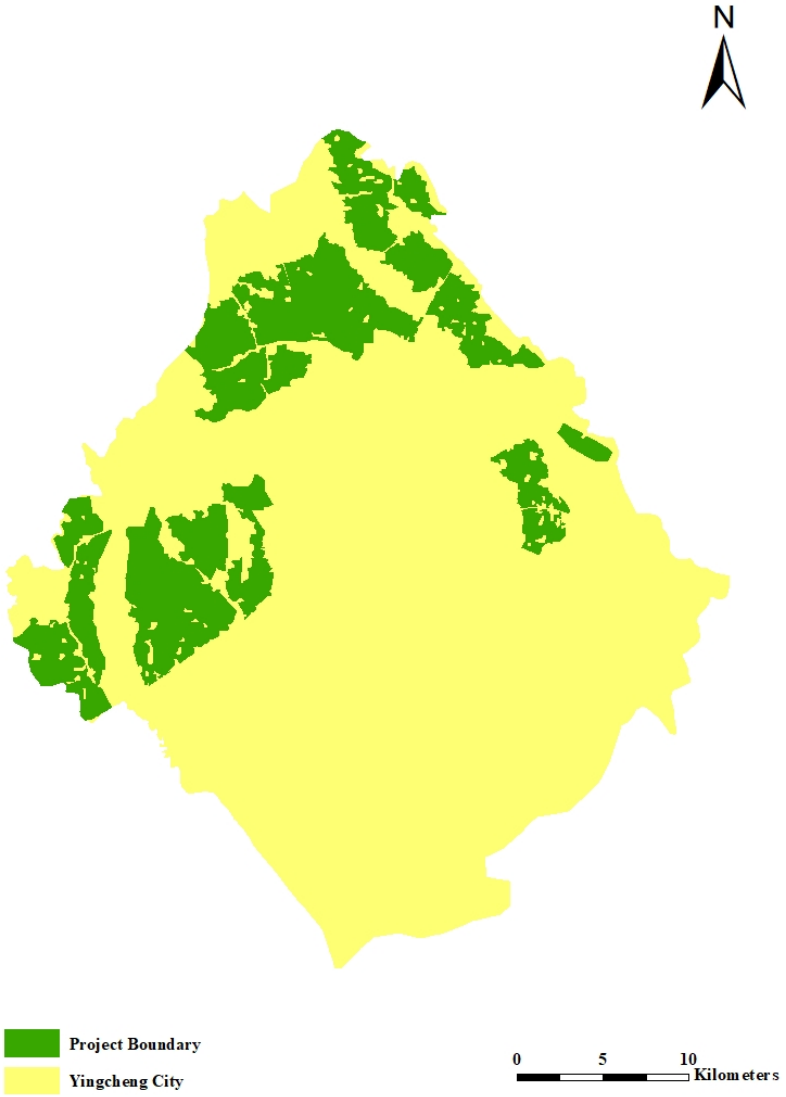

Figure 3-1 the map of the project boundary

3.4 Baseline Scenario

According to the small-scale methodology: *Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation*, the baseline scenario is the continuation of the current practice which is continuously flooded water regime without any organic amendment during rice cultivation in the project fields (see further details in Section 3.5).

3.5 Additionality

According to TOOL 21 “Demonstration of Additionality of Small-scale Project Activities (version 13.1), project participant shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions.

Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.

Barrier due to the prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

Other barriers: without the project activity, for another specific reason identifies by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Project activity would not have occurred due to investment barrier and technological barrier as analysed below.

Investment barrier

In the absence of the project activity, the living standard of farmers in Yingcheng City is poor and the economy is depressed, so it is difficult for them to build the cement ditches for timely drainage and irrigation according to the growth need of rice. According to the findings of the survey report[20], in Yingcheng City, the living balance of local farmers is only CNY 300 a year, many households would be facing difficulties to afford their livings. In the absence of project activities, the local government's funding has covered the material costs for the construction of high-standard farmland irrigation and drainage facilities, which is not enough to cover the labor costs[21]. And the households cannot afford the O&M cost during operation period. Lack of capital resources to help them for routine maintenance and management will lead to facilities abandoned, therefore, the investment is worthless in their mind. After the implementation of the project, the owner paid to local farmers at a price CNY 200 per ha[22], filled up the funding gap in the labor cost of irrigation and drainage ditches for high-standard farmland construction. At the same time, the benefits of emission reductions brought by the project can also make up for the operation and maintenance costs of irrigation and drainage

[20] The ex-ante investigation report in Yingcheng City in 2017 from Hubei Academy of Social Sciences.

[21] The Approval of High Standard Farmland Construction Task in 2017 was issued by Xiaogan Agricultural Bureau.

[22] Source: carbon reduction project cooperation agreement signed between the farmers and Haimingsen.

facilities local farmers. So, the baseline scenario is a financially more viable alternative to the project activity but would have led to higher emissions.

Technological barrier

The original water regime used during rice cultivation in baseline scenario, continuously flooded method, isless technologically advanced, because it only requires that the fields should be flooded throughout the whole season and there is no need to pay close attention to the growth status of rice for appropriate drainage and irrigation. Thus, simple soil ditches are enough in baseline scenario so that 100% famers within the project zone practiced continuously flooded method during rice cultivation [23], which means the new technology, intermittent flooded water regime, has a low market share.

In general, this project has both investment and technological barriers, so it is additional.

3.6 Methodology Deviations

No deviations from the procedures indicated by the methodology have been made.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As described in methodology AMS-Ⅲ.AU (version 4.0) mentioned above, the baseline scenario is the continuation of the current practice, e.g. continuously flooded rice cultivation in the project fields, the baseline emissions are estimated as follows:

$$BE_y = \sum_s BE_s \tag{1}$$

$$BE_y = \sum_{g=1}^{G} EF_{BL,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4} \tag{2}$$

Where:

Parameters	Description
BE_y	Baseline emissions in year y (tCO_2e)
BE_s	Baseline emissions from project fields in season s (tCO_2e)

[23] The ex-ante investigation report in Yingcheng City in 2017 from Hubei Academy of Social Sciences.

$EF_{BL,s,g}$	Baseline emissions factor of group g in season s ($kgCH_4$/ha per season)
$A_{s,g}$	Area of project fields of group g in season s (ha)
GWP_{CH_4}	Global warming potential of CH_4 (tCO_2e/tCH_4)
g	Group g, covers all project fields with the same cultivation pattern (G = total number of groups)

Determination of baseline emission factor on baseline reference fields

Baseline reference fields shall be set up in a way that they are representative of baseline emission in the project rice fields and at least three reference fields with the same pattern shall be determined in the project area. On these fields, measurements using the closed chamber method shall be carried out, each resulting in an emission factor expressed as $kgCH_4$/ha per season. The seasonally integrated baseline emission factor $EF_{BL,s,g}$ shall be derived as average value from the three measurements for each group.

