Initial Environmental Examination for Yingde Subproject

Project Number: 49084-001
May 2017

PRC: Small and Medium-Sized Enterprise Industrial Wastewater and Sludge Treatment Project

Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base Water Treatment Plants

Initial Environmental Examination

Building a better working world

ABBREVIATIONS

ADB – Asian Development Bank
AF – Affected Person
BOD_5 – Five-day Biochemical Oxygen Demand
BOO – Build-Own-Operate
CFU – Colony-forming Unit
COD – Chemical Oxygen Demand
CTEG – CT Environmental Group
DO – Dissolved Oxygen
EIA – Environmental Impact Assessment
EMP – Environmental Management Plan
E&S – Environmental and Social
GRM – Grievance Redress Mechanism
H_2O_2 – Hydrogen Peroxide
H_2S – Hydrogen Sulphide
HDPE – High-density Polyethylene
IEE – Initial Environmental Examination
LRB – Land Resources Bureau
NH_3 – Hydrazoic acid
NMHC – Non-methane Hydrocarbons
OSHA – Occupational Safety and Health Administration
PAM – Polyacrylamide
PPE – Personal Protective Equipment
PRC – People's Republic of China
REA – Rapid Environmental Assessment
RP – Resettlement Plan
SS – Suspended Solids
TDS – Total Dissolved Solids
TP – Total Phosphorus
WWTP – Wastewater Treatment Plant

WEIGHTS AND MEASURES

kg – kilogram
km – kilometre
kph – kilometre per hour
kW – kilowatt
m - metre
mg/L – milligram per Litre
m/s – metre per second
m^3/day – cubic metre per day
mm – millimetre

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Executive Summary

A. Background

This project's Initial Environmental Examination (project IEE) report is prepared for the proposed Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base Water Treatment Plants of CT Environmental Group Limited (CTEG), in Yingde City, Guangdong Province, PRC. The IEE is prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the domestic environmental impact assessment (DEIA) and project EIA prepared by Jiangxi Academy of Environmental Science and New ACEF (Beijing) Environmental Protection Co., Ltd, respectively and findings of site observations.

B. Project Content

The proposed Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base Water Treatment Plants will consist of two major components, a wastewater treatment plant and an industrial water supply plant, which will be located at the Hongxing zone of the Qingyuan Overseas Chinese Industrial Park Yinde Yinghong Industrial Park in Yingde City of the Guangdong Province, PRC with designed land area of around 18.67 hectares. The total design capacity of the wastewater treatment plant and the industrial water supply plant are 80,000m³/day and 140,000m³/day respectively. The wastewater treatment plant will employ a three-stage treatment process, including pre-treatment (primary treatment), anaerobic oxidation process (secondary treatment), Fenton reagents and disinfection (tertiary treatment). The total investment for the proposed project is estimated as CNY¥420 million.

Approximately 30% of the treated water will be diverted into the industrial water supply plant for further treatment before being used by other industrial enterprises as raw water, while the rest will be discharged through the drainage system into the Guantianshui creek, eventually leading to Beijiang River. The effluent shall satisfy the requirements of the Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB1118918-2002) and the Class I standard for the second time phase (DB44/26-2001). After the completion of the proposed subproject, wastewater will be treated properly without direct discharge of wastewater to the surrounding water bodies and help conserve water resources, therefore potential surface water and groundwater pollution can be avoided.

C. Anticipated Environmental Impacts and Environmental Management Plan

Major environmental issues during the construction phase include impacts on biodiversity, surface water quality, ground water quality, ambient air quality, socio-economic resources, physical cultural resources, community health and safety, occupational health and safety, noise pollution, solid waste, and soil erosion. There are no historical and archaeological sites within or near the subproject area, though if unknown archaeological resources and cultural relics are discovered during construction, all construction will be suspended until investigation is complete. Appropriate mitigation measures and monitoring programs have been developed to address potential hazards for workers in construction. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the strict implementation of mitigation measures specified in section IV 'Anticipated Environmental Impacts and Mitigation Measures' and section VIII 'Environmental Management Plan'.

The main potential adverse impacts during the operation phase include impacts on surface water quality, ground water quality, ambient air quality, noise pollution, solid and hazardous waste, biodiversity and water users, and occupational health and safety. It is expected that the effluent from this subproject will meet the national effluent standards under normal operation and the impact on surface water is minimal. Proper design, construction, management and maintenance of the subproject will also prevent negative impact on groundwater quality. Further, mitigation measures such as the installation of fume purification system and the plantation of landscape noise buffers, will reduce the impacts on ambient air quality and noise pollution. Careful management of solid and hazardous waste is required to minimise the impacts from waste generation.

For each impact, appropriate mitigation measures are described; strict monitoring and supervision will be undertaken to ensure that environmental impacts will be minimised to acceptable levels.

D. Alternative Analysis

Multiple alternative analyses were conducted to determine the most feasible way of achieving the subproject objectives while minimising environmental and social impacts, the three alternatives assessed were i) No-project scenario, ii) alternatives for secondary wastewater treatment process and iii) alternatives for odour control. Results for the first alternative showed that without a sufficient wastewater treatment facility and stable water for industrial use, industrial enterprises would have directly discharge the untreated wastewater into the surrounding water bodies illegally or limit their scale of production. Results from the second alternative showed the anaerobic oxidation process to be the dominant secondary wastewater treatment process as it is more efficient and effective than the conventional aeration process. Three alternatives were assessed for alternative odour control, results showed the biofiltration deodourisation processs as the most efficient, safe and stable treatment process.

E. Information Disclosure and Consultation

The public consultation of this proposed subproject was conducted in accordance with both the PRC requirement and the ADB requirements. The public consultation is divided into three phases, 1) Initial public consultation, 2) Second public consultation and 3) Public Survey. During the preparation of the IEE, initial public consultation has been completed in April 2016 and the second public consultation has started on 30 May 2016. Questionnaire were distributed to village committee, villagers and units nearby the subproject area on 14 June 2016. Public notices and summaries have been posted on Yinhong Town official website and in 8 affected locations nearby the proposed subproject site. Information disclosure and public consultation will continue throughout the subproject implementation.

F. Grievance Redress Mechanism

CTEG will establish a grievance redress mechanism (GRM) on site for handling environmental and social complaints, including complaint recording, consultation, issue investigation, mitigation action, follow-up, general timeframe for resolution and delegation of responsibilities. The GRM will address any possible concerns and dissatisfaction of affected groups regarding the social and environmental impact of its subprojects, and seek proper solutions. It should be able to promptly respond to the affected groups, be transparent and free of gender discrimination, and adapt to the cultural traditions of the affected groups and communities. Moreover, it should enable different affected groups to express their opinions, with no fear of reprisal. The E&S General manager will be responsible for (i) resolving appeals, complaints, and disputes concerning the environmental and social impacts of subprojects which have not been resolved by the plant managers at the subproject level, and (ii) for coordinating, guiding and supervising the subproject companies in handling appeals, complaints, and disputes.

CTEG subproject companies will establish local level complaints and grievance procedures in each RP. Each subproject company will also inform the local community and the AP of the grievance and appeal procedure through public information meetings, the resettlement information brochure and other media, so they can fully understand their rights for grievance and appeal.

G. Environment Management Plan

An environmental management plan (EMP) has been prepared for this subproject. It is an essential document to ensure the implementation of mitigation measures. The EMP defines appropriate mitigation measures for the anticipated environmental impacts, addresses the potential impacts and risks identified by the environmental assessment to avoid future adverse environmental impacts, and defines the institutional responsibilities and mechanisms to monitor and ensure the compliance with PRC and ADB's requirements.

H. Conclusion

This project's IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimised to an acceptable level. The project is feasible from an environment safeguards point of view.

I. Policy, Legal, and Administrative Framework

A. Relevant laws, regulations, guidelines, and standards of the People's Republic of China

This information and data used in this Initial Environmental Examination (IEE) is in line with the draft environmental impact assessment report prepared in June 2016, which was submitted to the local environmental agency for review. The environmental impact assessment was carried out in accordance with the development plan, technical design and investment framework agreement with the Government of Yinghong. The baseline environmental condition and the projected impacts were assessed with reference to the national environmental and social laws, regulations, guidelines, and standards and ADB Safeguards Policy Statement (SPS 2009), which follows the IFC EHS Guidelines. The national standard, which is more stringent, has been used in the assessment of the project.

The purposes, principles, classification and scopes of assessment were in strict accordance with the Environmental Protection Law of the People's Republic of China (1989), Regulation on Environmental Protection Management for Construction Project (1998), and the Environmental Impact Assessment Law of the People's Republic of China (2002). The methodologies adopted are stipulated in the Technical Guidelines. Understanding that participation is an important part for IEE, Measures on Public Participation in Environmental Protection (2015), the latest regulation on participation, was also made reference to during impact assessment. Other legal documents relevant to the project are shown in Table I-1.

