YUNSHUI WASTEWATER TREATMENT PLANT PROJECT IN GUANGDONG PROVINCE

Document Prepared by Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Yunshui Wastewater Treatment Plant Project is in Guangdong province (hereafter referred to as the project) introduces aerobic wastewater treatment plant to treat wastewater from towns in many regions of Guangdong Province, there are 16 wastewater treatment plants, each using the same treatment process (A^2O+MBR). The project owner is Yunshui Guangdong Environmental Protection Co., Ltd. The whole aerobic process includes pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process, with total maximum design influent flow of 175,150 m^3/d. The influent COD concentrations of all wastewater treatment plants are shown in the following table, and the effluent COD concentration is 40 mg/L. The wastewater is composed of residents' domestic wastewater within the service area. The project can reduce environmental pollution and destroy methane emissions from the open anaerobic lagoons in baseline scenario.

Table 1.1 COD concentration in the influent of wastewater treatment plants

Name of wastewater plant	Design flow	The COD of influent
Xiaqiao Town wastewater Treatment Plant	5,500 m^3/d	450 mg/L
Qujie Town wastewater Treatment Plant	7,000 m^3/d	500 mg/L
Xinyi City Dingbao Town wastewater treatment Plant	3,700 m^3/d	300 mg/L
Xinyi City Qianpai Town wastewater treatment Plant	6,300 m^3/d	450 mg/L
Xianqiao South Wastewater Treatment Plant	10,000 m^3/d	500 mg/L
Qiankeng Town North wastewater Plant	9,900 m^3/d	450 mg/L
Shangsha Town wastewater Treatment Plant	12,400 m^3/d	400 mg/L
Baita Town wastewater Treatment Plant	7,500 m^3/d	450 mg/L
Luoding Fourth Domestic wastewater Treatment Plant	21,000 m^3/d	500 mg/L
Shitan Town wastewater Treatment Plant	6,600 m^3/d	450 mg/L
Litan Town wastewater Treatment Plant	7,000 m^3/d	500 mg/L
jiulong Town wastewater Treatment Plant	7,000 m^3/d	350 mg/L
Shakou Town wastewater Treatment Plant	8,850 m^3/d	550 mg/L
Bomei Town wastewater Treatment Plant	28,000 m^3/d	550 mg/L
Nantang Town wastewater Treatment Plant	28,000 m^3/d	550 mg/L
Chikeng Town wastewater Treatment Plant	6,400 m^3/d	450 mg/L

In the baseline scenario, residents' domestic wastewater was treated through a series of deep open anaerobic lagoons. The open lagoons are the best available low-cost operation solution for wastewater treatment, which is also in compliance with local environmental regulations. However, open anaerobic lagoons would have been released into methane directly to the atmosphere when treating wastewater. In the project scenario, the wastewater will be treated through aerobic biological treatment technology, which includes pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process. Aerobic wastewater treatment plants produce essentially no methane emissions during the entire process of wastewater treatment, and the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001) " (40mg/L).

Emission reductions of this project are generated by reducing methane emissions of the open anaerobic lagoons in baseline scenario. The first wastewater treatment plant began construction on 02-July-2019, and it was officially put into operation on 18-September-2020, the earliest one began put into operation on 03-September-2020, and the last one was put into operation on 20-September-2020. Annual average estimation of GHG emission reductions from the project activity is 83,042 tCO_2e/year, the total GHG emission reductions are 830,420 t CO_2e during the fixed 10 years crediting period.

This monitoring period for the project is 03-September-2020 to 30-June-2022, which is the first monitoring period. The total emission reductions achieved in this monitoring period is 110,002 tCO_2e.

1.2 Sectoral Scope and Project Type

The project is not AFOLU project and not a grouped project

Sectoral Scope 13: Waste handling and disposal.

Project Type: According to the Section 3.9.1 of VCS standard v4.3, the annual emission reduction of this project is Less than 300,000 tonnes of CO_2e per year, which belongs to “project”.

Project Methodology: AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01).

1.3 Project Eligibility

As per section 2.1.1 of *VCS Standard* (Version 4.3), the scope of the VCS Program include：

1) The six Kyoto Protocol greenhouse gases:
2) Ozone-depleting substances.
3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process.
4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval.

5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.

The project activity reduces methane emissions by replacing open anaerobic ponds in the baseline scenario with the aerobic wastewater treatment plant. Meanwhile, the project is not belonged to the projects excluded in Table 1 of VCS Standard 4.3. Therefore, the project is eligible under the scope of VCS program.

According to section 3.1 of the *VCS-Standard* (Version 4.3), establishing a consistent and standardized certification process is critical to ensuring the integrity of VCS projects. Accordingly, certain high-level requirements must be met by all projects, as set out below:

Reference to VCS Standard (Version 4.3)	Requirement	Justification
3.1.1	Projects shall meet all applicable rules and requirements set out under the VCS Program, including this document. Projects shall be guided by the principles set out in Section 2.2.	The project meets all applicable rules and requirements as set out under the VCS Program.
3.1.2	Projects shall apply methodologies eligible under the VCS Program. Methodologies shall be applied in full, including the full application of any tools or modules referred to by a methodology, noting the exception set out in Section 3.13.1. The list of methodologies and their validity periods is available on the Verra website.	The project applies CDM approved methodology AM0080 (Version 01) which is an eligible VCS methodology along with tool or modules as applicable. Refer to section 3.1 and 3.2 of the JPM below for more details.
3.1.3	Projects and the implementation of project activities shall not lead to the violation of any applicable law, regardless of whether or not the law is enforced.	Projects are in compliance with currently applicable laws. According to the environmental impact assessment report (EIA) of the project, the project complies with all Chinese relevant laws and regulations. Refer to section 1.14 of the JPM below for more details.

3.1.4	Where projects apply methodologies that permit the project proponent its own choice of model (see the VCS Program document *Program Definitions* for definition of model), such model shall meet with the requirements set out in the VCS Program document *VCS Methodology Requirements* and it shall be demonstrated at validation that the model is appropriate to the project circumstances (i.e., use of the model will lead to an appropriate quantification of GHG emission reductions or removals).	Not applicable. There is no model needs to be chosen by the project proponent as per the applied methodology AM0080 (Version 01).
3.1.5	Where projects apply methodologies that permit the project proponent its own choice of third party default factor or standard to ascertain GHG emission data and any supporting data for establishing baseline scenarios and demonstrating additionality, such default factor or standard shall meet with the requirements set out in the VCS Program document *VCS Methodology Requirements*	Not applicable. There are no third party default factor or standard need to be chosen by the project proponent as per the applied methodology AM0080 (Version 01).
3.1.6	Projects shall preferentially apply methodologies that use performance methods (see the VCS Program document *VCS Methodology Requirements* for further information on performance methods) where a methodology is applicable to the project that uses a performance method for determining both additionality and the crediting baseline (i.e., a project shall not apply a methodology that uses a project method where such a performance method is applicable to the project).	Baseline scenario and additionality have been analysed as per the applied methodology AM0080 (Version 01) and tool 02 (Version 07). Refer to section 3.4 and 3.5 of the JPM for more details.

	Methodologies approved under the VCS Program that use performance methods provide a list of similar methodologies that use project methods (that were approved under the VCS Program or an approved GHG program at the time the performance method was developed). Such lists are not necessarily exhaustive but can serve as the starting point for determining whether a performance method is applicable to the project. Following the approval of a methodology that uses a performance method, projects may use any applicable pre-existing methodology that uses a project method for a six-month grace period.	
3.1.7	Where the rules and requirements under an approved GHG program conflict with the rules and requirements of the VCS Program, the rules and requirements of the VCS Program shall take precedence.	Not applicable.
3.1.8	Where projects apply methodologies from approved GHG programs, they shall comply with any specified capacity limits (see the VCS Program document *Program Definitions* for definition of capacity limit) and any other relevant requirements set out with respect to the application of the methodology and/or tools referenced by the methodology under those programs.	Not applicable. There is no specified capacity limits and any other relevant requirements set out as per the applied methodology and tools.
3.1.9	Where Verra issues new requirements relating to projects, registered projects do not need to adhere to the new requirements for the remainder of their project crediting periods (i.e., such	This is the first crediting period of the project, and it has fellow all the latest requirements of Verra.

	projects remain eligible to issue VCUs through to the end of their project crediting period without revalidation against the new requirements). The new requirements shall be adhered to at project crediting period renewal, as set out in Section 3.8.9.	

1.4 Project Design

The project activity involves the construction and operation of multiple aerobic wastewater treatment plant with the wastewater treatment capacity of 175,150 m^3 per day. The project activity involves 16 wastewater treatment plants, which belong to multiple project activity instances. This project is not a grouped project. The proposed project description is in Section 1.1 and the detail of installed technology is in Section 1.11. The proposed project location is described in Section 1.12.

Eligibility Criteria

The project is not a grouped project. Thus, this section is not applicable.

1.5 Project Proponent

Organization name	Yunshui Guangdong Environmental Protection Co., Ltd.
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1.6 Other Entities Involved in the Project

Organization name	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.
Role in the project	VCS Consultant
Contact person	Joanna Zhu

Title	Project Director
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1.7 Ownership

The project owner of the project is Yunshui Guangdong Environmental Protection Co., Ltd., who has the legal right to control and operate the project activities. The business license, approval of Environmental Impact Assessment (Approval of EIA), Feasibility Study Report[1] (FSR, which was issued on 15 February 2019), and project investment license are evidences for the ownership of the project and carbon credits generated.

1.8 Project Start Date

As per section 3.7 of VCS Standard (Version 4.3), the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals. The project activity is a non-AFOLU project, and the earliest wastewater treatment plant began put into operation on 03-September-2020. Thus, the project start date is 03-September-2020 (See Table 1.2 below for the time of construction and operation of the wastewater treatment plant).

Table 1.2 The time when wastewater treatment plant started construction and started operation

Name of wastewater plant	Time of starting construction	Time of starting operation
Xiaqiao Town wastewater Treatment Plant	21-September-2019	05-September -2020
Qujie Town wastewater Treatment Plant	12-September-2019	08-September -2020
Xinyi City Dingbao Town wastewater treatment Plant	03-October-2019	03-September -2020
Xinyi City Qianpai Town wastewater treatment Plant	19-September-2019	06-September -2020
Xianqiao South Wastewater Treatment Plant	05-August-2019	13-September -2020
Qiankeng Town North wastewater Plant	14-August-2019	10-September-2020

[1] All the 16 wastewater treatment plants belong to the same PP. The planned construction time of these plants is about the same, and the same aerobic treatment process (A2O+MBR) was used. And then, considering that these 16 wastewater treatment plants have the characteristics of small scale and large quantity. So the 16 plants were summarized as a consolidated project to complete the one FSR and one EIA. However, the design proposal for each plant was made according to its different capacity. The FSR was finally approved by Guangdong Provincial Government, which covered all the 16 plants.

Shangsha Town wastewater Treatment Plant	28-July-2019	14-September -2020
Baita Town wastewater Treatment Plant	31-August-2019	13-September -2020
Luoding Fourth Domestic wastewater Treatment Plant	15-July-2019	15-September-2020
Shitan Town wastewater Treatment Plant	12-September-2019	09-September -2020
Litan Town wastewater Treatment Plant	13-September-2019	12-September-2020
jiulong Town wastewater Treatment Plant	12-September-2019	11-September-2020
Shakou Town wastewater Treatment Plant	26-August-2019	12-September-2020
Bomei Town wastewater Treatment Plant	02-July-2019	18-September-2020
Nantang Town wastewater Treatment Plant	05-July-2019	20-September-2020
Chikeng Town wastewater Treatment Plant	19-September-2019	09-September-2020

1.9 Project Crediting Period

This project adopts fixed crediting periods of 10 years. The crediting period is 10 years from 03-September-2020 to 02-September-2030 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated volume of emission reduction from the project activity is 83,042 tCO_2e, which is less than 300,000 tonnes of CO_2e per year. As per section 3.9.1 of the VCS Standard (Version 4.3), the scale of the project activity is under “Project” category.

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
03-September-2020—31-December -2020	24,831
01-January-2021—31-December -2021	83,296
01-January-2022—31-December -2022	83,296

01-January-2023—31-December -2023	83,296
01-January-2024—31-December -2024	83,296
01-January-2025—31-December -2025	83,296
01-January-2026—31-December -2026	83,296
01-January-2027—31-December -2027	83,296
01-January-2028—31-December -2028	83,296
01-January-2029—31- December -2029	83,296
01-January-2030—02-December -2030	55,925
Total estimated ERs	830,420
Total number of crediting years	10
Average annual ERs	83,042

1.11 Description of the Project Activity

Yunshui Wastewater Treatment Plant Project is in Guangdong province introduces aerobic wastewater treatment plant to treat wastewater from towns in many regions of Guangdong Province, where the aerobic treatment process can significantly reduce greenhouse gas emissions. The wastewater is composed of residents' domestic wastewater within the service area. The milestone for the construction and operation of the project are shown in table 1.3 below.

Table 1.3 The milestone of 16 wastewater treatment

Name of wastewater plant	Time of starting construction	Time of starting commissioning	Time of starting operation
Xiaqiao Town wastewater Treatment Plant	21-September-2019	20-August-2020	05-September -2020
Qujie Town wastewater Treatment Plant	12-September-2019	23-August-2020	08-September -2020
Xinyi City Dingbao Town wastewater treatment Plant	03-October-2019	18-August-2020	03-September -2020
Xinyi City Qianpai Town wastewater treatment Plant	19-September-2019	21-August-2020	06-September -2020

Xianqiao South Wastewater Treatment Plant	05-August-2019	28-August-2020	13-September -2020
Qiankeng Town North wastewater Plant	14-August-2019	25-August-2020	10-September-2020
Shangsha Town wastewater Treatment Plant	28-July-2019	30-August-2020	14-September -2020
Baita Town wastewater Treatment Plant	31-August-2019	28-August-2020	13-September -2020
Luoding Fourth Domestic wastewater Treatment Plant	15-July-2019	1-September-2020	15-September-2020
Shitan Town wastewater Treatment Plant	12-September-2019	24-August-2020	09-September -2020
Litan Town wastewater Treatment Plant	13-September-2019	27-August-2020	12-September-2020
jiulong Town wastewater Treatment Plant	12-September-2019	26-August-2020	11-September-2020
Shakou Town wastewater Treatment Plant	26-August-2019	27-August-2020	12-September-2020
Bomei Town wastewater Treatment Plant	02-July-2019	3-September-2020	18-September-2020
Nantang Town wastewater Treatment Plant	05-July-2019	5-September-2020	20-September-2020
Chikeng Town wastewater Treatment Plant	19-September-2019	24-August-2020	9-September-2020

Types and levels of service provided by each of the 16 plants

Name of wastewater plant	Levels of service	Types of service[2]
Xiaqiao Town	Design flow: 5,500 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
Qujie Town	Design flow: 7,000 m^3/d	A^2O+MBR

[2] 16 wastewater treatment plants adopt the same aerobic treatment process.

	Design influent COD: 500 mg/L	
Xinyi City Dingbao Town	Design flow: 3,700 m^3/d Design influent COD: 300 mg/L	A^2O+MBR
Xinyi City Qianpai Town	Design flow: 6,300 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
Xianqiao South	Design flow: 10,000 m^3/d Design influent COD: 500 mg/L	A^2O+MBR
Qiankeng Town North	Design flow: 9,900 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
Shangsha Town	Design flow: 12,400 m^3/d Design influent COD: 400 mg/L	A^2O+MBR
Baita Town	Design flow: 7,500 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
Luoding Fourth	Design flow: 21,000 m^3/d Design influent COD: 500 mg/L	A^2O+MBR
Shitan Town	Design flow: 6,600 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
Litan Town	Design flow: 7,000 m^3/d Design influent COD: 500 mg/L	A^2O+MBR
jiulong Town	Design flow: 7,000 m^3/d Design influent COD: 350 mg/L	A^2O+MBR
Shakou Town	Design flow: 8,850 m^3/d Design influent COD: 550 mg/L	A^2O+MBR
Bomei Town	Design flow: 28,000 m^3/d Design influent COD: 550 mg/L	A^2O+MBR
Nantang Town	Design flow: 28,000 m^3/d Design influent COD: 550 mg/L	A^2O+MBR
Chikeng Town	Design flow: 6,400 m^3/d Design influent COD: 450 mg/L	A^2O+MBR
The treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001) " (40mg/L). So each of the wastewater treatment plants complied with the applicable water quality/discharge standards.		

Baseline scenario

Before the implementation of the project, the wastewater from 16 areas in Guangdong Province was treated by local 16 open anaerobic lagoons, and the methane was directly discharged into the atmosphere. There was no methane recovery and destruction facilities, and the sludge generated by the anaerobic lagoons was dried under controlled and aerobic conditions and its disposal in landfills with methane recovery. After the implementation of the project, the original open anaerobic lagoons have been removed. The information of the open anaerobic lagoons at the project site before the implementation of the project is as follows

Name of treatment plant	Types of service	Depth	Retention time	Levels of service
Xiaqiao Town	Open anaerobic lagoons	>5m	One year	Design flow: 5,500 m^3/d Design influent COD: 450 mg/L
Qujie Town	Open anaerobic lagoons	>5m	One year	Design flow: 7,000 m^3/d Design influent COD: 500 mg/L
Xinyi City Dingbao Town	Open anaerobic lagoons	>5m	One year	Design flow: 3,700 m^3/d Design influent COD: 300 mg/L
Xinyi City Qianpai Town	Open anaerobic lagoons	>5m	One year	Design flow: 6,300 m^3/d Design influent COD: 450 mg/L
Xianqiao South	Open anaerobic lagoons	>5m	One year	Design flow: 10,000 m^3/d Design influent COD: 500 mg/L
Qiankeng Town North	Open anaerobic lagoons	>5m	One year	Design flow: 9,900 m^3/d Design influent COD: 450 mg/L
Shangsha Town	Open anaerobic lagoons	>5m	One year	Design flow: 12,400 m^3/d Design influent COD: 400 mg/L
Baita Town	Open anaerobic lagoons	>5m	One year	Design flow: 7,500 m^3/d Design influent COD: 450 mg/L
Luoding Fourth	Open anaerobic lagoons	>5m	One year	Design flow: 21,000 m^3/d Design influent COD: 500 mg/L
Shitan Town	Open anaerobic lagoons	>5m	One year	Design flow: 6,600 m^3/d Design influent COD: 450 mg/L
Litan Town	Open anaerobic lagoons	>5m	One year	Design flow: 7,000 m^3/d Design influent COD: 500 mg/L
jiulong Town	Open anaerobic lagoons	>5m	One year	Design flow: 7,000 m^3/d Design influent COD: 350 mg/L

Shakou Town	Open anaerobic lagoons	>5m	One year	Design flow: 8,850 m^3/d Design influent COD: 550 mg/L
Bomei Town	Open anaerobic lagoons	>5m	One year	Design flow: 28,000 m^3/d Design influent COD: 550 mg/L
Nantang Town	Open anaerobic lagoons	>5m	One year	Design flow: 28,000 m^3/d Design influent COD: 550 mg/L
Chikeng Town	Open anaerobic lagoons	>5m	One year	Design flow: 6,400 m^3/d Design influent COD: 450 mg/L

Project technology description

Project activities mainly include pre-treatment process, secondary biological treatment process, tertiary deep treatment process and sludge treatment process. The process flow diagram of this project activity is shown in Figure 1-1.

- **Pre-treatment process**

The pre-treatment process includes coarse screen, adjusting tank, fine screen and horizontal-flow Grit Chamber. The purpose of pre-treatment process is to remove large suspended matter and dense sand particles from the wastewater.

- **Secondary biological treatment process**

The secondary biological treatment process includes A^2O biological treatment stage and MBR tank treatment stage, where the A^2O treatment includes pre-anoxic tank, anaerobic tank, anoxic tank, aerobic tank, combined as a reinforced concrete tank. The COD is basically removed in the aerobic stage.

- **Tertiary deep treatment process**

The deep treatment stage includes two stages. The first stage use water production tank; the second stage is the disinfection process of wastewater.

- **sludge treatment process**

The sludge treatment process consists of a sludge dewatering plant and a sludge storage tank where the sludge is dewatered to below 60% moisture content under controlled conditions and finally transported to a controlled landfill for landfill.

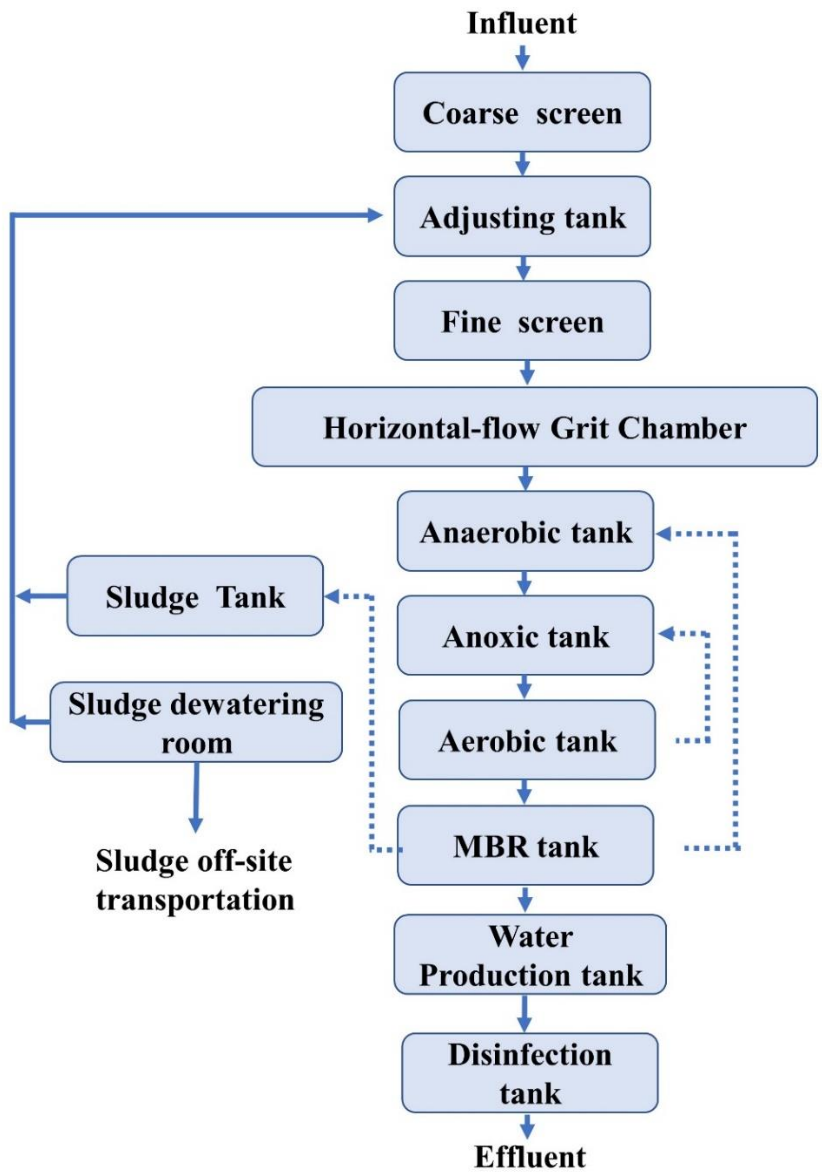


Figure 1-1 Process flow diagram of the project activity

Table 1 Parameters of the main structures and Equipments of for all wastewater plant

Main structures		Quantity	Parameters
coarse screen		16	B×L×H=8.8m×4.6m×6.1m
(1)	Rotary screen decontamination machine	32	B=900mm, N=2.2kw, B0=800mm, b=20mm, h=1,000mm, v=0.8m/s, $\triangle h_{max}$=200mm, N=2.2kw
(2)	Sluice	32	800mm×1,000mm

(3)	Shaftless screw conveyor	32	W=2.5m³/h，D＝260mm，N=1.1kw
(4)	Screw press	32	W=1.0m³/h，D＝260mm，N=1.1kw
Fine screen		16	B×L×H=13.6m×8.4m×2.0m
(1)	Rotary screen decontamination machine	48	V=0.8m/s, B=1,100mm, B0=1,000mm, b=5mm, h=1,000mm, α=75°, $\triangle h_{max}$=200mm, N=2.2kw
(2)	Shaftless screw conveyor	32	W=2.5m³/h，D＝260mm，N=1.1kw
(3)	Screw presses	32	W=1.0m³/h，D＝260mm，N=1.1kw
(4)	Sluice	64	W×H＝4.0m×1.5m
Horizontal-flow Grit Chamber		16	L×B×H =30m×20m × 8.4m
Anaerobic tank		16	L×B×H = 36.0m×16.3m×7.5m HRT=2.0 h
Anoxic tank		16	L×B×H = 25.2m×15m×7.5m HRT=4h, SRT=4.4d
(1)	Submersible mixer	64	D＝500mm，n＝371rpm，N=2.5kw
Aerobic tank		16	L×B×H = 30m×15m×7.5m HRT=14.22h, SRT=10d
(1)	Internal return pump	16	Q＝150m³/h，H＝1.0m，N＝4.0kw
(2)	Microporous aerator	4800	D＝300mm, Q＝3m³/h·piece
MBR tank		32	L×B×H = 10m×5m×7.5m
sludge suction machine		16	N＝0.55kw
Sludge Tank		16	L×B×H = 30m×15m×7.5m
Sludge dewatering room		16	L×B×H =20m×15.0m×4.5m

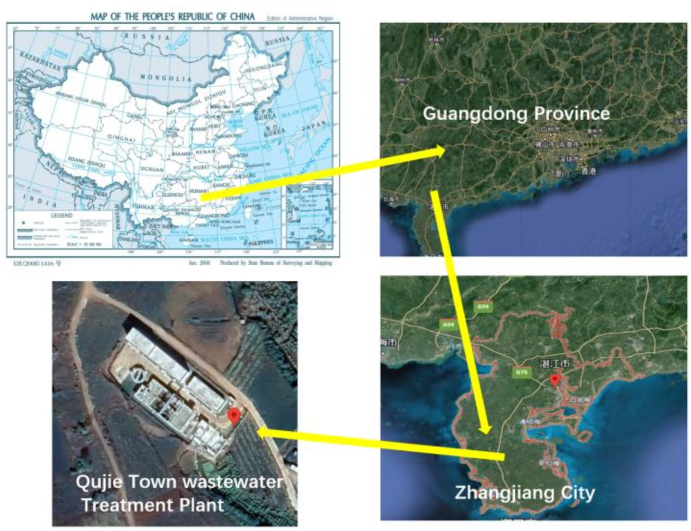
The manufacturer of all the wastewater treatment equipment of the 16 plants is Jiangsu Pengyao Environmental Protection Group Co., Ltd. As per equipment purchase contract of the project, the lifetime of the equipment mentioned above is no less than 10 years. Some of the main monitoring parameters, such as the influent flow and influent COD, effluent flow and effluent COD, volume of sludge transportation, and the electricity consumption of the wastewater plant, are monitored normally, and there is no missing data.

1.12 Project Location

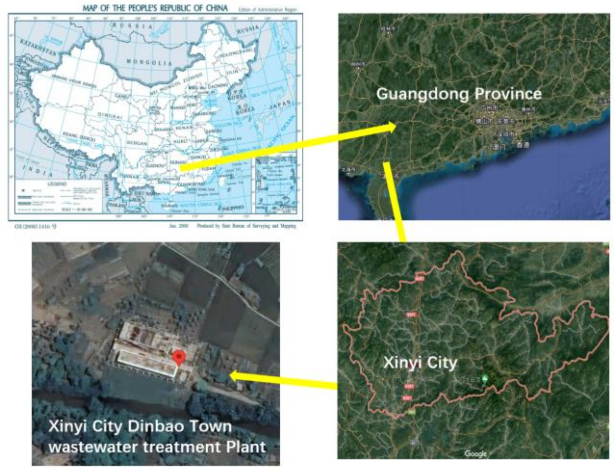
Yunshui Wastewater Treatment Plant Project in Guangdong province introduces 16 aerobic wastewater treatment plant to treat wastewater from towns in some regions of Guangdong Province. Project maps and coordinates of the wastewater plant are shown in figure and table 1-3 below.