In this project, all the dynamic and statistic parameters of rice paddies within the project area are the same, according to the ex-ante investigation report[24], which can be summarized as follows:

No.	Parameter	Type	Conditions within the project area
1	Water regime – on-season	Dynamic	Continuously flooded
2	Water regime – pre-season		Flooded

[24] The ex-ante investigation report of Yingcheng City in 2017 from Hubei Academy of Social Sciences

3	Organic amendment		No organic amendment
4	Soil pH	Static	The soil pH within project area is 6.5~7.5, which is in the range of larger than 5.5.
5	Soil organic carbon		The soil organic carbon is 1.54% which is in the range between 1% and 3%.
6	Climate		According to the Rice Almanac (Third Edition, 2002), the project zone, Yingcheng City, lies in agroecological zones 6 (AEZs), which is warm/cool humid subtropics with summer rainfall.

Therefore, all fields within project area have the same cultivation pattern and there is only one group in this project.

4.2 Project Emissions

According to the applied methodology AMS-Ⅲ.AU (version 4.0), the project emissions within the project boundary are calculated as follows:

$$PE_y = \sum_s PE_s \tag{3}$$

$$PE_s = \sum_{g=1}^{G} EF_{P,s,g} \times A_{s,g} \times 10^{-3} \times GWP_{CH_4} \tag{4}$$

Where:

Parameters	Description
PE_y	Project emissions in year y (tCO_2e)
PE_s	Project emissions from project fields in season s (tCO_2e)
$EF_{p,s,g}$	Project emission factor of group g in season s ($kgCH_4$/ha per season)

Determination of Project emission factor on Project reference fields

The seasonally integrated project emission factor $EE_{P,s,g}$ shall be determined using measurements on at least three project reference fields that fulfil the same conditions as the baseline reference fields, with the difference that they are cultivated according to the defined project cultivation practice. Project reference fields shall be established close to the baseline reference fields and begin with the growing season at the same time. $EE_{P,s,g}$ is the average of the measurement results from the three reference fields.

There is only one group for all rice paddies in this project, so a total of three project reference fields were established about 2km away from the baseline reference fields and began with the growing season at the same time.

4.3 Leakage

According to the applied methodology AMS-Ⅲ.AU (version 4.0), any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not considered under this methodology. So, leakage does not need to be considered in this project.

4.4 Net GHG Emission Reductions and Removals

The emission reductions achieved by the project activity shall be calculated as the difference between the baseline and the project emissions, which is also used as post-emission reduction:

$$ER_s = BE_s - PE_s \tag{5}$$

Where:

Parameters	Description
ER_s	Emission reductions in season s (tCO_2e)

Ex ante estimation of emission reductions

According to the applied methodology AMS-Ⅲ.AU (version 4.0), for the ex-ante estimation of emission reductions within the project design document prior to the project implementation, project proponent shall refer to own field experiments or estimate baseline and project emissions with the help of national data or IPCC tier 1 default values for emission and scaling factors.

In this project, using the IPCC tier 1 approach but undertaking measurements to determine baseline emission factors for continuously flooded fields, as per the following formula:

$$ER_y = EF_{ER} \times A_y \times L_y \times 10^{-3} \times GWP_{CH_4} \quad (6)$$

$$EF_{ER} = EF_{BL} - EF_P \quad (7)$$

$$EF_{BL} = EF_{BL,c} \times SF_{BL,w} \times SF_{BL,p} \times SF_{BL,o} \quad (8)$$

$$EF_P = EF_{BL,c} \times SF_{P,w} \times SF_{P,p} \times SF_{P,o} \quad (9)$$

Where:

Parameters	Description
ER_y	Emission reductions in year y (t CO_2e)
EF_{ER}	Adjusted daily emission factor (kgCH_4/ha/day). Alternatively, seasonal emission factor (kg CH_4/ha/season) may be determined
A_y	Area of project fields in year y (ha)
L_y	Cultivation period of rice in year y (days/year). This is not applicable when seasonal emission factor is determined.
GWP_{CH_4}	Global warming potential of CH_4 (t CO_2e/t CH_4)
EF_{BL}	Baseline emission factor (kg CH_4/ha/day) or (kg CH_4/ha/season)
EF_P	Project emission factor (kg CH_4/ha/day) or (kg CH_4/ha/season)
$EF_{BL,c}$	Baseline emission factor for continuously flooded fields without organic amendments (kg CH_4/ha/day) or (kg CH_4/ha/season)
$SF_{BL,w}$ or $SF_{P,w}$	Baseline or project scaling factors[25] to account for the differences in water regime during the cultivation period
$SF_{BL,p}$ or $SF_{P,p}$	Baseline or project scaling factors to account for the differences in water regime during the pre-season before the cultivation period

[25] For all scaling factor used in this methodology, the average values in 2006 IPCC Guidelines for National Greenhouse Gas Inventories are chosen.

$SF_{BL,o}$ or $SF_{P,o}$	Baseline or project scaling factors should vary for both type and amount of organic amendment applied

Determination of $EF_{BL,c}$

However, the baseline emission factor for continuously flooded fields without organic amendments ($EF_{BL,c}$) can be determined ex ante prior to the start of the project activity, in this case, the ex-ante value should be used to calculate emission reduction during the crediting period. It should be measured by using closed chamber in three reference fields which are chosen in the project area.

According to the guidance on methane measurement in the appendix of AMS-III.AU Methodology, the following requirements should be met.

The implementation of methane measurement in rice fields requires the involvement of experts in this field or at least experienced staff trained by experts (i.e. from research institutions). These guidelines cannot replace expertise in setting up chamber measurements. They rather set minimum requirements that serve for standardizing the conditions under which methane emissions are measured for projects under this methodology.

The closed chamber measurement requires the involvement of technicians trained by experts from Huazhong Agricultural University. The expert who is the leader of the experiment has a doctoral degree and his field of study is rice cultivation and GHG monitoring[26]. The expert set up the chamber measurements in 2017, the base is embedded just before transplanting, and the first gas sampling began on the second day after transplanting, followed by sampling every 7days. After sampling, the gas is stored in the evacuated vial, and the samples collected after three times should be taken together for laboratory analysis.

Project proponents shall prepare a detailed plan for the seasonal methane measurements before the start of the season. The plan shall include the schedule for the field and laboratory measurements, the logistics that are necessary to get the gas samples to the laboratory and a cropping calendar. The plan shall also include all reference field specific information regarding location and climate, soil, water management, plant characteristics, fertilizer treatment and organic amendments.

The details of the reference fields for measuring $EF_{BL,c}$ is shown as following:

Table 4-1 The details of Baseline reference fields

Specific Information	**Plot 1**	**Plot 2**	**Plot 3**
Area(ha)	0.42	0.36	0.42

[26] http://cpst.hzau.edu.cn/info/1022/4605.htm

Location	Xiefan Village, Yanghe Town, Yingcheng City, Xiaogan City
The type of rice	Hybrid rice
Climate	North subtropical humid monsoon climate zone
Soil	pH6.5 —7.5 and the soil organic carbon is 1.54%
Water management	Continuously flooded[27]
Fertilizer treatment	No any organic amendments

In addition, according to the guidance on methane measurement in the appendix of AMS-III.AU Methodology, the steps from field measurement to $EF_{BL,c}$ should be taken as follows.