Table I-1: Applicable Policy, Legal, and Administrative Framework of the People's Republic of China

Title	Year Issued or Amended/ Code
Applicable National Laws	
The Environmental Protection Law of the People's Republic of China	1989
The Environmental Impact Assessment Law of the People's Republic of China	2002
Water Law of the People's Republic of China	2002
Law of the People's Republic of China on Prevention and Control of Water Pollution	2008
Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution	2000, 2004
Law of the People's Republic of China on the Prevention and Control of Environmental Noise	1996, 2008
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste	2005
Law of the People's Republic of China on Water and Soil Conservation	1991
Cleaner Production Promotion Law of the People's Republic of China	2002
Urban and Rural Planning Law	2008
Land Administration Law	2004
Circular Economy Promotion Law	2009
Renewable Energy Law of the People's Republic of China	2006
Applicable National and Local Administrative Guidelines and Regulations	
Interim Procedures for Public Participation in Environmental Impact Assessment	2006
Measures on Public Participation *in Environmental Protection*	2015
Regulation on Classification of Construction Project Environmental Protection Management (MEP)	2009
Regulation on Environmental Protection Management for Construction Project	1998
Requirements for the EIA Summary of Construction Project	2010
The Administrative Measures for the Environmental Acceptance Inspection of Construction Projects	2002
The Administrative Regulations for Project Environmental Protection in Construction Projects	1998
The Notice on Enhancing Environmental Impact Assessment Management for Environmental Risk Prevention	2012
Applicable Standards	

Ambient Air Quality Standard	*GB 3095-2012*
Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant	*GB18918-2002*
Emission Standard for Industrial Enterprises Noise at Boundary	*GB 12348-2008*
Emission Standard for Odour Pollutants	*GB14554-1993*
Emission Standard of Environment Noise for Boundary of Site	*GB 12523-2011*
Emission Standards for Odour Pollutants	*GB 18599-2001*
Environmental Quality Standard for Noise	*GB 3096-2008*
Environmental Quality Standard for Soil	*GB15618-1995*
Environmental Quality Standard for Surface Water	*GB 3838-2002*
Industrial Restructuring Directory	*Revised in 2013*
Integrated Emission Standard of Air Pollutants	*GB 16297-1996*
Quality Standard for Ground Water	*GB/T 14848-93*
Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes	*GB 18597-2001*
Technical Guideline on EIA Regarding Acoustic Environment	*HJ 2.4-2009*
Technical Guideline on EIA Regarding Atmospheric Environment	*HJ 2.2-2008*
Technical Guideline on EIA Regarding Ecological Impact	*HJ 19-2011*
Technical Guideline on EIA Regarding Surface Water	*HJ/T 2.3-1993*
Technical Guideline on EIA: Outline	*HJ2.1-2011*
Technical Guideline on Environmental Risk Assessment for Construction Project	*HJ/T 169-2004*
Technical Specification on Water and Soil Conservation Plan	*GB50433-2008*
The Reuse of Urban Recycling Water – Water Quality Standard for Industry Use	*GB/T19923-2005*

Water Law of the PRC was enacted in October 2002 for the purposes of rationally developing, utilising, conserving and protecting water resources, preventing and controlling water disasters, bringing about sustainable utilisation of water resources, and meeting the need of national economic and social development. Articles 52 and 53 of the law, which state that the local governments should support centralised wastewater treatment facilities and increase the utilisation rate of recycled wastewater, and water supply enterprises shall take effective measures such as effective maintenance to reduce the leakage rate of the water supply network, are particularly applicable to this subproject.

B. Applicable ADB policies

All CTEG projects which are financed under ADB facility are required by the Environmental and Social Management System (ESMS) to comply with ADB's SPS 2009 requirements. The SPS promotes international good practices, as reflected in internationally recognised standards such as the World Bank Group's Environmental, Health and Safety Guidelines with the aim to ensure that the implementation of all ADB-supported projects' activities will not cause significant environmental, health, social and safety hazards.

All proposed projects are assessed for their expected environmental impacts, using ADB Rapid Environmental Assessment (REA) checklist and assigned to one of the following four categories:

i. **Category A**. Proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.

ii. **Category B**. Proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.

iii. **Category C**. Proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.

iv. **Category FI**. Proposed project involves the investment of ADB funds to, or through, a financial intermediary.

This subproject's potential environmental impacts have been classified as Category B for environment, requiring the preparation of this IEE report.

C. Evaluation Standards for the Project

1. Surface Water Quality

The treated wastewater will be discharged to the Guantianshui creek which drains into Beijiang River (Yingde Shakouwei to Yingcheng Baisha segment). Both water bodies are classified as Type III waters (applicable to the abstraction for human consumption in second class protection area) in the "Environmental Quality Standards for Surface Water (GB3838-2002)". Other surrounding water bodies such as Huangyan Creek and Kongtang Creek are classified as Type IV waters while Beijang River's Yingcheng Baisha to Xiangcheng bridge segment is classified as Type II waters. The standards set out for Type II, III and IV waters are shown in Table I-2.

Table I-2: Standard of the Environmental Quality Standards for Surface Water (GB3838-2002) (Unit: mg/L, except pH)

Parameters	Type II Standard	Type III Standard	Type IV Standard
pH		6-9	
Dissolved Oxygen	≥6	≥5	≥3
Sulphides	≤0.1	≤0.2	≤0.5
Permanganate Index	≤4	≤6	≤10
Petroleum Hydrocarbons	≤0.05	≤0.05	≤0.5
Cyanide	≤0.05	≤0.2	≤0.2
Total Phosphorus	≤0.1	≤0.2	≤0.3
Ammoniacal Nitrogen	≤0.5	≤1.0	≤1.5
Anionic Surfactants	≤0.2	≤0.2	≤0.3
Fluoride	≤1.0	≤1.0	≤1.5
Chromium (VI)	≤0.05	≤0.05	≤0.05
COD	≤15	≤20	≤30
BOD_5	≤3	≤4	≤6
Faecal Coliforms	≤2,000	≤10,000	≤20,000
Lead	≤0.01	≤0.05	≤0.05
Zinc	≤1.0	≤1.0	≤2.0
Cadmium	≤0.005	≤0.005	≤0.005
Arsenic	≤0.05	≤0.05	≤0.1
Copper	≤1.0	≤1.0	≤1.0
Mercury	≤0.00005	≤0.0001	≤0.001
Benzene		≤0.01	
Nickel		≤0.02	

Source: Environmental Quality Standards for Surface Water (GB3838-2002)

2. Effluent Discharge Standard

All wastewater collected will be treated in the wastewater treatment plant using three-stage treatment process (1: pre-treatment; 2: anaerobic oxidation; and 3: fenton reagents and disinfection). The effluent will be discharged to Guantianshui creek in accordance with the Class IA standard of Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) and the Class I standard for the second time phase for secondary municipal wastewater treatment plant set out in Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB44/26-2001), whichever is stricter.

Table I-3: Discharge Standard of Water Pollutants for the Treated Effluent (Unit: mg/L, except Faecal Coliforms: CFU/L, no unit for pH)

Parameters	Class IA Standard (GB18919-2002)	Class I Standard for the Second Time Phase (DB44/26-2001)
COD	50	40
BOD_5	10	20
SS	10	20
Petroleum Hydrocarbons	1	5
Anionic Surfactants	0.5	5
Ammoniacal Nitrogen	5 (8)*	10
Chroma (dilution)	30	40
pH	6-9	6-9
Faecal Coliforms	1000	-

* Note: Figure in parenthesis is applicable when the water temperature is lower than 12 °C.

Source: Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002)
Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB44/26-2001)

Thirty percent of the treated wastewater from the wastewater treatment plant will be diverted to the water supply facility and mixed with the raw water from Beijiang river. The water will be further purified through coagulation, sedimentation, and filtration. The quality of the treated water, will be in accordance with Water Quality Standard for Urban Water Supply (CJ/T206-2005) and Standard for Drinking Water Quality (GB5749-2006). Treated water will be supplied to the industrial enterprises as industrial raw water.

Table I-4: Discharge Standard of Water Pollutants for the Industrial Raw Water

	pH	Total number of bacteria (CFU/L)	Odour	Turbidity (NTU)	Total Suspended Solids (TSP) (	Chroma (dilution ratio)	Total Dissolved Solids (mg/L)
Water Quality Standard for Urban Water Supply (CJ/T206-2005)	6.5-8.5	≤100	Odourless	≤3	Nil	≤15	≤1000
Standard for Drinking Water Quality (GB5749-2006)							

Source: Water Quality Standard for Urban Water Supply (CJ/T206-2005) and Standard for Drinking Water Quality (GB5749-2006)

3. Ambient Air Quality

Ambient Air Quality Standards (GB3095-2012) was promulgated in February 2012 and has become effective from 1 Jan 2016. The standards have two classes (Class I and II) of concentration limits for key pollutants. Class I standards apply to natural reserves, scenic areas and other environmentally sensitive areas while Class II standards apply to all other areas including residential zones, industrial zones and rural areas. Class II standards are applicable to this subproject.

Table I-5: Ambient Air Quality Standards (Class II) (GB3095-2012) (Unit: ug/m^3, except CO: mg/m^3)

	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2	O_3	CO
Annual average	200	70	35	60	40	-	-
24-hour average	300	150	75	150	80	-	4
8-hour average	-	-	-	-	-	160	-
1-hour average	-	-	-	500	200	200	10

For the concentration level of NH_3 and H_2S at the subproject area, the applicable standard will be Hygienic Standards for the Design of Industrial Enterprises (TJ36-79). The specified standard values are listed in Table I-6.

Table I-6: Maximum Allowable Concentration of NH_3 and H_2S of Hygienic Standards for the Design of Industrial Enterprises (TJ36-79).

	Maximum Allowable Concentration (mg/m^3)
NH_3	200
H_2S	10

4. Groundwater

According to Guangdong Province Groundwater Environmental Function Zoning (Guangdong Government Office [2009] No.19), the subproject area is classified as development zone. Therefore Class III standard of Quality Standard for Groundwater (GB/T14848-93) is applicable to the subproject.

Table I-7: Class III standard of Quality Standard for Groundwater
(Unit: mg/L, except for Total Coliform: CFU/L and pH)

Parameters	Standard

pH	6.8-8.5
Ammoniacal Nitrogen	≤0.2
Copper	≤1.0
Lead	≤0.05
Cadmium	≤0.01
Nickel	≤0.05
Chromium (VI)	≤0.05
Volatile phenol	≤0.002
Arsenic	≤0.05
Mercury	≤0.001
Permanganate Index	≤3.0
NO_2-N	≤0.02
NO_3-N	≤20
Total Hardness	≤450
LAS	≤0.3
Fluoride	≤1.0
Cyanide	≤0.05
TDS	≤1000
Total number of bacteria	≤100
Iron	≤0.3
Total Coliform	≤3.0
Manganese	≤0.1
Chloride	≤250
Sulfate	≤250

Source: Quality Standard for Groundwater (GB/T14848-93)

5. Noise

According to the Environmental Quality Standard for Noise (GB3096-2008), Class II standards apply to mixed industrial, commercial and residential zones, Class III standards apply to industrial zones, Class IV-A standards apply to traffic arteries such as highways and main roads while Class IV-B standards apply to railways.