Xiaqiao Town wastewater Treatment Plant

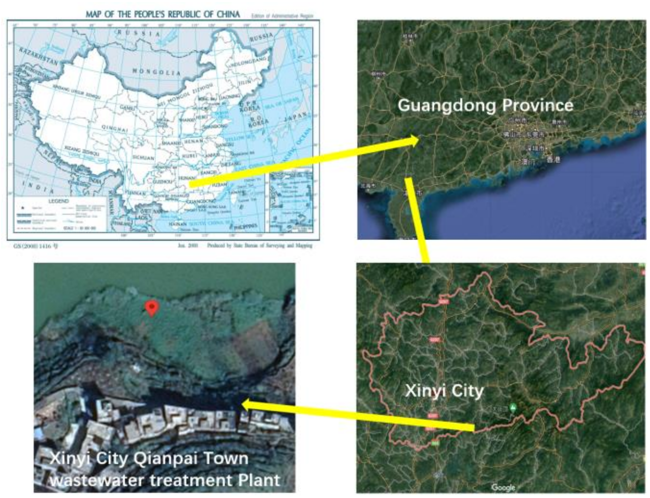
Qujie Town wastewater Treatment Plant



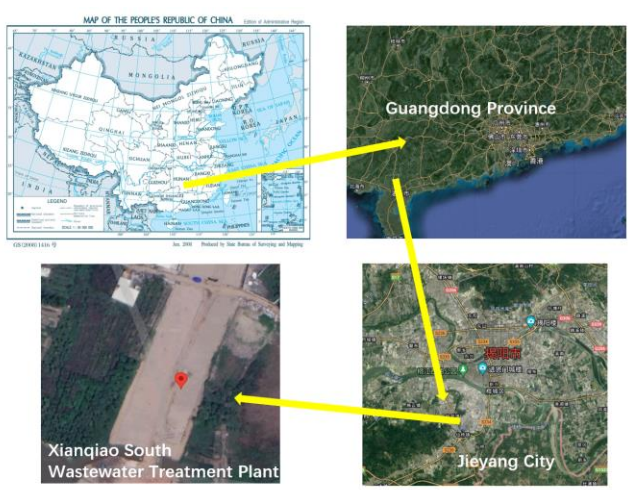
Xinyi City Dingbao Town wastewater treatment Plant



Xinyi City Qianpai Town wastewater treatment Plant

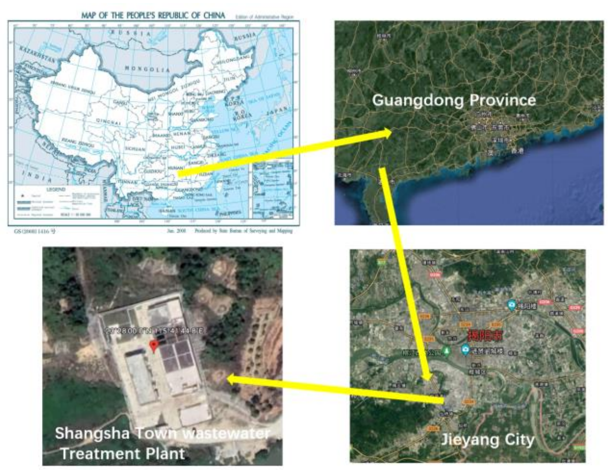


Xianqiao South Wastewater Treatment Plant

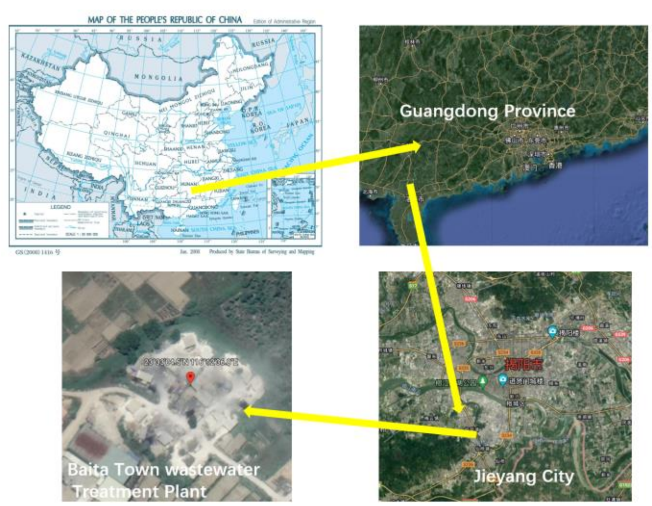


Qiankeng Town North wastewater Plant

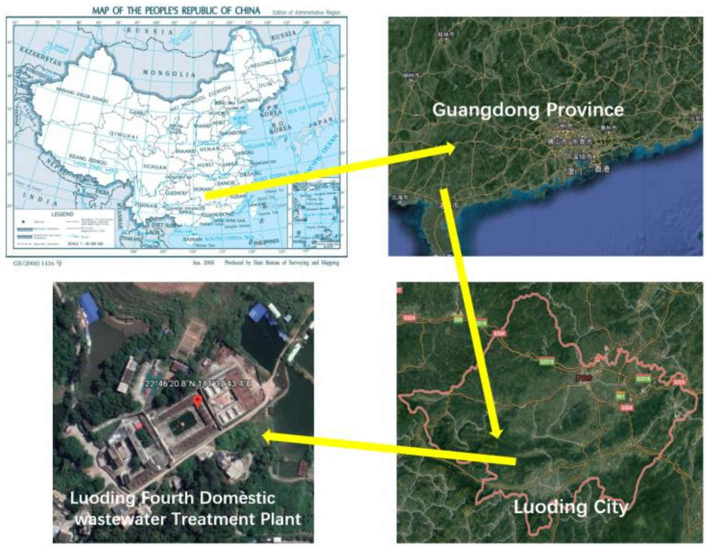
Shangsha Town wastewater Treatment Plant



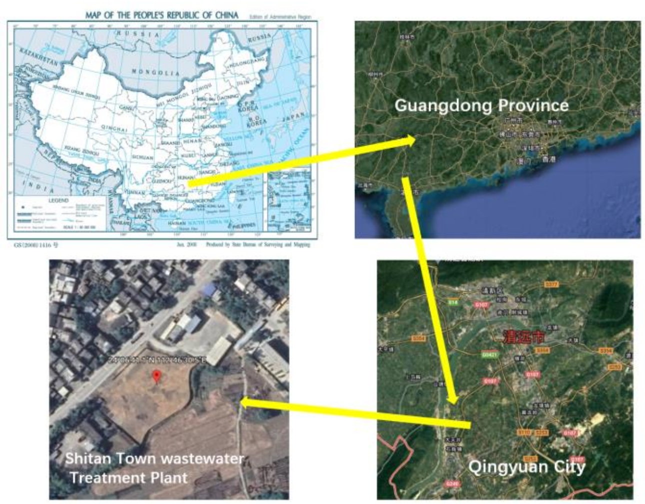
Baita Town wastewater Treatment Plant



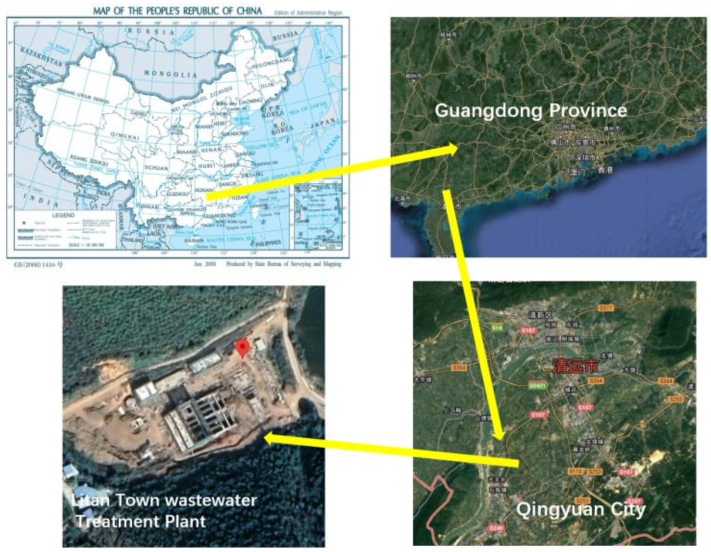
Luoding Fourth Domestic wastewater Treatment Plant



Shitan Town wastewater Treatment Plant



Litan Town wastewater Treatment Plant

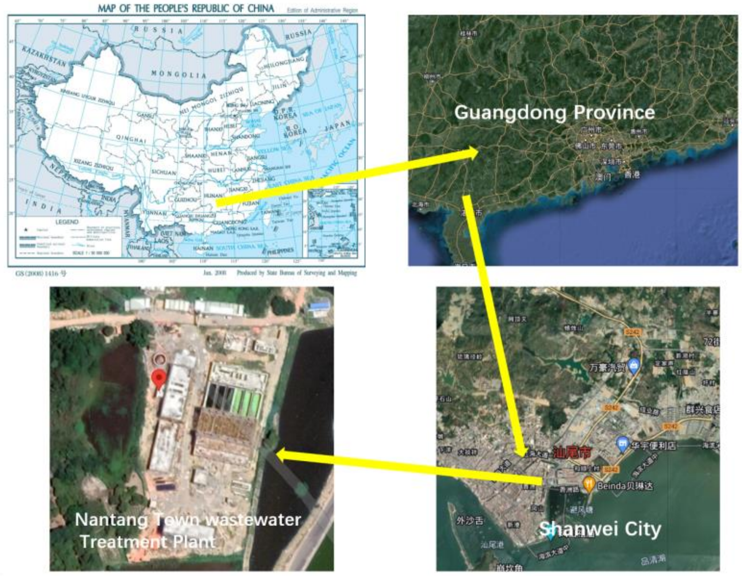


jiulong Town wastewater Treatment Plant

Shakou Town wastewater Treatment Plant

Bomei Town wastewater Treatment Plant

Nantang Town wastewater Treatment Plant



Chikeng Town wastewater Treatment Plant

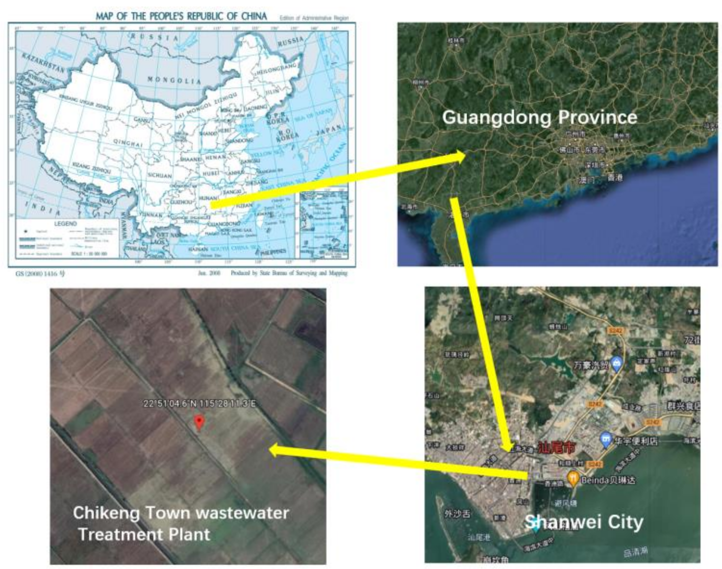


Table 1-3 Project coordinates of the wastewater plant

Name of the plant	City	Project coordinates
Xiaqiao Town wastewater Treatment Plant	Zhanjiang	20°26'55.0"N 110°06'40.8"E
Qujie Town wastewater Treatment Plant	Zhanjiang	20°28'47.3"N 110°19'23.5"E
Xinyi City Dingbao Town wastewater treatment Plant	Xinyi	22°18'29.7"N 110°58'08.8"E

Xinyi City Qianpai Town wastewater treatment Plant	Xinyi	22°23'23.1"N 111°15'03.3"E
Xianqiao South Wastewater Treatment Plant	Jieyang	23°28'56.3"N 116°21'24.0"E
Qiankeng Town North wastewater Plant	Jieyang	23°23' 33.28" N 116°00' 10.59" E
Shangsha Town wastewater Treatment Plant	Jieyang	23°27'60.0"N 115°41'44.8"E
Baita Town wastewater Treatment Plant	Jieyang	23°33'04.5"N 116°12'36.8"E
Luoding Fourth Domestic wastewater Treatment Plant	Luoding	22°46'20.8"N 111°32'43.4"E
Shitan Town wastewater Treatment Plant	Qingyuan	24°06'41.1"N 112°46'30.5"E
Litan Town wastewater Treatment Plant	Qingyuan	24°03'15.2"N 112°49'38.3"E
jiulong Town wastewater Treatment Plant	Yingde	24°8′6.54″N 112°55′2.61″E
Shakou Town wastewater Treatment Plant	Yingde	24°25'32.7"N 113°31'16.1"E
Bomei Town wastewater Treatment Plant	Shanwei	22°55′44.10″N 115°46′05.73″E
Nantang Town wastewater Treatment Plant	Shanwei	22°55'32.4"N 115°54'14.4"E
Chikeng Town wastewater Treatment Plant	Shanwei	115°28′11.26″E 22°51′04.55″N

1.13 Conditions Prior to Project Initiation

The project is a Greenfield project. Thus, there are no project activities at the project sites before the construction of the proposed project activities. Before the implementation of the project, the rural residents' domestic wastewater in the project site is treated by the existing local open anaerobic lagoons.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

According to the environmental impact assessment report (EIA) of the project, the project complies with all Chinese relevant laws and regulations. Mainly include:

1. Environmental Protection Law of the People's Republic of China;

2. Water Pollution Prevention and Control Law of the People's Republic of China;

3. Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes;

4. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution;

5. Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise;

6. Law of the People's Republic of China on Environmental Impact Assessment.

The project obtained one project approval and one EIA approval[3] from governmental authorities: Guangdong Development and Reform Commission and Guangdong Ecological Environment Department. Guangdong Housing and Urban-Rural Development Bureau and the project owner also signed a wastewater treatment service agreement. These approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, status and other regulatory frameworks.

1.15 Participation under Other GHG Programs

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

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program.

1.15.2 Projects Rejected by Other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program.

1.16 Other Forms of Credit

[3] All the 16 wastewater treatment plants belong to the same PP. The planned construction time of these plants is about the same, and the same aerobic treatment process (A2O+MBR) was used. And then, considering that these 16 wastewater treatment plants have the characteristics of small scale and large quantity. So the 16 plants were summarized as a consolidated project to complete the one FSR and one EIA. However, the design proposal for each plant was made according to its different capacity. The EIA was finally approved by Guangdong Ecological Environment Department, which covered all the 16 plants.

1.16.1 Emissions Trading Programs and Other Binding Limits

The project owner has signed the Declaration of No Double Counting Statement and Declaration of not involved in other GHG scheme on 05-February-2020. And then there is a cap & trade scheme in China. However, the project activity is not included in the mandatory emission control scheme since the scheme only cover the high-emission industries, such as power generation sector that emitted at least 26,000[4] tons of CO_2e/year. So there is no emission cap enforced for the project owner. The project proponent is not part of any emission trading program. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated under any other GHG programs.

1.16.2 Other Forms of Environmental Credit

The project hasn't sought or received another form of environmental credits.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project activity implemented by the project owner can contribute to sustainable development as defined by and tracked against the United Nations Sustainable Development Goals (SDGs). The specific analysis is as follows:

SDG6

The project activity treats wastewater by building 16 aerobic wastewater treatment plants in villages and towns in Guangdong Province, and the project can reduce water pollution and increase the proportion of wastewater treatment nationwide. So it can ensure availability and sustainable management of water and sanitation for more people.

SDG8

The project activity provides temporary and long-term employment to the local community during construction of the project activity as well as during operation. During construction, employment was offered for a lot of local labors contributing to social wellbeing and economic wellbeing. The involvement of local employees in the project activity helps to enhance the skills of the labour in the region by training them in different technical areas. As well, regional economic development can foster through contracts to local firms.

SDG13

[4] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk06/202203/t20220315_971468.html

China is currently pursuing a strong policy of carbon peaking and carbon neutrality goals. emission reductions of this project are generated by reducing methane emissions of the open anaerobic lagoons in baseline scenario. Annual average estimation of GHG emission reductions from the project activity is 83,042 tCO_2e/year, the total GHG emission reductions are 830,420t CO_2e during the fixed 10 years crediting period.

1.17.2 Sustainable Development Contributions Activity Monitoring

For this monitoring period covering 666 days[5], the actual emission reduction is 110,002 tCO_2e generated by the project, the cumulative wastewater treatment of the project reached 90,062,261[6] m^3, total 240 jobs for local people were created (including 120 females and 120 males). Please see below Table 1-5 for details.

[5] From 03/09/2020 to 30/06/2022

[6] In the current crediting period, the total wastewater treatment volume in the crediting period in 2020 (03-September-2020-31-December-2020) is 15,009,815 m^3, the wastewater treatment volume in 2021(01-January-2021-31-December-2021) is 50,258,160 m^3, and the wasrewater treatment volume in 2022 (01-January-2022-31-June-2022) is 24,794,286 m^3, so the wastewater treatment volume in the current crediting period is 90,062,261 m^3. Please refer to *Flow rate operation statistics of wastewater from Yunshui wastewater treatment plant project in Guangdong Province* for detailed.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	6.3	6.3.1 Proportion of domestic and industrial wastewater flows safely treated	Implemented activities to increase	During this monitoring period, the cumulative wastewater treatment of the project reached 90,062,261 m^3.	From the operation start date of this project activity to the end of this monitoring period, the cumulative wastewater treatment of the project reached 90,062,261 m^3.
2)	8.5	8.5.2 Unemployment rate, by sex, age and persons with disabilities	Implemented activities to decrease	During this monitoring period, 240 people including 120 females and 120 males were employed for operation, and maintenance of this project.	The project activity generates long-term working opportunities for 240 people during the operation period. From the operation start date of this project activity to the end of this monitoring period, 240 people were employed including 120 females and 120 males.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	During this monitoring period, the project has achieved GHG emission reductions of 110,002 tCO_2e.	From the operation start date of this project activity to the end of this monitoring period, the project has achieved GHG emission reductions of 110,002 tCO_2e.

1.18 Additional Information Relevant to the Project

Leakage Management

According to paragraph 35 of approved baseline and monitoring methodology AM0080" Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants" (Version 01), no leakage is considered in this methodology.

Commercially Sensitive Information

There is no information deemed as commercially sensitive for this project activity.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report for the Project has been approved by Guangdong Provincial Department of Ecology and Environment. A short summary of the environmental impacts is presented below. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development, the construction of the project is in line with national policies and has a emission reduction effect, and no net harm has been detected. Meanwhile, the implementation of the project will improve local-socio economic development through creating career opportunities. Please refer to Section 2.3 for the measures taken to mitigate these impacts during the construction and operation of the project.

2.2 Local Stakeholder Consultation

Local stakeholder consultation was conducted by project owner before the construction of the project and during the monitoring period through the means of meeting and questionnaire.

Local stakeholder consultation before the construction of the project

Invitation procedure

The stakeholder consultation was conducted by Yunshui Guangdong Environmental Protection Co., Ltd. with assistance from Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. Stakeholder groups were identified, and they were informed through oral and written means about the meeting. The invitation letter was sent by email to participants. This invitation email was done 2 weeks before the meeting date.

Place and date of the meeting

The stakeholder consultation was held at a meeting room of Unit 1505, Building A, No.264 Xingtai Road, Shiqiao Street, Panyu District, Guangzhou. on 02-May-2019.

Meeting Participants

The meeting was attended by local residents and representatives from the following stakeholder categories:

1. Local residents/farmers
2. Local government representatives
3. Representative of the project owner

There were 30 participants who accepted the invitation, attended the meeting and returned the questionnaire.

Table 2-1 Information of stakeholder attending the meeting

Items		Amount
Gender	Male	15
	female	15
Age	<25	5
	25-55	25
	>55	5
Education	Junior high school or below	5
	Senior high school	24
	College or above	6
Occupation	Worker	12
	Farmer	20
	Management personnel	1
	Civil servant	2

Meeting procedure

- Registration (30 min)
- Opening (15 min)
- Introduction by Yunshui Guangdong Environmental Protection Co., Ltd. (15 min)
- Description of the project and environmental impacts (30 min)
- Purpose of VCS, and relation of the project and VCS (30 min)
- Questions and Answers session (10 min)

- Completing questionnaire (20 min)

In the stakeholder consultation, all attendees were invited to express their comments. All attendees agreed the construction of the project and believed that the implementation of the project is beneficial. Only some feedback and comments were received, however, these feedbacks mainly focus on the questions of project technology, project mechanism operation and the environmental impact. Prompt response was made by PP during the meeting and the feedback and response were summarized as below table. There were no comments on project design and monitoring methods. The minutes of stakeholder meeting was recorded by PP.

Table 2-2 Feedback and response during the meeting

No.	Stakeholder feedback	Response by PP
1	How does this project generate emission reductions?	If there is no project activity using the aerobic wastewater treatment technology, the rural wastewater will continue to be treated by the existing open anaerobic pond, and the anaerobic will produce a large amount of greenhouse gas methane, while the aerobic treatment technology will only produce very low emissions. Thus generating a reduction in emissions.
2	What are the current emission reduction mechanisms?	GS, VCS or CCER.
3	Can I apply for the job in this project?	Everyone can apply as long as they meet our recruitment requirements.
4	If there is no proposed project activity, how is the wastewater generated in the rural areas treated?	The wastewater will be treated through open anaerobic lagoons.
5	What is the wastewater treatment technology used in the project?	A2O+MBR, it is an aerobic wastewater treatment technology

Local stakeholder consultation during the monitoring period

During this monitoring period, mean of a questionnaire survey was adopted for stakeholder consultation.

From 05-August-2020 to 10-August-2020, the project proponent put up public announcements at the villages near the project site. The purpose of this public announcements is to enable residents around the project to participate in the questionnaire survey. The content of the announcements mainly includes key information of the project, the way to participate the survey, the time period of the survey and contact information of the PP. The local residents who missed the questionnaire survey can contact the PP for further plan of the project.

A questionnaire survey was conducted by project proponent from 16-September-2020 to 26-September-2020. The questionnaires were distributed by the PP randomly in the surrounding areas of the 16 plants. There was a total of 6 questions in the questionnaire and it can be finished within 10 minutes. The completed questionnaires were collected by the PP immediately. Any other questions or suggestions about the project were also replied at the same time. Total 320 questionnaires were distributed and all questionnaires had been recollected. The basic information about the survey respondents is listed in Table 2-3. Responses and comments from these questionnaires are summarized in Table 2-4.

Table 2-3 Structure of stakeholder survey

Items		Amount
Gender	Male	160
	female	160
Age	<25	35
	25-55	250
	>55	35
Education	Junior high school or below	70
	Senior high school	150
	College or above	100
Occupation	Worker	160
	Farmer	64
	Management personnel	48
	Civil servant	48

Table 2-4 Summary of the survey results in monitoring period

No	Question	Response	Amount	Percentage
1	Do you know the purpose of this project?	Very much	93	93%
		A little	7	7%
		Not at all	0	0%
2	Do you think the project is good for the local environment?	Yes	300	94%
		I don't know	20	6%
		No	0	0%
3	What impact do you think the implementation of this project will have on your life?	Reduce surrounding wastewater pollution	150	47%
		Provide employment	100	31%
		Improve the surrounding environment	70	22%
4	Whether the project has a negative impact on the	Yes	0	0%
		No	320	100%

	surroundings during operation?	I don't know	0	0%
5	Do you know the aerobic wastewater treatment technology used in the project?	Yes	90	28%
		No	100	31%
		I don't know	130	41%
6	Are you willing to make positive comments on this project?	Yes	320	100%
		No	0	0%
		I don't know	0	0%
		No idea	15	15%

In summary, all the villagers and local government that attending the meeting and filling out questionnaires are all supportive of the project and to date there has been no need to modify the due to the comments received.

Continuous Input / Grievance Expression Process Book

16 grievance books are put in the communication room at the main door of wastewater treatment plant. The local stakeholders can provide feedbacks there as well. The town head will reach project owner if any comments are received.

2.3 Environmental Impact

The Environmental Impact Assessment (EIA) Report for the project has been approved by local governmental authorities. The environmental impacts and mitigation measures during the construction period and the operation period are summarized as follows.

Construction period

Air pollution

For the dust generated at the construction site, dust suppression measures such as watering were taken during construction. In addition, the transportation of powdered materials such as cement, dust, and sand was enclosed or covered, and the speed of vehicle traffic at the construction site was limited to reduce dust generation.Wastewater

The wastewater during the construction period of the project was mainly generated from the domestic sewage of construction workers, groundwater during foundation excavation and rinsing water after pouring concrete. Oil separation and sedimentation tanks was set up in the construction site so that the production wastewater can be reused for construction after oil separation and sedimentation. The groundwater and rinsing water was intercepted and treated centrally. The domestic sewage was collected in a septic tank and treated centrally, and then used as fertiliser for the surrounding farmland after precipitation and clarification.

Noise

Noise during the construction period was mainly generated by the construction machineries and vehicles. During the construction period, advanced low-noise equipment was used, and construction was prohibited at night; corresponding noise reduction, sound insulation and shock absorption measures was also adopted for noise sources.

Solid waste

Solid waste during the construction period includes construction waste and domestic waste. Domestic wastes were collected in trash cans and disposed of by the sanitation department. Construction wastes were promptly removed and transported to construction waste landfill sites designated by local government departments for disposal.

Operation period

Air Quality

The treatment facilities emitting odor in the wastewater treatment plant are closed units, and the odor was collected and then enters the deodorization system through the fan. After treatment, the odor emission can reach the emission standard of odorous pollutants and would not affect the air quality.

Water Quality

The wastewater is composed of residents' domestic wastewater within the service area, and the aerobic treatment process (A2O+MBR) was used , and the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001) ". Therefore, the project's effluent discharge meets national discharge standards and does not cause water pollution problems.

Noise

Low-noise equipment was selected for the wastewater treatment plant, and noise insulation and vibration reduction measures were taken for noise equipment.

Solid Waste

Solid waste was disposed of in accordance with methods that comply with national environmental regulations, the sludge generated by the daily operation of the wastewater treatment plant was dehydrated under aerobic conditions and then transported to the landfill for landfill treatment.

In conclusion, the project will not have a significant negative impact on the surrounding environment during both construction and operation period.

2.4 Public Comments

Besides, as per section 3.16.5 of the VCS Standard (Version 4.3), all projects are subject to a 30-day public comment period. The date on which the project is listed on the project pipeline marks the beginning of the project's 30-day public comment period. This project was open for public comment from 05-April-2022 to 05-May-2022[7]. No comments were received for the Project.

2.5 AFOLU-Specific Safeguards

Not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following methodologies are applicable to the project activity:

AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01.0)[8]

The latest version of the following tools will also be used in this Project activity:

Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)[9]

Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)[10]

Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)[11]

Tool 24 Common practice (Version 03.1)[12]

3.2 Applicability of Methodology

Justification for the choice of the selected methodology is shown in the following table:

[7] https://registry.verra.org/app/projectDetail/VCS/2938

[8]https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_5FZ9G0W3ZKWF7Y8X3F07T11YNQIDQR/EB47_repan02_AM0080_NM0250.pdf?t=RTJ8cXpjemxsfDCOO44xil_J65OfshjSTUAF

[9] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

[10] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf

AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01)	
Eligibility Criteria	**Justification for the Project Activity**
This methodology is applicable to project activities that implement a new aerobic wastewater treatment plant for the treatment of domestic and/or industrial wastewater. The sludge produced in the aerobic wastewater treatment plant in the project activity is either: (1) Treated in the same way as the sludge that would have been produced in the anaerobic open lagoons system in the baseline scenario would have been treated. This includes one of the following two options: (i) the sludge is dumped or left to decay; or (ii) the sludge is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery or used in soil application (2) Treated in a new anaerobic digester, with the biogas extracted from the anaerobic digester being flared and/or used to generate electricity and/or heat. The residues from the anaerobic digester are dehydrated, limed and stored before final disposal in a controlled landfill.	Yunshui Wastewater Treatment Plant Project in Guangdong province (hereafter referred to as the project) introduces 16 aerobic wastewater treatment plant to treat rural residents' domestic wastewater in 16 regions [13] of Guangdong Province. The previous 16 existing anaerobic open lagoons were replaced by the newly built aerobic wastewater treatment systems. As per the Baseline Survey Report, the sludge generated in this baseline scenarios was dried under controlled and aerobic conditions, and then sent to landfills with methane recovery for disposal (S2) respectively. As per Sludge Disposal Letter issued by Guangdong Housing and Urban-Rural Development Bureau, the sludge generated in this project scenario is also dried under controlled and aerobic conditions, and then sent to the same landfills with methane recovery for disposal(S2) respectively. The landfills are not included in the project boundary, and they are not associated facilities of the project. The contracts signed between the project owner and the landfills can also be used as evidence. So the sludge produced by the aerobic wastewater treatment plant in the project activities is treated in the same way as the sludge produced by the anaerobic open lagoon system. The treatment method is drying under controlled and aerobic conditions, and then transported to the landfills with methane recovery for landfill. The treatment scenario belongs to (1) (ii) Therefore, this condition is applicable.
The project activity either replaces an existing anaerobic open lagoons system, with or without conversion of the sludge treatment system, or is an alternative to a new to be built anaerobic open lagoons system;	The project activity is an alternative to existing anaerobic open lagoons system without conversion of the sludge treatment system. Therefore, this condition is applicable.

[13] Xiaqiao Town, Qujie Town, Dingbao Town, Qianpai Town, Xianqiao South, Qiankeng Town, Shangsha Town, Baita Town, Luoding, Shitan Town, Litan Town, jiulong Town, Shakou Town, Bomei Town, Nantang Town and Chikeng Town.

Loading in the wastewater streams has to be high enough to ensure that the existing or new to be built anaerobic open lagoons system develops an anaerobic bottom layer and that algal oxygen production can be ruled out;	As per the baseline survey report, the existing anaerobic open lagoons system in the baseline scenario are open anaerobic lagoons with a depth greater than 5 m. According to the stabilization lagoons design specification, the entire open lagoons is completely in an anaerobic environment at this depth level, anaerobic open lagoons system can develop an anaerobic bottom layer and that algal oxygen production can be ruled out[14]. Therefore, this condition is applicable.
The average depth of the existing or new to be built anaerobic open lagoons system is at least 1 meter. In case of an existing anaerobic open lagoons system in the baseline scenario, the depth of the lagoons should be verified based on historical data available for one year before the implementation of the project activity. In case of a new to be built anaerobic open lagoons system, the depth of the lagoons should be determined following the guidance provided in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario and assessment of additionality";	As established in section 1.1, the project activity is an alternative to existing anaerobic open lagoons system. As per the baseline survey report issued by Department of Ecological Environment of Guangdong Province, from 01-January-2018 to 31-December-2018, the depth of the local open anaerobic lagoons is more than 5m, so the lagoons depth can be verified based on the historical data reported in this baseline survey report. . Therefore, this condition is applicable.
The residence time of the organic matter in the anaerobic open lagoons system is at least 30 days. In case of an existing anaerobic open lagoons system in the baseline scenario, the residence time of the organic matter in the lagoon should be verified based on historical data available for one year before the implementation of the project activity. In case of a new to be built anaerobic open lagoons system, the residence time of organic matter in the lagoons should be determined following the guidance provided in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario and assessment of additionality".	As established in section 1.1, the project activity is an alternative to existing anaerobic open lagoons system. As per the baseline survey report issued by Department of ecological environment of Guangdong Province, from 01-January-2018 to 31-December-2018, residence time of organic matter in the existing open anaerobic lagoons at the project site is generally one year, so the residence time of organic matter can be verified based on the historical data reported in this baseline survey report. Therefore, this condition is applicable.
The wastewater would have been treated in an existing (W3) or new to be built (W6) anaerobic open lagoons system under clearly anaerobic conditions and without methane recovery and flaring;	As established in section 1.1 of the JPM, the wastewater would have been treated in existing (W3) anaerobic open lagoons system under clearly anaerobic conditions and without methane recovery and flaring. Therefore, this condition is applicable.