Table 4-2 On the field – technical options for the chamber design

Feature	Requirements	Conditions in the project
Chamber material	Option 1: Non-transparent ● Commercially available PVC containers or manufactured chambers (e.g using galvanized iron); ● Painted white or covered with reflective material (to prevent increasing inside temperature); ● Only suitable for short-term exposure (typically 30 min) followed by immediate removal from the field	The chamber used in this project is made of PVC materials covered with reflective material to prevent the increasing inside temperature. And it is only put just before the sampling and then is removed after 30 mins of sampling.
Placement in soil	Option 1: Fixed base ● Base made of non-corrosive material and remains in the field for the whole season;	The base used in this project is made of non-corrosive PVC material and was embedded before transplantation, remaining in the field for the whole season. Base allows tight

[27] Continuously flooded: fields have standing water throughout the rice growing season and may only dry out for harvest (end-season drainage)

	● Base should allow tight sealing of the chamber; ● Base should have bores in the submerged section to allow water exchange between inside and outside; ● Base should be installed at least 24 hours before the first sampling	sealing of the chamber and has bores in the submerged section to allow water exchange. The first sampling was taken 24 hours after the base installation (see details in Table 4-2 above).
Auxiliaries of chamber	● Thermometer for measuring the temperature inside the chamber; ● Fan (battery operated) inside the chamber for mix the inside air during sampling; ● Sampling port (rubber stopper placed in a bore of the chamber)	There are a thermometer and a fan inside the chamber and the sampling port is set on the top of the chamber.
Basal area	Rectangular or rounded, but has to cover minimum of four rice hills (ca. 0.1m^2 minimum)	The base is rectangular and installed covering four rice hills.
Height	Option 1: Fixed height Total height (protruding base + chamber) should exceed plant height	The total height of chamber and base is 1.5 meters which is higher than 1.2 meters, the largest height of the plant.

Table 4-3 On the field – air sampling

Feature	Requirements	Conditions in the project
Replicate chambers per plot	Minimum requirement: Three replicate chambers per plot	Three replicate chambers were placed in every plot.

Number of air samples per exposure/data points per measurement	Minimum requirement: Three samples per exposure	Three samples for every exposure.
Exposure time	30 minutes	30 minutes
Daytime of measurement	Morning	9.30 – 10.00 a.m.
Measurement interval	Minimum requirement: once per week	Once a week
Syringe	Suitability test (leak proof) before measurement Preferably equipped with a lock for ease of handling	The syringe with a lock was used in this project and it is checked for leak proof before every measurement.
Sample storage until analysis	● Storage < 24h: air samples can remain in syringe; ● Storage > 24h: transfer air samples into evacuated vial, store with slight overpressure	Three samples were taken before a laboratory analysis was performed, so the samples were stored in the evacuated vials.

Table 4-4 Laboratory analysis

Feature	Requirements	Conditions in the project
Method	Gas Chromatography with flame ionization detector (FID)	FID
Injection	Direct injection or with multi-port valve and sample loop	Direct injection
Column	Packed (e.g. molecular sieve) or capillary column	Packed
Calibration	With certified standard gas each day of analysis before and after the analyses are done	With certified standard gas each day of analysis before and after the analyses are done

It is demonstrated by *The Report of Measuring Methane Emission Rate by Closed Chamber in Yingcheng City in 2017* from Huazhong Agricultural University (see further details in Section 5.1 below) that the baseline emission factor for continuously flooded fields without

organic amendments ($EF_{BL,c}$) is 3.6672 kg CH_4/ha/day. The process of calculation is shown as follow:

Calculation of the emission rate for a plot (reference field)

(1) For each gas analysis, calculate the mass of CH_4 emissions with the help of the following formula:

$$m_{CH_{4,t}} = c_{CH_{4,t}} \times V_{chamber} \times M_{CH_4} \times \frac{1atm}{R \times T_t \times 1000} \quad (10)$$

Where:

Parameters	Description
m_{CH_4}	Mass of CH_4 in chamber at time t (mg)
t	Point of time of sample (e.g. 0,15,30 in case of three samples within 30 minutes)
$c_{CH_{4,t}}$	CH_4 concentration in chamber at time t, from gas analysis (ppm)
$V_{Chamber}$	Chamber volume (L), which is 50cm×50cm×50cm=125L.
M_{CH_4}	Molar mass of CH_4: 16g/mol
$1atm$	Assume constant pressure of 1atm, unless pressure measurement is installed
R	Universal gas constant: 0.08206 L atm/K^{-1}*mol^{-1}
T_t	Temperature at time t (K)

(2) Determine the slope of the line of best fit for the values of over time with the help of Excel:

$$s = \frac{\Delta m_{CH_4}}{\Delta t} \quad (11)$$

Where:

Parameters	Description
s	Slope of line of best fit (mg/min)

(3) Calculate the emission rate per hour for one chamber measurement:

$$RE_{ch} = s \times \frac{60min}{A_{chamber}} \quad (12)$$

Where:

Parameters	Description
RE_{ch}	Emission rate of chamber ch (mg*h^{-1}∗m^{-2})
ch	Index for replicate chamber on a plot
$A_{chamber}$	Chamber area (m^2)

(4) Calculate the average emission rate of a chamber measurement per plot:

$$RE_{plot} = \frac{\sum_{ch=1}^{Ch} RE_{ch}}{Ch} \tag{13}$$

Where:

Parameters	Description
RE_{plot}	Average emission rate of a plot (mg*h^{-1}∗m^{-2})
Ch	Number of replicate chambers per plot

(5) Further procedure: from the average emission rates per plot of each chamber measurement, derive the daily integrated emission factor by converting from mg/m^2 to kg/ha by multiplying with 0.01.

According to The Report of Measuring Methane Emission Rate with Continuously Flooded Method by Closed Chamber in Yingcheng City in 2017 from Huazhong Agricultural University. All values of $C_{CH4,t}$ can be outputted by the FID in laboratory, combining with the equations (10)~(13), and then RE_{plot} for each reference field (plot) monitored can be summarized in the table below.

RE_{plot} (mg/h*m^2) was converted from mg/m^2 to kg/ha by multiplying with 0.01. So, the final integrated results of RE_{plot} with the unit of (kg/day/ha) in the three reference fields is equal to $EF_{BL,c}$ (kgCH$_4$/day/ha) which are summarized in Table 4-5 below.

Table 4-5 RE_{plot} (kg/day/ha) in reference fields

	RE_{plot} (mg*h^{-1}∗m^{-2})	RE_{plot} (kg*day^{-1}*ha^{-1})
Plot 1	15.2021	3.6485
Plot 2	15.3158	3.6758
Plot 3	15.3215	3.6772
Average	15.2798	3.6672

the baseline emission factor for continuously flooded fields without organic amendments ($EF_{BL,c}$) is 3.6672 kg CH_4/ha/day

Determination of $SF_{BL,w}$ or $SF_{P,w}$

According to the methodology, the IPCC default for $SF_{BL,w}$ or $SF_{P,w}$ is as follows:

Water regime during the cultivation period		$SF_{BL,w}$ or $SF_{P,w}$
Irrigated	Continuously flooded[28]	1
	Intermittently flooded-single aeration[29]	0.60
	Intermittently flooded-multiple aeration[30]	0.52

For the baseline scenario, the water regime is continuously flooded, so the $SF_{BL,w}$ is 1. As described in Section 1.11, the water regime of this project activity is intermittently flooded with multiple aeration, so the $SF_{P,w}$ is 0.52.