As the subproject is situated in industrial area with a main road along the east boundary and a railway along the west boundary of the subproject area, therefore noise level in the subproject area should comply with the Classes III, IV-a and IV-b standards.

Table I-8: Environmental Quality Standards for Noise (GB3096-2008) (Unit: dB(A))

Class	Day (06:00-22:00)	Night (22:00-06:00)
III	65	55
IV-A	70	55
IV-B	70	60

II. Description of the Subproject

In July, 2015, CTEG entered into the Investment Agreement with the Yinghong Government, Yingde City in relation to an industrial wastewater treatment plant and an industrial water supply plant under the Build-Own-Operate (BOO) model, pursuant to which the Yinghong Government agreed to grant to CTEG the exclusive operation right to construct the facility and operate and manage the industrial wastewater treatment services and industrial water supply services in the industrial park.

The proposed subproject will be located at the Hongxing zone of the Qingyuan Chinese Industrial Park Yingde Yinghong Base ("industrial park") in Yingde City of the Guangdong Province, the PRC (Geographic coordinate: 24°21'15"(N), 113°25'51"(E)). The industrial park was established in August 2008 with total planned area of 37.8km^2. According to the information provided by Qingyuan Overseas Industrial Park Yingde Yinghong Base Management Committee, 26 enterprises from different industries such as metal manufacturing, nanotechnology, super absorbent polymer manufacturing, fertiliser, chemicals, resin and pigment supply, semi-conductor, machinery have decided to move into the industrial park. Among the 26 enterprises, 4 of them have already begun their formal operation, 4 companies have begun their trail operations, 16 companies are in the process of building their offices/plants while another 2 companies are in the planning and design stage.

The total area of the subproject will be around 18.67 hectares, wastewater treatment plant will occupy about 12 hectares of land while the industrial water supply plant will occupy approximately 6.67 hectares. This subproject will provide service to a total area of 26.21km^2 with a population of 227,100.

Under the Investment Agreement, the proposed subproject will be developed in two phases. In Phase 1 development, a wastewater treatment plant and a water supply facility with a design capacity of 20,000m^3/day and 50,000m^3/day, respectively will be developed and an additional 60,000m^3/day of wastewater treatment capacity as well as 90,000m^3/day of water supply will be added in the Phase 2 development.

Subproject Rationale and Expected Benefits

Currently there is no centralised wastewater treatment facility available in the industrial park. Most of the existing industrial enterprises have simply installed a septic tank to collect and treat their wastewater. The wastewater is then discharged to the nearby water bodies through drainage ditches. The effluent quality of each of the industry enterprises are not monitored before discharge to the drainage which cumulatively may impact the receiving water bodies.

The subproject will provide a centralised wastewater treatment services and sewer construction services for all enterprises stationed in the Hongxing zone of the industrial park. Once the wastewater treatment plant is complete, all municipal and industrial wastewater generated by the industrial enterprises in the Hongxing zone will be treated through three-stage treatment process (pre-treatment, anaerobic oxidation, and fenton reagents and disinfection), which can help preserve the water quality of the nearby rivers and creeks.

The total domestic and industrial wastewater which will be generated from the industrial park are estimated to be 19,900m^3/day and 76,100m^3/day for Phase 1 and Phase 2 development, respectively. The proposed wastewater treatment plant design treatment capacity is 20,000m^3/day in Phase 1 and additional 60,000m^3/day in Phase 2 to meet the projected demand. The wastewater treatment plant (WWTP) is designed with a safety factor of 20% to accommodate for emergency storage requirements.

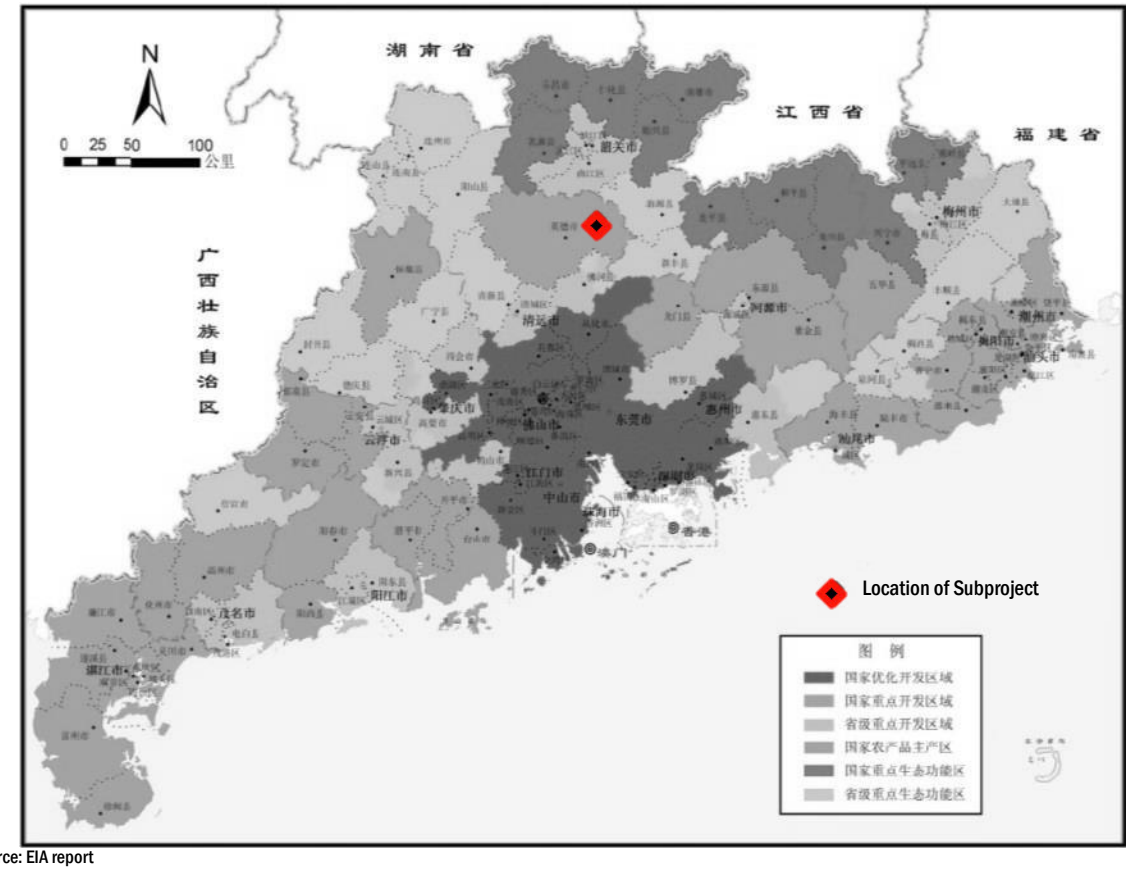
Regarding the existing source of industrial waste supply, most of the factories in the industrial park get raw water from their water wells for industrial use. The subproject's water supply facility can contribute to stable and reliable industrial water supply and help preserve ground water resources.

In response to the requirements set out in the "Notice of the State Council on Issuing the Action Plan for Prevention and Treatment of Water Pollution" (2015, No.17) and "Notice of the People's Government of Guangdong Province on Issuing the Implementation of an Action Plan for Prevention and Treatment of Water Pollution" (2015, No.131), People's government of Qingyuan city has issued the "Water Pollution Prevention and Control Work Plan" in June 2016. The work plan requires that all industrial enterprises are required to install an on-site pre-treatment facility to treat their wastewater before discharging to the centralised wastewater treatment plant. By end of 2017, wastewater treatment plant should be developed in industrial park with online monitoring devices installed to monitor the quality of influent and effluent.

The proposed WWTP of the subproject will collect and treat all domestic and industrial wastewater generated from the Hongxing zone of the industrial park with online monitoring devices installed at the wastewater intake point and discharge point to ensure that the quality of influent and effluent are in compliance with the requirements. The subproject will play an important role in water pollution control, supporting the local government to improve the overall water environment.

With a new WWTP and water supply facility to be built from the subproject, the improved environmental infrastructure will attract more industrial enterprises to establish a presence in the industrial park, bringing more job opportunities to the local people. It is expected that the subproject will bring significant benefits to the local economy.