[14]http://shigongdaquan.max.book118.com/%E5%BB%BA%E7%AD%91%E8%A7%84%E8%8C%83/%E5%BB%BA%E7%AD%91%E8%A7%84%E8%8C%83CJJ/CJJ54T-1993%E6%B1%A1%E6%B0%B4%E7%A8%B3%E5%AE%9A%E5%A1%98%E8%AE%BE%E8%AE%A1%E8%A7%84%E8%8C%83.pdf

The sludge that would have been produced in the baseline lagoons system would have been dumped or left to decay (S1), or dried under controlled and aerobic conditions and then disposed to a landfill with methane recovery or used in soil application (S2);	Yunshui Wastewater Treatment Plant Project in Guangdong province (hereafter referred to as the project) introduces 16 aerobic wastewater treatment plant to treat rural residents' domestic wastewater in 16 regions of Guangdong Province, and as per the baseline survey report of and Feasibility Study Report, the sludge generated in this baseline scenario (The rural residents' domestic wastewater was treated by 16 existing anaerobic open lagoons) is treated in the same way as in the project scenario (The rural residents' domestic wastewater was treated by 16 aerobic wastewater treatment plant), where they are all dried under controlled conditions and then sent to landfills with methane recovery for disposal (S2) respectively. Therefore, this condition is applicable.
The electricity produced with biogas in the project scenario, if any, would have been produced using fossil fuels in a captive power plant (E1), or obtained from the grid (E2);	As per Feasibility Study Report, biogas power generation does not exist in the project scenario. Therefore, this condition is not applicable.
The heat produced with biogas in the project scenario, if any, would have been produced using fossil fuels in a captive cogeneration power plant (H1), or using fossil fuels in a boiler (H2).	As per Feasibility Study Report, there is no biogas for heat production in the project scenario. Therefore, this condition is not applicable.
Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	
The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	Alternative scenarios, barrier analysis, investment analysis and common practice analysis will be carried out based on Tool 02. Refer to section 3.4 and 3.5 of the JPM for more details.
Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)	
If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the	The project activity will use electricity from grid (the Project is connected to the South China Power Grid (SCPG), which falls under scenario A of Tool 05 (Version 03.0). Therefore, emissions related to electricity consumption need to be calculated. Electricity bill were provided as evidence.

site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	
This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	This methodological tool is applied for calculating for emission by electricity consumption in project activity. Therefore, this criterion is not applicable.
This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.	Yunshui Wastewater Treatment Plant Project introduces aerobic wastewater treatment plant to treat wastewater from towns in some regions of Guangdong Province to replace the traditional open anaerobic lagoon. No captive renewable power generation technologies will be installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. Tool 05 is used for calculating project emissions of CO_2. This criterion is not applicable.
Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of	Baseline scenario is 16 open anaerobic lagoons. No electricity was used, this criterion is not applicable.

electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	The electricity used by the project activity comes only from the South China Power Grid (SCPG). Electricity bill were provided as evidence. Emission factor for the project electricity system will be calculated for grid power plants only as per Tool 07.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system is located totally in Guangdong Province of China, which is not an Annex I country.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The electricity used by the project activity comes only from the South China Power Grid (SCPG). As per requirements of this criterion, the value applied to the CO_2 emission factor of biofuels were zero. The latest available emission factor of SCPG issued by China DNA on 29/12/2020 was used to calculate emission factor.
Tool 24 Common practice (Version 03.1)	
This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality.	The project applies the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" that use the common practice test for the demonstration of additionality.
In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	It is consistent of Tool 24 (Version 03.1) and AM0080 (Version 01.0) on approaches for the conduction of the common practice test.

3.3 Project Boundary

According to the methodology AM0080, the spatial extent of the project boundary includes:

1) The site and facilities where the wastewater and sludge are treated in both the baseline and the project scenario;

2) Any on-site power plants that supply electricity to the wastewater and sludge treatment systems;

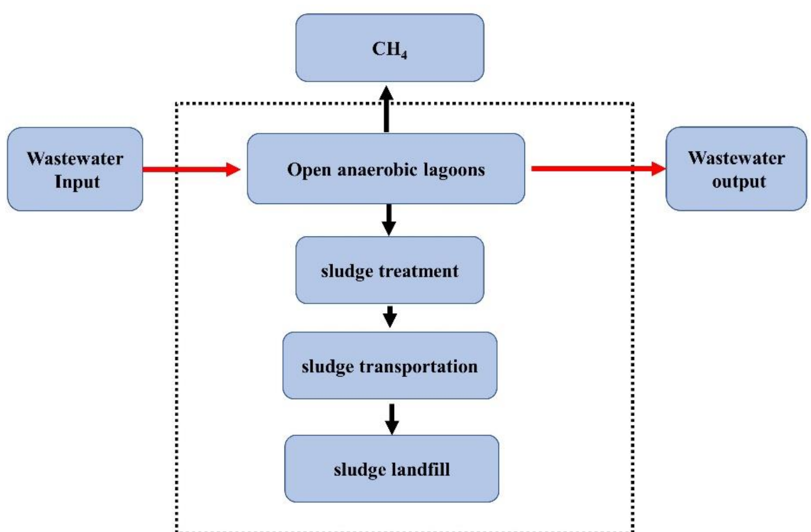
3) Any on-site facilities that generate heat used by the wastewater and sludge treatment systems;

4) If applicable, the anaerobic digester, the power and/or heat generation equipment and/or the flare installed under the project activity;

5) If grid electricity is displaced from electricity generation with biogas from an aerobic digester: the power plants connected to the grid, with the geographical boundary as specified in the latest approved version of the "Tool to calculate the emission factor for an electricity system".

So the project boundary includes the existing baseline open lagoons, the physical and geographic boundary of the 16 wastewater treatment plants, which mainly includes the site and facilities for wastewater and sludge, sludge transportation, landfill for sludge landfill, the power plants connected to the grid (SCPG).

The baseline situation is shown in Figure 3-1 below.



The project activity boundary is defined as Figure 3-2 below.

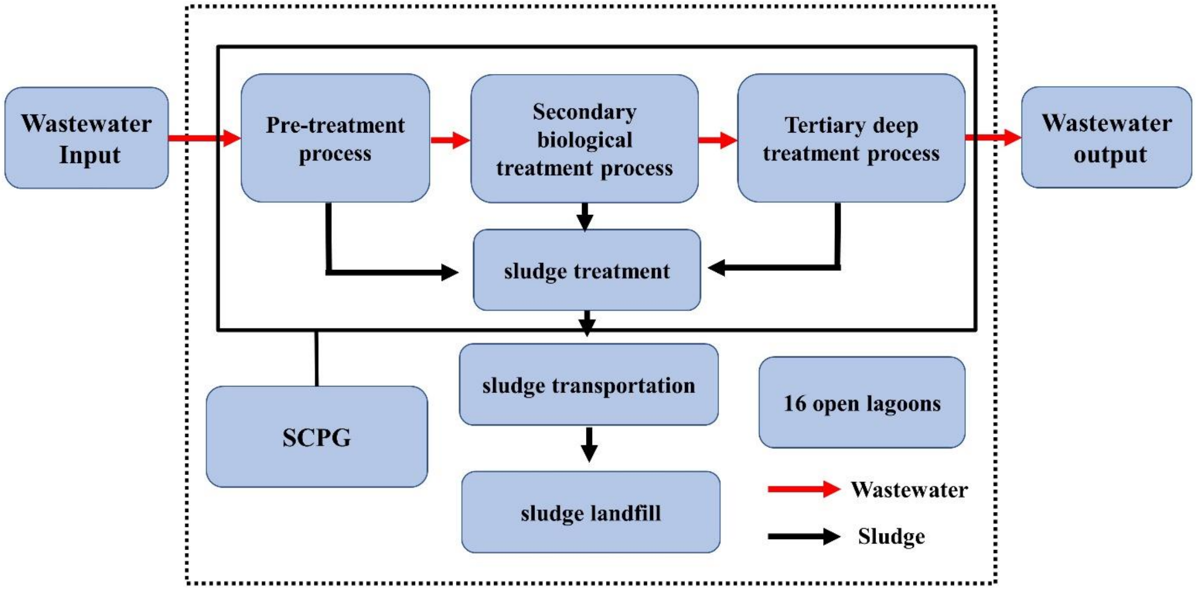


Figure 3-2 Diagram of the project boundary

The emission sources included in the project boundary are described in Table 3-3 below:

Table 3-3 Emission sources included in or excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Wastewater and sludge treatment	CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
		CH_4	Included	Major source of emissions in the baseline.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Electricity and thermal energy generation	CO_2	Excluded	For the project, the emissions from power generation / thermal energy in the baseline scenario do not exist, so it can be excluded.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Transportation of sludge	CO_2	Included	Emissions from transportation of sludge is included
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project	Wastewater and	CH_4	Included	Major source of emissions in the project.

Source		Gas	Included?	Justification/Explanation
	sludge treatment	CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
		N_2O	Excluded	In case of projects that involve land application of sludge this is an important emission source. However, the sludge was sent to the landfill for sanitary landfill, and there is no land use. Therefore, N_2o emission is 0.
	On-site use of electricity and fossil fuels	CO_2	Included	May be an important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Transportation of sludge	CO_2	Included	Emissions from transportation of sludge may be included.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

3.4 Baseline Scenario

As per section of AM0080 Mitigation of greenhouse gases emissions with treatment of wastewater in aerobic wastewater treatment plants (Version 01.0), the most plausible baseline scenario shall be determined through the use of Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0) by the application of the following steps:

The most plausible baseline scenario is identified in the following steps:

Step 0. Demonstration that a proposed project activity is the First-of-its-kind;

Step 1. Identification of alternative scenarios;

Step 2. Barrier analysis;

Step 3. Investment analysis (if applicable);

Step 4. Common practice analysis.

Step 0: As per Tool 02"Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0), this step is optional. So this step can be skipped.

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed project activity

The identification of alternative baseline scenario should include all realistic and credible alternatives to the project activity that are consistent with current laws and regulations of the host country and that provide output or service (i.e. wastewater treatment capacity) with comparable quality as the proposed project activity. To identifying relevant alternative scenarios, provide an overview of other technologies or practices used for wastewater treatment that have been implemented prior to the start of the project activity or are currently underway in the relevant geographical area. The realistic and credible alternative(s) for the implementation of a new wastewater treatment may include.

Identification of alternative scenarios – Wastewater			
Option	Description	Credibility	**Conclusion**
W1	Direct release of wastewaters to a nearby water body;	This option cannot be considered an alternative in the absence of the project activity as the direct release of wastewater to nearby water body is prohibited according to national legislation. This violates the Environmental Protection Law of the People's Republic of China [15] . Therefore, W1 can therefore not be considered as an alternative.	No
W2	Aerobic wastewater treatment facilities (e.g., activated sludge or filter bed type treatment);	Aerobic treatment processes such as activated sludge and biofilm comply with national government legislation on water quality and water discharge [16] . **Therefore, W2 can therefore be considered as an alternative.**	Yes
W3	Existing anaerobic open lagoons system without methane recovery and flaring;	According to the FSR and local baseline survey report, the anaerobic lagoons is open without methane recovery and flaring system. And then as per the feasibility study report of the project, water consumption and wastewater type of the 16 rural areas remains stable [17][18] .The treated wastewater should	Yes

[15] http://www.gov.cn/zhengce/2014-04/25/content_2666434.htm

[16] https://baijiahao.baidu.com/s?id=1727515723531310380&wfr=spider&for=pc

[17] http://stats.gd.gov.cn/attachment/0/421/421375/3284461.pdf

[18] According to the 7th National Population Census Bulletin of Guangdong Province, the rural population in Guangdong Province has remained relatively stable from 2010 to 2020. So the population of the 16 regions where the project is located was stable during this period and is likely to remain stable for a considerable period in the future. It can be inferred that the water consumption of residents will also remain stable.

		meet Level A standard (50mg/L) of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001 (40mg/L) regardless of what treatment technology Therefore, the investment analysis for the baseline scenario and project scenario is reasonable. Therefore, W3 can therefore be considered as an alternative.	
W4	Existing anaerobic open lagoons system with methane recovery and flaring;	According to thelocal baseline survey report, the anaerobic lagoons is open without methane recovery and flaring system. Therefore, W4 can therefore not be considered as an alternative.	No
W5	Existing anaerobic open lagoons system with methane recovery and utilization for energy generation;	According to the local baseline survey report, the anaerobic lagoons in the project site is open without methane recovery and flaring system. Therefore, W5 can therefore not be considered as an alternative.	No
W6	New to be built anaerobic open lagoons system without methane recovery and flaring;	The construction and operation of the open anaerobic lagoons comply with laws and regulation[19]. However, before the construction of the project, the residents' domestic wastewater is treated by the existing open anaerobic pond without methane recovery and flaring, so it is not necessary to build anaerobic open lagoons system.. Therefore, W6 cannot be considered as an alternative.	No
W7	New to be built anaerobic open lagoons system with methane recovery and flaring;	The construction and operation of the open anaerobic lagoons comply with laws and regulation[20]. However, before the construction of the project, the residents' domestic	No

[19] http://www.moa.gov.cn/nybgb/2019/201907/202001/t20200103_6334298.htm

[20] http://www.moa.gov.cn/nybgb/2019/201907/202001/t20200103_6334298.htm

		wastewater is treated by the existing open anaerobic pond without methane recovery and flaring, so it is not necessary to build anaerobic open lagoons system.Therefore, W7 can therefore not be considered as an alternative.	
W8	New to be built anaerobic open lagoons system with methane recovery and utilization for energy generation;	The construction and operation of the open anaerobic lagoons comply with laws and regulation[21]. However, before the construction of the project, the residents' domestic wastewater is treated by the existing open anaerobic pond without methane recovery and flaring, so it is not necessary to build anaerobic open lagoons system. Therefore, W8 can therefore not be considered as an alternative.	No
W9	Anaerobic digester without methane recovery and flaring;	Nowadays, anaerobic wastewater digesters are normally applied in small quantity industrial wastewater treatment units, this time the influent of wastewater treatment plant is quite large as listed in section 1.1. And then anaerobic digestion reactors in the field of wastewater treatment are generally suitable for treating organic wastewater with high concentration and difficult to biodegrade, and the effluent generally cannot meet the current primary A standard for wastewater discharge (less than 40mg/L)[22]. Therefore, W9 can therefore not be considered as an alternative.	No
W10	Anaerobic digester with methane recovery and flaring;	Nowadays, anaerobic wastewater digesters are normally applied in small quantity industrial wastewater treatment units, this time the influent of wastewater treatment plant is quite large, and then anaerobic digestion reactors in the field of wastewater treatment are generally suitable for treating organic wastewater with high concentration and difficult to biodegrade, and the effluent	No

[21] http://www.moa.gov.cn/nybgb/2019/201907/202001/t20200103_6334298.htm

[22] https://www.mee.gov.cn/gkml/hbb/bgth/201108/W020110826366697455079.pdf

		generally cannot meet the current primary A standard for wastewater discharge (less than 40mg/L)[22]. Therefore, W10 can therefore not be considered as an alternative.	
W11	Anaerobic digester with methane recovery and utilization for electricity or heat generation.	Nowadays, anaerobic wastewater digesters are normally applied in small quantity industrial wastewater treatment units, this time the influent of wastewater treatment plant is quite large, and then anaerobic digestion reactors in the field of wastewater treatment are generally suitable for treating organic wastewater with high concentration and difficult to biodegrade, and the effluent generally cannot meet the current primary A standard for wastewater discharge (less than 40mg/L)[22]. Therefore, W11 can therefore not be considered as an alternative.	No

Identification of alternative scenarios – Sludge			
Option	Description	Credibility	**Conclusion**
S1	The sludge would have been dumped or left to decay	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the quality of life[23]. Therefore, S1 can therefore not be considered as an alternative.	No
S2	The sludge would have been dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery or with use in soil application	According to the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, the activities of solid waste eventually placed in landfills that meet the requirements of environmental protection regulations are in accordance with the requirements of laws and regulations[23]. As per to the Baseline Survey Report, in baseline scenario, the sludge was dried under controlled and aerobic conditions,	Yes

[23] https://www.mee.gov.cn/ywgz/fgbz/fl/202004/t20200430_777580.shtml

		and then disposed to landfills with methane recovery. And as per the Sludge Disposal Letter issued by Guangdong Housing and Urban-Rural Development Bureau, the sludge in the project activity should be dried under controlled and aerobic conditions, and then transported to the local 16 landfills, which has a methane recovery device. **Therefore, S2 can therefore be considered as an alternative.**	
S3	Disposal of sludge in sludge pits under clearly anaerobic conditions	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the quality of life[23]. In addition, the anaerobic treatment of sludge in the sludge pits is actually an incomplete treatment method. Therefore, S3 can therefore not be considered as an alternative.	No
S4	Land application of the sludge	According to national legislation, sludge is a waste product and must therefore be treated in a manner that prevents the waste to have a nocuous impact on the environment and the quality of life[23]. Considering the COD concentration of the wastewater influent and some of its industrial characteristics, the land use of sludge cannot be considered. Therefore, S4 can therefore not be considered as an alternative.	No
S5	Composting	At present, the sludge composting technology has some disadvantages, such as large land area, long treatment period, easy enrichment of heavy metals, emission of greenhouse gases and odor, which restrict the promotion of the technology. Therefore, S5 can therefore not be considered as an alternative	No

S6	Mineralization	The option complies with the national legislation, and might be considered for W2 and W3 in absence of the project activity. However, the sludge mineralization technology developed both domestically and internationally is not mature and expensive enough to be used industrially. Therefore, S6 can therefore not be considered as an alternative.	No
S7	Disposal of sludge in a landfill without landfill gas capture	This option does not comply with national legislation. The Technical Specifications for Sludge Treatment of Municipal Wastewater Treatment Plant stipulates that when sludge from municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60%[24]. However, S7 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S7 can therefore not be considered as an alternative.	No
S8	Disposal of sludge in a landfill with landfill gas capture and flare	This option does not comply with national legislation. The technical specification for sanitary landfill treatment of domestic waste in China stipulates that when sludge from municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60% above[24]. However, S8 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S8 can therefore not be considered as an alternative.	No

[24] http://www.mee.gov.cn/gkml/hbb/bgth/201004/W020100401574292358556.pdf

S9	Disposal of sludge in a landfill with landfill gas capture and utilization for energy generation	This option does not comply with national legislation. The technical specification for sanitary landfill treatment of domestic waste in China stipulates that when sludge from municipal wastewater treatment plants enters a domestic waste landfill, its sludge moisture content should be less than 60%[24]. However, S9 scenario does not specify reducing the moisture content of the sludge to below 60% before sending it to the landfill. Therefore, the sludge needs to be dewatered before entering the landfill for landfill treatment. Therefore, S9 can therefore not be considered as an alternative.	No
S10	Anaerobic digestion without methane recovery	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries, so the sludge often produces less gas in the process of anaerobic digestion, and the benefits of sludge treatment projects are low, and the gas production of many anaerobic digestion projects are not up to the design value; in addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment[25]. Therefore, S10 can't be considered as an alternative.	No
S11	Anaerobic digestion with methane recovery and flaring	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries, so the sludge often produces less gas in the process of anaerobic digestion, and the benefits of sludge treatment projects are low, and the gas production of many anaerobic digestion projects are not up to the design	No

[25] http://qikan.cqvip.com/Qikan/Article/Detail?id=7105351862

		value; in addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment[25]. Therefore, S11 can not be considered as an alternative.	
S12	Anaerobic digestion with methane recovery and utilization for energy generation.	Sludge from wastewater treatment plants has the characteristics of high sand content and low organic matter in China, in which the organic matter content of sludge is only 30%-60%, much lower than 60%-75% in foreign countries, so the sludge often produces less gas in the process of anaerobic digestion, and the benefits of sludge treatment projects are low, and the gas production of many anaerobic digestion projects are not up to the design value; in addition, the high sand content will also cause a certain degree of damage to the anaerobic digestion equipment[25]. Therefore, S12 can not be considered as an alternative.	No

Identification of alternative scenarios – Electricity			
Option	Description	Credibility	**Conclusion**
E1	Power generation using fossil fuels in a captive power plant;	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E1 cannot be considered as an alternative.	No
E2	Electricity generation in the grid;	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E2 cannot be considered as an alternative.	No
E3	Electricity generation using renewable sources of energy.	Open anaerobic lagoon in the baseline scenario do not consume electricity. Therefore, E3 cannot be considered as an alternative.	No

Identification of alternative scenarios – Heat			
Option	Description	Credibility	**Conclusion**

H1	Heat generation using fossil fuels in a captive cogeneration plant;	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. Therefore, H1 cannot be considered as an alternative.	No
H2	Heat generation using fossil fuels in a boiler;	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. . Therefore, H2 cannot be considered as an alternative.	No
H3	Heat generation using renewable sources of energy.	Neither aerobic wastewater treatment plants nor open anaerobic ponds use fossil fuels to generate heat in a captive cogeneration plant. . Therefore, H3 cannot be considered as an alternative.	No

In summary, the remaining realistic and credible alternative scenarios for wastewater treatment processes are:

Alternative	Wastewater/Sludge /Electricity/Heat	Description
1	W2-S2	Aerobic wastewater treatment facilities (e.g. activated sludge or filter bed type treatment) with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery. This scenario is same to the project but is not a VCS project activity
2	W3-S2	Existing anaerobic open lagoons system without methane recovery and flaring with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery, for each of the 16 open anaerobic lagoons used in the pre-project scenario, the residence time of the organic matter are all one year, and depth are all more than 5m respectively. This scenario continue adopts best available and commonly used low-cost solution for wastewater treatment.

3.5 Additionality

Additionality for the project activity is demonstrated using Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0).

Step 1b: Consistency with mandatory laws and regulations

The above options are all considered to follow all mandatory applicable legal and regulatory requirements:

As per "Technical specifications for Anaerobic-Anoxic-Oxic activated sludge process" issued by Ministry of Ecology and Environment of the People's Republic of China, So aerobic sewage treatment technology is a typical sewage treatment method at present, which conforms to Chinese laws and regulations and can effectively prevent and control sewage pollution.

According to "Guideline on Best Available Technologies of Pollution Prevention and Control for Township-villages" issued by Ministry of environmental protection of the people's Republic of China, the open anaerobic lagoon is a kind of wastewater treatment method recognized by the state, which need minimum financial cost and is compliance with laws and regulations. Therefore, it is the most economic, viable and reasonable for project owners[26]. As per "Guiding opinions on promoting rural domestic sewage treatment"[27] issued by Ministry of agriculture and rural affairs of the people's Republic of China, the state actively promotes low-cost, low energy consumption, easy maintenance and high-efficiency sewage treatment technologies, oxidation lagoons (including anaerobic lagoons) and other ecological treatment modes.

And then as per overview of sludge treatment industry in China[28], at present, the treatment of sludge is still mainly landfill.

Therefore, the Scenario W2-S2: "Aerobic wastewater treatment facilities with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery" and Scenario W3-S2: Existing anaerobic open lagoons system without methane recovery and flaring with sludge being dried under controlled and aerobic conditions and its disposal in a landfill with methane recovery" are all consistency with mandatory laws and regulations. So, the outcome of Step 1b is unchanged from Step 1a.

The outcome of Step 1b is unchanged from Step 1a.

Step 2: Barrier analysis

There are no technology barriers, acceptability barriers and financial barriers that may prevent these two alternative scenarios to occur. As per Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0), go to Step 3 investment analysis.

Step 3: Investment analysis

As per paragraph 25 in section 4.4 of Tool 02 of Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0). Identify the financial indicator, such as IRR, NPV,

[26] https://www.mee.gov.cn/gkml/hbb/bgg/201307/W020130726461701943622.pdf

[27] http://www.moa.gov.cn/nybgb/2019/201907/202001/t20200103_6334298.htm

[28] http://pdf.dfcfw.com/pdf/H3_AP202008131398231167_1.pdf

cost benefit ratio, or unit cost of service (e.g. levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context. The unit cost of wastewater treatment (UCWT) has been used as the most meaningful indicator for the investment comparison analysis. The unit cost of service is calculated taking into consideration costs defined in the methodology: Land cost, Engineering, procurement and construction cost, operation and maintenance cost, administration cost, fuel cost, capital cost and interest, revenue from electricity and/or heat sales, all other costs of implementing the technology of each alternative option and all revenues generated by the implementation of the proposed technology except for carbon credits revenues.

Inputs to the financial analysis

The parameters required in calculating UCWT for the two remaining alternatives after step 2 are listed in Table 3-4 below

Table 3-4 Calculating UCWT for the two remaining alternatives

Financial analysis		
Parameters \ Alternatives	Value[29]	
	Alternative 1 (W2-S2)	Alternative 2 (W3-S2)
Construction Investment (10,000 RMB)	89,159.94	0
1 Annual Operation Cost (10,000 RMB):	8,075.65	3,196[30]
1.1 Power cost (10,000 RMB)	1,499.08	——
1.2 Salary and welfare cost (10,000 RMB)	1,920.00	——
1.3 Water cost (10,000 RMB)	153.46	——
1.4 Sludge treatment cost (10,000 RMB)	846.45	——
1.5 Reagent fee (10,000 RMB)	259.48	——
1.6 Maintenance cost (10,000 RMB)	243.23	——

[29] The data source for Alternative 1 is from FSR(which was issued on 15 February 2019), the data source for Alternative 2 is from Guideline on Project Construction and Investment for Rural Sewage Treatment.

[30] According to the "Guideline on Project Construction and Investment for Rural Sewage Treatment", the annual operation cost of anaerobic open lagoons is 0.5 RMB/m^3, so the operating cost is 175,150m^3/d×0.5RMB/m^3×365d=3,1960,000 RMB/year.

1.7 Management and other cost (10,000 RMB)	2,910.72	——
1.8 Depreciation of fixed assets (10,000 RMB)	243.23	——
Average Annual Total Cost (10,000 RMB)	11,936.81	4,362
Amount of Wastewater Treated (10000 m^3/Year)	6,393	6,393
UCWT (10,000 RMB)	1.87	0.68

The comparison of the two alternatives lead to the conclusion that based on the chosen parameters, anaerobic open lagoons system with sludge dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery, is the financially most attractive scenario.

Sensitivity analysis

A sensitivity analysis of +/- 10% on the following parameters was conducted:

a. Construction Investment;

b. Annual Operation Cost; and

c. Wastewater Treated.

Table 3-5 Sensitivity Analysis of UCWT on Construction Investment (Unit: RMB/m^3)

Construction Investment	**-10%**	**-5%**	**0%**	**5%**	**10%**	**Critical point**
Alternative 1 (W2-S2)	1.80	1.83	1.87	1.90	1.93	-206%
Alternative 2 (W3-S2)	0.5	0.5	0.5	0.5	0.5	

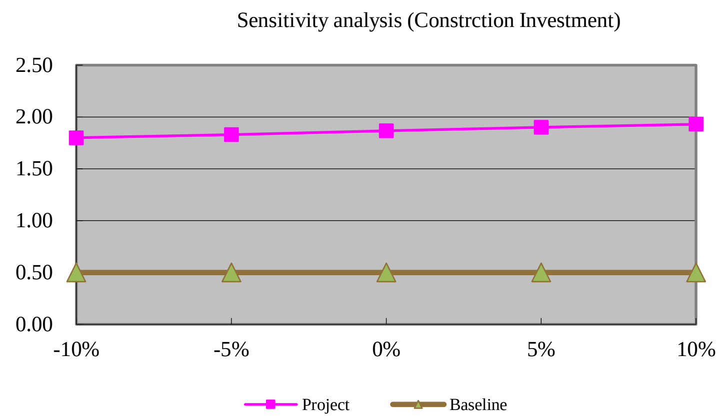


Figure 3-2 Sensitivity Analysis (Construction Investment)

According to Table 3-4, Alternative 2 is the most economical attractive alternative. The unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2 only when the construction cost of Alternative 1 decreases by 206%. The price index of investment in fixed asset for Guangdong Province has continued increased in recent years[31]. Therefore, it is not likely to implement the project activity with the Construction Investment reducing by 206%.

Table 3-6 Sensitivity Analysis of UCWT on Annual Operation Cost (Unit: RMB/m^3)

Annual Operation Cost	-10%	-5%	0%	5%	10%	Critical point
Alternative 1 (W2-S2)	1.75	1.81	1.87	1.93	1.99	-114%
Alternative 2 (W3-S2)	0.45	0.48	0.50	0.53	0.55	

[31] http://www.gd.gov.cn/zwgk/sjfb/sjkx/content/post_2090799.html

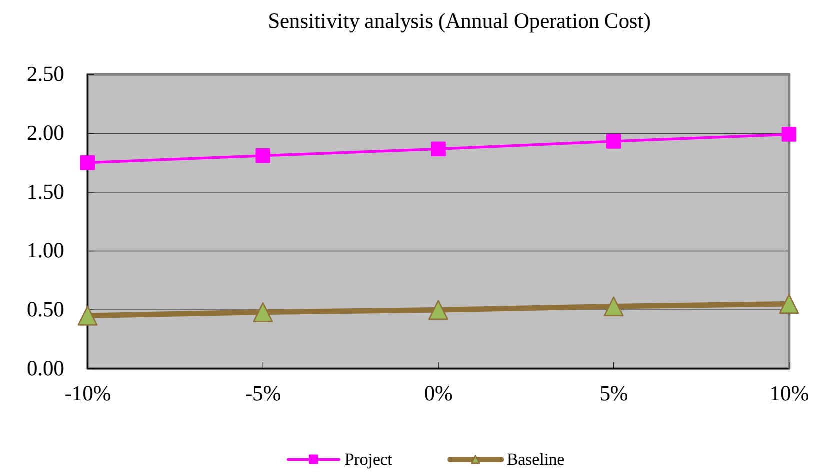


Figure 3-3 Sensitivity Analysis (Annual Operation Cost)

When the Annual Operation Cost decreases 114%, the unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2. The Annual Operation Cost mainly consist of power cost, salary and welfare cost, water cost, sludge treatment cost, reagent fee, maintenance cost, management and other management cost. According to the Feasibility Study Report, the above costs remain basically stable, so, it is not likely to decrease the Annual Operation Cost by 114%.