Determination of $SF_{BL,p}$ or $SF_{P,p}$

In addition, IPCC default for $SF_{BL,p}$ or $SF_{P,p}$ is provided in the following table.

Water regime prior to cultivation period	$SF_{BL,p}$ or $SF_{P,p}$
Non-flooded pre-season<180 days (indicating double cropping)	1
Non-flooded pre-season>180 days (indicating single cropping)	0.68

In the project area, all the rice cultivation is single cropping, so both $SF_{BL,p}$ and $SF_{P,p}$ are 0.68.

Determination of $SF_{BL,o}$ or $SF_{P,o}$

Accordingly, since no amendments are applied under both baseline and project scenario, $SF_{BL,o}$ and $SF_{P,o}$ are calculated as follows according to the Methodology.

[28] Continuously flooded: fields have standing water throughout the rice growing season and may only dry out for harvest (end-season drainage)

[29] Single aeration: fields have a single aeration during the cropping season at any growth stage (except for end-season drainage)

[30] Multiple aeration: fields have more than one aeration period during the cropping season (except for end-season drainage)

$$SF_o = \left(1 + \sum_i ROA_i \times CFOA_i\right)^{0.59} \quad (14)$$

Where:

Parameters	Description
ROA_i	Application rate of organic amendment type i, in dry weight for straw and fresh weight for others, tonne ha^{-1}
$CFOA_i$	Conversion factor for organic amendment type i (in terms of its relative effect with respect of straw applied shortly before cultivation)

There are no organic amendments applied under both baseline and project scenario, so ROA_i=0 and both$SF_{BL,o}$ and $SF_{P,o}$ are 1.

Taking all the information above, the table below can be reached.

$EF_{BL,c}$(kg CH_4/ha/day)	3.6672
$SF_{BL,w}$	1
$SF_{P,w}$	0.52
$SF_{BL,p}$ / $SF_{P,p}$	0.68
Ly	132
GWP_{CH_4}	28
A_y (ha)	13,540
P.S. The GWP_{CH_4} is taken from the Fifth Assessment report, GHG Protocol	

Under this methodology, any effects of the project activity on GHG emissions outside the project boundary are deemed to be negligible and do not have to be considered, so the leakage of this project activity is zero.

Thus, the emission reduction should be calculated as follows:

$$EF_{BL} = EF_{BL,c} \times SF_{BL,w} \times SF_{BL,p}$$

$$= 3.6672 kgCH_4 * ha^{-1} * day^{-1} \times 1 \times 0.68$$

$$= 2.4937 kgCH_4 * ha^{-1} * day^{-1}$$

$$EF_P = EF_{BL,c} \times SF_{P,w} \times SF_{P,p}$$

$$= 3.6672 kgCH_4 * ha^{-1} * day^{-1} \times 0.52 \times 0.68$$

$$= 1.2967 kgCH_4 * ha^{-1} * day^{-1}$$

$$EF_{ER} = EF_{BL} - EF_P$$

$$= 2.4937\ kgCH_4 * ha^{-1} * day^{-1} - 1.2967 kgCH_4 * ha^{-1} * day^{-1}$$

$$= 1.1970 kgCH_4 * ha^{-1} * day^{-1}$$

$$ER_y = EF_{ER} \times A_y \times L_y \times 10^{-3} \times GWP_{CH_4}$$

$$= 1.1970 kgCH_4 * ha^{-1} * day^{-1} \times 13{,}540\ ha \times 132\ days \times 10^{-3} \times 28\ t\ CO2e/t\ CH4$$

$$= 59{,}902 tCO_2e$$

Therefore, for a whole year, the emission reduction is approximately 59,902 tCO_2e.

The ex ante calculations of baseline and project emissions are shown in excel and the results are summarized in the Table following.

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)
07-May -2018 to 06-May-2019	N/A[31]	N/A	0	59,902
07-May -2019 to06-May-2020	N/A	N/A	0	59,902
07-May -2020 to 06-May-2021	N/A	N/A	0	59,902
07-May -2021 to 06-May-2022	N/A	N/A	0	59,902
07-May -2022 to 06-May-2023	N/A	N/A	0	59,902
07-May -2023 to 06-May-2024	N/A	N/A	0	59,902

[31] According to the CDM small-scale methodology: ***Methane emission reduction by adjusted water management practice in rice cultivation (v4.0)***, Para 5.8.1 Ex ante estimation of emission reductions, PP has chosen option 1 for the calculation of Ex ante ER, while the according to the Equation (6) $ER_y = EF_{ER} \times A_y \times L_y \times 10^{-3} \times GWP_{CH_4}$ in the methodology, the ex ante of ER value is calculated directly but not calculated by Baseline emissions minus project emissions. So PP provided N/A in the table in section 4.4.

07-May -2024 to 06-May-2025	N/A	N/A	0	59,902
Total	N/A	N/A	0	419,314

5 MONITORING

5.1 Data and Parameters Available at Validation

The relevant ex ante calculation data are listed in this section.

Data / Parameter	A_y
Data unit	ha
Description	Area of project fields in year y
Source of data	The size of project field is determined through GPS by Yingcheng Agricultural Bureau
Value applied	The total area is 13,540 ha
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	The parameter is used to calculate the estimated net GHG removals.
Comments	N/A

Data / Parameter	GWP_{CH_4}
Data unit	t CO_2e/t CH_4
Description	Global warming potential of CH_4
Source of data	The number of GWP_{CH_4} is taken from the IPCC's Fifth Assessment report, GHG Protocol
Value applied	28

Justification of choice of data or description of measurement methods and procedures applied	Any future revision of the IPCC's assessment report should be taken account.
Purpose of Data	The parameter is used to calculate the estimated net GHG removals.
Comments	N/A

Data / Parameter	$EF_{BL,c}$
Data unit	kg CH_4/ha/day
Description	baseline emission factor for continuously flooded fields without organic amendments
Source of data	The Report of Measuring Methane Emission Rate of Paddy Fields by Closed Chamber in Yingcheng City
Value applied	3.6672kg CH_4/ha/day
Justification of choice of data or description of measurement methods and procedures applied	The report of Measuring Methane Emission Rate of Paddy Fields by Closed Chamber in Yingcheng City.
Purpose of Data	The parameter is used to calculate the baseline emission factor EF_{BL}.
Comments	N/A

Data / Parameter	L_y
Data unit	Days/year
Description	Cultivation period of rice in year y
Source of data	It is an experience value for the days of single-cropping rice cultivation in Yingcheng City
Value applied	132

Justification of choice of data or description of measurement methods and procedures applied	Since this value is used for ex-ante emission reduction calculation before the project started, there was no cultivation logbooks from farmers. Therefore, this value is an experience value.
Purpose of Data	The parameter is used to calculate the ex-ante emission reductions
Comments	N/A