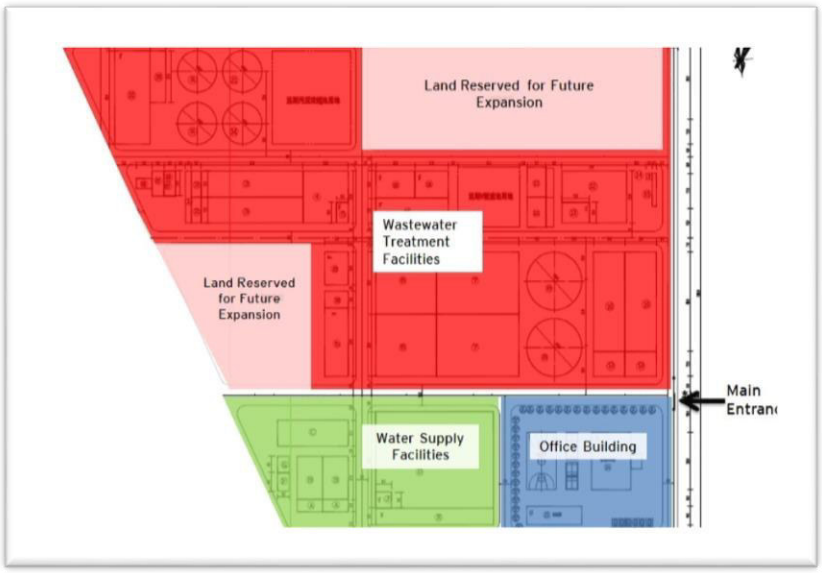
Figure II-1: Location of the proposed subproject on the map of Guangdong Province, the PRC



Source: EIA report

Figure II-2: Locations of the subproject and the surrounding environment

Figure II-3: Layout of the wastewater treatment plant and the industrial water supply plant (Phase 1)



Subproject Output and Activities

Phase 1 Development

The wastewater treatment plant will have the capacity to treat industrial and domestic wastewater, which will be mainly collected from home appliance, coating and painting, and composites manufacturers of the industrial park during Phase 1. The estimated pollutants concentrations of wastewater generated by major industries in the industrial park are shown in Table II-1 below:

Table II-1: The Estimated Pollutants Concentrations of Wastewater Generated by Major Industries during Phase 1 (Unit: mg/L, except for pH)

Parameters	Manufacturer			
	Home appliance	Composites	Coating & Painting	Electronics
COD	10,000	500-2000	≤1000	Most of the wastewater generated are recycled onsite without discharging outside the facilities
SS	2,000	900-950	≤800	
Ferrous	3,000	-	-	
Phosphate	2,400	-	-	
pH	3-5	6-9	6-9	
BOD_5	-	250-650	≤400	
Petroleum Hydrocarbons	-	50-120	≤63	
Ammoniacal Nitrogen	-	30-100	≤125	
Chromium	ND	ND	ND	
Cadmium	ND	ND	ND	
Mercury	ND	ND	ND	
Nickel	ND	ND	ND	

Source: EIA report
ND – no data

Additional industries which will be connected to the WWTP during Phase 2 of the subproject is not yet determined. However, all industrial enterprises are required to conduct onsite pre-treatment for their wastewater generated before discharging to the proposed WWTP to ensure that the influent quality is in accordance with the standard stipulated in the concession agreement made between the subproject and the respective industrial enterprise. In general, considering the influent standard of other industrial park with similar nature, the allowable influent pollutant concentration for the WWTP will be as below:

Table II-2: Allowable Influent Pollutant Concentration

Parameter	Allowable Pollutant Concentration levels
pH	6-9
COD_{Cr}	≤1000 mg/L
BOD_5	≤300 mg/L
SS	≤300 mg/L
Petroleum Hydrocarbons	≤5 mg/L
Ammoniacal Nitrogen	≤30 mg/L
Chromium	ND
Cadmium	ND
Mercury	ND
Nickel	ND

ND – no data

According to the EIA report, it is anticipated that the total volume of wastewater generated from the Hongxing zone of the industrial park and Yunling town would be approximately 19,900m^3/day in Phase 1. Industrial wastewater and domestic wastewater is designed to account for 63.3% and 36.7% respectively. However, CTEG has not entered into any service agreement with the local government regarding the provision of domestic wastewater treatment, the Phase I of the proposed wastewater treatment plant will be mainly used for industrial wastewater collection and treatment.

In Phase 1, the proposed water supply facility will provide 50,000m^3 of water per day for industrial enterprises in Qingyuan Chinese Overseas Industrial Park Yingde Yinghong Base. The water supply intake point will be located on upstream side of the Beijiang River (Geographic coordinate: 24°21'43.9"(N), 113°29'32.7"(E)). A water quality sampling was conducted in May 2016 at the water intake point, the results show that the existing water quality of the intake point meet Class III standard of Environmental Quality Standards for Surface Water (GB3838-2002).

Phase 2 Development

During the Phase 2 development, a new wastewater treatment plant with a design capacity as 60,000m^3/day will be built. According to the EIA report, the projected wastewater generated by the industrial enterprises in the Hongxing zone of the Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Industrial Park and the Yunling town will be 57,800m^3/day and 18,300 m^3/day respectively. The wastewater treatment plant with a total design capacity of 80,000m^3/day is expected to meet the long-term needs (76,100m^3/day) of the industrial enterprises and the nearby community. Meanwhile, 30% of the total treated wastewater (i.e. 24,000m^3/day will be diverted to the water supply facility for further treatment and delivered to the nearby enterprises for industrial use.

Water supply facility will expand its capacity from 50,000m^3/day to 140,000m^3/day in Phase 2 development. The water source will include 24,000m^3/day of treated wastewater from the wastewater treatment plant and 116,000m^3/day of water extracted from Beijiang River.

Table II-3: Estimated Influent Quality of Water Supply Facility in Phase 2

	COD	BOD	SS	Ammoniacal Nitrogen	pH	Petroleum Hydrocarbons	Chroma
30% of treated wastewater (24,000 m3/day)	40	10	10	5	6.9	0.05	30
Beijiang River (116,000 m3/day)	10	1.5	30	0.08	6-9	0.05	12
Mixed influent	**15**	**3**	**27**	**1**	**6-9**	**0.05**	**15**

Table II-3 shows that the influent quality of the water supply facility in Phase 2 is still in compliance with Class III standard of Environmental Quality Standards for Surface Water (GB3838-2002).

River flow during the dry season is estimated to be 90% of its average flowrate. The annual water intake is approximately 0.5% of the annual river runoff of Beijiang River which is approximately 8.7billion m^3. As the annual water intake from Beijiang River during the Phase 2 development would be only 51.1million m^3, the extent of water abstraction is within the safe levels and shall not adversely impact downstream uses.

The construction date of phase 2 development will highly depend on the numbers of industrial enterprises stationed in the industrial park and the rate of population growth in the surrounding communities. Industrial enterprises will be identified at a later stage prior to the start of Phase 2.

Figure II-4: A resin and pigment supply company in Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base

Subproject Components

Wastewater Treatment Plant (WWTP)

The wastewater treatment plant uses a three-stage treatment process, which includes pre-treatment (primary treatment), anaerobic oxidation process (secondary treatment), Fenton reagents and disinfection (tertiary treatment).

During the pre-treatment process, all domestic wastewater will be collected and diverted to the fine grid for removing coarse suspended sediments. It will enter into the rotary drum screen with industrial wastewater to remove fine particle. Coagulant (ferrous sulfate) and flocculant (PAM) will be added to the mixed wastewater in coagulation reaction tank and then settled in primary sedimentation tank to eliminate most of the suspended particles. Sludge will be generated from this process and it will be pumped to the sludge thickener.

Anaerobic oxidation process will be used in secondary treatment stage. The wastewater will enter the anaerobic hydrolysis-acidification reactor, which can facilitate removal of organic matter from wastewater by converting undissolved organic matter into easily degradable ones and breaking large organic molecular into small ones. In aeration tank, air is injected to supply oxygen and provide rapid mixing to convert the suspended solids into larger solids as activated sludge. The activated sludge with its living organisms will be kept in suspension to absorb dissolved organic matter in wastewater. After that, the wastewater will enter the secondary sedimentation tank where part of the activated sludge will be returned to the aeration tank for mixture with the wastewater while the excess activated sludge will be transported to sludge thickener for further treatment before disposal.

Fenton's reagent, which is a solution of hydrogen peroxide (H_2O_2) with ferrous iron, will be added during the tertiary treatment. The reaction of the iron and H_2O_2 will generate Hydroxyl radical (OH) and oxidise contaminants. After this process, organic matter in the wastewater will be significantly reduced.

All chemicals used during the process will be managed in accordance with CTEG's process safety management of hazardous chemicals. The wastewater treatment plant will be designed in accordance with the requirements set out in the Fire Prevention Code of Petrochemical Enterprise Design (GB50160-2008) to ensure that chemicals will be properly stored with measures such as double containment and bunding to help reduce the risk of chemicals spill.

Once the final sedimentation and filtration process is completed, the treated wastewater will be discharged through the 2.3km long pipeline into the Guantianshui creek, which will eventually lead to Beijiang River. The pipeline would be DN1200, which will be laid underground next to the roads with the design flow rate in Phase 1 and Phase 2 as 0.21m/s and 0.62m/s respectively.

The process of the wastewater treatment is given in Figure II-5. Approximately 30% of the treated water will be diverted into the industrial water supply plant for further treatment before being used by other industrial enterprises as raw water in Phase 2. The process flow of the water supply plant is shown in Figure II-6.

Figure II-5: Wastewater treatment plant flow diagram

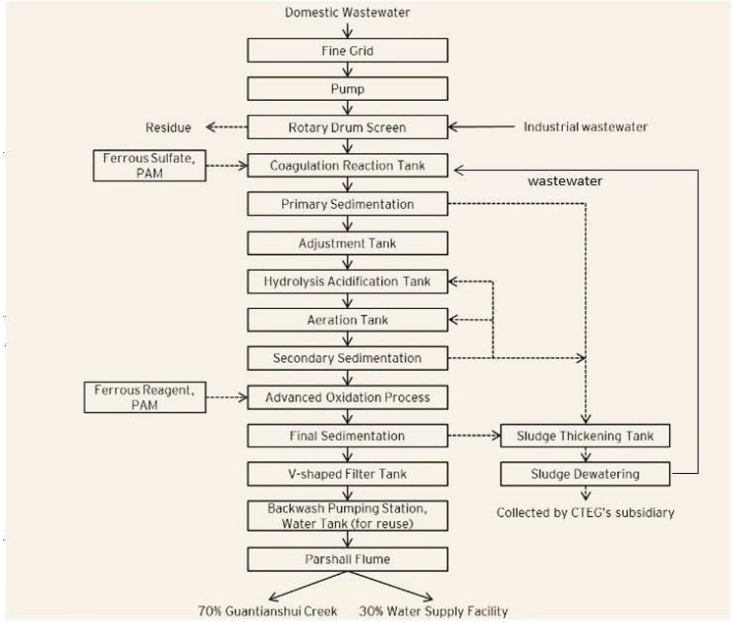
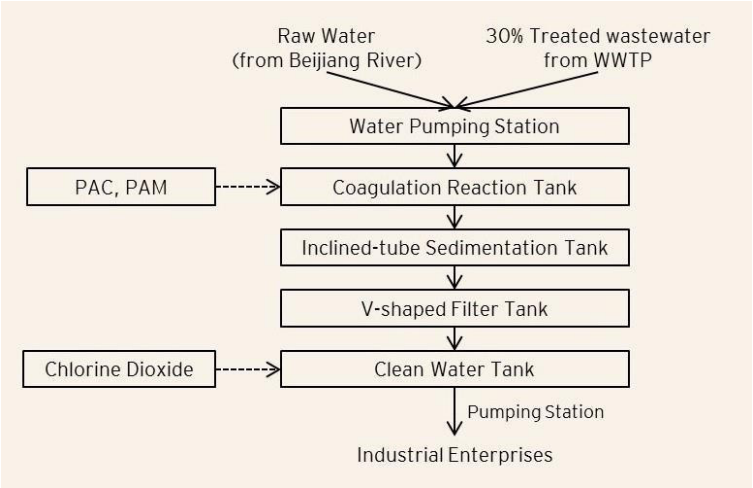


Figure II-6: Industrial water supply plant flow diagram



Effluent Quality of the Wastewater Treatment Plant

The effluent from the wastewater treatment plant will meet the Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) and the Class I standard for the second time phase for secondary municipal wastewater treatment plant set out in Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB4426-2001), whichever is stricter.