Table 3-7 Sensitivity Analysis of UCWT on Wastewater Treated (Unit: RMB/m^3)

Wastewater Treated	**-10%**	**-5%**	**0%**	**5%**	**10%**	**Critical point**
Alternative 1 (W2-S2)	2.07	1.97	1.87	1.78	1.70	270%
Alternative 2 (W3-S2)	0.56	0.53	0.50	0.48	0.45	

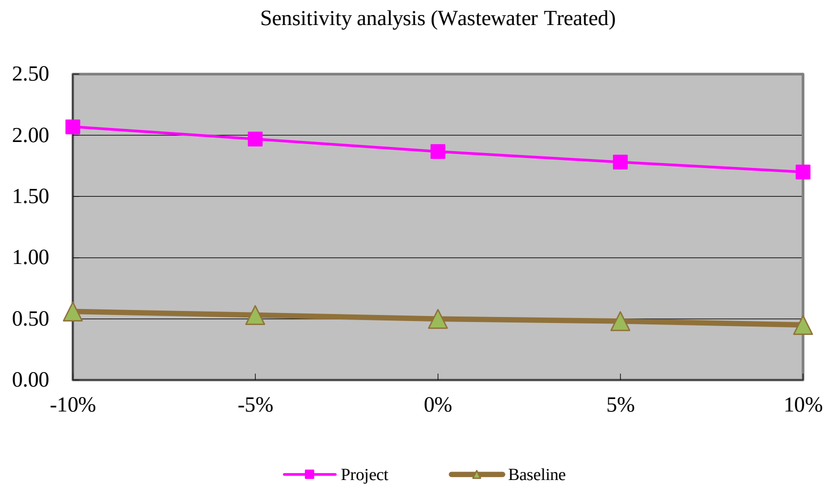


Figure 3-5 Sensitivity Analysis (Wastewater Treated)

When the Wastewater Treated increased by 270.00%, the unit wastewater treatment cost of Alternative 1 becomes the same as Alternative 2. However, from the wastewater treatment service agreement and the Feasibility Study Report of the project, the design treatment capacity of each wastewater treatment plant is already the maximum design value. A further 270% increase in the amount of wastewater to be treated is not possible. So, the increase in amount of wastewater treated by 270.00% is unrealistic.

The sensitivity analysis further confirms that construction of alternative 2 is the most economically attractive option. Compared with the proposed project activity under taken without being registered as a VCS project activity, construction of a new open anaerobic lagoon in several towns in Guangdong Province is the lowest cost option and is selected as the most economically attractive alternative.

According to the unit cost of wastewater treatment, alternative 2 is the most economically attractive option. Furthermore, the sensitivity analysis is conclusive and confirms the result of the investment comparison analysis.

Therefore, the lowest unit cost of wastewater treatment (alternative 2) is considered as the baseline scenario.

Investment analysis has been conducted in section B.4. As per Tool 24 Common practice (Version 03.1), Step 4 common practice analysis will be conducted as follows:

Step 4: Common practice analysis

The proposed project will achieve significant greenhouse gas (GHG) reductions by replacing open anaerobic lagoons in the baseline scenario with 16 aerobic wastewater plants. Therefore, according to the Tool 24“Common practice (version03.1), the measure of the proposed project belongs to “Methane formation avoidance”. Thus, sub-steps are adopted to take the common practice analysis

Sub-step 4a. The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above.

The proposed project is belonged to type (D) measure listed in the latest version of the Tool 24 common practice (version 03.1), i.e., Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation). As per additionality tool, the Tool 24 common practice (version03.1) available on the UNFCCC website is applied as below:

Sub-step 4a.1: calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

As described in section 1.1 of this JPM, the total design treatment capacity of 16 wastewater treatment plants of the project is 175,150 m^3/d, so treatment capacity of wastewater treatment projects between 87,575 m^3/d - 262,725 m^3/d a re included in the range of similar projects.

Sub-step 4a.2: identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

Guangdong Province is selected as the applicable geographical area for the common practice, and the reasons are detailed as follows:

- Due to the differences of economic development level, population size, industrial structure, fundamental infrastructure, strategic planning etc, the investment environment of each province in China varies widely. Therefore, a project in the same province as the proposed project (i.e. Guangdong Province) was selected as a similar project.

In summary, the waste water treatment projects within the same province are selected for the common practice analysis.

(b) The projects apply the same measure as the proposed project activity;

Projects using aerobic biological treatment technology for wastewater treatment should be used.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

The project is an aerobic wastewater treatment process, the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001) " (40mg/L), sludge will be dried under controlled and aerobic conditions, with disposal in a landfill with methane recovery;

Besides, the following conditions should also be fulfilled:

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

(e) If similar projects can use the aerobic wastewater treatment process, and the sludge produced by the project is dried under controlled and aerobic conditions, and then transported to the landfills with methane recovery for landfill treatment, it shall be considered as a comparable service. The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

Based on the calculation in Sub-step 4a.1, the treatment capacity ranges of similar project are that can treat wastewater from 87,575 m^3/d - 262,725 m^3/d.

(f) The projects started commercial operation before the project design document is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project act.

The similar project started commercial operation before the start date of the project at 03-September-2020, which is earlier date.

Based on the above analysis, it can be concluded that the similar project belongs to "avoiding methane formation" with treatment of wastewater treatment before 03-September-2020, the aerobic wastewater treatment process is used, the treated effluent meets the Level A standard of the "Emission Standard for Pollutants from Municipal Wastewater Treatment Plants (GB18918-2002)" and the level 1 standard of the Guangdong local standards "water pollutants emission limits (DB44/26-2001) " (40mg/L), and the sludge is dried under controlled and aerobic conditions, and then transported to the landfills with methane recovery for landfill treatment, the wastewater treatment capacity is 87,575 m^3/d–262,725 m^3/d in Guangdong Province, which is similar to the proposed project activities.

Sub-step 4a.3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

Through searching UNFCC website[32], CDM website[33], China CER exchange info-platform[34], GS website[35], VCS website[36], Guangdong Provincial Statistics Bureau website[37]. local Development

[32] https://unfccc.int/

[33] https://cdm.unfccc.int/

[34] https://cdm.ccchina.org.cn/zylist.aspx?clmId=160

[35] https://www.goldstandard.org/

[36] https://verra.org/

[37] http://stats.gd.gov.cn/

and Reform Commission of Guangdong Province website[38] and other public information, there are no similar projects, therefore N_{all}=0

Sub-step 4a.4: within similar projects identified in Step 3, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

N_{diff}=0

Sub-step 4a.5: calculate factor F=1-N_{diff}/N_{all} representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

According to the analysis above, N_{all}= N_{diff}, and the factor F=1-N_{diff}/N_{all}=1-1 =0<0.2. Therefore, the result of common practice assessment is: N_{all}-N_{diff}=0 < 3. Therefore, the proposed activity is not a common practice in the region.

Conclusion of the assessment and demonstration of additionality

As per paragraph 18 of Tool 24 Common practice (Version 03.1), the proposed project activity is not a “common practice” within a sector in the applicable geographical area.

As per paragraph 40 of Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0), the project activity is additional.

3.6 Methodology Deviations

There is no methodology deviation for the project.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

This section details the applicable formulas from the methodologies applied to the project Activity. The baseline emission of the project may have consisted of the following emission sources in water treatment, sludge treatment, transport and energy consumption:

i) Baseline methane emissions from anaerobic treatment of the wastewater in open lagoons;

ii) Baseline emissions on account of decomposition of final sludge;

[38] http://drc.gd.gov.cn/

iii) Baseline emissions associated with electricity generation avoided, equivalent to electricity generated with biogas recovery in project activity;

iv) Baseline carbon dioxide emissions on account of heat consumption in water and sludge treatment processes;

Therefore, baseline emissions can be calculated as:

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2e/year)
$BE_{CH_4,ww,y}$	=	Methane emissions from anaerobic treatment of the wastewater in the baseline scenario in year y (tCO_2e/year)
$BE_{CH_4,sl,y}$	=	Methane emissions from treatment of sludge in the baseline scenario in year y (tCO_2e/year)
$BE_{EL,y}$	=	CO_2 emissions associated with electricity generation that is displaced by the project activity and/or electricity consumption in the baseline scenario in year y (tCO_2/year)
$BE_{HG,y}$	=	CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year y (tCO_2/year)
$BE_{TR,sl,y}$	=	CO_2 emissions associated with transportation of sludge in the baseline scenario in year y(tCO_2/year)

i). Calculation of baseline emissions from treatment of wastewater ($BE_{CH4,ww,y}$):

$$BE_{CH_4,ww,y} = GWP_{CH_4} \times B_o \times COD_{BL,ww,y} \times MCF_{BL,ww,y} \quad (2)$$

Where:

$BE_{CH_4,ww,y}$	=	Methane emissions from anaerobic treatment of the wastewater in the baseline scenario in year y (tCO_2e/year)
GWP_{CH_4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
B_o	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
$COD_{BL,ww,y}$	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
$MCF_{BL,ww,y}$	=	Average baseline methane conversion factor in year y, representing the fraction of organic load that would be degraded to CH_4 in the baseline scenario (fraction)

$COD_{BL,ww,y}$=$AD_{BL} \times COD_{PJ,ww,y}$[39] (3)

Where：

$COD_{BL,ww,y}$	=	Quantity of chemical oxygen demand that would have been treated in the baseline scenario in year y (tCOD/year)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$COD_{PJ,ww,y}$	=	Quantity of chemical oxygen demand that is treated in the aerobic wastewater treatment plant in the project activity in year y (tCOD/year)

With $COD_{PJ,ww,y}$=$\sum Q_{PJ,ww,y} \times W_{PJ,COD,ww,m}$ (4)

Where：

$Q_{PJ,ww,y}$	=	Quantity of wastewater that is treated in the aerobic wastewater plant in the project activity in month m
$W_{PJ,COD,ww,m}$	=	Average Chemical Oxygen Demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m
m	=	Months of year y of the crediting period

With AD_{BL}=$(1 - (COD_{BL,out,x}/COD_{BL,in,x}))$[40] (5)

[39] According to page 10 of methodology, if there would be an effluent from the lagoons in the baseline, $COD_{BL,ww,y}$ should be adjusted by an effluent adjustment factor which relates the COD supplied to the lagoon with the COD in the effluent. In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoons instead of the newly-build anaerobic lagoons, so the calculation formula of $COD_{BL,ww,y}$ should be the formula (4) of page 10 in methodology.

[40] In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoons. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoons in 2018(From 01-January-2018 to 31-December-2018). Please see the feasibility study report for more details. Therefore, according to page 9 of methodology, ADBL should be calculated according to the Option A of page 9 in the methodology.

Where：

AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$COD_{BL,out,x}$	=	COD of the effluent of open lagoons in the baseline scenario in the period x (tCOD)
$COD_{BL,in,x}$	=	COD directed to the open lagoons in the baseline scenario in the period x (tCOD)
x	=	Representative historical reference period (at least one year)

Determination of $MCF_{BL,ww,y}$

The quantity of methane generated from COD disposed to the open lagoon depends mainly on the temperature and the depth of the lagoon. Accordingly, the methane conversion factor is calculated based on a factor $f_{BL,d}$, expressing the influence of the depth of the lagoon on methane generation, and a factor $f_{BL,T,y}$ expressing the influence of the temperature on the methane generation. In addition, a conservativeness factor of 0.89 is applied to account for the considerable uncertainty associated with this approach. For the purpose of ex ante estimations, $f_{BL,d}$ and $f_{BL,T,y}$ will be calculated by referring to the local historical temperature data from the Meteorological Bureau. $MCF_{BL,ww,y}$ is calculated as follows:.

With $MCF_{BL,ww,y}$=$f_{BL,d} \times f_{BL,T,y}$×0.89 (6)

Where:

$MCF_{BL,ww,y}$	=	Average baseline methane conversion factor in year y, representing the fraction of organic load that would be degraded to CH_4 in the baseline scenario (fraction)
$f_{BL,d}$	=	Factor expressing the influence of the depth of the lagoon on methane generation (fraction)
$f_{BL,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y(fraction)
0.89	=	Conservativeness factor

For the purpose of ex ante estimations, IPCC default values of methane conversion factors ($MCF_{BL,ww,y}$) for different treatment types and conditions should be used as per IPCC Guidelines. As per baseline survey report, the depth of the local anaerobic lagoons system of the project is more than 5 m, and then as per table 6.8 of chapter 6 in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, when the depth of anaerobic system is greater than 5m, the default value of MCF is 0.8. Referring to the local historical average temperature of the project[41], the calculation results of $MCF_{BL,ww,y}$ are all lower than 0.8 (See the calculation results shown in the following table). Therefore, if the calculation value is used, the results will be more conservative. Therefore, $MCF_{BL,ww,y}$ will use the calculated value instead of the default value of IPCC.

Determination of $f_{BL,T,y}$

$f_{BL,T,y}$ will be calculated by formula (8) on page 10 of methodology, for ex-ante calculation, the local historical temperature data will be used[41]. The calculation formula is as follows: *With* $f_{BL,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{BL,available,m}}{\sum_{m=1}^{12} AD_{BL} \times Q_{PJ,ww,m} \times w_{PJ,ww,COD,m}}$ (7)

Where:

$f_{BL,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y(fraction)
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m(fraction)
$COD_{BL,available,m}$	=	Quantity of chemical oxygen demand available for degradation in month m (tCOD)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$Q_{PJ,ww,m}$	=	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (m^3)
$w_{PJ,ww,COD,m}$	=	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m ($tCOD/m^3$)
m	=	Months of year y of the crediting period

$$With\ f_{T,m} = \begin{cases} 0 \quad if\ T_{2,m} < 283K \\ exp\left(\frac{E \times (T_{2,m} - T_1)}{R \times T_1 \times T_{2,m}}\right) \quad if\ 283K < T_{2,m} < 303K \\ 1 \quad if\ T_{2,m} > 303K \end{cases} \qquad (8)$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m(fraction)
E	=	Activation energy constant (15,175 cal/mol)

[41] https://m.tianqi.com/qiwen/city/

T1	=	303.16 K (273.16 K + 30 K)
R	=	Ideal gasconstant (1.987 cal/K.mol)
$T_{2,m}$	=	Average temperature at the project site in month m (K)
m	=	Months of year y of the crediting period

As indicated in the equation above, the value of $f_{T,m}$ cannot exceed 1 and should be assumed to be zero if the ambient temperature is below 10°C.

Determination of $COD_{BL,available,m}$

The quantity of chemical oxygen demand available for degradation in the open lagoon for each month m, is given by the balance of the quantities of wastewater directed to the lagoon, the quantity of organic compounds that decay in the lagoons, and the quantity of any effluent water from the lagoon. Therefore, $COD_{BL,available,m}$ is assumed to be equal to the amount of organic matter directed to the open lagoon, less any effluent, plus the COD that may have remained in the lagoon from previous months.

The baseline scenario of the project is that the wastewater continues to be treated by the open anaerobic lagoons, as per the baseline survey report, the retention time of organic matter in the local anaerobic lagoons of the project is 1 year. The calculation formula is as follows:

With $COD_{BL,available,m}$=$AD_{BL} \times Q_{PJ,ww,m} \times w_{PJ,ww,m}$×(1-$f_{T,m}$)×$COD_{BL,available,m-1}$ (9)

Where:

$COD_{BL,available,m}$	=	Quantity of chemical oxygen demand available for degradation in month m (tCOD)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons in the baseline scenario (fraction)
$Q_{PJ,ww,m}$	=	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m (m^3)
$w_{PJ,ww,m}$	=	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m ($tCOD/m^3$)
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m (fraction)
$COD_{BL,available,m-1}$	=	Months of year y of the crediting period

m = Months of year y of the crediting periodThe results of each wastewater treatment plant are summarized as the following table. Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

The ex-ante baseline emissions from treatment of wastewater are calculated as:

Wastewater Treatment Plant	$BE_{CH_4,ww,y}$ tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	2,725

Qujie Town wastewater Treatment Plant	3,849
Xinyi City Dingbao Town wastewater treatment Plant	1,212
Xinyi City Qianpai Town wastewater treatment Plant	3,122
Xianqiao South Wastewater Treatment Plant	5,503
Qiankeng Town North wastewater Plant	4,901
Shangsha Town wastewater Treatment Plant	5,450
Baita Town wastewater Treatment Plant	3,713
Luoding Fourth Domestic wastewater Treatment Plant	11,558
Shitan Town wastewater Treatment Plant	3,270
Litan Town wastewater Treatment Plant	3,846
jiulong Town wastewater Treatment Plant	2,694
Shakou Town wastewater Treatment Plant	5,399
Bomei Town wastewater Treatment Plant	17,605
Nantang Town wastewater Treatment Plant	17,119
Chikeng Town wastewater Treatment Plant	3,168

ii). Calculation of baseline emissions from treatment of sludge ($BE_{CH4,sl,y}$)

Based on the analysis of the baseline scenario in Section 3.4, the sludge that produced in the baseline scenario from the treatment of wastewater in the open lagoons system was treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recovery (S2), the corresponding methane emissions ($BE_{CH4,sl,y}$) are considered to be negligible and are not accounted for.

Therefore, the baseline emissions from treatment of sludge are calculated as:

$BE_{CH_4,sl,y}$=0 tCO_2e/year

iii). Calculation of baseline emissions from consumption of electricity ($BE_{EL,y}$)

There is no power consumption in this baseline scenario. Therefore, the baseline emissions from treatment of sludge are calculated as:

$BE_{EL,y}$=0 tCO_2e/year

iv). Baseline emissions from the generation of heat ($BE_{HG,y}$)

There are no emissions from the generation of heat in this baseline scenario, therefore, the baseline emissions from treatment of sludge are calculated as:

$BE_{HG,y}$=0 tCO_2e/year

v). Baseline emissions from transportation of sludge ($BE_{TR,sl,y}$)

The baseline emissions resulting from transportation of sludge that was produced in the baseline scenario should be calculated as:

$$BE_{TR,sl,y} = \sum_i N_{BL,i,y} \times D_{BL,i} \times F_{BL,i} \times NCV_{BL,j} \times EF_{BL,j} \quad (10)$$

Where:

$BE_{TR,sl,y}$	=	CO_2 emissions associated with transportation of sludge in the baseline scenario in year y (tCO_2/year)
$N_{BL,i,y}$	=	Number of trips (vehicle of type i with similar loading capacity) for transportation of the sludge that would have been produced in the baseline scenario in year y (trips)
$D_{BL,i}$	=	Average distance per trip, that would have been travelled by the transportation vehicle of type i, for transportation of sludge in the baseline scenario (km)
$F_{BL,i}$	=	Specific fuel consumption of the transportation vehicle of type i (mass or volume units of fuel/km)
$NCV_{BL,j}$	=	Net calorific value of the transportation fuel j (TJ/mass or volume units)
$EF_{BL,j}$	=	CO_2 emission factor of the transportation fuel j (tCO_2/TJ)
i	=	Vehicle type
j	=	Fuel type used in vehicles
y	=	Year of the crediting period

If the emissions associated with transportation of sludge in the baseline scenario and in the project scenario are found to be comparable (i.e. within +1% range) or emissions in the project scenario are lower, then both can be excluded in the calculation of baseline emissions and project emissions as a simplification. According to Section 4.1 and 4.2 of Chapter 4, the ex-ante calculated values of project emissions and baseline emissions due to sludge transportation are: $BE_{TR,sl,y}$ =49.83 tCO_2e/year; $PE_{TR,sl,y}$ =217.18 tCO_2e/year. Since $PE_{TR,sl,y}$ > $BE_{TR,sl,y}$ and ($PE_{TR,sl,y}$ / $BE_{TR,sl,y}$-1) = 335.8%>1%, so the emissions associated with transportation of sludge in the baseline scenario and in the project scenario cannot be simplified.

Determination of $N_{BL,i,y}$

$$N_{BL,i,y} = \frac{Q_{BL,sl,y}}{q_{BL,i}} \quad (11)$$

Where：

$N_{BL,i,y}$	=	Number of trips (vehicle of type i with similar loading capacity) for transportation of final sludge generated by the waste water treatment system in the baseline scenario in the year y (trips)
$Q_{BL,sl,y}$	=	Quantity of sludge that would have been produced and treated in the baseline scenario in the year y (tonnes)
$q_{BL,i}$	=	Average vehicular capacity of the transportation vehicle of type i (tonnes/trip)

y = Year of the crediting period

The results of each wastewater treatment plant are summarized as the following table. Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

The ex-ante baseline emissions from transportation of sludge are calculated as:

Wastewater Treatment Plant	$BE_{TR,sl,y}$ tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	0.61
Qujie Town wastewater Treatment Plant	1.15
Xinyi City Dingbao Town wastewater treatment Plant	0.64
Xinyi City Qianpai Town wastewater treatment Plant	0.84
Xianqiao South Wastewater Treatment Plant	3.87
Qiankeng Town North wastewater Plant	1.90
Shangsha Town wastewater Treatment Plant	4.87
Baita Town wastewater Treatment Plant	1.65
Luoding Fourth Domestic wastewater Treatment Plant	1.58
Shitan Town wastewater Treatment Plant	4.89
Litan Town wastewater Treatment Plant	4.51
jiulong Town wastewater Treatment Plant	2.64
Shakou Town wastewater Treatment Plant	3.98
Bomei Town wastewater Treatment Plant	9.41
Nantang Town wastewater Treatment Plant	6.16
Chikeng Town wastewater Treatment Plant	1.14
Total	49.83

Therefore, baseline emissions can be calculated as

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y}$$

$$= BE_{CH_4,ww,y} + BE_{TR,sl,y}$$

Wastewater Treatment Plant	BE tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	2,725
Qujie Town wastewater Treatment Plant	3,850
Xinyi City Dingbao Town wastewater treatment Plant	1,212

Xinyi City Qianpai Town wastewater treatment Plant	3,122
Xianqiao South Wastewater Treatment Plant	5,506
Qiankeng Town North wastewater Plant	4,902
Shangsha Town wastewater Treatment Plant	5,455
Baita Town wastewater Treatment Plant	3,714
Luoding Fourth Domestic wastewater Treatment Plant	11,560
Shitan Town wastewater Treatment Plant	3,274
Litan Town wastewater Treatment Plant	3,850
jiulong Town wastewater Treatment Plant	2,696
Shakou Town wastewater Treatment Plant	5,403
Bomei Town wastewater Treatment Plant	17,614
Nantang Town wastewater Treatment Plant	17,124
Chikeng Town wastewater Treatment Plant	3,169
Total	95,176

4.2 Project Emissions

The project emissions associated with project wastewater and sludge treatment systems may consist of the following emissions sources;

i) Methane emissions on account of inefficiency of the wastewater treatment system;

ii) Project emissions from physical leakage of methane from anaerobic digesters and flare system;

iii) Project N_2O emissions on account of energy final sludge land application;

iv) Project emissions on account of energy consumption (electrical and/or thermal) of the wastewater and sludge treatment systems;

v) Project emissions from fossil fuel consumption in the project activity;

vi) Project emissions on account of transportation of final sludge produced.

Project emissions are calculated as follows:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y} \quad (12)$$

Where：

PE_y = Project emissions in the year y (tCO_2e/year)

$PE_{CH_4,ww,y}$	=	Project emissions from inefficiency of the wastewater treatment system and presence of degradable organic carbon in the treated wastewater.
$PE_{CH_4,sl,y}$	=	Methane emissions from treatment of sludge in the project activity in year y (tCO_2/year).
$PE_{N_2O,sl,y}$	=	Project N_2O emissions on account of energy final sludge land application.
$PE_{EC,y}$	=	Project emissions associated with electricity consumption in the project activity.
$PE_{FC,y}$	=	Project emissions associated with fossil fuel consumption in the project activity.
$PE_{TR,sl,y}$	=	Project emissions on account of transportation of final sludge produced in the year y(tCO_2/annum).

i) Methane emissions from treatment of wastewater ($PE_{CH4,ww,y}$)

Project emissions due to wastewater treatment comprise two components, emissions from the aerobic wastewater treatment plant due to inadequate operation and/or overloading, and emissions due to the presence of degradable organic carbon in the treated wastewater after leaving the aerobic wastewater treatment plant:

$$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_{4,},effl,y} \quad (13)$$

Methane emissions from the aerobic wastewater treatment plant $PE_{CH_4,wwtp,y}$:

Due to the highly site specific nature of the factors leading to the development of anaerobic conditions in aerobic wastewater treatment plants, it is difficult to provide a clear-cut procedure and monitoring parameters to determine CH_4 emissions for plants under inadequate operational conditions. This methodology applies a proxy parameter, the oxidisation ratio (OR) described further below. In order to conservatively account for emissions, the higher value (MCF=0.4) of the IPCC MCF range for aerobic treatment plant should be used if the oxidisation ratio (OR) is out of an acceptable range. If the oxidisation ratio is within the acceptable range, emissions should be considered zero.

Therefore, methane emissions from the aerobic wastewater treatment plant in year y due to inadequate operation and/or overloading should be calculated as follows:

If $OR_i \geq 0.8$, $PE_{CH_4,wwp,y} = 0$ (14)

If $OR_i < 0.8$, $PE_{CH_4,wwp,y} = \sum_{i=1}^{365} GWP_{CH_4} \times B_{0,ww} \times 0.4 \times (COD_{PJ,ww,i} - COD_{PJ,effl,i})$ (15)

Where:

$PE_{CH_4,wwtp,y}$	=	Methane emissions from the aerobic wastewater treatment plant in year y due to inadequate operation and/or overloading (tCO_2e/year);
$PE_{CH_{4,},effl,y}$	=	Methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant in year y (tCO_2e/year);
OR_i	=	Oxidisation ratio, representing the ratio between organic matter in the output and organic matter in the input of the aerobic wastewater treatment plant in day i of year y (fraction);

GWP_{CH_4}	=	Global Warming Potential of CH_4. (tCO_2/tCH_4);
$B_{0,ww}$	=	Maximum methane producing capacity of the wastewater treated in the year y.(Faction)
0.4	=	Default methane conversion factor (MCF) for not well managed plants (fraction);
$COD_{PJ,ww,i}$	=	Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD);
$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD).

The quantities of chemical oxygen demands in the wastewater and effluent are calculated as follows:

$$COD_{PJ,ww,i}=Q_{PJ,ww,i} \times w_{PJ,COD,ww,i} \quad (16)$$

$$COD_{PJ,effl,i}=Q_{PJ,effl,i} \times w_{PJ,COD,effl,i} \quad (17)$$

Where:

$COD_{PJ,ww,i}$	=	Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD)
$Q_{PJ,ww,i}$	=	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in day i of year y (m^3)
$w_{PJ,COD,ww,i}$	=	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in day i of year y ($tCOD/m^3$)
$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)
$Q_{PJ,effl,i}$	=	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i of year y (m^3)
$w_{PJ,COD,effl,i}$	=	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i of year y ($tCOD/m^3$)

Determination of the oxidisation ratio (OR_i)

The determination of whether the aerobic wastewater treatment system is well operated (managed) or not is made by monitoring the quality of the wastewater at the outlet of the treatment plant to make sure it meets the target specified in the design of the project activity. If it does meet this requirement it can be trusted to be a well-managed facility with little to no CH_4 emissions during the project implementation. In many developing countries the urban areas either do not have separate storm water drain systems or the storm water drain systems do not work properly. Due to this reason, during rainy seasons, the wastewater gets diluted from the ingress of rainwater before reaching the treatment plant. Because of the dilution effect, the COD in the wastewater decreases and can appear within the acceptable range even if the treatment plant is not in operation;

The legislation in many of the developing countries specifies the maximum limit for wastewater COD, but the legislation generally does not specify the particular wastewater treatment technology which should be used to achieve the objective. It is possible to achieve an acceptable level of COD in the final effluent by diluting it (directly mixing water to it) just before it is discharged into the final receiving body (mostly fresh water streams).

In fact, according to the feasibility study report, the project does not have the above two problems.

To address these two issues, the following approach is suggested:

$$OR_i = \frac{COD_{PJ,ww,i} - COD_{PJ,effl,i}}{COD_{PJ,ww,i}} \quad (18)$$

Where:

OR_i	=	Oxidisation ratio, representing the ratio between organic matter in the output and organic matter in the input of the aerobic wastewater treatment plant in day i of year y (fraction)
$COD_{PJ,ww,i}$	=	Quantity of chemical oxygen demand that enters the aerobic wastewater treatment plant in the project activity in the day i of year y (tCOD)
$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)

After calculation, the OR_i of each wastewater treatment plants is greater than 0.8, so $PE_{CH_4,wwtp,y}$=0 tCO_2e/year. Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

ii). **Methane emissions due to the presence of degradable organic carbon in the effluent $PE_{CH4,effl,y}$**

The methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant are calculated as:

$$PE_{CH_4,effl,y} = GWP_{CH_4} \times MCF_{PJ,effl,y} \times \sum_{i=1}^{365} COD_{PJ,effl,i} \times B_0 \quad (19)$$

Where:

$PE_{CH_4,effl,y}$	=	Methane emissions due to the presence of degradable organic carbon in the effluent from the aerobic wastewater treatment plant in year y (tCO_2e/year)
GWP_{CH_4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
$MCF_{PJ,effl,y}$	=	Average methane conversion factor in year y, representing the fraction of organic load in the effluent that is degraded to CH_4 in year y. The factor is based on the type of treatment and discharge pathway of the effluent of the aerobic wastewater treatment plant (fraction)
B_0	=	Maximum methane producing capacity of wastewater treated in the year y, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (tCH_4/tCOD)

$COD_{PJ,effl,i}$	=	Quantity of chemical oxygen demand in the effluent of the wastewater treatment plant in the project activity in the day i of year y (tCOD)
y	=	Year of the crediting period

Determination of $MCF_{PJ,effl,y}$

$$MCF_{PJ,effl,y} = f_{PJ,d,y} \times f_{PJ,T,y} \times 0.89 \qquad (20)$$

Where:

$MCF_{PJ,effl,y}$	=	Average baseline methane conversion factor in year y, representing the fraction of organic load in the effluent that is degraded to CH_4 in year y. The factor is based on the type of treatment and discharge pathway of the effluent of the aerobic wastewater treatment plant (fraction)
$f_{PJ,d,y}$	=	Factor expressing the influence of the depth on methane generation in year y
$f_{PJ,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y
0.89	=	Conservativeness factor

As per the methodology, for the purpose of ex ante estimations, IPCC default values of methane conversion factors (MCF) for different treatment types and conditions should be used as per IPCC Guidelines.

In this time, as per table 6.8 of chapter 6 in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, for a well-managed aerobic wastewater treatment plant, the default value of MCF is 0. The calculation results of $MCF_{PJ,effl,y}$ is 0 (See the calculation results shown in the following table). Therefore, the IPCC value is actually the same as the calculated value. In order to maintain the integrity of the calculation process, the calculated value is still used this time.