Data / Parameter	$SF_{BL,w}$
Data unit	N/A
Description	Baseline scaling factors to account for the differences in water regime during the cultivation period
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since the rice is cultivated under continuously flooded condition in baseline scenario, the 1 of value is used.
Purpose of Data	The parameter is used to calculate the baseline emission factor $\mathrm{EF_{BL}}$ and ex ante emission reduction calculation.
Comments	N/A

Data / Parameter	$SF_{P,w}$
Data unit	N/A
Description	Project scaling factors to account for the differences in water regime during the cultivation period
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Value applied	0.52
Justification of choice of data or description of measurement methods and procedures applied	Since the rice is cultivated under intermittently flooded condition in project scenario, the 0.52 of value is used.
Purpose of Data	The parameter is used to calculate the project emission factor EF_P and ex ante emission reduction calculation.
Comments	N/A

Data / Parameter	$SF_{BL,p}$
Data unit	N/A
Description	Baseline scaling factors to account for the differences in water regime in the pre-season before the cultivation period.
Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	0.68
Justification of choice of data or description of measurement methods and procedures applied	Since the cultivation mechanism in rice filed is single cropping in baseline scenario, the 0.68 of value is used.
Purpose of Data	The parameter is used to calculate the baseline emission factor EF_{BL} and ex ante emission reduction calculation.
Comments	N/A

Data / Parameter	$SF_{P,p}$
Data unit	N/A
Description	Project scaling factors to account for the differences in water regime in the pre-season before the cultivation period.

Source of data	It is chosen from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied	0.68
Justification of choice of data or description of measurement methods and procedures applied	Since the cultivation mechanism in rice filed is single cropping in project scenario, the 0.68 of value is used.
Purpose of Data	The parameter is used to calculate the project emission factor EF_P and ex ante emission reduction calculation.
Comments	N/A

Data / Parameter	$SF_{BL,o}$
Data unit	*N/A*
Description	Baseline scaling factors should vary for both type and amount of organic amendment applied
Source of data	It is calculated using equation (14) above.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	*Since no organic amendment was used in baseline scenario, which means the* ROA_i*=0, so* $SF_{BL,o}$ *is 1.*
Purpose of Data	*The parameter is used to calculate the baseline emission factor* EF_{BL} *and ex ante emission reduction calculation.*
Comments	*N/A*

Data / Parameter	$SF_{P,o}$
Data unit	N/A

Description	Project scaling factors should vary for both type and amount of organic amendment applied.
Source of data	It is calculated using equation (14) above.
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	Since no organic amendment was used in project scenario, which means the ROA_i=0, so $SF_{P,o}$ is 1.
Purpose of Data	The parameter is used to calculate the project emission factor EF_P and ex-ante emission reduction calculation.
Comments	N/A

5.2 Data and Parameters Monitored

Data / Parameter	$A_{s,g}$
Data unit	ha
Description	Aggregated project area in a given season s
Source of data	To determine by collecting the project field sizes in a project database. Project proponent shall set up a database which holds data and information that allow an unambiguous identification of participating rice farms, including the size of field.
Description of measurement methods and procedures to be applied	The size of project fields shall be determined by GPS or satellite data. Should such technologies not be available, established field size measurement approaches shall be used provided that uncertainties are taken into account in a conservative manner.
Frequency of monitoring/recording	Every season
Value applied	N/A
Monitoring equipment	GPS or satellite data

QA/QC procedures to be applied	General guidelines for SSC CDM methodologies
Purpose of data	The parameter is used to calculate the baseline emissions from project fields in season s (BE_s) and project emissions from project fields in season s (PE_s).
Calculation method	N/A
Comments	Only compliant farms are considered

Data / Parameter	$EF_{BL,s,g}$
Data unit	kg CH_4/ha per season
Description	Baseline emission factor of group g in a given season s
Source of data	Field measurements in baseline reference fields
Description of measurement methods and procedures to be applied	As per instructions in the appendix (Guidelines for measuring methane emissions from rice fields) and IPCC 2006, volume 4, chapter 5.5.
Frequency of monitoring/recording	Once a week. Regular measurements as per closed chamber method guidance, seasonally integrated
Value applied	N/A
Monitoring equipment	Closed chamber
QA/QC procedures to be applied	The implementation of methane measurement in rice fields shall be conducted by technicians trained by experts from Huazhong Agricultural University. All the data should be cross-checked by technicians and experts.
Purpose of data	The parameter is used to calculate the baseline emissions from project fields in season s (BE_s).
Calculation method	N/A
Comments	N/A

Data / Parameter	$EF_{P,s,g}$
Data unit	kg CH_4/ha per season

Description	Project emission factor of group g in a given season s
Source of data	Field measurements in project reference fields
Description of measurement methods and procedures to be applied	As per instructions in the appendix (Guidelines for measuring methane emissions from rice fields) and IPCC 2006, volume 4, chapter 5.5.
Frequency of monitoring/recording	Once a week. Regular measurements as per closed chamber method guidance, seasonally integrated
Value applied	N/A
Monitoring equipment	Closed chamber
QA/QC procedures to be applied	The implementation of methane measurement in rice fields shall be conducted by technicians trained by experts from Huazhong Agricultural University. All the data should be cross-checked by technicians and experts.
Purpose of data	The parameter is used to calculate the project emissions from project fields in season s (PE_s).
Calculation method	N/A
Comments	N/A

5.3 Monitoring Plan

Monitoring process

(1) Monitoring of farmers' compliance with project cultivation practice (determination of $A_{s,g}$)

In order to determine whether the project fields are cultivated according to intermittently flooded cultivation practice, and thus assure that measurements on the reference fields are representative for the emissions from the project fields, a cultivation logbook shall be maintained for all project fields. With the help of the logbook, all parameters, as following, that are part of the project cultivation practice shall be documented by the farmers:

(a) Sowing date;

(b) Fertilizer, organic amendments, and crop protection application (date and amount);

(c) Water regime on the field (e.g. "dry/moist/flooded") and dates where the water regime is changed from one status to another;

(d) Yield.

In addition, farmers shall state whether they have followed fertilization recommendations[32] provided with the introduction of the adjusted water management practice.

Project proponent has established a database which holds data and information of these 3,223 households involved in this project activity, which contains the name, ID number, address of the head of the household, size of the field, completion date of construction, the starting date of rice season. Therefore, the sampling below is based on the database.

Since the reporting and verification shall be done on the basis of samples of the logbooks from the farmers, according to the latest version of the "*Standard for sampling and surveys for CDM project activities and programme of activities (version 9.0)*", the process of sampling is shown as follows:

- **Objectives and Reliability Requirements**

In this project, every farmers' household owning the paddy fields is regarded as an isolate unit. This sampling plan is for 3,223 households involved in this project. The project had applied intermittently flooded water regime with the same type, same category and same technology. After the implementation, this new water regime displaced the traditional continuously flooded method during rice cultivation in the project area. The farmers' logbooks should be sampled for assuring the project activity. In this case, the project proponent shall use 90/10 confidence/precision according to the sampling standard mentioned above.

- **Target Population**

From the description, the target population is the related 3,223 households planting the rice.