Table II-4: Comparison between discharge standards and designed effluent quality

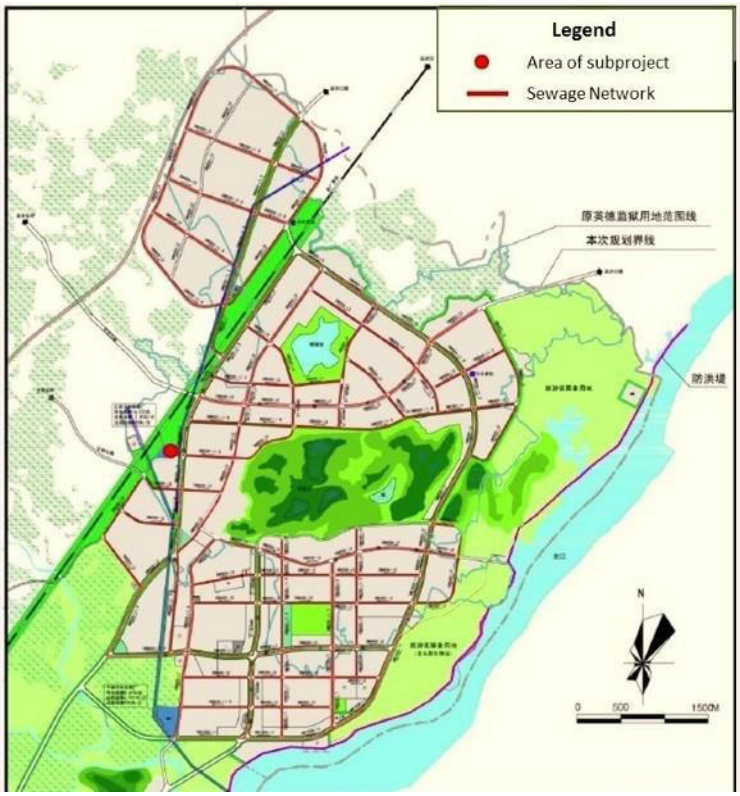
	COD	BOD_5	SS	NH_3-N	Chroma (dilution)	pH	Petroleum
	mg/L	mg/L	mg/L	mg/L	mg/L	-	mg/L
Designed effluent quality from the wastewater treatment plant	≤ 40	≤ 10	≤ 10	≤ 5	≤ 30	6-9	≤ 0.05
Grade 1A Standard, GB18918-2002	≤ 50	≤ 10	≤ 10	≤ 5	≤ 30	6-9	≤ 1
Class I standard for the second time phase DB44/26-2001	≤ 40	≤ 20	≤ 20	≤ 10	≤ 40	6-9	≤ 5
IFC EHS General Guidelines	125	30	50	10	-	6-9	-

Source: EIA report

Sewer network connected to the WWTP

Currently there is no sewer network serving the industrial park. CTEG will be responsible for the construction, monitoring and maintenance of sewer network connecting to the WWTP. The construction of the sewer network will be conducted in phases in line with the development of the industrial park. The proposed sewer network for the Hongxing zone of the industrial park is showed in Figure II-7. The sewer network for industrial wastewater and domestic wastewater within the industrial park run approximately 6.87km (main sewer line: 3,51km; branch sewer line: 3.36km) and 26.86km (main sewer line: 6.28km; branch sewer line: 20.58km) respectively.

Figure II-7 Proposed Sewer network of the Industrial Park



Pipeline connection to industrial wastewater sources

All enterprises within the industrial park are required to pre-treat their wastewater before discharging to the sewer network connected to the subproject's WWTP. The quality of the effluent discharged from industrial enterprises of various sectors shall comply with the effluent standards set out in the EIA report and the respective emission standards of their own sector.

The wastewater generated by the industries will be diverted to the sewer network connected to the subproject's WWTP. CTEG will be responsible for the monitoring and maintenance of the connection points between the factories and sewer network.

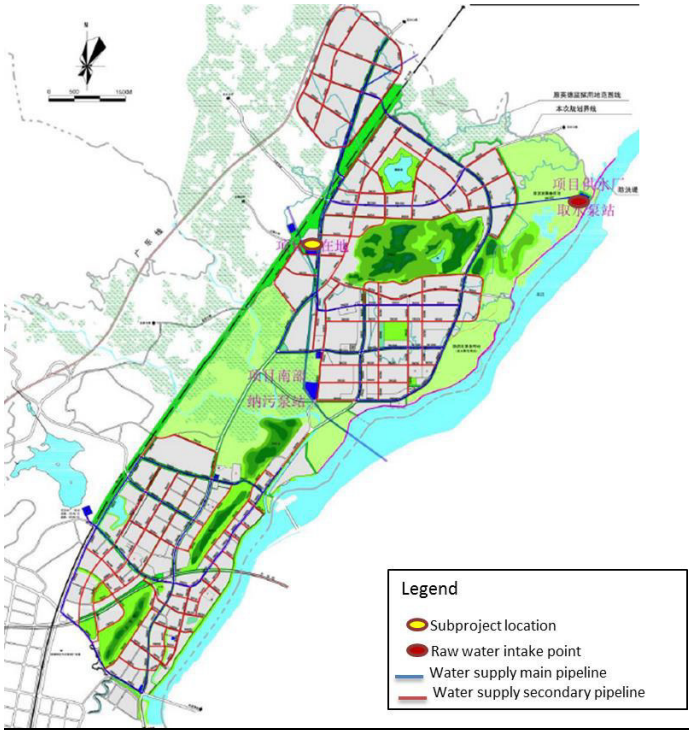
CTEG will sign service agreements with each enterprise in the industrial park stating allowable limits for effluent to sewer and maximum permissible limits for contaminants in the wastewater discharged. Enterprises have responsibilities to install wastewater pretreatment system onsite such as grille bar screening machine and grit chamber to remove plastic bags, fiber, and debris like pumice before discharging their wastewater to the WWTP. Enterprises are required to clean the grit chamber at least once a month. The subproject will be responsible for inspecting the wastewater pretreatment system before it is officially launched. Enterprises are required to ensure that the wastewater discharged comply with the allowable volume of wastewater and pollutant concentration levels as stipulated in the service agreement. If enterprises need a larger allowable volume of wastewater or higher permissible pollution concentration in wastewater discharged to the WWPT, they are required to submit a written request to CTEG at least one month in advance for approval.

Similar to influent quality, the allowable volume of wastewater discharged from each industrial enterprise to the WWTP will also be covered in the service agreement between industrial enterprise and CTEG. Online wastewater monitoring devices will be installed at the connection points between factories and sewer as well as sewer and WWTP to ensure that the quality and volume of effluent are within the allowable limits. Industrial enterprises are allowed to discharge 10% higher than the volume agreed in the service agreement. However, prior written application is required if industrial enterprise intends to discharge excess quantity of wastewater to the WWTP.

Water Supply Pipes

CTEG will be responsible for the construction, monitoring and maintenance of raw water pipeline connecting from the water intake point at the upstream of the Beijiang River to the water supply facility as well as the water supply pipelines connecting from the water supply facility to the industrial enterprises. The construction of the water supply pipelines will be conducted in phases in line with the development of the industrial park. The raw water supply pipeline is approximately 7.56km long, while the main and secondary water supply pipelines will run around 12.2km and 8.5km respectively. The proposed layout of the raw water pipeline and water supply network for the industrial park is showed in Figure II-8.

Figure II-8 Proposed water supply network of the Industrial Park



Pipeline connecting WWTP and the discharge point

The treated wastewater will be discharged to Guantianshui creek via an underground pipeline. The pipeline (DN1200) will be built along Zhanye Avenue and Yinghong Avenue to connect the WWTP to the discharge point. The design flow rate of the pipeline in Phase 1 and Phase 2 is 0.21m/s and 0.62 m/s respectively. The discharge point will be situated at the intersection of Guantianshui creek and Yinghong Avenue, and above the recorded river water level to ensure that the discharge would not be affected during storms.

Odour control facility

Facilities which can cause odour nuisance such as drainage grid, sump pit, coagulation reaction tank, septic tank, anaerobic hydrolysis-acidification reactor, sludge thickening, and sludge conditioning tank will be installed with concrete lids and odour control systems to minimise any detrimental impact on the surrounding environment from odour. Biofiltration technology with high removal efficiency of biodegradable and water-soluble contaminants will be used for this subproject.

All odourous airstreams generated from different locations will be extracted by centrifugal-type extract fans and delivered to the biofilter compartments for centralised odour removal. Firstly the air will be humidified in a pre-wash device for preliminary removal of ammonia, hydrogen sulphide (H2S) and methyl mercaptan (CH3SH). The odour removal efficiency of this stage can reach around 90%.