Determination of $f_{PJ,T,y}$

$$f_{PJ,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{PJ,available,m}}{\sum_{m=1}^{12} Q_{PJ,effl,m} \times w_{PJ,COD,effl,m}} \qquad (21)$$

Where:

$f_{PJ,T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year y
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m
$COD_{PJ,available,m}$	=	Quantity of chemical oxygen demand in the effluent from the aerobic wastewater treatment plant available for degradation in month m (tCOD)
$Q_{PJ,effl,m}$	=	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (m^3)
$w_{PJ,COD,effl,m}$	=	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y ($tCOD/m^3$)
m	=	Months of year y of the crediting period

$$With\ f_{T,m} = \begin{cases} 0 \quad if\ T_{2,m} < 283K \\ exp\left(\frac{E\times\ (T_{2,m}-T_1)}{R\times T_1\times T_{2,m}}\right)\ if\ 283K < T_{2,m} < 303K \\ 1\ \ if\ T_{2,m} > 303K \end{cases} \qquad (22)$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m (fraction)
E	=	Activation energy constant (15,175 cal/mol)
T_1	=	303.16 K (273.16 K + 30 K)
R	=	Ideal gasconstant (1.987 cal/K.mol)
$T_{2,m}$	=	Average temperature at the project site in month m (K)
m	=	Months of year y of the crediting period

As indicated in the equation above, the value of $f_{T,m}$ cannot exceed 1 and should be assumed to be zero if the ambient temperature is below 10°C.

$$COD_{PJ,available,m} = Q_{PJ,effl,m} \times w_{PJ,COD,effl,m} + \left(1 - f_{T,m}\right) \times COD_{PJ,available,m-1} \qquad (23)$$

Where:

$COD_{PJ,available,m}$	=	Quantity of chemical oxygen demand available for degradation in the effluent from the aerobic wastewater treatment plant in month m (tCOD)
$Q_{PJ,effl,m}$	=	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y (m^3)
$w_{PJ,COD,effl,m}$	=	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in month m of year y ($tCOD/m^3$)
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month m
$COD_{PJ,available,m-1}$	=	Months of year y of the crediting period
m	=	Months of year y of the crediting period

Methane emissions due to the presence of degradable organic carbon in the effluent are calculated as:

$PE_{CH4,effl,y}$=0 tCO_2e/year

Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

So the methane emissions from treatment of wastewater ($PE_{CH4,ww,y}$) can be calculated as:

$PE_{CH_4,ww,y} = PE_{CH_4,wwtp,y} + PE_{CH_4,,effl,y}$ = 0 tCO_2e/ year+0 tCO_2e/year=0 tCO_2e/year

iii). Methane emissions from treatment of sludge in the project activity in year y ($PE_{CH4,sl,y}$)

Sludge in this project activity is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery or used in soil application, corresponding project emissions are considered to be negligible and should not be accounted for.

Therefore:

$PE_{CH_4,sl,y}$=0 tCO_2e/year

iv). N_2O emissions from treatment of sludge in the project activity in year y ($PE_{N2O,sl,y}$)

Nitrous oxide emissions are assumed to be negligible and need not be accounted for if the sludge is:

- Dried under controlled and aerobic conditions, and then disposed to a landfill; or,
- Treated in a new anaerobic digester and the residues from the anaerobic digester are dehydrated, limed and stored before final disposal in a controlled landfill.

As per FSR[1] of the project activity, sludge generated by the project activity will be dried under controlled and aerobic conditions, with disposal in 16 Landfill Sites with methane recovery. Therefore:

$PE_{N2O,sl,y} = 0$ tCO_2e/year

v). Project emissions associated with electricity consumption in the project activity ($PE_{EC,y}$)

Project emissions from electricity consumption ($PE_{EC,y}$) used to run the entire aerobic wastewater treatment plant shall be calculated using Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0). Electricity consumption from each relevant plant should be monitored and summed up to EC_y

As per paragraph 16 of Tool 05 (Version 03.0), project emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$PE_{Ec,y} = \sum j\, EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \qquad (24)$$

Where:

$PE_{Ec,y}$	=	Project emissions from electricity consumption in year y (t CO_2/yr).
$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
$EF_{EL,j,y}$	=	Emission factor for electricity generation for source j in year y(t CO_2/MWh).
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year y.

The electricity consumed by facilities of the 16 wastewater treatment plant systems is sourced from local power grid connected to South China Power Grid (SCPG). Scenario A: Electricity consumption from the grid is applied to the proposed project. For project electricity consumption sources, a default value of 20% is used for $TD_{Lj,y}$.

Determination of the emission factor for electricity generation ($EF_{EL,j,y}$)

For the project, the actual electricity consumption of the 16 wastewater treatment plant during the operation period is sourced from the local grid company. "Scenario A: electricity consumption from the grid "is consistent with the situation of the project. So "Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" (($EF_{EF,j,\ y}$=($EF_{grid,CM,\ y}$)(version 07.0) is applied.

For project electricity consumption sources, a default value of 20% is used for $TDL_{j,y}$.

Step 1. Identify the relevant electricity system

According to the Tool, project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity. The Chinese DNA has published a delineation of the project electricity system and connected electricity system. According to the delineation, the project electricity system of the local grid to which the Project activity is connected is SCPG.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

For the operating margin, "Option I: only grid power plants are included in the calculation" was selected.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor $(EF_{grid,OM,y}\ )$ is based on the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM.

Detailed information to carry out a dispatch data analysis is not publicly available; therefore, method (b) and method (c) is not suitable for the project.

As annual data from each power plant on power generation, fuel type and fuel consumption are available, and low-cost / must-run resources constitute 49.09%, which is less than 50% of total grid generation. Therefore, the simple OM method is chosen for the calculation of the OM emission factor $EF_{grid,OM,y}$.

The Simple OM can be calculated using either of the two following data vintages for years(s) y:

(a) (Ex-ante option): If the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

(b) (Ex-post option): If the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring.

Here ex-ante vintage is chosen, and the $EF_{grid,OM,y}$ is fixed during the second crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method.

The Simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit, or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimpl,y} = \frac{\sum_{i,m} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{m} EG_{y}} \quad (25)$$

Where:

$\boldsymbol{EF_{grid,OMsimpl,y}}$ = simply operating margin CO_2 emission factor in year y (tCO_2/MWh)

$\boldsymbol{FC_{i,y}}$ =Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit).

$\boldsymbol{NCV_{i,y}}$ =Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)

$\boldsymbol{EF_{CO2,i,y}}$ =CO_2 emission factor of fuel type i in year y (tCO_2/GJ)

$\boldsymbol{EG_{y}}$ =Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)

$\boldsymbol{i}$ =All fuel types combusted in power sources in the project electricity system in year y

$\boldsymbol{y}$ =The relevant year as per the data vintage chosen in Step 3

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. In this JPM, the Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2016-2018. Emission factors ($EF_{CO2,i,y}$) of each type of fossil fuel come from 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories default values.

The Simple OM Emission Factor ($EF_{grid,OMsimpl,y}$) of the project is calculated based on the fuel consumption data for electricity generation of the NWPG, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the China Electric Power Yearbook (2016~2018, published annually) and China Energy Statistical Yearbook (2016~2018).

Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the SCPG is calculated as 0.8042 tCO_2e/MWh.

STEP 5. Calculate the build margin emission factor

In terms of vintages of data, project participants can choose between one of the following two options:

Option 1 For the first crediting period, calculate the build margin emission factor, ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the second crediting period should be used. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2 For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The JPM chooses Option 1, which requires the project participant to calculate the Build Margin Emission Factor $EF_{grid,BM,y}$, ex-ante based on the most recent information available on units already built for sample group m at the time of JPM submission.

According to the "Tool to calculate the emission factor for an electricity system", the build margin emissions factor ($EF_{grid,BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2e/MWh) of all power units m during the most recent year y for which power generation data is available. The calculation equation is as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \tag{26}$$

Where:

$\boldsymbol{EF_{grid,BM,y}}$ =Build margin CO_2 emission factor in year y (tCO_2/MWh)

$\boldsymbol{EG_{m,y}}$ =Net quantity of electricity generated and delivered to the grid by power unit m in year y (tCO_2/MWh)

$\boldsymbol{EF_{EL,m,y}}$ =CO_2 emission factor of power unit m in year y (tCO_2/MWh)

$\boldsymbol{m}$ =Power units included in the build margin

$\boldsymbol{y}$ =Most recent historical year for which electricity generation data is available

As it is difficult to obtain the detailed data on the power generation, fuel consumption and thermal efficiency of each newly built power unit from public documents. According to "Tool to calculate the emission factor for an electricity system" (version 07.0). The BM emission factor is calculated as follows:

(1) Using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

(2) Use of capacity additions during last 1 ~ 3 years for estimating the build margin emission factor for grid electricity.

(3) Use of weights estimated using installed capacity in place of annual electricity generation.

The newly built power plants in the past few years are bundled into "grouped new power plant" according to their construction year, their province and their fuel type. The annual net electricity generation in the year y of each "grouped new power plant" is estimated according to their total capacity and the average utilization hours, as the following equation:

$$EG_{m,y} = CAP_m \times H_{m,y} \tag{27}$$

where:

$EG_{m,y}$	=	Annual net electricity generation the unit *m* in year *y* (MWh)
CAP_m	=	Installed capacity of the unit *m* (MW)
$H_{m,y}$	=	Utilization hour of the unit m in the year *y* (h), determined according to the average utilization hour of the same type of unit in the same province
y	=	The most recent year for which the generation data is available. For the calculation of BM in 2019, *y* = 2017

m = grouped new power plant

Since the newly built power plants in the same province (A), in the same year (t) and using the same fuel type (k) are grouped into "a grouped new power plant", CAP_m represents the total installed capacity of fuel type k power plants located in the province A and in the year t:

$$CAP_m = CAP_{A,t,k} \quad (28)$$

where:

CAP_m = Installed capacity of the unit *m* (MW), with *m* representing the specified combination of A, t, and k

$CAP_{A,t,k}$ = Total installed capacity of fuel type *k* power plants located in the province *A* and in the year *t*

A = Provinces covered by the NWPG, namely, Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Autonomous Region, Xinjiang Autonomous Region

t = Years related to the grouped new power plants, for the 2019 calculation, t represents 2017, 2016, 2015.... Until the aggregated electricity generation of the grouped new power plants reaches 20% of the total electricity generation of the NWPG

k = Fuel type of the grouped new power plants, including hydro, thermal (coal, gas, oil, waste incineration, other thermal), nuclear, wind, solar and others.

Figure 3 shows the procedure to determine the sample group of power units *m*.

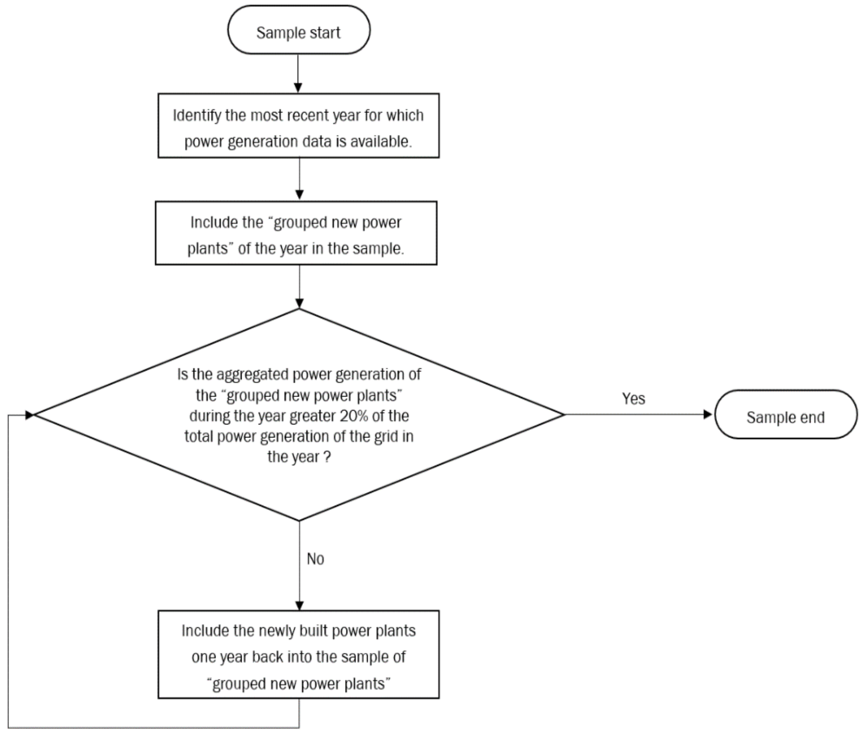


Figure 3 Procedure to determine the sample group of power units *m* used for the BM emission factor calculation

The emission factors of each fuel type $EF_{EL,m,y}$ are determined according to the Option A2 in the TOOL07, as the following equation:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \tag{29}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (t CO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (t CO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost / must-run power units
3.6	=	Conversion factor (GJ/MWh)

Among the fuel types, the emission factors of hydro, nuclear, wind, solar, other thermal and others are 0. Concerning the emission factors of coal, gas, oil and waste incineration, Equation (22) takes the following form due to conservativeness:

$$EF_{best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{best,y}} \quad (30)$$

Where:

$EF_{best,m,y}$	=	Emission factor of power unit *m* with the best technology commercially available in year *y* (t CO_2/MWh)
$\eta_{best,y}$	=	Power generation efficiency of the best technology commercially available in year *y*
m	=	Power units serving the grid with coal, gas, oil or waste incineration in year *y*

According to the latest and available data at the time of this JPM submission, $EF_{grid,BM,y}$ is calculated to be 0.2135 tCO_2e/MWh.

Step 6. Calculate the combined margin emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. And the JPM choose option A.

The combined margin emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} \quad (31)$$

Where:

$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y, tCO_2/MWh
ω_{OM}	=	Weighting of operating margin emissions factor
$EF_{grid,BM,y}$	=	Building margin CO_2 emission factor in year y, tCO_2/MWh.
ω_{BM}	=	Weighting of build margin emissions factor.

As per 2019 China regional power grid carbon dioxide baseline emission factor OM calculation instructions published by Ministry of Ecology and Environment of the People's Republic of China, $EF_{grid,OM,y}$= of South China Power Grid (SCPG) is 0.8042 tCO_2/MWh. $EF_{grid,BM,y}$= of South China Power Grid (SCPG) is 0.2135 tCO_2/MWh. Therefore:

$EF_{grid,CM,y}$ = 0.8042 tCO_2e/MWh*0.5+0.2135 tCO_2e/MWh*0.5 = 0.50885(tCO_2e/MWh)

The parameters involved in the calculation of the $PE_{Ec,y}$ are listed below(The data is from the FSR[1], which was issued on 15 February 2019):

Wastewater Treatment Plant	EC_{PJ} MWh/year
Xiaqiao Town wastewater Treatment Plant	607.07
Qujie Town wastewater Treatment Plant	772.63
Xinyi City Dingbao Town wastewater treatment Plant	408.39
Xinyi City Qianpai Town wastewater treatment Plant	764.92
Xianqiao South Wastewater Treatment Plant	1,250.56
Qiankeng Town North wastewater Plant	981.88
Shangsha Town wastewater Treatment Plant	1,229.82
Baita Town wastewater Treatment Plant	843.84
Luoding Fourth Domestic wastewater Treatment Plant	3,120.8
Shitan Town wastewater Treatment Plant	654.58
Litan Town wastewater Treatment Plant	724.25
jiulong Town wastewater Treatment Plant	724.25
Shakou Town wastewater Treatment Plant	877.74
Bomei Town wastewater Treatment Plant	2,747.02
Nantang Town wastewater Treatment Plant	2,777.02
Chikeng Town wastewater Treatment Plant	602.3

The project emissions from electricity consumption are calculated as:

Wastewater Treatment Plant	$PE_{Ec,y}$ tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	370.69
Qujie Town wastewater Treatment Plant	471.78
Xinyi City Dingbao Town wastewater treatment Plant	249.37
Xinyi City Qianpai Town wastewater treatment Plant	467.08
Xianqiao South Wastewater Treatment Plant	763.62
Qiankeng Town North wastewater Plant	599.56
Shangsha Town wastewater Treatment Plant	750.95
Baita Town wastewater Treatment Plant	515.27
Luoding Fourth Domestic wastewater Treatment Plant	1,905.62
Shitan Town wastewater Treatment Plant	399.70

Litan Town wastewater Treatment Plant	442.24
jiulong Town wastewater Treatment Plant	442.24
Shakou Town wastewater Treatment Plant	535.97
Bomei Town wastewater Treatment Plant	1,677.39
Nantang Town wastewater Treatment Plant	1,695.70
Chikeng Town wastewater Treatment Plant	367.78

vi). Project emissions from transportation of sludge ($PE_{TR,sl,y}$)

The project emissions resulting from transportation of final sludge produced in the project activity should be calculated as:

$$PE_{TR,sl,y} = \sum_i N_{PJ,i,y} \times D_{PJ,i,y} \times F_{PJ,i,y} \times NCV_{PJ,j,y} \times EF_{PJ,j,y} \quad (32)$$

Where:

$PE_{TR,sl,y}$	=	CO_2 emissions associated with transportation of sludge in the project activity in year y (tCO_2/year)
$N_{PJ,i,y}$	=	Number of trips (vehicle of type i with similar loading capacity) for transportation of the sludge produced in the project activity in the year y (trips)
$D_{PJ,i,y}$	=	Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y (km)
$F_{PJ,i,y}$	=	Specific fuel consumption of the transportation vehicle of type i in the year y (mass or volume units of fuel/km)
$NCV_{PJ,j,y}$	=	Net calorific value of the transportation fuel j in the year y (TJ/mass or volume units)
$EF_{PJ,j,y}$	=	CO_2 emission factor of the transportation fuel j in the year y (tCO_2/TJ)
i	=	Type of vehicle
j	=	Type of fuel used in vehicles
y	=	Year of the crediting period

As per the methodology, if the emissions associated with transportation of sludge in the baseline scenario and in the project scenario are found to be comparable (i.e., within +1% range) or emissions in the project scenario are lower, then both can be excluded in the calculation of baseline emissions and project emissions as a simplification. According to Section 4.1 and 4.2 of Chapter 4, the ex-ante calculated values of project emissions and baseline emissions due to sludge transportation are: $BE_{TR,sl,y}$ =49.83 tCO_2e/year; $PE_{TR,sl,y}$ =217.18 tCO_2e/year. Since $PE_{TR,sl,y}$ > $BE_{TR,sl,y}$ and ($PE_{TR,sl,y}$ / $BE_{TR,sl,y}$ -1) = 335.8%>1%, so the emissions associated with transportation of sludge in the baseline scenario and in the project scenario cannot be simplified.

Determination of $N_{PJ,i,y}$

$$N_{PJ,i,y} = \frac{Q_{PJ,sl,y}}{q_{PJ,i}} \quad (33)$$

Where:

$Q_{PJ,sl,y}$ = Quantity of sludge produced in the project activity in the year y (tonnes)

$q_{PJ,i}$ = Average vehicular capacity of the transportation vehicle of type i (tonnes/trip)

The results of each wastewater treatment plant are summarized as the following table. Please refer to the ex-ante ER spreadsheet for the detailed calculation process and parameters for calculation.

Wastewater Treatment Plant	$PE_{TR,sl,y}$ tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	0.98
Qujie Town wastewater Treatment Plant	0.55
Xinyi City Dingbao Town wastewater treatment Plant	1.86
Xinyi City Qianpai Town wastewater treatment Plant	1.21
Xianqiao South Wastewater Treatment Plant	12.07
Qiankeng Town North wastewater Plant	6.26
Shangsha Town wastewater Treatment Plant	11.78
Baita Town wastewater Treatment Plant	5.50
Luoding Fourth Domestic wastewater Treatment Plant	9.13
Shitan Town wastewater Treatment Plant	24.98
Litan Town wastewater Treatment Plant	25.32
jiulong Town wastewater Treatment Plant	14.18
Shakou Town wastewater Treatment Plant	18.36
Bomei Town wastewater Treatment Plant	49.94
Nantang Town wastewater Treatment Plant	29.33
Chikeng Town wastewater Treatment Plant	5.74

Project emissions are calculated as follows:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y}$$
$$= PE_{EC,y} + PE_{TR,sl,y}$$

Wastewater Treatment Plant	PE tCO_2e/year
Xiaqiao Town wastewater Treatment Plant	372
Qujie Town wastewater Treatment Plant	473

Xinyi City Dingbao Town wastewater treatment Plant	252
Xinyi City Qianpai Town wastewater treatment Plant	469
Xianqiao South Wastewater Treatment Plant	776
Qiankeng Town North wastewater Plant	606
Shangsha Town wastewater Treatment Plant	763
Baita Town wastewater Treatment Plant	521
Luoding Fourth Domestic wastewater Treatment Plant	1,915
Shitan Town wastewater Treatment Plant	425
Litan Town wastewater Treatment Plant	468
jiulong Town wastewater Treatment Plant	457
Shakou Town wastewater Treatment Plant	555
Bomei Town wastewater Treatment Plant	1,728
Nantang Town wastewater Treatment Plant	1,726
Chikeng Town wastewater Treatment Plant	374
Total	11,880

4.3 Leakage

No leakage is considered in this methodology.

$$LE_y = 0$$

4.4 Estimated Net GHG Emission Reductions and Removals

Emission reductions for any given year of the crediting period are obtained by subtracting project emissions and leakage from baseline emissions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions reductions of the project activity in year y (tCO_2e/year)

BE_y = Baseline emissions in year y (tCO_2e/year)

PE_y = Project emissions in year y (tCO_2e/year)

LE_y = Leakage emissions in year y (tCO_2e/year)

Since the project involves 16 wastewater treatment plants, please refer to the ex-ante spreadsheets for the detailed calculation process and parameters. The results of emissions reductions are calculated as:

Xiaqiao Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PE_y (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
05-September-2020—31-December-2020	881	120	0	761
01-January-2021—31-December -2021	2,725	372	0	2,353
01-January-2022—31-December -2022	2,725	372	0	2,353
01-January-2023—31-December -2023	2,725	372	0	2,353
01-January-2024—31-December -2024	2,725	372	0	2,353
01-January-2025—31-December -2025	2,725	372	0	2,353
01-January-2026—31-December -2026	2,725	372	0	2,353
01-January-2027—31-December -2027	2,725	372	0	2,353
01-January-2028—31-December-2028	2,725	372	0	2,353
01-January-2029—31- December-2029	2,725	372	0	2,353
01-January-2030—02-September -2030	1,829	250	0	1,579
Total (t CO_2e)	27,235	3,718	0	23,517
Qujie Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
08-September-2020—31-December-2020	1,213	149	0	1,064
01-January-2021—31-December -2021	3,850	473	0	3,377
01-January-2022—31-December -2022	3,850	473	0	3,377
01-January-2023—31-December -2023	3,850	473	0	3,377
01-January-2024—31-December -2024	3,850	473	0	3,377
01-January-2025—31-December -2025	3,850	473	0	3,377
01-January-2026—31-December -2026	3,850	473	0	3,377
01-January-2027—31-December -2027	3,850	473	0	3,377

01-January-2028—31-December-2028	3,850	473	0	3,377
01-January-2029—31- December-2029	3,850	473	0	3,377
01-January-2030—02-September -2030	2,584	317	0	2,267
Total (t CO_2e)	38,447	4,723	0	33,724
Xinyi City Dingbao Town wastewater treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
03-September-2020—31-December-2020	398	82	0	316
01-January-2021—31-December -2021	1,212	252	0	960
01-January-2022—31-December -2022	1,212	252	0	960
01-January-2023—31-December -2023	1,212	252	0	960
01-January-2024—31-December -2024	1,212	252	0	960
01-January-2025—31-December -2025	1,212	252	0	960
01-January-2026—31-December -2026	1,212	252	0	960
01-January-2027—31-December -2027	1,212	252	0	960
01-January-2028—31-December-2028	1,212	252	0	960
01-January-2029—31- December-2029	1,212	252	0	960
01-January-2030—02-September -2030	814	155	0	659
Total (t CO_2e)	12,120	2,505	0	9,615
Xinyi City Qianpai Town wastewater treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
06-September-2020—31-December-2020	1,001	150	0	851
01-January-2021—31-December -2021	3,122	469	0	2,653
01-January-2022—31-December -2022	3,122	469	0	2,653
01-January-2023—31-December -2023	3,122	469	0	2,653
01-January-2024—31-December -2024	3,122	469	0	2,653
01-January-2025—31-December -2025	3,122	469	0	2,653
01-January-2026—31-December -2026	3,122	469	0	2,653

01-January-2027—31-December - 2027	3,122	469	0	2,653
01-January-2028—31-December-2028	3,122	469	0	2,653
01-January-2029—31- December-2029	3,122	469	0	2,653
01-January-2030—02-September -2030	2,096	315	0	1,781
Total (t CO_2e)	31,195	4,686	0	26,509
Xianqiao South Wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
13-September-2020—31-December-2020	1,659	234	0	1,425
01-January-2021—31-December - 2021	5,506	776	0	4,730
01-January-2022—31-December - 2022	5,506	776	0	4,730
01-January-2023—31-December - 2023	5,506	776	0	4,730
01-January-2024—31-December - 2024	5,506	776	0	4,730
01-January-2025—31-December - 2025	5,506	776	0	4,730
01-January-2026—31-December - 2026	5,506	776	0	4,730
01-January-2027—31-December - 2027	5,506	776	0	4,730
01-January-2028—31-December-2028	5,506	776	0	4,730
01-January-2029—31- December-2029	5,506	776	0	4,730
01-January-2030—02-September -2030	3,696	521	0	3,175
Total (t CO_2e)	54,909	7,739	0	47,170
Qiankeng Town North wastewater Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
10-September-2020—31-December-2020	1,518	188	0	1,330
01-January-2021—31-December - 2021	4,902	606	0	4,296
01-January-2022—31-December - 2022	4,902	606	0	4,296
01-January-2023—31-December - 2023	4,902	606	0	4,296
01-January-2024—31-December - 2024	4,902	606	0	4,296
01-January-2025—31-December - 2025	4,902	606	0	4,296

01-January-2026—31-December - 2026	4,902	606	0	4,296
01-January-2027—31-December - 2027	4,902	606	0	4,296
01-January-2028—31-December-2028	4,902	606	0	4,296
01-January-2029—31- December-2029	4,902	606	0	4,296
01-January-2030—02-September -2030	3,290	407	0	2,883
Total (t CO_2e)	48,926	6,049	0	42,877
Shangsha Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
14-September-2020—31-December-2020	1,629	228	0	1,401
01-January-2021—31-December - 2021	5,455	763	0	4,692
01-January-2022—31-December - 2022	5,455	763	0	4,692
01-January-2023—31-December - 2023	5,455	763	0	4,692
01-January-2024—31-December - 2024	5,455	763	0	4,692
01-January-2025—31-December - 2025	5,455	763	0	4,692
01-January-2026—31-December - 2026	5,455	763	0	4,692
01-January-2027—31-December - 2027	5,455	763	0	4,692
01-January-2028—31-December-2028	5,455	763	0	4,692
01-January-2029—31- December-2029	5,455	763	0	4,692
01-January-2030—02-September -2030	3,662	512	0	3,150
Total (t CO_2e)	54,386	7,607	0	46,779
Baita Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
13-September-2020—31-December-2020	1,119	157	0	962
01-January-2021—31-December - 2021	3,714	521	0	3,193
01-January-2022—31-December - 2022	3,714	521	0	3,193
01-January-2023—31-December - 2023	3,714	521	0	3,193
01-January-2024—31-December - 2024	3,714	521	0	3,193

01-January-2025—31-December - 2025	3,714	521	0	3,193
01-January-2026—31-December - 2026	3,714	521	0	3,193
01-January-2027—31-December - 2027	3,714	521	0	3,193
01-January-2028—31-December-2028	3,714	521	0	3,193
01-January-2029—31- December-2029	3,714	521	0	3,193
01-January-2030—02-September -2030	2,493	350	0	2,143
Total (t CO_2e)	37,038	5,196	0	31,842
Luoding Fourth Domestic wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
15-September-2020—31-December-2020	3,420	567	0	2,853
01-January-2021—31-December - 2021	11,560	1,915	0	9,645
01-January-2022—31-December - 2022	11,560	1,915	0	9,645
01-January-2023—31-December - 2023	11,560	1,915	0	9,645
01-January-2024—31-December - 2024	11,560	1,915	0	9,645
01-January-2025—31-December - 2025	11,560	1,915	0	9,645
01-January-2026—31-December - 2026	11,560	1,915	0	9,645
01-January-2027—31-December - 2027	11,560	1,915	0	9,645
01-January-2028—31-December-2028	11,560	1,915	0	9,645
01-January-2029—31- December-2029	11,560	1,915	0	9,645
01-January-2030—02-September -2030	7,759	1,285	0	6,474
Total (t CO_2e)	115,219	19,087	0	96,132
Shitan Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
09-September-2020—31-December-2020	1,023	133	0	890
01-January-2021—31-December - 2021	3,274	425	0	2,849
01-January-2022—31-December - 2022	3,274	425	0	2,849
01-January-2023—31-December - 2023	3,274	425	0	2,849

01-January-2024—31-December -2024	3,274	425	0	2,849
01-January-2025—31-December -2025	3,274	425	0	2,849
01-January-2026—31-December -2026	3,274	425	0	2,849
01-January-2027—31-December -2027	3,274	425	0	2,849
01-January-2028—31-December-2028	3,274	425	0	2,849
01-January-2029—31- December-2029	3,274	425	0	2,849
01-January-2030—02-September -2030	2,198	285	0	1,913
Total (t CO_2e)	32,687	4,243	0	28,444
Litan Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
12-September-2020—31-December-2020	1,171	142	0	1,029
01-January-2021—31-December -2021	3,850	468	0	3,382
01-January-2022—31-December -2022	3,850	468	0	3,382
01-January-2023—31-December -2023	3,850	468	0	3,382
01-January-2024—31-December -2024	3,850	468	0	3,382
01-January-2025—31-December -2025	3,850	468	0	3,382
01-January-2026—31-December -2026	3,850	468	0	3,382
01-January-2027—31-December -2027	3,850	468	0	3,382
01-January-2028—31-December-2028	3,850	468	0	3,382
01-January-2029—31- December-2029	3,850	468	0	3,382
01-January-2030—02-September -2030	2,584	314	0	2,270
Total (t CO_2e)	38,405	4,668	0	33,737
jiulong Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
11-September-2020—31-December-2020	827	140	0	687
01-January-2021—31-December -2021	2,696	457	0	2,239
01-January-2022—31-December -2022	2,696	457	0	2,239