Table 5-1 the number of farmers in each town in Yingcheng City

Name of Town	The number of households
Sanhe Town	366
Tangchi Township	474
Tiandian Town	419
Yanghe Town	1100
Yangling Town	864
Total	3,223

- **Sample Method**

[32] The optimal amount of nitrogen fertilization is 10-12kg/mu recommended by Technical Guidelines for Intermittently Flooded Rice Cultivation Method in Hubei Province

Since the households are numerous and scattered, the water regime used during rice cultivation is identical, stratified random sampling is adopted in order that each one can be selected with equal probability. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. The stratification requires that information on the stratification variable, e.g. survey sample household will be changed once per year. Simple random sampling method will be taken in each stratum by using Microsoft Excel.

- **Sample Size**

According to the "*Standard for sampling and surveys for CDM project activities and programme of activities (version 9.0)*", the desired confidence level is 90% and the desired precision is 10%. Based on the statistical principles and sampling survey method, 306 samples should be sufficient to satisfy the desired confidence and precision. For mean value sampling, the required sampling quantity is calculated by the following steps:

$$n_1 = \frac{Z^2\sigma^2}{d^2} \tag{15}$$

Step1:

Where:

Parameters	Description
Z	The symbol used in general formula for confidence intervals. The validation team confirms it is to be 1.645 when confidence interval is 90%
σ	The population standard deviation, which is not available to PP
d	The maximum error of estimate

Step 2: Deformation of basic formula

$$n_1 = \frac{Z^2\sigma^2}{d^2} = \frac{Z^2(\frac{\sigma^2}{X^2})}{d^2/X^2} = Z^2V^2/e^2 \tag{16}$$

Where:

Parameters	Description
V	the coefficient of variation, and $V = \sigma/X$. As population standard deviation σ shall be smaller than the sample mean value X, hence from conservative consideration point of view, making V=1 can get the biggest sample size. It is conservative

e	the relative sampling error, and $e = d/X$, which is the precision. In this case, e=10% as discussed above

Consequently, $n_1 = \frac{Z^2V^2}{e^2} = \frac{1.645^2}{0.01} = 270.6$, and round up to 271.

Step 3: Correction based on population size

$$n_2 = \frac{n_1 N}{n_1 + N} \tag{17}$$

Where:

Parameters	Description
N	The population size, it is 3,223 under project context

Therefore,

$n_2 = \frac{n_1 N}{n_1 + N} = \frac{271 \times 3{,}223}{271 + 3{,}223}$ =249.98, and round up to be 250, it takes $n_2 = 250$ is preferable.

Step 4: Correction based on sampling approach

$$n_3 = Bn_2 \tag{18}$$

Where:

Parameters	Description
B	The survey design effect

As discussed in *Procedures for Administering Data Collection and Minimizing Non-Sampling Errors*. The project adopts multi-stage sampling approach. In this case, $B \leq 1$ as per Sampling Design and Methodology. It's conservative consideration.

Thus, $n_3 = Bn_2 = 1 \times n_2 = 250$

Step 5: Correction based on responding rate

$$n_4 = \frac{n_3}{r} \tag{19}$$

Where:

The responding rate is adopted to be less 90% according to investigation report.

Thus, $n_4 = \frac{n_3}{r} = \frac{250}{90\%} = 277.78, and\ round\ up\ to\ be\ 278, it\ takes\ n_4 = 278\ is\ preferable.$

Step 6: Correction based on contingency consideration

$$n = 110\% \times n_4 \tag{20}$$

Where:

Consequently, the sample size $n = 110\% \times n_4 = 110\% \times 278 = 305.8$. $, and\ round\ up\ to\ be\ 306, it\ takes\ n = 306\ is\ preferable$

The calculation result for n is 306. Therefore, although all the households are required to complete the logbooks, only 306 sample logbooks from households will be selected from the sampling frame according to stratified sampling method at the beginning of each year during the crediting period. The template of logbook was compiled by Search Co2 in accordance with the requirements of methodology. An inclusion of 306 samples in total, the sample size of each township was decided on the method of proportional distribution.

- **Sampling Frame**

In the investigation, sampling frame is worked out independently by taking town as sampling unit. Sampled group will be changed in each monitoring period. Firstly, calculate the ratio of households in every administrative town to the total population of Yingcheng City. According to the ratio of every town, calculate the sampling size of every town, and then set the amount of sampling 306 households, the actual sampling size is the ratio of every town multiply by 306. Finally, according to the number of samples needed for each town, the random sampling function of Excel is used to extract from the database mentioned above.

Table 5-2. The sampling size of logbooks from households in each town in the project area

Name of Town	The number of households
Sanhe Town	35
Tangchi Township	45
Tiandian Town	40
Yanghe Town	104
Yangling Town	82
Total	306

After the sampling logbooks are collected by the technicians, the expert will check the contents in the logbooks first to confirm whether the nitrogen application amount and drainage and irrigation frequency recorded by the farmers meet the requirements of the project activity, and then hand it to Search Co2 for final check, and then complete the monitoring report.

(2) Monitoring of baseline and project emissions (determination of $EF_{BL,s,g}$ and $EF_{P,s,g}$)

According to the applied methodology AMS-Ⅲ.AU (version 4.0), post-emission reduction shall be calculated by the formulas (1) – (5) shown in Section 5.1 and Section 5.2 above. So, $EF_{BL,s,g}$ and $EF_{P,s,g}$ shall be measured by technicians based on the requirements in the appendix (Guidelines for measuring methane emissions from rice fields) and IPCC 2006, volume 4, chapter 5.5.

The implementation of methane measurement in rice fields requires the involvement of experts in this field or at least experienced staff trained by experts (i.e. from research institutions). These guidelines cannot replace expertise in setting up chamber measurements. They rather set minimum requirements that serve for standardizing the conditions under which methane emissions are measured for projects under this methodology.

Project proponents shall prepare a detailed plan for the seasonal methane measurements before the start of the season. The plan shall include the schedule for the field and laboratory measurements, the logistics that are necessary to get the gas samples to the laboratory and a cropping calendar. The plan shall also include all reference field specific information regarding location and climate, soil, water management, plant characteristics, fertilizer treatment and organic amendments.

The following guidance is structured according to the steps from field measurement to emission factor calculation. Project proponents shall make sure that the measurements on project and baseline reference fields are carried out in an equal manner and simultaneously.