The humidified air will be injected into a bed of filter material, which provides breeding ground for the microorganisms. When the air flow slowly upward through filter material and the pollutants will be absorbed, giving the opportunities for microorganisms to degrade the pollutants by oxidation and produce by-products in the form of CO_2, water, sulphuric acid (H_2SO_4) and nitric acid (HNO_3). Sprinkler system is also installed to maintain a stable moist environment for the biofilter. Around 99% of the odour concentrations will be removed before it is discharged to the atmosphere by a 15m high vent pipe.

In addition, a selected biological deodourant liquid (Bio-C) will be applied in open areas such as sludge dewatering zone to manage odour impacts. High-pressure atomisation nozzles will be installed near to the odour sources. The biological liquid

will be atomised and sprayed evenly onto the source of the odour. When the odour molecule comes in contact with microorganism in the biological liquid, it will be broken down, absorbed and oxidised to become a harmless molecule. This process is expected to achieve odour removal efficiency in excess of 60%.

III. Description of the Environment

A. Location

The subproject area is located in Yinghong District of Yingde City, which is the largest city by land area in Guangdong Province in the PRC (Geographic coordinate: 23°50′31″~24°33′11″, 112°45′15″~113°55′38″(E)). The City is located in the north of Guangdong Province, approximately 140km from Guangzhou, the capital city of Guangdong Province in the PRC. The land surrounding the subproject is mainly used for industrial use. There are also some villages (around 500m away), hospitals (1200m away), schools (700m away), farmland (rice, sweet potato, cassava, soybean, vegetables, tea), and Wuhan-Guangzhou High-speed railway line (along the west boundary) near the subproject area.

B. Topography and Geology

The subproject site is located in the mountainous region of the northern Guangdong Province and south of the Nan Mountains, which are a series of mountain ranges in South China extending through Guangxi Province to Guangzhou Province. The area encompasses mountainous and hilly terrain, small flatland, and slope declines from north to south. In general the slopes are gentle with angles of less than 6 degrees. Yingde City also has well-developed areas of karst landscape which is characterised by large caves formation, sinkholes and springs.

According to "the 1:200,000 Geological Map of Yingde of the PRC", most of the exposed stratus are of Paleozoic Era's Devonian and Carboniferous period, Mesozoic Era's Cretaceous period and Cenozoic Era's Quaternary period. Sandshale and Limestone are two dominant rocks in the subproject area. Various types of soil including latosol, red earth, red limestone soil, yellow soil and paddy soil can be found in Yingde City.

C. Climate

Yingde City has subtropical monsoon climate characterised by warm, humid with long frost-free period. According to the meteorological data, the average temperature of the County is 20.7^{o}C with the highest monthly average in Jul y (28.9^{o}C) and lowest monthly average in January (10.9^{o}C). Annual average evaporation and annual average precipitation are 1685.5mm and 1982.4mm respectively. The rainfall is not evenly distributed throughout the year, with approximately 51% of the annual precipitation occurs between April and June and 22% occurs from October to March. The spatial distribution of rainfall is also uneven, with around 2100mm in both the north and the south while 1900mm in other areas within the city. The prevailing winds in Yingde City are northeasterly with annual average wind speeds between 1.7 and 2.7 m/s. On average there are 2 days per year with the daily wind speeds exceeding 17 m/s.

As the proposed subproject is situated downstream of Beijiang River in hilly area and has a subtropical monsoon climate with a peak of precipitation from April and June, floods could occur within a short period of time after a heavy rain. For the subproject area the 100-year floodwater level is 36.53m, 50-year level is 35.49m while 20-year level is 34.15m (Pearl river datum).

D. River System and Water Resources

There are four main rivers near the subproject area including Beijiang River, Guantianshui Creek, Huangyan Creek and the Kongtang Creek.

Beijiang River is situated at the east of the subproject area, it is one of the main rivers in Guangdong Province and the second largest river in Pearl River system with two key tributaries including the Lian River and the Weng River. Beijiang River, which is 468km long and has a catchment area of 46.686 km^2, is the northern tributary of the Pearl River originating from Damaoshan Mountain, Xinfeng County in Jiangxi Province. There is a Baishiyao hydropower station built on upstream Beijiang River near the subproject area with an installed capacity of 92,000kW.

The treated wastewater will be discharged from the wastewater treatment plant through the pipe to Guantianshui creek, which originates from "Yingde city 1032 mountain" via Yuanding and converges to Beijiang River. It is 30km long with an average river flow rate of 4.9m^3/s during dry season.

Huangyan Creek originates from Hengshitang town, via Huangmenlou and eventually converges to Beijiang River. The length of the creek is 34.5km with an average river flow rate of 6.19m^3/s. Kongtang Creek, which is 13km long and 2-3m wide with an average river flow rate as 0.23m^3/s in the dry season, originates from Dongshan and flows into Huangyan Creek near Shangliao.

Beijang River's Yingcheng Baisha to Xiangcheng bridge segment is classified as Type II waters, which is applicable to the abstraction for human consumption in first class protection area, the protected areas for rare fishes, and the spawning fields of fishes and shrimps. Guantianshui creek and Beijiang River's Yingde Shakouwei to Yingcheng Baisha segment are classified as Type III waters, which is applicable to the abstraction for human consumption in second class protection area, protected areas for the common fishes and swimming areas. Huangyan Creek and Kongtang Creek are classified as Class IV waters. It is mainly applicable to the water areas for industrial use and entertainment which is not directly touched by human bodies.

Figure III-1: Kongtang Creek

Figure III-2: Huangyan Creek

Figure III-3: Guantianshui Creek

Figure III-4: Beijiang River

E. Natural Resources

Yingde City has advantageous natural environmental and resource conditions. The northern part of Yingde is characterised by its undulating landscape with large tracts of natural broadleaf forest. To the south is hilly area with artificial cultivation dominated by broad-leaved forest. The central and eastern part has artificial coniferous forest of mainly pine and cedar. The western part is hilly area of limestone. The eco-system was forest-based.

The subproject area is located at the northwestern part of Yingde City. In terms of ecological function area, the subproject area is classified as intensive development zone (集约利用区) with leading ecological value of agricultural and urban development. The direction of development of such zone includes strengthening soil protection measures against erosion, river shelterbelt system, and ecological agriculture.

In the subproject area, the vegetation cover is mainly orchard. It is also characterized by large pieces of grassland/shrub land, scattered land of artificial plantation comprised Eucalyptus, Acacia, and bamboo. With intensive human activities, vegetation degradation is present. The area has very little soil erosion except for area with quarry sites, construction activities, and agricultural activities.

The current plant community includes Mangium, Eucalyptus forest, bamboo forest, orchards, tea garden/ shrub bushes. Dominant species of tree within the scope of the investigation includes Acacia confusa, Eucalyptus exserta, Olives, Bambusa chungii McClure, Bambusa textilis McClure, Rhus succedanea. Dominant species of the investigation includes Mimosa sepiaria (簕仔树), Lantana camara (马缨丹), Rhodomyrtus tomentosa (桃金娘) and Ilex asprella (梅叶冬青). Dominant species of herbaceous plants investigation includes Dicranopteris dichotoma (芒萁), Arundinella anomala (野古草), Eriachne (鹧鸪草) and Blechnum orientale (乌毛蕨). Common vines include Mussaenda pubescens (玉叶金花) and Embelia laeta (酸藤子).

The vegetation types are broad-leaved forest, bamboo forest, scrubland/grassland, orchards and farmland (including tea garden and tree nursery). Undulating area has forests. Sloping area has shrubs and grass. Common community includes Rhodomyrtus tomentosa - Dicranopteris dichotoma community (桃金娘-芒萁群落), Mimosa sepiaria - Lantana camara community (簕仔树-马缨丹群落). Grasslands are common in proximity to village settlements. Human activities have given rise to herbaceous community. Common community includes Dicranopteris dichotoma community (芒萁群落), Neyraudia reynaudiana community (类芦群落) and Bidens alba community (百花鬼针草群落). The eco-environmental quality of the subproject area is average considering the vegetation cover. The evaluation was based on three major factors, namely biomass, production, and number of species (specie richness).

The natural environment and habitat has been disrupted by intensive human activities. According to the EIA report of Master Plan of the Hongxing zone of the Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base, terrestrial ecosystem survey and mapping were focused on the industrial park. Onsite survey was conducted as part of the local EIA preparation to determine vegetation habitat, species and productivity. In addition, the vegetation and wildlife desktop review and remote sensing data interpretation of U.S. Landset data for 2010 was conducted.

Vegetation community general survey: The elevation, latitude and longitude of the sampling areas were collected by GPS tractor. The vegetation types and the characteristics of each vegetation community were recorded. The photos of typical vegetation appearance and structure were also recorded.

Vegetation community field survey: the typical vegetation community sections were determined to conduct sampling survey. The sampling area for tree was 10m × 10m, for shrub was 5m × 5m, and for herb was 2m × 2m. All types, numbers, DBH (diameter at breast height) and vegetation coverage were recorded.

Vegetation species survey: In the course of the investigation, the vegetation species in the study area, the status of various economic plants and their living conditions were determined. The field survey and key sampling survey methodology were used to investigate the areas with good vegetation in the planning area. Samples and sampling areas were set up, photos were also taken at the scene. A route surveying were conducted for the areas between the sampling locations and areas with poor vegetation.

Vegetation productivity survey: The biomass and yield of the main vegetation types in the study area were measured by the regression analysis. Some vegetation types were referenced to relevant domestic and foreign data to estimate the vegetation productivity in the study area.