01-January-2023—31-December -2023	2,696	457	0	2,239
01-January-2024—31-December -2024	2,696	457	0	2,239
01-January-2025—31-December -2025	2,696	457	0	2,239
01-January-2026—31-December -2026	2,696	457	0	2,239
01-January-2027—31-December -2027	2,696	457	0	2,239
01-January-2028—31-December-2028	2,696	457	0	2,239
01-January-2029—31- December-2029	2,696	457	0	2,239
01-January-2030—02-September -2030	1,810	307	0	1,503
Total (t CO_2e)	26,901	4,560	0	22,341
Shakou Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
12-September-2020—31-December-2020	1,643	169	0	1,474
01-January-2021—31-December -2021	5,403	555	0	4,848
01-January-2022—31-December -2022	5,403	555	0	4,848
01-January-2023—31-December -2023	5,403	555	0	4,848
01-January-2024—31-December -2024	5,403	555	0	4,848
01-January-2025—31-December -2025	5,403	555	0	4,848
01-January-2026—31-December -2026	5,403	555	0	4,848
01-January-2027—31-December -2027	5,403	555	0	4,848
01-January-2028—31-December-2028	5,403	555	0	4,848
01-January-2029—31- December-2029	5,403	555	0	4,848
01-January-2030—02-September -2030	3,627	373	0	3,254
Total (t CO_2e)	53,897	5,537	0	48,360
Bomei Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
18-September-2020—31-December-2020	5,067	497	0	4,570
01-January-2021—31-December -2021	17,614	1,728	0	15,886

01-January-2022—31-December - 2022	17,614	1,728	0	15,886
01-January-2023—31-December - 2023	17,614	1,728	0	15,886
01-January-2024—31-December - 2024	17,614	1,728	0	15,886
01-January-2025—31-December - 2025	17,614	1,728	0	15,886
01-January-2026—31-December - 2026	17,614	1,728	0	15,886
01-January-2027—31-December - 2027	17,614	1,728	0	15,886
01-January-2028—31-December-2028	17,614	1,728	0	15,886
01-January-2029—31- December-2029	17,614	1,728	0	15,886
01-January-2030—02-September -2030	11,823	1,160	0	10,663
Total (t CO_2e)	175,416	17,209	0	158,207
Nantang Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
20-September-2020—31-December-2020	4,832	487	0	4,345
01-January-2021—31-December - 2021	17,124	1,726	0	15,398
01-January-2022—31-December - 2022	17,124	1,726	0	15,398
01-January-2023—31-December - 2023	17,124	1,726	0	15,398
01-January-2024—31-December - 2024	17,124	1,726	0	15,398
01-January-2025—31-December - 2025	17,124	1,726	0	15,398
01-January-2026—31-December - 2026	17,124	1,726	0	15,398
01-January-2027—31-December - 2027	17,124	1,726	0	15,398
01-January-2028—31-December-2028	17,124	1,726	0	15,398
01-January-2029—31- December-2029	17,124	1,726	0	15,398
01-January-2030—02-September -2030	11,494	1,159	0	10,335
Total (t CO_2e)	170,442	17,180	0	153,262
Chikeng Town wastewater Treatment Plant				
Year	**BE_y (t CO_2e)**	**PEy (t CO_2e)**	**LE_y (t CO_2e)**	**ER_y (t CO_2e)**
09-September-2020—31-December-2020	990	117	0	873

01-January-2021—31-December -2021	3,169	374	0	2,795
01-January-2022—31-December -2022	3,169	374	0	2,795
01-January-2023—31-December -2023	3,169	374	0	2,795
01-January-2024—31-December -2024	3,169	374	0	2,795
01-January-2025—31-December -2025	3,169	374	0	2,795
01-January-2026—31-December -2026	3,169	374	0	2,795
01-January-2027—31-December -2027	3,169	374	0	2,795
01-January-2028—31-December-2028	3,169	374	0	2,795
01-January-2029—31- December-2029	3,169	374	0	2,795
01-January-2030—02-September -2030	2,127	251	0	1,876
Total (t CO_2e)	31,638	3,734	0	27,904

The emission reductions can be obtained as below:

Table 4-1 The estimation of ER_y

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)
03-September-2020—31-December-2020	28,391	3,560	0	24,831
01-January-2021—31-December -2021	95,176	11,880	0	83,296
01-January-2022—31-December -2022	95,176	11,880	0	83,296
01-January-2023—31-December -2023	95,176	11,880	0	83,296
01-January-2024—31-December -2024	95,176	11,880	0	83,296
01-January-2025—31-December -2025	95,176	11,880	0	83,296
01-January-2026—31-December -2026	95,176	11,880	0	83,296

01-January-2027—31-December -2027	95,176	11,880	0	83,296
01-January-2028—31-December-2028	95,176	11,880	0	83,296
01-January-2029—31-December-2029	95,176	11,880	0	83,296
01-January-2030—02-September -2030	63,886	7,961	0	55,925
Total	948,861	118,441	0	830,420

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	GWP_{CH4}
Data unit	tCO_2/tCH_4
Description	Global Warming Potential of methane valid for the commitment period
Source of data	IPCC Fifth Assessment Report - Climate Change 2014 and VCS Standard Version 4.3
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Default IPCC value applied.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	$EF_{EL,j,y}$ ($EF_{grid,CM,y}$)
Data unit	tCO_2/MWh
Description	Combined margin emission factor for the grid in year y

Source of data	Calculate the combined margin emission factor, using the procedures in Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0). The data of $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are from Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China[42].
Value applied	0.5089 tCO_2/MWh (0.8042 tCO_2/MWh*0.5+0.2135 tCO_2/MWh *0.5)
Justification of choice of data or description of measurement methods and procedures applied	As per Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0).
Purpose of Data	Calculation of project emissions
Comments	N/A

Data / Parameter	Bo
Data unit	tCH_4/tCOD
Description	Maximum methane producing capacity of wastewater, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand
Source of data	Table 6.2 in Ch6 of Vol5 in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories & AM0080 v.1 p.28
Value applied	0.21
Justification of choice of data or description of measurement methods and procedures applied	Default IPCC value applied. The default IPCC value for Bo is 0.25 kg CH_4/kg COD. However, taking into account the uncertainty of this estimate, project participants should use a value of 0.21 kg CH_4/kg COD as a conservative assumption for Bo.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

[42] https://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/W020201229610353340851.pdf

Data / Parameter	$COD_{BL,in,x}$ and $COD_{BL,out,x}$
Data unit	tCOD/year
Description	Respectively, COD directed to the open lagoons in the baseline scenario in the period x, and COD of the effluent of open lagoons in the baseline scenario in the period x.
Source of data	The data is from the feasibility study report. In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoons. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoons in 2018(From 01-January-2018 to 31-December-2018).
Value applied	Open anaerobic lagoon in Xiaqiao Town $COD_{BL,in,x}$= 596.72 tCOD/year; $COD_{BL,out,x}$= 29.68 tCOD/year Open anaerobic lagoon in Qujie Town wastewater $COD_{BL,in,x}$= 864.23 tCOD/year; $COD_{BL,out,x}$= 44.00 tCOD/year Open anaerobic lagoon in Xinyi City Dingbao Town $COD_{BL,in,x}$= 209.05 tCOD/year; $COD_{BL,out,x}$= 12.08 tCOD/year Open anaerobic lagoon in Xinyi City Qianpai Town $COD_{BL,in,x}$= 746.02 tCOD/year; $COD_{BL,out,x}$= 36.99 tCOD/year Open anaerobic lagoon in Xianqiao South Wastewater $COD_{BL,in,x}$= 1,416.40 tCOD/year; $COD_{BL,out,x}$= 71.11 tCOD/year Open anaerobic lagoon in Qiankeng Town $COD_{BL,in,x}$= 1,285.67 tCOD/year; $COD_{BL,out,x}$= 65.10 tCOD/year Open anaerobic lagoon in Shangsha Town $COD_{BL,in,x}$= 1,456.09 tCOD/year; $COD_{BL,out,x}$= 75.22 tCOD/year

	Open anaerobic lagoon in Baita Town $COD_{BL,in,x}$= 856.94 tCOD/year; $COD_{BL,out,x}$= 43.40 tCOD/year Open anaerobic lagoon in Luoding $COD_{BL,in,x}$= 3,201.78 tCOD/year; $COD_{BL,out,x}$= 159.94 tCOD/year Open anaerobic lagoon in Shitan Town $COD_{BL,in,x}$= 745.85 tCOD/year; $COD_{BL,out,x}$= 37.16 tCOD/year Open anaerobic lagoon in Litan Town $COD_{BL,in,x}$= 865.92 tCOD/year; $COD_{BL,out,x}$= 44.71 tCOD/year Open anaerobic lagoon in jiulong Town $COD_{BL,in,x}$= 602.19 tCOD/year; $COD_{BL,out,x}$= 30.79 tCOD/year Open anaerobic lagoon in Shakou Town $COD_{BL,in,x}$= 1,105.42 tCOD/year; $COD_{BL,out,x}$= 47.17 tCOD/year Open anaerobic lagoon in Bomei Town $COD_{BL,in,x}$= 3,524.73 tCOD/year; $COD_{BL,out,x}$= 153.17 tCOD/year Open anaerobic lagoon in Nantang Town $COD_{BL,in,x}$= 3,769.02 tCOD/year; $COD_{BL,out,x}$= 159.22 tCOD/year Open anaerobic lagoon in Chikeng Town $COD_{BL,in,x}$= 745.79 tCOD/year; $COD_{BL,out,x}$= 37.69 tCOD/year Please refer to ex-ante ER spreadsheet for detailed monthly data.
Justification of choice of data or description of measurement methods and procedures applied	In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoons. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoons in 2018(From 01-January-2018 to 31-December-2018). The data is from the feasibility study report. Therefore, the data is reasonable.

Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$f_{BL,d}$
Data unit	fraction
Description	Factor expressing the influence of the depth of the lagoon on methane generation
Source of data	As per the methodology, apply the following values for the corresponding average depth of the open lagoon: Depth > 5 m: 70% Depth 1 – 5 m: 50% Depth < 1 m: 0%
Value applied	70% (Depth > 5 m)
Justification of choice of data or description of measurement methods and procedures applied	As per the baseline survey report, the baseline scenario is 16 existing anaerobic lagoons system with depth greater than 5m, so the value is taken as 70%.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$Q_{BL,sl,y}$
Data unit	t
Description	Quantity of sludge that would have been produced and treated in the baseline scenario in the year y
Source of data	In this project, the baseline scenario is that wastewater continues to be treated by existing anaerobic lagoons. Before the construction of the project, in order to investigate the influent COD and flow, effluent COD and flow, quantity of sludge transportation, the local government conducted a complete monitoring process on the influent COD and flow, effluent COD and flow, quantity of sludge transportation of the anaerobic lagoons in 2018(From 01-January-2018 to 31-December-2018), and the data is from the

	feasibility study report. And then in order to ensure a conservative computation of baseline emissions, the lowest amongst the monthly values was considered and multiplied by the quantity of wastewater treated to estimate the sludge that would have been produced.
Value applied	Open anaerobic lagoons in Xiaqiao Town $Q_{BL,sl,y}$ = 265.96 t/a Open anaerobic lagoons in Qujie Town $Q_{BL,sl,y}$ = 350.09 t/a Open anaerobic lagoons in Xinyi City Dingbao Town $Q_{BL,sl,y}$ = 143.30 t/a Open anaerobic lagoons in Xinyi City Qianpai Town $Q_{BL,sl,y}$ = 331.54 t/a Open anaerobic lagoons in Xianqiao $Q_{BL,sl,y}$ = 571.69 t/a Open anaerobic lagoons in Qiankeng Town $Q_{BL,sl,y}$ = 571.59 t/a Open anaerobic lagoons in Shangsha Town $Q_{BL,sl,y}$ = 736.70 t/a Open anaerobic lagoons in Baita Town $Q_{BL,sl,y}$ = 380.88 t/a Open anaerobic lagoons in Luoding $Q_{BL,sl,y}$ = 1293.75 t/a Open anaerobic lagoons in Shitan Town wastewater Treatment Plant: $Q_{BL,sl,y}$ = 332.03 t/a Open anaerobic lagoons in Litan Town $Q_{BL,sl,y}$ = 350.67 t/a Open anaerobic lagoons in jiulong $Q_{BL,sl,y}$ = 352.40 t/a Open anaerobic lagoons in Shakou Town $Q_{BL,sl,y}$ = 406.92 t/a Open anaerobic lagoons in Bomei Town $Q_{BL,sl,y}$ = 1297.18 t/a Open anaerobic lagoons in Nantang Town $Q_{BL,sl,y}$ = 1385.98 t/a

	Open anaerobic lagoons in Chikeng Town$Q_{BL,sl,y}$ = 331.87 t/a
Justification of choice of data or description of measurement methods and procedures applied	The data is investigated by the official department, and the final data is from the feasibility study report
Purpose of Data	Calculation of baseline emissions from treatment of sludge
Comments	-

Data / Parameter	$D_{BL,i}$
Data unit	km
Description	Average distance per trip, that would have been travelled by the transportation vehicle of type i, for transportation of sludge in the baseline scenario
Source of data	Historical data available on-site, the distance of sludge transportation between open anaerobic lagoons and landfills can be determined by baseline survey report.
Value applied	The distance of sludge transportation between open anaerobic lagoons and landfills Xiaqiao Town: $D_{BL,i}$ = 17.2 km Qujie Town: $D_{BL,i}$ = 24.8 km Xinyi City Dingbao Town: $D_{BL,i}$ = 33.2 km Xinyi City Qianpai Town: $D_{BL,i}$ = 19 km Xianqiao South: $D_{BL,i}$ = 50.8 km Qiankeng Town: $D_{BL,i}$ = 25 km Shangsha Town: $D_{BL,i}$ = 49.6 km Baita Town: $D_{BL,i}$ = 32.6 km Luoding:

	$D_{BL,i}$ = 9.2 km Shitan Town: $D_{BL,i}$ = 110.8 km Litan Town: $D_{BL,i}$ = 96.8 km jiulong Town: $D_{BL,i}$ = 56.4 km Shakou Town: $D_{BL,i}$ = 73.6 km Bomei Town: $D_{BL,i}$ = 54.6 km Nantang Town: $D_{BL,i}$ = 33.4 km Chikeng Town: $D_{BL,i}$ = 25.8 km
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$F_{BL,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Source of data	As per historical data available on-site in baseline survey report, the fuel used by the local sludge transport vehicle is diesel, the fuel consumption per kilometer is also from the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, ＞4 tonne ＜8 tonne)[43].
Value applied	0.251

[43] https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf

Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$NCV_{BL,j}$ and $EF_{BL,j}$
Data unit	Respectively: TJ/tonne, and tCO_2/TJ
Description	Respectively: net calorific value of the transportation fuel j , and CO_2 emission factor of the transportation fuel j
Source of data	As per historical data available on-site in baseline survey report, the fuel used by the local sludge transport vehicle is diesel, historical data available on-site was also from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel)[44]
Value applied	$NCV_{BL,j,y}$ = 0.04333 TJ/tonne; $EF_{BL,j,y}$ = 74.1 tCO_2/TJ
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

Data / Parameter	$q_{BL,i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Source of data	5. The local sludge transport vehicle specifications have historical data, which can be easily obtained by the project participants in the baseline survey report.

[44] https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf

Value applied	5
Justification of choice of data or description of measurement methods and procedures applied	–
Purpose of Data	Calculation of baseline emissions
Comments	–

5.2 Data and Parameters Monitored

Data / Parameter	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$
Data unit	m^3
Description	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Source of data	Flow rate operation statistics of wastewater from 16 wastewater treatment plants project in Guangdong Province
Description of measurement methods and procedures to be applied	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was measured by the electromagnetic flowmeter converter. The monitoring team of the wastewater treatment plants will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Parameter monitored continuously and aggregated daily and monthly for calculations
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual flow rate will be monitored. $Q_{PJ,ww,i}$ is maximum design influent flow , $Q_{PJ,ww,m}$ is obtained by multiplying $Q_{PJ,ww,i}$ by the number of days in the corresponding month. Please refer to the ex-ante ER spreadsheet for the detailed parameters for calculation.
Monitoring equipment	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was monitored by the electromagnetic flowmeter converter. Each of the 16 wastewater treatment plants has an electromagnetic flowmeter converter to monitor the flow into the wastewater treatment plant, it was installed in front of pre-treatment process of the wastewater plant.
QA/QC procedures to be applied	The electromagnetic flowmeter converter, including the frequency of calibration, should be done once three years in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions

Calculation method	-
Comments	The data will be stored for the crediting period + 2 years

Data / Parameter	$W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$
Data unit	$tCOD/m^3$
Description	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Source of data	COD operation statistics of wastewater from 16 wastewater treatment plants project in Guangdong Province
Description of measurement methods and procedures to be applied	Influent COD concentration of 16 each wastewater plant was measured by the 16 COD_{cr} water quality online automatic monitors. The unit of Influent COD concentration is mg/L, the unit of $W_{PJ,COD,ww,i}$ is t/m^3, so $W_{PJ,COD,ww,i}$ can be obtained by dividing Influent COD concentration by 1,000,000 through unit conversion, The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	COD monitoring frequency is once every two hours[45], the average daily COD was calculated based on the 24-hourly data, the average monthly COD was calculated based on all the daily data of this month, the average monthly values will be used for calculations.
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual COD concentration will be monitored. Xiaqiao Town wastewater Treatment Plant: $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000450\ tCOD/m^3$ Qujie Town wastewater Treatment Plant: $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000500\ tCOD/m^3$ Xinyi City Dingbao Town wastewater treatment Plant: $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000300\ tCOD/m^3$ Xinyi City Qianpai Town wastewater treatment Plant: $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000450\ tCOD/m^3$ Xianqiao South Wastewater Treatment Plant: $W_{PJ,COD,ww,m} = W_{PJ,COD,ww,i} = 0.000500\ tCOD/m^3$

[45] According to the requirements of methodology, the monitoring and evaluation rate of this parameter is once a day, and the actual monitoring is once every two hours, so the actual monitoring frequency is higher.

	Qiankeng Town North wastewater Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000450 tCOD/m^3 Shangsha Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000400 tCOD/m^3 Baita Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000450 tCOD/m^3 Luoding Fourth Domestic wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000500 tCOD/m^3 Shitan Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000450 tCOD/m^3 Litan Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000500 tCOD/m^3 jiulong Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000350 tCOD/m^3 Shakou Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000550 tCOD/m^3 Bomei Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000550 tCOD/m^3 Nantang Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000550 tCOD/m^3 Chikeng Town wastewater Treatment Plant: $W_{PJ,COD,ww,m}$ =$W_{PJ,COD,ww,i}$=0.000450 tCOD/m^3
Monitoring equipment	COD_{cr} water quality online automatic monitor
QA/QC procedures to be applied	The electromagnetic flowmeter converter, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	The average monthly values will be used for calculations.
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$T_{2,m}$
Data unit	K
Description	Average temperature at the project site in month m

Source of data	Data from the website at https://m.tianqi.com/qiwen/city/, the data of this website comes from the China Meteorological Administration, which has conducted by on-site measurements, and the data is the historical monthly average, so the data is reliable.
Description of measurement methods and procedures to be applied	The temperature is obtained from the Meteorological Bureau website: https://m.tianqi.com/qiwen/city/
Frequency of monitoring/recording	Continuously, aggregated in monthly average values
Value applied	The temperature is obtained from the Meteorological Bureau website: https://m.tianqi.com/qiwen/city/ Xiaqiao Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_zhanjiang/ Qujie Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_zhanjiang/ Xinyi City Dingbao Town wastewater treatment Plant Source: https://m.tianqi.com/qiwen/city_xinyi1/ Xinyi City Qianpai Town wastewater treatment Plant Source: https://m.tianqi.com/qiwen/city_xinyi1/ Xianqiao South Wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_jieyang/ Qiankeng Town North wastewater Plant Source: https://m.tianqi.com/qiwen/city_jieyang/ Shangsha Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_jieyang/ Baita Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_jieyang/ Luoding Fourth Domestic wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_luoding/ Shitan Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_qingyuan3/ Litan Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_qingyuan3/ jiulong Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_yingde/

	Shakou Town wastewater Treatment Plant Source: https://m.tianqi.com/qiwen/city_yingde/ **Bomei Town wastewater Treatment Plant** Source: https://m.tianqi.com/qiwen/city_Shanwei/ **Nantang Town wastewater Treatment Plant** Source: https://m.tianqi.com/qiwen/city_Shanwei/ **Chikeng Town wastewater Treatment Plant** Source: https://m.tianqi.com/qiwen/city_Shanwei/ Please refer to the ex-ante ER spreadsheet for the detailed parameters for calculation.
Monitoring equipment	Temperatures are monitored by the local weather bureau
QA/QC procedures to be applied	The data source used in the ex-ante calculation is the historical monthly average data of the project site. The website is: https://m.tianqi.com/qiwen/city/ The data source of this website is China Meteorological Administration, the China Meteorological Administration is the authority, and the China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications. Ex-post on-site measurement of the temperature will be conducted by local meteorological bureau as per the requirements of the applied methodology. The monthly average temperature of the 16 plants during this monitoring period will be summarized in temperature monitoring report for the 16 wastewater treatment plants. The higher the average temperature, the larger the related baseline emissions. To get the conservative value of the average temperature, the results wii be cross-checked with the public statistics, which is sourced from: https://www.tianqi24.com/city/history.html.
Purpose of data	Calculation of baseline emissions and project emissions
Calculation method	-
Comments	The data will be stored for the crediting period +2 years.

Data / Parameter	$Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$

Data unit	m^3
Description	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively
Source of data	Flow rate operation statistics of wastewater from 16 wastewater treatment plants project in Guangdong Province
Description of measurement methods and procedures to be applied	$Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$ was measured by the electromagnetic flowmeter converter. The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Parameter monitored continuously and aggregated daily and monthly for calculations
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual flow rate will be monitored. $Q_{PJ,effl,i}$ is quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i of year y, $Q_{PJ,effl,m}$ is obtained by multiplying $Q_{PJ,effl,i}$ by the number of days in the corresponding month. Please refer to the ex-ante ER spreadsheet for the detailed parameters for calculation.
Monitoring equipment	$Q_{PJ,effl,m}$ and $Q_{PJ,effl,i}$ was measured by the electromagnetic flowmeter converter. Each of the 16 wastewater treatment plants has an electromagnetic flowmeter converter to monitor the flow which leaves the wastewater treatment plant, it was installed after tertiary deep treatment process of the wastewater plant.
QA/QC procedures to be applied	The electromagnetic flowmeter converter, including the frequency of calibration, should be done once three years in accordance with national standards or requirements..
Purpose of data	Calculation of baseline emissions and project emissions.
Calculation method	-
Comments	The data will be stored for the crediting period + 2 years

Data / Parameter	$W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$
Data unit	t COD/m^3
Description	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively

Source of data	COD operation statistics of wastewater from 16 wastewater treatment plants project in Guangdong Province
Description of measurement methods and procedures to be applied	Effluent COD concentration of 16 each wastewater plant was measured by the 16 COD_{cr} water quality online automatic monitors. The unit of effluent COD concentration is mg/L, the unit of $W_{PJ,COD,effl,i}$ is t/m^3, so $W_{PJ,COD,effl,m}$ can be obtained by dividing effluent COD concentration by 1,000,000 through unit conversion, The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	COD monitoring frequency is once every two hours[46], the average daily COD was calculated based on the 24-hourly data, the average monthly COD was calculated based on all the daily data of this month, the average monthly values will be used for calculations.
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual COD concentration will be monitored. $W_{PJ,COD,effl,i}$= $W_{PJ,COD,effl,m}$=0.000040 t COD/m^3
Monitoring equipment	COD_{cr} water quality online automatic monitor
QA/QC procedures to be applied	The COD_{cr} water quality online automatic monitor, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$f_{PJ,d,y}$
Data unit	fraction
Description	Factor expressing the influence of the depth on methane generation in year y
Source of data	Apply the following values for the corresponding average depth: Depth > 5 m: 70%

46 According to the requirements of methodology, the monitoring and evaluation rate of this parameter is once a day, and the actual monitoring is once every two hours, so the actual monitoring frequency is higher.

	Depth 1 – 5 m: 50% Depth < 1 m: 0% The effluent from each wastewater treatment plant is discharged through the effluent channel, and the depth of the effluent channel is less than 1 m in general (The data is from FSR[1], which was issued on 15 February 2019). Therefore, Depth < 1 m: 0%
Description of measurement methods and procedures to be applied	As per Technical Construction Plan for Wastewater Treatment Plant which refer to the Standard for design of outdoor wastewater engineering, the design depth of the effluent channels of the 16 wastewater treatment plants is not more than 1m, so there is no need for monitoring equipment for the effluent channel, The monitoring team of the wastewater treatment plant will not need to monitor and record this data.
Frequency of monitoring/recording	N/A
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual depth will be monitored. 0% (Depth < 1 m)
Monitoring equipment	The depth of the effluent channel is monitored once a month. As per FSR[1], the design depth of the effluent channels of the 16 wastewater treatment plants is not more than 1m, so there is no need for monitoring equipment for the effluent channel.
QA/QC procedures to be applied	The design depth of the effluent channels of the 16 wastewater treatment plants is not more than 1m, so there is no need for monitoring equipment for the effluent channel, so the QA/QC procedures is not applicable.
Purpose of data	Calculation of project emissions
Calculation method	Conduct monthly measurements of depth under normal operating conditions and take the annual average value for calculations
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$Q_{PJ,sl,y}$
Data unit	tonnes
Description	Quantity of sludge produced in the project activity in the year y

Source of data	Sludge statistics of wastewater from 16 wastewater treatment plants project in Guangdong Province
Description of measurement methods and procedures to be applied	The amount of sludge produced by the wastewater treatment plants will be weighed by weighbridge. The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Record the total sludge once a day, and aggregated yearly for calculations.
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual quantity of sludge will be monitored. Xiaqiao Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,029.30 t/a Qujie Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 810.30 t/a Xinyi City Dingbao Town wastewater treatment Plant: $Q_{PJ,sl,y}$ = 543.85 t/a Xinyi City Qianpai Town wastewater treatment Plant: $Q_{PJ,sl,y}$ = 927.10 t/a Xianqiao South Wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,470.95 t/a Qiankeng Town North wastewater Plant: $Q_{PJ,sl,y}$ = 1,127.85 t/a Shangsha Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,412.55 t/a Baita Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 854.10 t/a Luoding Fourth Domestic wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 3,744.90 t/a Shitan Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,204.50 t/a Litan Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,277.50 t/a jiulong Town wastewater Treatment Plant: $Q_{PJ,sl,y}$= 1,255.60 t/a Shakou Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,584.10 t/a

	Bomei Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 5,011.45 t/a Nantang Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 4,814.35 t/a Chikeng Town wastewater Treatment Plant: $Q_{PJ,sl,y}$ = 1,146.10 t/a
Monitoring equipment	Weighbridge. Each of the 16 wastewater treatment plants has a weighbridge to monitor sludge generated from the wastewater treatment plants, it was installed after the sludge treatment process of the wastewater plants.
QA/QC procedures to be applied	The weighbridge, including the frequency of calibration, should be done once a year in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$D_{PJ,i,y}$
Data unit	km
Description	Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y
Source of data	The ex-ante data can be available in the feasibility study report. The local government conducted on-site measurements on the distance between the wastewater treatment plants and the landfills, The data can be obtained from the letter on sludge treatment issued by the Guangdong Housing and Urban-Rural Development Bureau, and the data in the feasibility study report also comes from the on-site measurements of the government. Ex-post data will be monitored.
Description of measurement methods and procedures to be applied	The distance of sludge transportation between the wastewater treatment plants and landfills will be determined by online On-Board Diagnostics installed in sludge transport vehicle. The monitoring team of the wastewater treatment plant will be responsible for exporting and recording the data from online On-

	Board Diagnostics every year, this data will be recorded in the fuel consumption record book of sludge transport vehicle.
Frequency of monitoring/recording	Once a year
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. Xiaqiao Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 7 km Qujie Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 5 km Xinyi City Dingbao Town wastewater treatment Plant: $D_{PJ,i,y}$ = 25.2 km Xinyi City Qianpai Town wastewater treatment Plant: $D_{PJ,i,y}$ = 9.6 km Xianqiao South Wastewater Treatment Plant: $D_{PJ,i,y}$ = 60.6 km Qiankeng Town North wastewater Plant: $D_{PJ,i,y}$ = 41 km Shangsha Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 61.6 km Baita Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 47.6 km Luoding Fourth Domestic wastewater Treatment Plant: $D_{PJ,i,y}$ = 18 km Shitan Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 153.2 km Litan Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 146.4 km jiulong Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 83.4 km Shakou Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 85.6 km Bomei Town wastewater Treatment Plant: $D_{PJ,i,y}$= 73.6 km Nantang Town wastewater Treatment Plant: $D_{PJ,i,y}$= 45 km

	Chikeng Town wastewater Treatment Plant: $D_{PJ,i,y}$ = 37 km
Monitoring equipment	Online On-Board Diagnostics installed in sludge transport vehicle.
QA/QC procedures to be applied	The parameter is obtained from the transporter. Furthermore, the same can also be verified during the proposed crediting period. This will ensure reliability and hence 'Low' level of uncertainty of the parameter. The ex-post distance of sludge transportation between the wastewater treatment plants and landfills will be determined by online On-Board Diagnostics installed in sludge transport vehicle, and it will be cross-check with the Sludge Disposal Letter issued by the Guangdong Housing and Urban-Rural Development Bureau(It was issued on 01-August-2020). Finally, the larger value will be selected because the calculation result is more conservative
Purpose of data	Calculation of project emissions.
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$F_{PJ,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Source of data	For ex-ante calculation, the data was obtained from the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, ＞4 tonne＜8 tonne)[47]. The ex-post data will be monitored.
Description of measurement methods and procedures to be applied	Fuel consumption of the transportation vehicle of 16 wastewater plants will be measured by the online On-Board Diagnostics installed in sludge transport vehicle. The monitoring team of the wastewater treatment plant will be responsible for exporting and recording the data from the online On-Board Diagnostics installed in sludge transport vehicle, this

[47] https://www.ndrc.gov.cn/xxgk/zcfb/tz/201511/W020190905506438255108.pdf

	data will be recorded in the fuel consumption record book of sludge transport vehicle.
Frequency of monitoring/recording	Once every three years
Value applied	0.251 (For ex ante estimation, the data is from Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, ＞4 tonne＜8 tonne))[47]
Monitoring equipment	Online On-Board Diagnostics installed in sludge transport vehicle
QA/QC procedures to be applied	The ex-post data will be monitored by Online On-Board Diagnostics installed in sludge transport vehicle, it will be cross-check with the data which comes from the guideline for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel, ＞4 tonne ＜8 tonne)[47]. The larger data will be used as an ex-post calculation because it is more conservative.
Purpose of data	Calculation of project emissions.
Calculation method	–
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$NCV_{PJ,j,y}$ and $EF_{PJ,j,y}$
Data unit	Respectively: TJ/mass or volume units, and tCO_2/T
Description	Respectively: net calorific value of the transportation fuel j, and CO_2 emission factor of the transportation fuel j in the year
Source of data	$NCV_{PJ,j,y}$ is obtained from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel)[47] $EF_{PJ,j,y}$: IPCC 2006 Vol2 Ch3 table 3.2.1(The parameter $EF_{PJ,j,y}$ in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories remains unchanged relative to IPCC 2006)
Description of measurement methods	The Net Calorific Value of the transportation fuel is taken from default value in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises[48].