Table 5-3 On the field – technical options for the chamber design

Feature	Conditions	
Chamber material	Option 1: Non-transparent ● Commercially available PVC containers or manufactured chambers (e.g. using galvanized iron); ● Painted white or covered with reflective material (to prevent increasing inside temperature); ● Only suitable for short-term exposure (typically	Option 2: Transparent ● Manufactured chambers using acrylic glass; ● Advantage of transparent chambers: could be placed for longer time spans on the field if equipped with a lid that remains open between measurements

	30 min) followed by immediate removal from the field	and is only closed during measurements
Placement in soil	Option 1: Fixed base ● Base made of non-corrosive material and remains in the field for the whole season; ● Base should allow tight sealing of the chamber; ● Base should have bores in the submerged section to allow water exchange between inside and outside; ● Base should be installed at least 24 hours before the first sampling	Option 2: Without base ● Chamber have to be placed on the soil with open lid to allow escape of eventual ebullition
Auxiliaries of chamber	● Thermometer for measuring the temperature inside the chamber; ● Fan (battery operated) inside the chamber for mix the inside air during sampling; Sampling port (rubber stopper placed in a bore of the chamber)	
Basal area	Rectangular or rounded, but has to cover minimum of four rice hills (ca. 0.1m^2 minimum)	
Height	Option 1: Fixed height Total height (protruding base + chamber) should exceed plant height	Option 2: Flexible height ● Adjustable to plant height; ● Chambers with different heights or modular design

Table 5-4 On the field – air sampling

Feature	Conditions
Replicate chambers per plot	Minimum requirement: Three replicate chambers per plot
Number of air samples per exposure/data points per measurement	Minimum requirement: Three samples per exposure
Exposure time	30 minutes
Daytime of measurement	Morning
Measurement interval	Minimum requirement: once per week
Syringe	Suitability test (leak proof) before measurement Preferably equipped with a lock for ease of handling
Sample storage until analysis	● Storage < 24h: air samples can remain in syringe; Storage > 24h: transfer air samples into evacuated vial, store with slight overpressure

Table 5-5 Laboratory analysis

Feature	Conditions
Method	Gas Chromatography with flame ionization detector (FID)
Injection	Direct injection or with multi-port valve and sample loop
Column	Packed (e.g. molecular sieve) or capillary column
Calibration	With certified standard gas each day of analysis before and after the analyses are done

In this project, there is only one field group, thus, three baseline reference fields and project reference fields should be selected respectively for methane emission measurement. Besides, project reference fields shall be established close to the baseline reference fields and begin with the growing season at the same time as required by the methodology that the measurements on project and baseline reference fields are carries out in an equal manner and simultaneously. The emission is the average of the measurement results from the three reference fields.

The seasonally integrated emission factor $BF_{BL,s,g}$ (baseline) and $EF_{P,s,g}$ (project) shall be derived as average value from the three measurements for each group.

Table 5-6 On the field – technical options for the chamber design

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Chamber material	Option 1: Non-transparent ● Commercially available PVC containers or manufactured chambers (e.g. using galvanized iron); ● Painted white or covered with reflective material (to prevent increasing inside temperature); ● Only suitable for short-term exposure (typically 30 min) followed by immediate removal from the field	The chamber used in this project is made of PVC materials covered with reflective material to prevent the increasing inside temperature. And it is only put just before the sampling and then is removed after 30 mins of sampling.	The chamber used in this project is made of PVC materials covered with reflective material to prevent the increasing inside temperature. And it is only put just before the sampling and then is removed after 30 mins of sampling.
Placement in soil	Option 1: Fixed base ● Base made of non-corrosive material and remains in the field for the whole season; ● Base should allow tight sealing of the chamber; ● Base should have bores in the submerged section	The base used in this project is made of non-corrosive PVC material and was embedded before transplantation, remaining in the field for the whole season. Base allows tight sealing of the chamber and has bores in the submerged section to allow water exchange. The first sampling was	The base used in this project is made of non-corrosive PVC material and was embedded before transplantation, remaining in the field for the whole season. Base allows tight sealing of the chamber

	to allow water exchange between inside and outside; ● Base should be installed at least 24 hours before the first sampling	taken 24 hours after the base installation (see details in Table 4-2 above).	and has bores in the submerged section to allow water exchange. The first sampling was taken 24 hours after the base installation (see details in Table 4-2 above).
Auxiliaries of chamber	● Thermometer for measuring the temperature inside the chamber; ● Fan (battery operated) inside the chamber for mix the inside air during sampling; ● Sampling port (rubber stopper placed in a bore of the chamber)	There are a thermometer and a fan inside the chamber and the sampling port is set on the top of the chamber.	There are a thermometer and a fan inside the chamber and the sampling port is set on the top of the chamber.
Basal area	Rectangular or rounded, but has to cover minimum of four rice hills (ca. 0.1m^2 minimum)	The base is rectangular and installed covering four rice hills.	The base is rectangular and installed covering four rice hills.
Height	Option 1: Fixed height Total height (protruding base + chamber) should exceed plant height	The total height of chamber and base is 1.5 meters which is higher than 1.2 meters, the largest height of the plant.	The total height of chamber and base is 1.5 meters which is higher than 1.2 meters, the

			largest height of the plant.

Table 5-7 On the field – air sampling

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Replicate chambers per plot	Minimum requirement: Three replicate chambers per plot	Three replicate chambers were placed in every plot.	Three replicate chambers were placed in every plot.
Number of air samples per exposure/data points per measurement	Minimum requirement: Three samples per exposure	Three samples for every exposure.	Three samples for every exposure.
Exposure time	30 minutes	30 minutes	30 minutes
Daytime of measurement	Morning	9.30 – 10.00 a.m.	9.30 – 10.00 a.m.
Measurement interval	Minimum requirement: once per week	Once a week	Once a week
Syringe	Suitability test (leak proof) before measurement Preferably equipped with a lock for ease of handling	The syringe with a lock was used in this project and it is checked for leak proof before every measurement.	The syringe with a lock was used in this project and it is checked for leak proof before every measurement.
Sample storage until analysis	● Storage < 24h: air samples can remain in syringe; ● Storage > 24h: transfer air samples into evacuated vial,	Three samples were taken before a laboratory analysis was performed, so the samples were stored in the evacuated vials.	Three samples were taken before a laboratory analysis was performed, so the samples were stored in

	store with slight overpressure		the evacuated vials.

Table 5-8 Laboratory analysis

Feature	Requirements	Conditions in the baseline reference fields	Conditions in the project reference fields
Method	Gas Chromatography with flame ionization detector (FID)	FID	FID
Injection	Direct injection or with multi-port valve and sample loop	Direct injection	Direct injection
Column	Packed (e.g. molecular sieve) or capillary column	Packed	Packed
Calibration	With certified standard gas each day of analysis before and after the analyses are done	With certified standard gas each day of analysis before and after the analyses are done	With certified standard gas each day of analysis before and after the analyses are done

Calculation of the emission rate for a plot (reference field)

(1) For each gas analysis, calculate the mass of CH_4 emissions with the help of the following formula:

$$m_{CH_4} = c_{CH_{4,t}} \times V_{Chamber} \times M_{CH_4} \times \frac{1atm}{R \times T_t \times 1000} \quad (21)$$

Where:

Parameters	Description
m_{CH_4}	Mass of CH_4 in chamber at time t (mg)

t	Point of time of sample (e.g. 0,15,30 in case of three samples within 30 minutes)
$c_{CH_{4,t}}$	CH_4 concentration in chamber at time t, from gas analysis (ppm)
$V_{Chamber}$	Chamber volume (L)
M_{CH_4}	Molar mass of CH_4: 16g/mol
$1atm$	Assume constant pressure of 1atm, unless pressure measurement is installed
R	Universal gas constant: 0.08206 L atm/K^{-1}*mol^{-1}
T_t	Temperature at time t (K)

(2) Determine the slope of the line of best fit for the values of over time with the help of software (e.g. Excel):

$$s = \frac{\Delta m_{CH_4}}{\Delta t} \tag{22}$$

Where:

Parameters	Description
s	Slope of line of best fit (mg/min)

(3) Calculate the emission rate per hour for one chamber measurement:

$$RE_{ch} = s \times \frac{60min}{A_{chamber}} \tag{23}$$

Where:

Parameters	Description
RE_{ch}	Emission rate of chamber ch (mg/h*m^2)
ch	Index for replicate chamber on a plot
$A_{chamber}$	Chamber area (m^2)

(4) Calculate the average emission rate of a chamber measurement per plot:

$$RE_{plot} = \frac{\sum_{ch=1}^{Ch} RE_{ch}}{Ch} \quad (24)$$

Where:

Parameters	Description
RE_{plot}	Average emission rate of a plot (mg/h*m^2)
Ch	Number of replicate chambers per plot

(5) Further procedure: from the average emission rates per plot of each chamber measurement, derive the seasonally integrated emission factor by integration of the measurement results over the season length. The simplest way of integration is multiplying the emission rate with the number of hours of the measurement interval (e.g. one week) and accumulating the results of every measurement interval over the season. Convert from mg/m^2 to kg/ha by multiplying with 0.01.