The most common vegetation species in the study area include:

Tree	Acacia confuse, Canarium album (Lour.) Raeusch, Bambusa chungii McClure (White bamboo), Bambusa textilis, Rhus succedanea
Shrub	Mimosa sepiaria Benth (Simucronate Mimosa), Lantana camara (big-sage), Rhodomyrtus tomentosa (rose myrtle), Ilex asprella (Rough-leaved Holly)
Herb	Dicranopteris dichotoma(Thunb.)Bernh, Arundinella anomala, Eriachne, Blechnum orientale
Vine	Mussaenda pubescens, Embelia laeta (L.) Mez

Wildlife survey was conducted in the same study area as the vegetation survey. No rare or endangered species was identified in the assessment area. There are mainly low mountains, hills, woodlands, orchards and farmland in the study area. Instead, fauna adapted to human activities and have activity in vicinity to or in relations to settlements including brushwood and paddy fields, orchards, and vegetable patch. Common fauna includes insects, rodents, snakes, toads, frogs and magpies, sparrows and other birds. Common pastoral animals are pigs, cattle, dogs, chickens, ducks, geese, and other traditional species.

Major wildlife species in the study area include:

Birds	Magpie, cuckoo, sparrow, quail, starling, Chinese bamboo partridge, oriole, mandarin duck, swallow, Oriental magpie-robin, woodpecker, Pheasants, partridges, Chinese hwamei
Lagomorpha/ Rodents	Voles, Daurian ground squirrel, hare
Fishes	Major breeding species include Silver carp, bighead carp, blue, crucian carp, mud carp, carp Species of relatively high economic values include Mandarin Fish, Xenocypris davidi Bleeker, Catfish/loach/eel
Mollusks	Viviparidae, stone snails, Unionidae, snails, sea snail, Tubificidae, etc.
Amphibians	Frogs, toads, Quasipaa spinosa, Odorrana versabilis, tree frogs, mud frogs, etc.
Reptiles	Turtle, soft shelled turtle, green bamboo snake, Deinagkistrodon, Lycodon rufozonatus, black racer
Annelida	Earthworms, leeches, terrestrial leech
arthropods	Bees, dragonflies, mantis, grasshoppers, cicadas, mosquitoes, butterflies, fireflies, bedbugs, Tryporyza incertulas (walker), wasps

According to the EIA report of Master Plan of the Hongxing zone of the Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Base, aquatic ecological survey was conducted during the preparation of the local EIA, targeted at the Yingde Shakou section of Beijiang river. Information collected includes aquatic ecological survey findings from People's Government of Guangdong Province, Yingde City's water resources authorities and agricultural authorities, qualified scientific research units in Guangdong Province, and fisheries and aquaculture departments of cities along Beijiang River.

The information collected covers three key areas: Plankton, Benthos, and fishery resources.

In the Yingde section of Beijiang river, 7 phylums with a total of 110 genera of Phytoplankton were found: 49 genera of Chlorophyta, 19 genera of Cyanophyta, 34 genera of Bacillariophyta, 3 genera of Xanthophyta, 3 genera of Euglenophyta, and 1 genus each for Cryptophyta and Pyrrophyta. Meanwhile, a total of 95 species of Zooplankton were found in the same area: 25 species of Protozoa, 22 species of Rotifers, 27 species of Cladocerans, and 21 species of Copepods. 253,660 individuals of Phytoplankton (equivalent to 1.4633 mg of biomass) and 198.4 individuals of Zooplankton (equivalent to 1.72 mg of biomass) were found per litre of water.

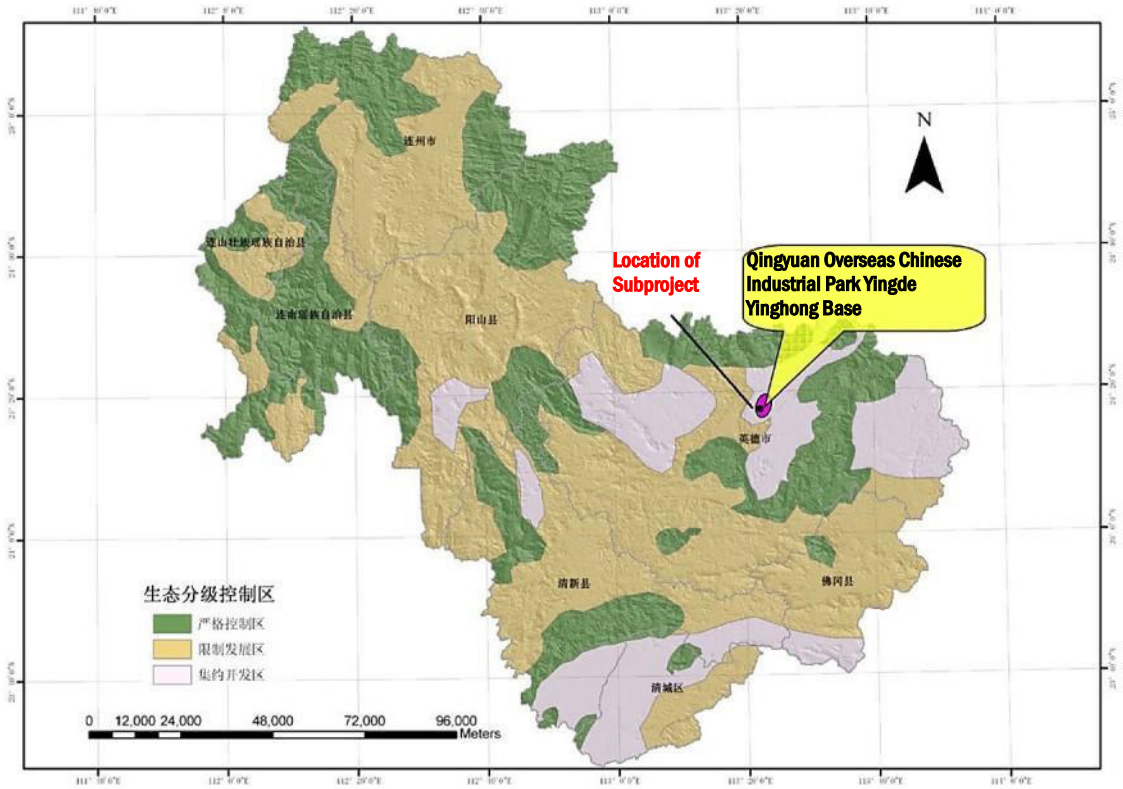
8 classes with a total of 84 species of Benthos were found in the Yingde section of Beijing river, which include 1 species of Turbellaria, 1 species of Polychaeta, 8 species of Oligochaetea, 2 species of Hirudinea, 16 species of Gastropoda, 13 species of Lamellibranchia, 2 species of Crustacea, 44 species of Insecta. On average, 1327.35 individuals of Benthos per m^3 of water were found, equivalent to 234.63 gram of biomass per m^3 of water.

An onsite fishery resources survey was conducted on 14-20 July 2009 in the Yingde section of Beijiang river, 28 species of fishes were identified, they are divided into 5 orders, 11 families, and 25 genera: Cypriniformes (2 orders, 14 genera, 14 species), Siluriformes (3 orders, 5 genera, 6 species), Perciformes (4 orders, 5 genera, 6 species), Anguilliformes (1 orders, 1 species), and Salmoniformes (1 orders, 1 species), accounts 19.3% of fish species recorded in Beijiang river. The following species were identified: Anguilla japonica (鳗鲡), Lateolabrax japonicus (花鲈), Mylopharyngodon piceus (青鱼), Cyprinus carpio (鲤), Carassius auratus(鲫), Silurus asotus(鲇), Ervthroculter hypselonotus (大眼红鲌), Megalobramahoffmanni (广东鲂), Xenocypris davidi (黄尾鲴), Leiocassis virgatus (条纹鮠), Rhinogobius giurinus (子陵栉鰕虎), Mastacembelus

armatus (大刺鳅) and Cirrhinus molitorella (鲮鱼). 10 species of fish listed as national priority protected aquatic animals have presence in the area. This include Siniperca kneri (大眼鳜), Mystus guttatus (斑鳢), Pelteobagrus fulvidraco (黄颡鱼), Cyprinus carpio (鲤), Carassius auratus (鲫), Cirrhinus molitorella (鲮), Megalobrama hoffmanni (广东鲂), Mylopharyngodon piceus (青鱼), Anguilla japonica (鳗鲡) , Lateolabrax japonicas (花鲈).

The subproject area is located at area classified as intensive development zone. The land use is characterized by mix use function of urban and agriculture. There are no critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities within the subproject area.

Figure III-5： Location of project within the Qingyuan Overseas Chinese Industrial Park and Regional Ecological Functions



Source: EIA report

F. Socioeconomic Condition

The location of the project is in the northwest of Yingde City. It is an important passage between northwest Guangdong and the Pearl River Delta Region. It is accessible by ground transportation. It is well-connected to transport establishment including Beijing-Guangzhou Railway, Wuhan–Guangzhou High-Speed Railway, Guangle Expressway, and G78 Shantou–Kunming Expressway.

Yingde City is a Qingyuan prefecture-level city. It is the largest Counties of the PRC within Guangdong in terms of area. It is famous for high quality black tea production. The registered population in 2013 is around 1.1 million. Yinghong District is located in the central part of Yingde City. In 2013, the registered population is 34,614, of which around 15,000 are non-agricultural population, 12,000 are overseas returnees. Gross Output Value of Industrial Enterprises above Designated Size is CNY¥ 1,114 million, of which the Yinghong base accounted for CNY¥ 848 million. Investment in fixed assets amounted to over CNY¥2,210 million. The total agricultural output value was over CNY¥ 510 million.

The development plan for Yingde City from 2011 to 2030 (英德市城市总体规划（2011-2030）) has targeted to focus on the development of tourism, livability, and industries including logistics, electronics and electrics, and services. For Yinghong district, the direction will be similar but with more focus on ecological value, modernisation of manufacturing and agriculture, as well as tertiary industries.

In Yingde, the investment in key infrastructure project in 2015 amounted to CNY¥ 9,120 million. This includes wastewater related projects, 238 rural power grid related projects, 632 telecommunication infrastructure project, irrigation related project, natural gas pipeline projects and transportation related projects. Investment has also been made to poverty alleviation. For 69 key related project, the sum amounted to around CNY¥ 278 million.