[48] According to the methodology, this data needs on-site measurements, but at present, due to the technical conditions, this data cannot be monitored, so the official default value will be used.

and procedures to be applied	The CO_2 emission factor of the transportation fuel is taken from IPCC default value[48].
Frequency of monitoring/recording	Once a year
Value applied	$NCV_{PJ,j,y}$= 0.04333 TJ/tonne; $EF_{PJ,j,y}$= 74.1 tCO_2/TJ (For ex ante estimation, $NCV_{PJ,j,y}$ is from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel)[47], $EF_{PJ,j,y}$ is from IPCC 2006 Vol2 Ch3 table 3.2.1(There is no update for the parameter of $EF_{BL,j,y}$, $EF_{PJ,j,y}$ in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.)
Monitoring equipment	—
QA/QC procedures to be applied	No QA/QC procedure will be required for the parameter
Purpose of data	Calculation of project emissions.
Calculation method	—
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$q_{PJ,i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Source of data	For ex-ante calculation, the data was obtained from the feasibility study report. For ex-post calculation, the 16 wastewater treatment plants have vehicles specially used for sludge transportation. Therefore, during the actual monitoring process, the types of sludge transportation vehicles will be easily obtained. Therefore, the data will be recorded in the statistics of wastewater and sludge of Guangdong Yunshui wastewater treatment plants project,
Description of measurement methods and procedures to be applied	Manual records from 16 wastewater treatment plants The monitoring team of the wastewater treatment plant will be responsible for monitoring and recording the data.
Frequency of monitoring/recording	Once a day

Value applied	5 (For ex ante estimation, the data is from Feasibility Study Report of the project. The actual average vehicular capacity will be monitored)
Monitoring equipment	N/A
QA/QC procedures to be applied	–
Purpose of data	Calculation of project emissions.
Calculation method	N/A
Comments	The data will be stored for the crediting period + 2 years.

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
Source of data	Electricity meters.
Description of measurement methods and procedures to be applied	16 electricity meters will be installed at 16 wastewater plants. Readings will be done monthly.
Frequency of monitoring/recording	The data is monitored continuously and recorded once a month
Value applied	For ex ante estimation, the data is from Feasibility Study Report of the project. The actual electricity consumption will be monitored. Xiaqiao Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 607.07 MWh Qujie Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 772.63 MWh Xinyi City Dingbao Town wastewater treatment Plant: $EC_{PJ,j,y}$ = 408.39 MWh Xinyi City Qianpai Town wastewater treatment Plant: $EC_{PJ,j,y}$ = 764.92 MWh Xianqiao South Wastewater Treatment Plant: $EC_{PJ,j,y}$ = 1,250.56 MWh

	Qiankeng Town North wastewater Plant: $EC_{PJ,j,y}$ = 981.88 MWh Shangsha Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 1,229.82 MWh Baita Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 843.84 MWh Luoding Fourth Domestic wastewater Treatment Plant: $EC_{PJ,j,y}$ = 3,120.80 MWh Shitan Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 654.58 MWh Litan Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 724.25 MWh jiulong Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 724.25 MWh Shakou Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 877.74 MWh Bomei Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 2,747.02 MWh Nantang Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 2,777.02 MWh Chikeng Town wastewater Treatment Plant: $EC_{PJ,j,y}$ = 602.30 MWh
Monitoring equipment	Electricity meters installed in the wastewater plant
QA/QC procedures to be applied	Readings will be verified using monthly electricity bills. Calibration of the electricity meters will be done according to national standard by qualified organizations. Readings will be cross-checked using monthly electricity bills of the wastewater plant. For missing data, average monthly electricity consumption in the JPM or average electricity consumption of the previous months whichever is higher will be used. This is the most conservative approach.
Purpose of data	To calculate project emissions
Calculation method	Electricity bill
Comments	N/A

Data / Parameter	$TDL_{j,y}$
Data unit	–
Description	Average technical transmission and distribution losses for providing electricity to source j in year y.
Source of data	As per the Methodological Tool 05 (V3.0) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" In case of scenario B and scenario C, case C.II, assume $TDL_{j,y}$=0 as a simplification. In case of other scenarios (scenario A and scenario C, cases C.I and C.III), choose one of the following options: 1. Use annual average value based on the most recent data available within the host country. 2. Use as default values of 20% for: (a) project or leakage electricity consumption sources; (b) baseline electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies. 3. Use as default values of 3% for: (a) baseline electricity consumption sources. (b) project and leakage electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is smaller than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.
Description of measurement methods and procedures to be applied	Scenario A: Electricity consumption from the grid is applied to the proposed project. For project electricity consumption sources, a default value of 20% is used for $TDL_{j,y}$.
Frequency of monitoring/recording	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Value applied	20%
Monitoring equipment	-
QA/QC procedures to be applied	–

Purpose of data	To calculate project emissions
Calculation method	–
Comments	For (a): $TDL_{j,y}$ should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation.

5.3 Monitoring Plan

The monitoring plan presented in this JPM assures that real, measurable, long term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the project. This monitoring plan will be implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

Monitoring framework

Figure 5-1 below outlines the organization structure of the monitoring system for the related three parameters. The project owner will be responsible for the whole monitoring work. The VCS monitoring team will be responsible for the monitoring of all the parameters to be monitored. All the data will be reviewed by the project developer and VVB.

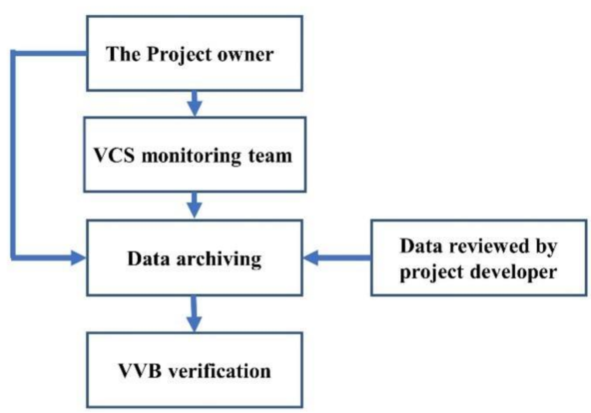
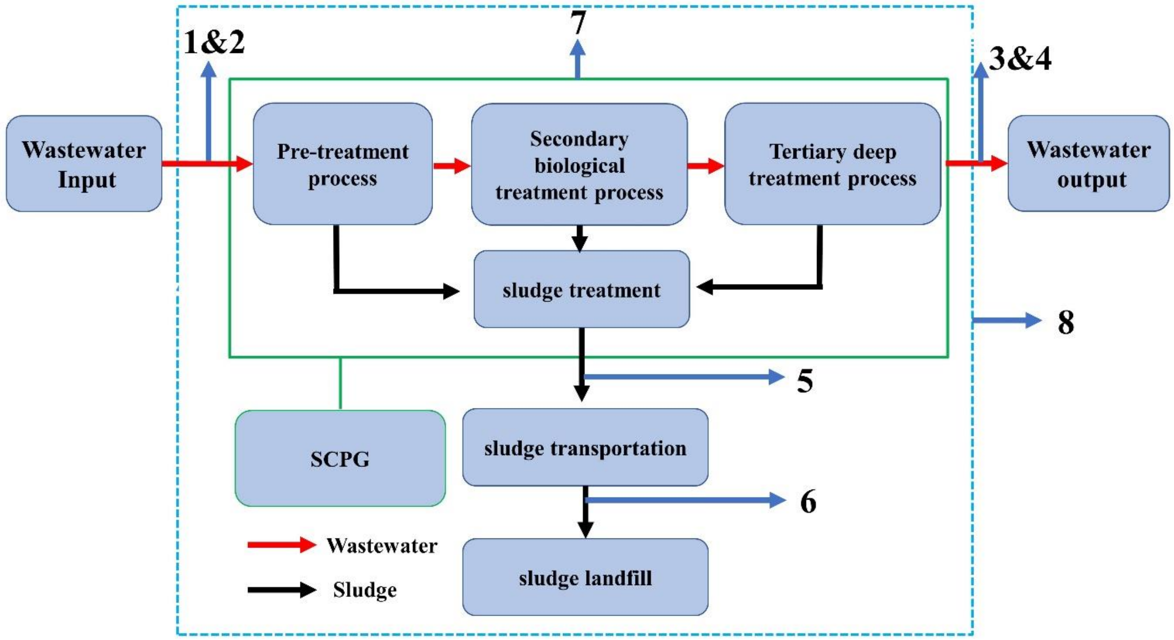


Figure 5-1 Organization Structure of the Monitoring Team

Monitoring equipment and installation

Installation and configuration of monitoring devices are shown as Figure 5-2. In order to ensure measurements with a low degree of uncertainty, the data metering equipment and gauges will be calibrated and checked by an appropriately qualified third party according to an appropriate national standard. The calibration records will be appropriately maintained and made available for review by VVB.



1： Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,ww,m}$ and $Q_{PJ,ww,I}$;

2: COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$:

3: Electromagnetic flowmeter converter. Monitoring parameters: $Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$;

4. COD_{cr} water quality online automatic monitor. Monitoring parameters: $W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$:

5. Weighbridge. Monitoring parameters: $Q_{PJ,sl,y}$;

6. Online On-Board Diagnostics installed in sludge transport vehicle. Monitoring parameters: $D_{PJ,i,y}$ and $F_{PJ,i}$;

7. Electricity meters. Monitoring parameters: $EC_{PJ,j,y}$;

8. China Meteorological Administration regularly calibrates and maintains the temperature monitoring equipment according to the national specifications. Monitoring parameters: $T_{2,m}$;

Figure 5-2 Installation and Configuration of Meters

Quality control and quality assurance procedures

A quality management system will be established, which ensures the quality and accuracy of the measured data.

Training

For all members involved in the project, necessary trainings will be provided by the project owner. Besides, the project owner should ensure that only skilled employees are allowed to undertake the monitoring work. The training contents should be regard to the general and technical aspects of the project to the extent appropriate, as well as basic understandings of VCS Standard and climate change.

Data management

All data collected as part of monitoring plan should be saved with at least 1 backup copy until the end of the crediting period. After the crediting period ends, the data should be archived electronically on hard disks and be kept at least 2 years after the end of the last crediting period.

Corrective actions

The project will sign an agreement that it will not participate in other environment credits, other GHG programs and has not been rejected by any other GHG Programs. The whole VCS monitoring team will follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate. The quality control and quality assurance procedures include the handling and correction of nonconformities in the implementation of the project or the monitoring plan. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes will be carried out immediately by the project owner, with the help of external experts if necessary.

- A corrective action plan should then be developed to eliminate the non-conformity and its causes to prevent its recurrence.

- Corrective actions are implemented and reported back to the VCS monitoring team.

- Relative information will be included in the monitoring report and reported to VVB during the verification.

If the data record is missing or damaged during the monitoring periods, the following makeup process will be conducted:

-The general principle is that zero value will be used for the missing or damaged data. This is most conservative approach. The monitoring personnel will be trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. During the monitoring process, the monitoring personnel will be required to strictly abide by the above conservative principle in data recording, i.e., use zero values for all the missing or damaged data.

-If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the meantime, use zero value for the missing or damaged data;

-If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the meantime, use zero value for the missing or damaged data;

-If some data recorded are significantly higher than the normal range, the monitoring personnel should ask for the reason. If the measurement is high due to the damage of measurement equipment, zero value will be used for that day's data. And need to calibrate and maintain the measuring equipment immediately and avoid this situation in the future.

If the monitoring results are satisfactory in terms of correct reporting, data completeness and correct analysis, the data will be accepted for the monitoring report.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$
Data unit	m^3
Description	Quantity of wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Value applied:	Please refer to the ER spreadsheet for the detailed applied value.
Comments	The data will be stored for the crediting period + 2 years $Q_{PJ,ww,m}$ and $Q_{PJ,ww,i}$ was monitored by the electromagnetic flowmeter converter, it was installed in front of pre-treatment process of the wastewater plant. And it can monitor the influent flow continuously and record it per hour. All the hourly influent flow data were exported by the monitoring team to form the daily and monthly record at the beginning of the next month. The average daily influent flow was calculated based on the 24-hourly data. The average monthly influent flow was calculated based on all the daily data of this month.

	The manufacturer of the electromagnetic flowmeter converter is Dalian sigma Instrument Co., Ltd, it was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG1033-2007" Verification Regulation of electromagnetic flowmeter converter" in China. The measure range of electromagnetic flowmeter converter is 0~1000m³/h, and the serial No., model, accuracy, the calibration date and validity date of the electromagnetic flowmeter converter are shown in the following table:

wastewater Treatment Plant	Type	Accuracy	Series number	Calibration date	Validity
Xiaqiao Town	SEAGMA LDG250-BSYZ5	$0.001m^3/h$	Q-XQ-1	27-August-2020 26-August-2021	1 years
Qujie Town			Q-QJ-1		
Dingbao Town			Q-DB-1		
Qianpai Town			Q-QP-1		
Xianqiao South			Q-XQN-1		
Qiankeng Town			Q-QK-1		
Shangsha Town			Q-SS-1		
Baita Town			Q-BT-1		
Luoding			Q-LD-1		
Shitan Town			Q-ST-1		
Litan Town			Q-LT-1		
jiulong Town			Q-JL-1		
Shakou Town			Q-SK-1		
Bomei Town			Q-BM-1		
Nantang Town			Q-NT-1		
Chikeng Town			Q-CK -1		

Data / Parameter	$Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$
Data unit	m^3
Description	Quantity of effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively.

<table>
<tr><td>Value applied:</td><td>Please refer to the ER spreadsheet for the detailed applied value.</td></tr>
<tr><td>Comments</td><td>The data will be stored for the crediting period + 2 years

$Q_{PJ,effl,i}$ and $Q_{PJ,effl,m}$ was monitored by the electromagnetic flowmeter converter, it was installed at the effluent channel of the wastewater plant. And it can monitor the effluent flow continuously and record it per hour. All the hourly effluent flow data were exported by the monitoring team to form the daily and monthly record at the beginning of the next month. The average daily effluent flow was calculated based on the 24-hourly data. The average monthly influent flow was calculated based on all the daily data of this month.

The manufacturer of the electromagnetic flowmeter converter is Dalian sigma Instrument Co., Ltd, it was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG1033-2007" Verification Regulation of electromagnetic flowmeter converter" in China.

The measure range of electromagnetic flowmeter converter is 0~1000m^3/h, and the serial No., model, accuracy, the calibration date and validity date of the electromagnetic flowmeter converter are shown in the following table:

<table>
<tr><th>wastewater Treatment Plant</th><th>Type</th><th>Accuracy</th><th>Series number</th><th>Calibration date</th><th>Validity</th></tr>
<tr><td>Xiaqiao Town</td><td rowspan="13">SEAGMA LDG250-BSYZ5</td><td rowspan="13">0.001m^3/h</td><td>Q-XQ-2</td><td rowspan="13">27-August-2020 26-August-2021</td><td rowspan="13">1 years</td></tr>
<tr><td>Qujie Town</td><td>Q-QJ-2</td></tr>
<tr><td>Dingbao Town</td><td>Q-DB-2</td></tr>
<tr><td>Qianpai Town</td><td>Q-QP-2</td></tr>
<tr><td>Xianqiao South</td><td>Q-XQN-2</td></tr>
<tr><td>Qiankeng Town</td><td>Q-QK-2</td></tr>
<tr><td>Shangsha Town</td><td>Q-SS-2</td></tr>
<tr><td>Baita Town</td><td>Q-BT-2</td></tr>
<tr><td>Luoding</td><td>Q-LD-2</td></tr>
<tr><td>Shitan Town</td><td>Q-ST-2</td></tr>
<tr><td>Litan Town</td><td>Q-LT-2</td></tr>
<tr><td>jiulong Town</td><td>Q-JL-2</td></tr>
<tr><td>Shakou Town</td><td>Q-SK-2</td></tr>
</table>
</td></tr>
</table>

	Bomei Town			Q-BM-2		
	Nantang Town			Q-NT-2		
	Chikeng Town			Q-CK -2		

Data / Parameter	$W_{PJ,COD,ww,m}$ and $W_{PJ,COD,ww,i}$
Data unit	$tCOD/m^3$
Description	Average chemical oxygen demand in the wastewater that is treated in the aerobic wastewater treatment plant in the project activity in month m and in day i, respectively
Value applied:	Please refer to the ER spreadsheet for the detailed applied value.
Comments	The data will be stored for the crediting period + 2 years. $W_{PJ,COD,ww,i}$ and $W_{PJ,COD,ww,m}$ was monitored by the COD_{cr} water quality online automatic monitor, it was installed in front of pre-treatment process of the wastewater plant. The COD water quality online automatic monitor COD every two hours. All the COD data were exported by the monitoring team to form the daily and monthly record aggregated at the beginning of the next month. The average daily COD concentration was calculated based on the 24-hourly data. The average monthly COD concentration was calculated based on all the daily data of this month. The manufacturer of the CODcr water quality online automatic monitor is Guangzhou Yiwen huansu Technology Co., Ltd,, it was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG1012-2019" Verification Regulation of COD_{cr} water quality online automatic monitor" in China. The measure range of COD water quality online automatic monitors is 0~2000 mg/L, and the serial No., model, accuracy, the calibration date and validity date of the flowmeter are shown in the following table:

wastewater Treatment Plant	Type	Accuracy	Series number	Calibration date	Validity

	Xiaqiao Town	ZHYQ3059	0.1mg/L	In-COD-XQ-1	29-August-2020 28-August-2021	1 years
	Qujie Town			In-COD -QJ-1		
	Dingbao Town			In-COD -DB-1		
	Qianpai Town			In-COD -QP-1		
	Xianqiao South			In-COD -XQN-1		
	Qiankeng Town			In-COD-QK-1		
	Shangsha Town			In-COD-SS-1		
	Baita Town			In-COD-BT-1		
	Luoding			In-COD-LD-1		
	Shitan Town			In-COD-ST-1		
	Litan Town			In-COD-LT-1		
	jiulong Town			In-COD-JL-1		
	Shakou Town			In-COD-SK-1		
	Bomei Town			In-COD-BM-1		
	Nantang Town			In-COD-NT-1		
	Chikeng Town			In-COD-CK -1		

Data / Parameter	$T_{2,m}$
Data unit	K
Description	Average temperature at the project site in month m
Value applied:	Please refer to the ER spreadsheet for the detailed applied value, and the data comes from this website: https://www.tianqi24.com/city/history.html.
Comments	The data will be stored for the crediting period + 2 years On-site measurement of the temperature was conducted by local meteorological bureau as per the requirements of the applied

	methodology. The monthly average temperature of the 16 plants during this monitoring period was summarized in temperature monitoring report for the 16 wastewater treatment plants. The higher the average temperature, the larger the related baseline emissions. To get the conservative value of the average temperature, the results were cross-checked with the public statistics. The lower value was used, which is sourced from: https://www.tianqi24.com/city/history.html..

Data / Parameter	$W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$
Data unit	$tCOD/m^3$
Description	Average chemical oxygen demand in the effluent that leaves the aerobic wastewater treatment plant in the project activity in day i and month m, respectively
Value applied:	Please refer to the ER spreadsheet for the detailed applied value.
Comments	The data will be stored for the crediting period + 2 years $W_{PJ,COD,effl,i}$ and $W_{PJ,COD,effl,m}$ was monitored by the COD_{cr} water quality online automatic monitor, it was installed at the end of the tertiary deep treatment process. The COD water quality online automatic monitor COD every two hours. All the COD data were exported by the monitoring team to form the daily and monthly record aggregated at the beginning of the next month. The average daily COD concentration was calculated based on the 24-hourly data. The average monthly COD concentration was calculated based on all the daily data of this month. The measure range of CODcr water quality online automatic monitor is 0~2000mg/L, and the manufacturer of the CODcr water quality online automatic monitor is Guangzhou Yiwen huansu Technology Co., Ltd,, it was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG1012-2019" Verification Regulation of COD_{cr} water quality online automatic monitor" in China.

The serial No., model, accuracy, the calibration date and validity date of the COD_{cr} water quality online automatic monitor are shown in the following table:

wastewater Treatment Plant	Type	Accuracy	Series number	Calibration date	Validity
Xiaqiao Town	ZHYQ3059	0.1mg/L	Out-COD-XQ-1	25-August-2020 24-August-2021	1 years
Qujie Town			Out-COD -QJ-1		
Dingbao Town			Out-COD -DB-1		
Qianpai Town			Out-COD -QP-1		
Xianqiao South			Out-COD -XQN-1		
Qiankeng Town			Out-COD -QK-1		
Shangsha Town			Out-COD -SS-1		
Baita Town			Out-COD -BT-1		
Luoding			Out-COD -LD-1		
Shitan Town			Out-COD -ST-1		
Litan Town			Out-COD -LT-1		
jiulong Town			Out-COD -JL-1		
Shakou Town			Out-COD -SK-1		
Bomei Town			Out-COD -BM-1		
Nantang Town			Out-COD -NT-1		

	Chikeng Town			Out-COD - CK -1		

Data / Parameter	$f_{PJ,d,y}$
Data unit	fraction
Description	Factor expressing the influence of the depth on methane generation in year y
Value applied:	0% (Depth < 1 m)
Comments	The data will be stored for the crediting period + 2 years. The effluent channels of the 16 wastewater treatment plants is not more than 1m, so there is no need for monitoring equipment for the effluent channels, In the current monitoring period, the depth of the effluent channels does not exceed 1m.

Data / Parameter	$Q_{PJ,sl,y}$
Data unit	tonnes
Description	Quantity of sludge produced in the project activity in the year y
Value applied:	Please refer to the ER spreadsheet for the detailed applied value.
Comments	The data will be stored for the crediting period + 2 years $Q_{PJ,sl,y}$ was monitored by the weighbridge, it was installed at the end of the sludge treatment process, then the sludge is transported to the landfill. The 16 weighbridges continuously weighs the dried sludge produced by the 16 wastewater plants every day, and then transports it to the landfill for landfill treatment. The monitoring team records the total quality of sludge produced every day to form a monthly record at the beginning of the next month, and calculates the annual total sludge weight according to the monthly sludge data. The measure range of weighbridge is 0~50t, and the manufacturer of the weighbridge is Keli Sensing Technology (Ningbo) Co., Ltd., it

	was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG 539-2016" Verification Regulation of weighbridge" in China. The serial No., model, accuracy, the calibration date and validity date of the flowmeter are shown in the following table:

wastewater Treatment Plant	Type	Accuracy	Series number	Calibration date	Validity
Xiaqiao Town	SCS-50t/10kg	10kg	202006001	23-August-2020 22-August-2021	1 years
Qujie Town			202006002		
Dingbao Town			202006003		
Qianpai Town			202006004		
Xianqiao South			202006005		
Qiankeng Town			202006006		
Shangsha Town			202006007		
Baita Town			202006008		
Luoding			202006009		
Shitan Town			202006010		
Litan Town			202006011		
jiulong Town			202006012		
Shakou Town			202006013		
Bomei Town			202006014		
Nantang Town			202006015		
Chikeng Town			202006016		

Data / Parameter	$D_{PJ,i,y}$
Data unit	Km
Description	Average distance per trip travelled by the transportation vehicle of type i for transportation of sludge generated by the wastewater treatment system in the project activity in the year y
Value applied:	The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board

	Diagnostics installed in sludge transport vehicle, and it was cross-check with the Sludge Disposal Letter issued by the Guangdong Housing and Urban-Rural Development Bureau(It was issued on 01-August-2020). Finally, the larger value was selected because the calculation result is more conservative. $D_{PJ,i,y}$—Xiaqiao Town wastewater Treatment Plant The data monitored by the On-Board Diagnostics installed in sludge transport vehicle is 7 km, and the sludge treatment issued by the Guangdong Housing and Urban-Rural Development Bureau is 7.4 km. Therefore, 7.4 km was selected for calculation. The transportation distance of the following wastewater treatment plants is taken in the same way. $D_{PJ,i,y}$—Qujie Town wastewater Treatment Plant 5.2 km $D_{PJ,i,y}$—Xinyi City Dingbao Town wastewater treatment Plant 25.2 km $D_{PJ,i,y}$—Xinyi City Qianpai Town wastewater treatment Plant 9.8 km $D_{PJ,i,y}$—Xianqiao South Wastewater Treatment Plant 60.6 km $D_{PJ,i,y}$—Qiankeng Town North wastewater Plant 41 km $D_{PJ,i,y}$—Shangsha Town wastewater Treatment Plant 61.6 km $D_{PJ,i,y}$—Baita Town wastewater Treatment Plant 47.6 km $D_{PJ,i,y}$—Luoding Fourth Domestic wastewater Treatment Plant 18.2 km $D_{PJ,i,y}$—Shitan Town wastewater Treatment Plant 153.2 km $D_{PJ,i,y}$—Litan Town wastewater Treatment Plant 146.8 km

	$D_{PJ,i,y}$—**jiulong Town wastewater Treatment Plant** 83.4 km $D_{PJ,i,y}$—**Shakou Town wastewater Treatment Plant** 85.6 km $D_{PJ,i,y}$—**Bomei Town wastewater Treatment Plant** 73.8 km $D_{PJ,i,y}$—**Nantang Town wastewater Treatment Plant** 45.6 km $D_{PJ,i,y}$—**Chikeng Town wastewater Treatment Plant** 37.6 km
Comments	The data will be stored for the crediting period + 2 years. The distance of sludge transportation between the wastewater treatment plants and landfills was determined by online On-Board Diagnostics installed in sludge transport vehicle, and it was cross-check with the Sludge Disposal Letter issued by the Guangdong Housing and Urban-Rural Development Bureau(It was issued on 01-August-2020), the larger value was selected because the calculation result is more conservative. This data is monitored once a year.

Data / Parameter	$F_{PJ,i}$
Data unit	Liter/km
Description	Specific fuel consumption of the transportation vehicle of type i
Value applied:	0.251
Comments	The data will be stored for the crediting period + 2 years. In this monitoring period, the fuel used by transport vehicles is diesel, fuel consumption of the transportation vehicle of 16 wastewater plants was measured by the online On-Board Diagnostics installed in sludge transport vehicle, the monitoring data of this parameter are all lower than 0.251 Liter/km, and the detailed monitoring results can be found in the fuel consumption record book of sludge transport vehicle.

No.	Wastewater Treatment Plant	$F_{PJ,i}$
1	Xiaqiao	0.192
2	Qujie	0.201
3	Dinbao	0.212
4	Qianpai	0.198
5	Xianqiao	0.194
6	Qiankeng	0.195
7	Shangsha	0199
8	Baita	0.203
9	Luoding	0.201
10	Shitan	0.203
11	Litan	0.201
12	jiulong	0.201
13	Shakou	0.198
14	Bomei	0.192
15	Nantang	0.193
16	Chikeng	0.194

According to the Table 1 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel ＞4 tonne ＜8 tonne), the default value of this parameter is 0.251 Liter/km.

Therefore, the data in this monitoring period are all taken as 0.251 for calculation, so the results are more conservative.

Data / Parameter	$NCV_{PJ,j,y}$ and $EF_{PJ,j,y}$
Data unit	Respectively: TJ/mass or volume units, and tCO_2/T
Description	Respectively: net calorific value of the transportation fuel j, and CO_2 emission factor of the transportation fuel j in the year

Value applied:	$NCV_{PJ,j,y}$= 0.04333 TJ/tonne; $EF_{PJ,j,y}$= 74.1 tCO_2/TJ ($NCV_{PJ,j,y}$ is from Table 2 in Guidelines for Accounting Methods and Reporting of Greenhouse Gas Emissions of Transportation Enterprises (Diesel), $EF_{PJ,j,y}$ is from IPCC 2006 Vol2 Ch3 table 3.2.1(There is no update for the parameter of $EF_{BL,j,y}$, $EF_{PJ,j,y}$ in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.)
Comments	The data will be stored for the crediting period + 2 years. In this monitoring period, the fuel used by transport vehicles is diesel, according to the methodology, this data needs on-site measurements, but at present, due to the technical conditions, this data cannot be monitored, so the official default value will be used, this data in this guideline was not updated throughout the monitoring period.

Data / Parameter	$q_{PJ,i}$
Data unit	tonnes/trip
Description	Average vehicular capacity of the transportation vehicle of type i
Value applied:	5
Comments	The data will be stored for the crediting period + 2 years. During the actual monitoring process, the types of sludge transportation vehicles was easily obtained, and the data was recorded in the statistics of wastewater and sludge of Guangdong Yunshui wastewater treatment plants project,

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
Value applied:	Please refer to the ER spreadsheet for the detailed applied value.

Comments

The data will be stored for the crediting period + 2 years.

16 electricity meters are installed in 16 wastewater treatment plants to monitor the electricity consumption of the wastewater treatment plants.

The project owner signed a power purchase agreement with the local grid company, and the reading of the meter is recorded on time every month. At the end of each month, all electricity bills are settled by the project owner and the local grid company, and all electricity consumption data are confirmed by the electricity bill provided by the grid company. The electricity bill includes the power supply period, meter information (location, accuracy, maximum range), electricity consumption, and electricity costs.

According to the monitoring plan, there is no missing data in this monitoring period.