Monitoring team

The monitoring team consists of the project proponent, Search Co2, technicians and experts from Huazhong Agricultural University.

Firstly, Search Co2 sets the number of plots, and drafts cultivation logbooks template, tables, etc.

Secondly, project proponent and Search Co2 confirm the monitoring frequency and notify the technicians and the agricultural bureau. The technicians also need to instruct the farmers and check the famers' logbooks every month.

Finally, according to the requirements in the Appendix of methodology, the gas sampling on field should be conducted once a week in baseline and project reference fields, respectively. Then, the $EF_{BL, s, g}$ and $EF_{P, s, g}$ can be obtained from the calculation of the emission rate for baseline reference fields according to the requirements in the Appendix of methodology, and the $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings is derived from the laboratory analysis.

The implementation of methane measurement in both baseline and project reference fields is involved by the experts from Huazhong Agricultural University which is an agriculture and forestry university owned the certificate to do the laboratory analysis. Therefore, the accuracy of the monitoring results is effectively guaranteed. And the monitoring results will be double-checked by the experts from the agricultural department.

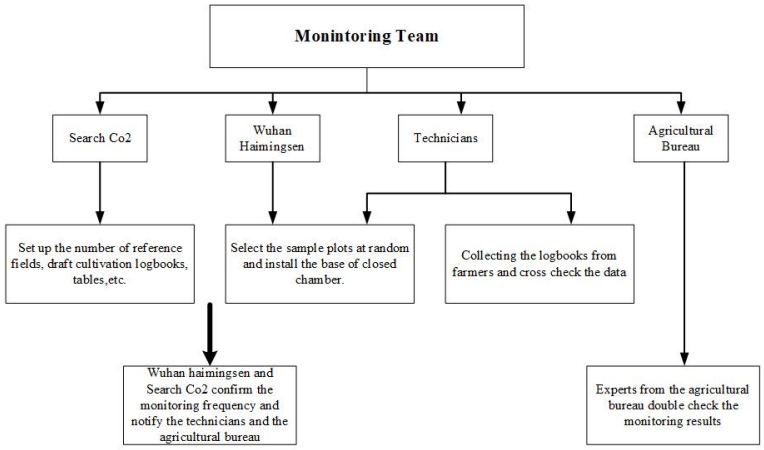

Figure 5-1 The figure of the monitoring team

Determine the reference fields

The reference fields are fixed rice paddies with area of around 0.40 ha[33]. The measurements on project and baseline reference fields are carried out in an equal manner and simultaneously. The baseline reference fields should be selected that they are representative of baseline scenario where single-cropping rice is planted by continuously flooded method without any organic amendments, while the project reference fields should be selected that they are representative of project scenario where single-cropping rice is planted by intermittent flooded method without any organic amendments.

Monitoring frequency

The monitoring frequency should be determined according to the methodology requirements for each parameter in the project after the project registration in order to ensure the continuity of the benefits. Firstly, the aggregated project area in a given season s ($A_{s,g}$) is required to be monitored by technicians for every season. Should farmers relevantly deviate from the defined project cultivation practice, so that their fields cannot be deemed to be represented by the reference fields any more, those fields shall not be taken into account for the determination of the aggregated project area $A_{s,g}$ of that season.

Secondly, baseline and project emission factor of group g in a given season s ($EF_{BL,s,g}$ and $EF_{P,s,g}$) are obtained from the calculation of the emission rate for baseline reference fields according to the requirements in the Appendix of methodology, and the $C_{CH4,t}$ (CH_4 concentration in chamber at time t) of weekly gas samplings is derived from the laboratory analysis. So, technicians should do the on-field sampling one a week, while the laboratory

[33] The Report of Measuring Methane Emission Rate of Paddy Fields by Closed Chamber in Yingcheng City.

analysis is conducted by experts from Huazhong Agricultural University every three times of samplings. It is an agriculture and forestry university owned the certificate to do the laboratory analysis and the expert who is the leader of the experiment has a doctoral degree and his field of study is rice cultivation and GHG monitoring. Therefore, the accuracy of monitoring results can be guaranteed.

The installation and calibration of the closed chamber and laboratory analysis shall be in accordance with the requirements in the Appendix of methodology. The equipment used in this project has been qualified by China National Accreditation Service for Conformity Assessment[34]. Among them, FID has been judged to be qualified by the Regulations of Calibrate Metrological Verification. And the syringe, evacuated vial and the closed chamber used in this project have been judged to be qualified by the application requirement of CNAS-CL01 Accreditation Criteria for Testing and Calibrating Laboratory Competencies.

Data management

All data collected as part of monitoring is archived electronically. All information should be stored by the technology department of the project proponent and all the materials have physical copies for backup. All data collected shall be archived at least two years after the end of the last crediting period of the project activity.

QA/QC

A systematic internal review and correction process will be used to assure/control the quality. The technicians are required to collect the logbooks from farmers once a month and cross check the data with experts. Similarly, the process of monitoring is also supervised by experts. When they find some unusual data, they will feed back to technicians and then correct the data before share it with Search Co2. Search Co2 will draft the monitoring report based on the raw data and cross-check with the agricultural bureau experts. If there are not any further comments from the experts, Search Co2 will finalise the report. All parties are required to reply any questions raised within 30 days.

Emergency procedure

In this project, it is possible to cause equipment damage or missing data due to negligence and improper operation.

First of all, before the start of each growing season, Search Co2 should train technicians on how to check whether the equipment is working properly. After that, the technicians should check whether the equipment in the field is in good condition.

Secondly, if there is any damage, the replacement should be completed before the land preparation, and the replacement should be recorded by Wuhan Haimingsen and Search

[34] See more details in the Attachment of Laboratory Accreditation Certificate

Co2 to ensure that the replaced equipment meets the requirements of this project. All the equipment should be in place before the start of growing season (land preparation).

Thirdly, the technician should pay close attention to weather forecasts during rice planting. If extreme weather, such as heavy rain, is imminent, on-field gas sampling should be carried out before and after the extreme weather to ensure the monitoring frequency, at least once a week, required in the Appendix of methodology.

Finally, if data loss or equipment damage occurs during the monitoring process, the corresponding emission reduction will be deducted in the most conservative way.