The manufacturer of the electricity meters is Wasion Group Limited, the model and accuracy are DTSK341-Z and 0.5S respectively, and it was calibrated by an officially accredited entity (South China National Centre of Metrology) in compliance with JJG 596-2012" Electrical Meters for Measuring Alternating-current Electrical Energy" in China.

The serial No., the calibration date and validity date of the electricity meters are shown in the following table:

<table>
<tr><th>Wastewater Treatment Plant</th><th>Series number</th><th>Calibration date</th><th>Validity</th></tr>
<tr><td>Xiaqiao Town</td><td>03001SF00000271700097967</td><td rowspan="8">28-August-2020</td><td rowspan="8">5 years</td></tr>
<tr><td>Qujie Town</td><td>03001SF00000211800071045</td></tr>
<tr><td>Dingbao Town</td><td>03001SF00000211800078357</td></tr>
<tr><td>Qianpai Town</td><td>03001SF00000271700098940</td></tr>
<tr><td>Xianqiao South</td><td>03001SF00000211800081023</td></tr>
<tr><td>Qiankeng Town</td><td>03001SF00000271700098465</td></tr>
<tr><td>Shangsha Town</td><td>03001SF00000211800078357</td></tr>
<tr><td>Baita Town</td><td>03001SF00000271700095957</td></tr>
</table>

	Luoding	03001SF00000271700095625		
	Shitan Town	03001SF00000221900061146		
	Litan Town	03001SF00000211800071045		
	jiulong Town	03001SF00000271700095957		
	Shakou Town	03001SF00000271700026321		
	Bomei Town	03001SF00000231500061245		
	Nantang Town	03001SF00000271700026321		
	Chikeng Town	03001SF00000271700095625		

Data / Parameter	$TDL_{j,y}$
Data unit	_
Description	Average technical transmission and distribution losses for providing electricity to source j in year y.
Value applied:	20%
Comments	The value of this parameter sourced from Tool 05 “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (Version 03.0) and this tool is not updated in this monitoring period.

6.2 Baseline Emissions

In this section, the detailed calculation formula and its description are also described in section 4.1

i). Calculation of baseline emissions from treatment of wastewater ($BE_{CH4,ww,y}$):

During this monitoring period, $BE_{CH4,ww,y}$ is 132,108 tCO_2e, the results of each wastewater treatment plant are summarized as the following table. Please refer to the ER spreadsheet for the detailed calculation process.

No.		$BE_{CH4,ww,y}$ (tCO_2e)

	Wastewater Treatment Plant	03-September-2020 to 31-December-2020	01-Janurary-2021 to 31-December-2021	01-Janurary-2022 to 30-June-2022	1st Monitoring Period
1	Xiaqiao	550	2,053	1,090	3,693
2	Qujie	835	2,916	1,624	5,375
3	Dinbao	223	761	393	1,377
4	Qianpai	712	2,581	1,365	4,658
5	Xianqiao	1,193	4,714	2,503	8,409
6	Qiankeng	1,122	4,327	1,910	7,359
7	Shangsha	1,199	4,805	2,562	8,566
8	Baita	754	3,020	1,563	5,337
9	Luoding	2,472	10,457	5,667	18,596
10	Shitan	652	2,580	1,352	4,584
11	Litan	740	2,998	1,571	5,309
12	jiulong	560	2,074	1,101	3,735
13	Shakou	883	3,777	2,021	6,682
14	Bomei	2,922	12,200	6,483	21,605
15	Nantang	2,932	12,582	6,665	22,179
16	Chikeng	700	2,600	1,344	4,644
Total		18,449	74,446	39,214	132,108

ii). Calculation of baseline emissions from treatment of sludge ($BE_{CH4,sl,y}$)

The sludge that produced in the baseline scenario from the treatment of wastewater in the open lagoons system was treated by means of controlled drying under aerobic conditions and then disposed to a landfill with methane recovery (S2), the corresponding methane emissions ($BE_{CH4,sl,y}$) are considered to be negligible and are not accounted for. Therefore:

$BE_{CH_4,sl,y}$=0 tCO_2e/year

iii). Calculation of baseline emissions from consumption of electricity ($BE_{EL,y}$)

There is no power consumption in this baseline scenario, therefore:

$BE_{EL,y}$=0 tCO_2e/year

iv). Baseline emissions from the generation of heat ($BE_{HG,y}$)

There are no emissions from the generation of heat in this baseline scenario, therefore:

$BE_{HG,y}$=0 tCO_2e/year

v). Baseline emissions from transportation of sludge ($BE_{TR,sl,y}$)

During this monitoring period, $BE_{TR,sl,y}$ is 18.73 tCO_2e, the results of each wastewater treatment plant are summarized as the following table. Please refer to the ER spreadsheet for the detailed calculation process.

No.	Wastewater Treatment Plant	$BE_{TR,sl,y}$ (tCO_2e)			
		03-September-2020-31-December-2020	01-January-2022-30-June-2022	01-January-2022-30-June-2022	1st Monitoring Period
1	Xiaqiao	0.35	1.13	0.56	2.03
2	Qujie	0.47	1.44	0.80	2.71
3	Dinbao	0.21	0.65	0.31	1.17
4	Qianpai	0.45	1.40	0.68	2.54
5	Xianqiao	0.71	2.37	1.17	4.25
6	Qiankeng	0.73	2.35	1.16	4.24
7	Shangsha	0.91	3.04	1.50	5.44
8	Baita	0.49	1.64	0.80	2.92
9	Luoding	1.57	5.33	2.62	9.52
10	Shitan	0.44	1.40	0.68	2.53
11	Litan	0.46	1.51	0.73	2.70
12	jiulong	0.46	1.52	0.74	2.72
13	Shakou	0.53	1.74	0.85	3.11
14	Bomei	1.54	5.36	2.66	9.56
15	Nantang	1.60	5.69	2.80	10.09
16	Chikeng	0.44	1.40	0.69	2.53
Total		11.34	37.98	18.73	68.05

Therefore, baseline emissions can be calculated as:

$$BE_y = BE_{CH_4,ww,y} + BE_{CH_4,sl,y} + BE_{EL,y} + BE_{HG,y} + BE_{TR,sl,y}$$

$$= BE_{CH_4,ww,y} + BE_{TR,sl,y}$$

Year	$BE_{CH_4,ww,y}$ (tCO_2e)	$BE_{TR,sl,y}$ (tCO_2e)	BE_y (tCO_2e)
	A	B	C=A+B

03-September-2020-31-December-2020	18,449	11.34	18,460
01-January-2022-30-June-2022	74,446	37.98	74,484
01-January-2022-30-June-2022	39,214	18.73	39,233
1st Monitoring Period	132,108	68.05	132,176

6.3 Project Emissions

In this section, the detailed calculation formula and its description are also described in section 4.1. Therefore, please refer to section 4.1 for the detailed calculation formula.

i) Methane emissions from treatment of wastewater ($PE_{CH4,ww,y}$)

After calculation, OR_i >0.8, so $PE_{CH_4,wwtp,y}$=0 tCO_2e/year

Please refer to the ER spreadsheet for the detailed calculation process.

ii). Methane emissions from treatment of sludge in the project activity in year y ($PE_{CH4,sl,y}$)

Sludge in this project activity is dried under controlled and aerobic conditions, and then disposed to a landfill with methane recovery or used in soil application, corresponding project emissions are considered to be negligible and should not be accounted for. Therefore:

$PE_{CH_4,sl,y} = 0$ tCO_2e/year

iii). N_2O emissions from treatment of sludge in the project activity in year y ($PE_{N2O,sl,y}$)

Nitrous oxide emissions are assumed to be negligible and need not be accounted for if the sludge is:

- Dried under controlled and aerobic conditions, and then disposed to a landfill; or,
- Treated in a new anaerobic digester and the residues from the anaerobic digester are dehydrated, limed and stored before final disposal in a controlled landfill.

Sludge generated by the project activity was dried under controlled and aerobic conditions, with disposal in Landfill Site with methane recovery. Therefore: $PE_{N2O,sl,y} = 0$ tCO_2e/year

iv). Project emissions associated with electricity consumption in the project activity ($PE_{EC,y}$)

During this monitoring period, $PE_{EC,y}$ is 21,754.51 tCO_2e, the results of each wastewater treatment plant are summarized as the following table. Please refer to the ER spreadsheet for the detailed calculation process.

No.	Wastewater Treatment Plant	$PE_{EC,y}$ (tCO_2e)			
		03-September-2020-31-December-2020	01-January-2022-30-June-2022	01-January-2022-30-June-2022	1st Monitoring Period
1	Xiaqiao	123.88	381.74	190.56	696.18
2	Qujie	146.74	485.75	242.52	875.00
3	Dinbao	79.62	256.86	128.11	464.59
4	Qianpai	148.15	480.69	239.84	868.68
5	ianqiao	248.55	786.32	392.65	1,427.51
6	Qiankeng	199.39	617.48	309.15	1,126.02
7	Shangsha	247.20	772.91	386.97	1,407.07
8	Baita	171.06	530.45	264.50	966.00
9	Luoding	625.23	1,963.06	979.82	3,568.12
10	Shitan	130.78	411.69	205.88	748.35
11	Litan	145.13	454.74	227.05	826.92
12	jiulong	144.92	454.13	226.72	825.77
13	Shakou	175.99	551.69	275.19	1,002.86
14	Bomei	527.91	1,726.06	863.75	3,117.73
15	Nantang	525.41	1,748.93	871.56	3,145.90
16	Chikeng	120.32	378.36	189.11	687.80
Total		3,760.26	12,000.84	5,993.40	21,754.51

v). **Project emissions from transportation of sludge ($PE_{TR,sl,y}$)**

During this monitoring period, $PE_{TR,sl,y}$ is tCO_2e, the results of each wastewater treatment plant are summarized as the following table. Please refer to the ER spreadsheet for the detailed calculation process.

No.	Wastewater Treatment Plant	$PE_{TR,sl,y}$ (tCO_2e)			
		03-September-2020-31-December-2020	01-January-2022-30-June-2022	01-January-2022-30-June-2022	1st Monitoring Period
1	Xiaqiao	0.31	0.95	0.46	1.72

2	Qujie	0.17	0.54	0.27	0.98
3	Dinbao	0.60	1.79	0.90	3.29
4	Qianpai	0.38	1.19	0.59	2.16
5	ianqiao	3.49	11.49	5.70	20.68
6	Qiankeng	1.86	5.97	2.97	10.80
7	Shangsha	3.29	11.05	5.42	19.77
8	Baita	1.58	5.25	2.64	9.47
9	Luoding	2.55	8.65	4.31	15.51
10	Shitan	7.36	23.44	11.72	42.52
11	Litan	7.25	23.85	11.83	42.93
12	jiulong	4.12	13.27	6.66	24.05
13	Shakou	5.39	17.79	8.87	32.04
14	Bomei	13.44	46.36	22.98	82.78
15	Nantang	7.84	27.81	13.77	49.42
16	Chikeng	1.76	5.57	2.83	10.16
Total		61.40	204.96	101.92	368.28

So the project emissions can be calculated:

$$PE_y = PE_{CH_4,ww,y} + PE_{CH_4,sl,y} + PE_{N_2O,sl,y} + PE_{EC,y} + PE_{FC,y} + PE_{TR,sl,y}$$

$$=PE_{EC,y} + PE_{TR,sl,y}$$

Year	**$PE_{EC,y}$(tCO_2e)**	**$PE_{TR,sl,y}$ (tCO_2e)**	**BE_y (tCO_2e)**
	A	**B**	**C=A+B**
03-September-2020-31-December-2020	3,760.26	61.4	3,832
01-January-2022-30-June-2022	12,000.84	204.96	12,212
01-January-2022-30-June-2022	5,993.40	101.92	6,105
1st Monitoring Period	21,754.51	368.28	22,149

6.4 Leakage

The used technology is not equipment transferred from another activity, so no leakage is considered in this methodology.

$$LE_y = 0$$

6.5 Net GHG Emission Reductions and Removals

Emission reductions for any given year of the crediting period are obtained by subtracting project emissions and leakage from baseline emissions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions reductions of the project activity in year y (tCO_2e/year)

BE_y = Baseline emissions in year y (tCO_2e/year)

PE_y = Project emissions in year y (tCO_2e/year)

LE_y = Leakage emissions in year y (tCO_2e/year)

Emissions reductions are calculated as:

Table 5-1 The estimation of ER_y

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
03-September-2020-31-December-2020	18,452	3,832	0	14,620
01-January-2021-31-December-2021	74,476	12,212	0	62,264
01-January-2022-30-June-2022	39,223	6,105	0	33,118
Total (t CO_2e)	132,151	22,149	0	110,002

Comparison of actual emission reduction achieved and estimated emission reduction:

Year	Estimated emission reduction in JPM (tCO_2e)	Actual Emission reduction achieved (tCO_2e)	Difference
03-September-2020-31-December-2020	24,831[49]	14,620	-41.12%

[49] Please refer to Section 4.4 for the calculation of ex-ante emission reduction from 03-September-2020 to 31-December-2020.

01-January-2021-31-December-2021	83,296	62,264	-25.25%
01-January-2022-30-June-2022	41,306[50]	33,118	-19.82%
03-September-2020-30-June-2022	149,433	110,002	-26.39%[51]

The estimated emission reduction in the JPM in 2020 (03-September-2020-31-December-2020) is 24,831 tCO_2e, and the actual emission reduction in this monitoring period is 14,620 tCO_2e, which is 41.12% lower than the estimated emission reduction in the JPM. The estimated emission reduction in the JPM in 2021 (01-January-2021-31-December-2021) is 83,296 tCO_2e, and the actual emission reduction in this monitoring period is 62,264 tCO_2e, which is 25.25% lower than the estimated emission reduction in the JPM. The estimated emission reduction in the JPM in 2022 (01-January-2022-30-June-2022) is 41,306 tCO_2e, and the actual emission reduction in this monitoring period is 33,118 tCO_2e, which is 19.82% lower than the estimated emission reduction in the that in the JPM. Therefore, during this monitoring period, the actual emission reduction is 26.39%[52] lower than that estimated in JPM.

During this monitoring period, the project's influent COD and flow do not reaching the design value, which is within a reasonable range of variation. In addition, the electricity consumption of the project is higher than the estimated value in JPM. Therefore, the actual emission reduction is lower than the design value due to higher electricity consumption and lower influent flow and influent COD.

Therefore, the actual emission reduction values for this monitoring period are considered reasonable.

[50] The annual emission reduction of PD is 83,296 tCO_2e , so the estimated emission reduction from 01-January-2022 to 30-June-2022 can be calculated as: 83,296 tCO_2e÷365d×181 d=41,306 tCO_2e.

[51] It can be calculated as: (110,002 tCO_2e-149,433 tCO_2e)/ 149,433 tCO_2e *100%=-26.39%

APPENDIX 1: SUPPORTING EVIDENCE

Supporting evidence for contribution to SDG 6.0 Proportion of domestic and industrial wastewater flows safely treated

Evidence 1: It is estimated that the annual wastewater treatment capacity of the project is 63,929,750 m³ and wastewater treatment capacity of the project of first monitoring period is 90,062,261 m³ (03-September -2020 to 30-June-2022)

Evidence 1: Flow rate operation statistics of wastewater from Yunshui wastewater treatment plant project in Guangdong Province

Supporting evidence for contribution to SDG 8.5 Unemployment rate, by sex, age and persons with disabilities

Evidence: 240 local residents (120 females and 120 males) are employed permanently during the operation period of the project during project implementation and monitoring activities.

Image showing the roster of all staff members:

云水广东污水处理厂项目员工花名册

序号	职位名称	姓名	性别	入职日期	工作状态	所属污水厂	家庭住址	身份证号
1	污水厂运营	汪学海	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199308134010
2	污水厂运营	宋乐天	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	44082519940813514X
3	污水厂运营	吕俊明	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199508131853
4	污水厂运营	吴畅畅	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199608133167
5	污水厂运营	徐飞鹏	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199308136435
6	污水厂运营	蔡天元	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199208136182
7	污水厂运营	韩江红	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199108135539
8	污水厂运营	卢曼文	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	44082519930813286X
9	污水厂运营	黄宏茂	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199608131650
10	污水厂运营	常乐山	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	4408251989081381225
11	污水厂运营	金俊名	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199208135897
12	污水厂运营	何靖琪	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199408135900
13	污水厂运营	于永贞	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199308135037
14	污水厂运营	黄开朗	女	2020.8.5	正常	下桥镇污水处理厂	下桥镇	4408251997308138965
15	污水厂运营	蔡鹤轩	男	2020.8.5	正常	下桥镇污水处理厂	下桥镇	440825199108135678
16	污水厂运营	朱映阳	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	44082519930813454X
17	污水厂运营	叶婉然	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825198808138756
18	污水厂运营	卢理全	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825198508139746
19	污水厂运营	朱宏畅	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199308134093
20	污水厂运营	宋永年	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199108138866
21	污水厂运营	夏和泽	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	44082519930813419X
22	污水厂运营	曹才俊	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825198308131281
23	污水厂运营	乔俊良	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199208134579
24	污水厂运营	马鹏飞	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199008135522
25	污水厂运营	崔经武	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199208139599
26	污水厂运营	邵永丰	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199408138484
27	污水厂运营	崔宏伯	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199508136291
28	污水厂运营	杜永新	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825199108137440
29	污水厂运营	郑高丽	男	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825198808139716

30	污水厂运营	陆安翔	女	2020.8.5	正常	曲界镇污水处理厂	曲界镇	440825198608131946
31	污水厂运营	余文翰	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983198608131457
32	污水厂运营	张向阳	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199308132080
33	污水厂运营	董良朋	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983198408134498
34	污水厂运营	黄永年	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983198808134043
35	污水厂运营	方明朗	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983198708133591
36	污水厂运营	王乐章	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983198908136925
37	污水厂运营	董嘉年	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199508131879
38	污水厂运营	崔鸿云	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199408137861
39	污水厂运营	胡博瀚	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	44098319960813405X
40	污水厂运营	任嘉颖	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199308139888
41	污水厂运营	郑学义	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199108135853
42	污水厂运营	冯凯安	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	44098319990813506X
43	污水厂运营	文弘义	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199408133137
44	污水厂运营	侯正初	女	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	440983199508139548
45	污水厂运营	龙睿博	男	2020.8.5	正常	丁堡镇污水处理厂	丁堡镇	44098319980813261X
46	污水厂运营	谢博雅	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983198308136364
47	污水厂运营	赖永宁	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983198708133436
48	污水厂运营	丁雨华	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983198608138881
49	污水厂运营	尹昊英	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	4409831997308137197
50	污水厂运营	冯嘉致	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199408134326
51	污水厂运营	秦高逸	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199308136995
52	污水厂运营	邱俊友	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	44098319920813844X
53	污水厂运营	林宏邈	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199908136717
54	污水厂运营	彭才捷	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199208139928
55	污水厂运营	胡嘉茂	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199308131799
56	污水厂运营	秦浩博	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199208135066
57	污水厂运营	姚德辉	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199508133778
58	污水厂运营	程濮存	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199808135561
59	污水厂运营	史阳伯	男	2020.8.5	正常	钱排镇污水处理厂	钱排镇	4409831995308139878
60	污水厂运营	赵朋义	女	2020.8.5	正常	钱排镇污水处理厂	钱排镇	440983199008138296
61	污水厂运营	陆烨赫	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202198308133354
62	污水厂运营	崔雅昶	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	44520219950813202X
63	污水厂运营	徐英杰	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	44520219870813447X
64	污水厂运营	陆德容	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199608133883

65	污水厂运营	任元正	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199108131332
66	污水厂运营	吴欣荣	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199208136167
67	污水厂运营	谭元忠	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199408139211
68	污水厂运营	刘乐咏	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	44520219860813958X
69	污水厂运营	毛鸿彩	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199308132159
70	污水厂运营	贺彭祖	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199308135227
71	污水厂运营	任宇寰	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199908138999
72	污水厂运营	余兴德	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199408138946
73	污水厂运营	郑承恩	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199308136491
74	污水厂运营	潘嘉祥	女	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199208135067
75	污水厂运营	万信鸥	男	2020.8.5	正常	仙桥南污水处理厂	仙桥南	445202199808131316
76	污水厂运营	田绍元	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	44522219880813942X
77	污水厂运营	何茂才	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199308132656
78	污水厂运营	唐致远	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199308132440
79	污水厂运营	孔向阳	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222198708138396
80	污水厂运营	丁元纬	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222198608138360
81	污水厂运营	文玉泉	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222198508139719
82	污水厂运营	袁景明	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199608133387
83	污水厂运营	邵正卿	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199408137553
84	污水厂运营	汤俊誉	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	44522219930813414X
85	污水厂运营	蔡英勋	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	44522219920813853X
86	污水厂运营	孙坚成	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199308132121
87	污水厂运营	黄修文	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199308132998
88	污水厂运营	宋宏胜	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	44522219940813926X
89	污水厂运营	萧景同	男	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199108133835
90	污水厂运营	邹学海	女	2020.8.5	正常	钱坑镇污水处理厂	钱坑镇	445222199208139342
91	污水厂运营	赵飞虎	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199408131370
92	污水厂运营	曹景焕	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199308137267
93	污水厂运营	邱修洁	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199508134512
94	污水厂运营	梁天佑	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199108132283
95	污水厂运营	赵成双	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199208138652
96	污水厂运营	陈立辉	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199308139825
97	污水厂运营	夏安宜	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199608134491
98	污水厂运营	熊砂	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199708138263
99	污水厂运营	汤玄	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199308137633

100	污水厂运营	段德海	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199408135641
101	污水厂运营	江乐咏	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199508135793
102	污水厂运营	朱安澜	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199608134426
103	污水厂运营	薛涵畅	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199708134871
104	污水厂运营	丁光誉	女	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199108131680
105	污水厂运营	卢斯年	男	2020.8.5	正常	上砂镇污水处理厂	上砂镇	445222199108133739
106	污水厂运营	杨晓博	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199108139020
107	污水厂运营	陈文曜	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199308134495
108	污水厂运营	许思远	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	44522119940813836X
109	污水厂运营	蔡和安	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199208138138
110	污水厂运营	沈飞舟	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	44522119960813692X
111	污水厂运营	宋志勇	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199708139915
112	污水厂运营	萧天禄	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199308131281
113	污水厂运营	黄德运	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199508133193
114	污水厂运营	漕宜年	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199608132586
115	污水厂运营	徐俊发	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221198708134719
116	污水厂运营	丁茂德	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199708131345
117	污水厂运营	赵子石	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199808131251
118	污水厂运营	邹文康	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199108132563
119	污水厂运营	胡正谊	男	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199208136175
120	污水厂运营	朱晋鹏	女	2020.8.5	正常	白塔镇污水处理厂	白塔镇	445221199308131540
121	污水厂运营	汪新翰	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381199208132379
122	污水厂运营	钱嘉树	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381199408138529
123	污水厂运营	卢鹏运	男	2020.8.5	正常	罗定污水处理厂	罗定市	4453811996308134534
124	污水厂运营	易良工	女	2020.8.5	正常	罗定污水处理厂	罗定市	4453811998308131944
125	污水厂运营	陆星宇	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381199108138076
126	污水厂运营	任星波	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381198908135969
127	污水厂运营	马光华	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381198808132037
128	污水厂运营	蒋嘉胜	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381198708132046
129	污水厂运营	傅星海	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381198408132096
130	污水厂运营	夏经赋	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381198908131469
131	污水厂运营	汤逸明	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381199408133494
132	污水厂运营	曾光熙	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381199308138983
133	污水厂运营	廖哲圣	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381199108135692
134	污水厂运营	孔弘懿	女	2020.8.5	正常	罗定污水处理厂	罗定市	445381199208133465

135	污水厂运营	吴星纬	男	2020.8.5	正常	罗定污水处理厂	罗定市	445381199408131755
136	污水厂运营	王宾鸿	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199108135920
137	污水厂运营	尹明朗	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199208131577
138	污水厂运营	史德润	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	44180219950813754X
139	污水厂运营	邵涵亮	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199208136175
140	污水厂运营	姜嘉木	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199608135564
141	污水厂运营	张元思	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199708135092
142	污水厂运营	程经武	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199208135984
143	污水厂运营	罗飞鸿	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199108137717
144	污水厂运营	崔弘扬	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199708139626
145	污水厂运营	康建白	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199208135893
146	污水厂运营	周志文	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199608131548
147	污水厂运营	孔俊拔	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199808138912
148	污水厂运营	谢嘉石	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802198708133463
149	污水厂运营	梁和悦	男	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199108138533
150	污水厂运营	萧雨石	女	2020.8.5	正常	石潭镇污水处理厂	石潭镇	441802199208134781
151	污水厂运营	周高阳	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802198808138437
152	污水厂运营	袁嘉运	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802198608133626
153	污水厂运营	卢经国	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199208137573
154	污水厂运营	林天瑞	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	4418021994308131042
155	污水厂运营	刘苑杰	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199308131198
156	污水厂运营	武奇思	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199308137360
157	污水厂运营	蔡康裕	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199608137573
158	污水厂运营	刘文耀	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199108138084
159	污水厂运营	孔学博	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199308138357
160	污水厂运营	武文山	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199608138567
161	污水厂运营	邹天翰	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199608135455
162	污水厂运营	任新觉	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	44180219970813404X
163	污水厂运营	潘逸仙	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	44180219910813601X
164	污水厂运营	彭茂德	女	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199508135529
165	污水厂运营	任凯旋	男	2020.8.5	正常	浸潭镇污水处理厂	浸潭镇	441802199808133273
166	污水厂运营	史昊空	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199308137745
167	污水厂运营	罗嘉祥	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199308135274
168	污水厂运营	王季同	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199308137665
169	污水厂运营	邵鸿志	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199408133718

170	污水厂运营	白天泽	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199608132346
171	污水厂运营	朱阳冰	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	44188119970813727X
172	污水厂运营	崔俊贤	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199108131427
173	污水厂运营	曾毅然	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199408137317
174	污水厂运营	董鸿煊	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199808132562
175	污水厂运营	黎学博	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199108133412
176	污水厂运营	曾星洲	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199208132482
177	污水厂运营	朱永言	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199408136357
178	污水厂运营	董皓轩	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199608132641
179	污水厂运营	杜蕴和	男	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199008136453
180	污水厂运营	戴英发	女	2020.8.5	正常	九龙镇污水处理厂	九龙镇	441881199108134364
181	污水厂运营	邓景明	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199108136859
182	污水厂运营	彭永望	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199208132242
183	污水厂运营	萧冠宇	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199408132735
184	污水厂运营	吴嘉瑞	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	44188119960813306X
185	污水厂运营	邱伟博	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199808134036
186	污水厂运营	蒋成益	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199108138187
187	污水厂运营	姚同光	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199208134538
188	污水厂运营	萧华灿	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199308131686
189	污水厂运营	汪苑博	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199308134896
190	污水厂运营	毛明俊	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199508133262
191	污水厂运营	卢元恺	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199608132313
192	污水厂运营	郝天瑞	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199608135627
193	污水厂运营	郑祺福	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199308134212
194	污水厂运营	康浩渺	女	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199408131742
195	污水厂运营	冯凯歌	男	2020.8.5	正常	沙口镇污水处理厂	沙口镇	441881199308133797
196	污水厂运营	郝英杰	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199108137087
197	污水厂运营	钱锐翰	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199308137732
198	污水厂运营	阎天泽	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199408131965
199	污水厂运营	赖鹏鹍	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199308135251
200	污水厂运营	文成荫	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199308132443
201	污水厂运营	段思远	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199308135753
202	污水厂运营	杜阳旭	女	2020.8.5	正常	博美镇污水处理厂	博美镇	44158119970813212X
203	污水厂运营	吕成业	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199408135219
204	污水厂运营	吴绍钧	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199608133824
205	污水厂运营	文阳波	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199808135630
206	污水厂运营	任自怡	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199308137741
207	污水厂运营	康文光	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581199208133299
208	污水厂运营	彭嘉木	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581198908133760
209	污水厂运营	金兴平	男	2020.8.5	正常	博美镇污水处理厂	博美镇	441581198708133555
210	污水厂运营	文星火	女	2020.8.5	正常	博美镇污水处理厂	博美镇	441581198808135780
211	污水厂运营	梁宇寰	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581198708131138
212	污水厂运营	毛斯伯	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581198808131228
213	污水厂运营	高建华	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199108137556
214	污水厂运营	吴嘉熙	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199408133143
215	污水厂运营	马信鸿	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199508134419
216	污水厂运营	李敏才	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199608133469
217	污水厂运营	宋阳舒	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	44158119980813251X
218	污水厂运营	毛宁	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199908134588
219	污水厂运营	史飞翮	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199208131111
220	污水厂运营	康雪松	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199308132063
221	污水厂运营	孔元正	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199308134232
222	污水厂运营	袁兴思	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199308134920
223	污水厂运营	孟天宇	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199308132878
224	污水厂运营	贾正文	女	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199508133644
225	污水厂运营	韩茂德	男	2020.8.5	正常	南塘镇污水处理厂	南塘镇	441581199708135534
226	污水厂运营	谭宏壮	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199308136926
227	污水厂运营	龚子石	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	44152119930813595X
228	污水厂运营	潘俊誉	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	44152119950813244X
229	污水厂运营	孙瀚海	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199308138712
230	污水厂运营	冯博雅	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199608132929
231	污水厂运营	汪弓	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199708133110
232	污水厂运营	曹永宁	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199808133860
233	污水厂运营	史光华	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199408137314
234	污水厂运营	韩奇正	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521198808132247
235	污水厂运营	萧恺歌	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521198708136194
236	污水厂运营	郭鸿振	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521198808134820
237	污水厂运营	江俊美	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199108138130
238	污水厂运营	侯星波	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199208134549
239	污水厂运营	崔立人	男	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199508136696
240	污水厂运营	马晋鹏	女	2020.8.5	正常	赤坑镇污水处理厂	赤坑镇	441521199108133286

Supporting evidence for contribution to SDG 13.0 Tons of greenhouse gas emissions avoided or removed

Evidence 1A: The project design document has estimated 83,042 tCO_2e emission reductions, the emission reductions of first monitoring period is 110,002 tCO_2e.

Evidence 1B: Emission reductions achieved during the First Monitoring Period

Below Table showing the emission reductions during the first monitoring period:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
25-September -2020 to 31-June-2022	132,151	22,149	0	110,002

Supporting evidence for contribution to SDG 13.0 Tons of greenhouse gas emissions avoided or removed