Tourism, one of the focus in the development plan, brought about around CNY¥ 5,760 million revenue in 2015 from over 10 million visitors. Currently, there are one newly established Provincial Forest Park in Yingde, and a number of declared prototype establishments for tourism such as Guangdong Provincial Rurual Tourism Prototype-Village. There is no physical or cultural heritage, structures or sites that are of historical, archaeological, paleontological, or architectural significance exists within the subproject area.

G. Environmental Quality Baseline

The section describes the baseline surface water quality, ambient air quality, groundwater quality and noise assessment for the subproject area.

1. Surface Water Quality

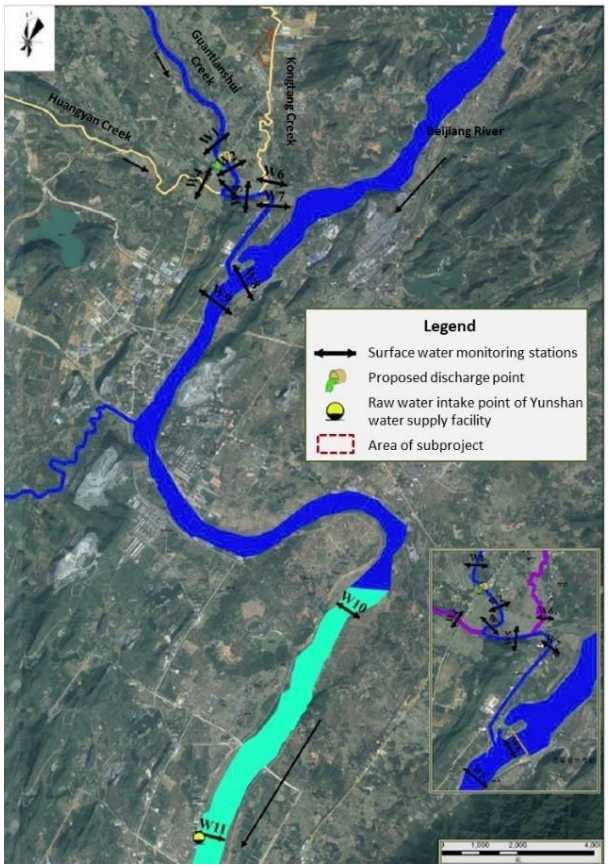
Monitoring was conducted at eleven locations near the subproject areas as shown in Table III-1 below.

Table III-1: List of Surface Water Quality Monitoring Stations

Ref.	Locations	Applicable Surface Water Quality Standard	
W1	500m upstream of discharge point	Environmental quality standards for surface water (GB3838-2002)	Class III
W2	500m downstream of discharge point		Class III
W3	950m downstream of discharge point		Class III
W4	500m upstream from the junction of Huangyan creek and Guantianshui creek		Class IV
W5	500m downstream from the junction of Huangyan creek and Guantianshui creek		Class III
W6	500m upstream from the junction of Kontang creek and Guantianshui creek		Class IV
W7	500m downstream from the junction of Kontang creek and Guantianshui creek		Class III
W8	200m upstream from the junction of Guantianshui creek and Beijiang River		Class III
W9	500m downstream from the junction of Guantianshui creek and Beijiang River		Class III
W10	14,200m downstream from the junction of Guantianshui creek and Beijiang River		Class III
W11	21,000m downstream from the junction of Beijiang River (water supply intake point of Yunshan waterwork)		Class II

Source: EIA report

Figure III-6: Locations of the Water Quality Monitoring Stations



The sampling was conducted once per day for three consecutive days from 21st to 23rd May 2016 by Guangzhou Haiqintiancheng Technical Testing Services Co., Ltd. 24 water quality parameters were sampled, and the corresponding surface water quality standards of each monitoring station are shown in Table III-2. The monitoring results are shown in Table III-3.

Table III-2: Surface water quality standards of eleven monitoring stations

Parameters	Unit	Corresponding environmental quality standards for surface water										
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11
		Class III	Class III	Class III	Class IV	Class III	Class IV	Class III	Class III	Class III	Class II	Class II
Temperature	°C	-	-	-	-	-	-	-	-	-	-	-
pH	/	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Dissolved Oxygen	mg/L	≥5	≥5	≥5	≥3	≥5	≥3	≥5	≥5	≥5	≥6	≥6
Sulphides	mg/L	≤0.2	≤0.2	≤0.2	≤0.5	≤0.2	≤0.5	≤0.2	≤0.2	≤0.2	≤0.1	≤0.1
Permanganate Index	mg/L	≤6	≤6	≤6	≤10	≤6	≤10	≤6	≤6	≤6	≤0.4	≤0.4
Suspended Solids	mg/L	≤30	≤30	≤30	≤60	≤30	≤60	≤30	≤30	≤30	≤25	≤25

Petroleum Hydrocarbons	mg/L	≤0.05	≤0.05	≤0.05	≤0.5	≤0.05	≤0.5	≤0.05	≤0.05	≤0.05	≤0.05	-
Cyanide	mg/L	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.2	≤0.05	-
Total Phosphorus	mg/L	≤0.2	≤0.2	≤0.2	≤0.3	≤0.2	≤0.3	≤0.2	≤0.2	≤0.2	≤0.1	≤0.1
Ammoniacal Nitrogen	mg/L	≤1	≤1	≤1	≤1.5	≤1	≤1.5	≤1	≤1	≤1	≤0.50	≤0.50
Anionic Surfactants	mg/L	≤0.2	≤0.2	≤0.2	≤0.3	≤0.2	≤0.3	≤0.2	≤0.2	≤0.2	≤0.2	-
Fluoride	mg/L	≤1	≤1	≤1	≤1.5	≤1	≤1.5	≤1	≤1	≤1	≤1	-
Chromium (VI)	mg/L	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	-
COD	mg/L	≤20	≤20	≤20	≤30	≤20	≤30	≤20	≤20	≤20	≤15	≤15
BOD_5	mg/L	≤4	≤4	≤4	≤6	≤4	≤6	≤4	≤4	≤4	≤3	≤3
Faecal Coliforms	CFU/L	≤10,000	≤10,000	≤10,000	≤20,000	≤10,000	≤20,000	≤10,000	≤10,000	≤10,000	≤20,000	≤20,000
Lead	mg/L	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.01	-
Zinc	mg/L	≤1.0	≤1.0	≤1.0	≤2.0	≤1.0	≤2.0	≤1.0	≤1.0	≤1.0	≤1.0	-
Cadmium	mg/L	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	≤0.005	-
Arsenic	mg/L	≤0.05	≤0.05	≤0.05	≤1.0	≤0.05	≤1.0	≤0.05	≤0.05	≤0.05	≤0.05	-
Copper	mg/L	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	≤1.0	-
Mercury	mg/L	≤0.0001	≤0.0001	≤0.0001	≤0.001	≤0.0001	≤0.001	≤0.0001	≤0.0001	≤0.0001	≤0.0005	-
Benzene	mg/L	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	≤0.01	-
Nickel	mg/L	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	≤0.02	-

Table III-3: Surface water quality sampling at eleven sampling sites

Parameters	Unit	W1			W2			W3			W4			W5			W6			W7		
		21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5
Temperature	°C	26.9	27.0	27.2	27.9	28.0	27.9	27.9	28.1	28.0	30.4	30.0	30.2	28.3	28.5	28.5	27.7	27.7	27.9	28.4	28.7	28.8
pH	/	6.63	6.65	6.66	6.84	6.85	6.78	6.91	6.95	6.88	7.11	6.99	6.95	6.93	6.85	6.79	6.84	6.88	6.82	6.92	6.93	6.86
Dissolved Oxygen	mg/L	7.81	7.74	7.68	8.53	8.45	8.50	8.36	8.20	8.31	8.31	8.28	8.23	8.33	8.36	8.27	8.05	8.10	8.02	8.23	8.25	8.30
Sulphides	mg/L	0.005	0.005	0.005	0.006	0.006	0.007	0.005	0.005	0.005	0.019	0.020	0.020	0.009	0.008	0.011	0.007	0.007	0.008	0.008	0.007	0.010
Permanganate Index	mg/L	1.9	2.0	1.9	2.2	2.1	2.2	2.0	1.9	2.0	3.7	3.7	3.8	2.2	2.1	2.2	3.4	3.4	3.5	2.1	2.1	2.1
Suspended Solids	mg/L	4	5	5	4	4	4	4	6	6	5	6	5	5	5	7	6	8	8	6	7	6
Petroleum Hydrocarbons	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cyanide	mg/L	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Total Phosphorus	mg/L	0.03	0.04	0.05	0.04	0.05	0.05	0.03	0.05	0.06	0.09	0.08	0.09	0.06	0.09	0.09	0.10	0.09	0.09	0.06	0.08	0.08
Ammoniacal Nitrogen	mg/L	0.028	0.032	0.030	0.039	0.042	0.051	0.045	0.048	0.037	0.062	0.065	0.059	0.028	0.031	0.034	0.037	0.034	0.034	0.053	0.051	0.051
Anionic Surfactants	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Fluoride	mg/L	0.08	0.07	0.6	0.07	0.06	0.8	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chromium (VI)	mg/L	0.005	0.004	0.006	0.006	0.006	0.006	0.005	0.004	0.005	0.006	0.005	0.006	0.004	0.005	0.004	0.006	0.006	0.005	0.004	0.005	0.006
COD	mg/L	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
BOD_5	mg/L	1.2	1.3	1.0	1.4	1.4	1.3	1.1	1.1	1.1	2.1	2.1	2.1	1.2	1.3	1.2	2.1	2.1	2.1	1.2	1.4	1.2
Faecal Coliforms	CFU/L	3,500	2,400	3,500	490	330	430	5,400	6,300	4,900	2,400	2,200	2,800	2,400	3,500	2,200	35,000	63,000	2,400	3,500	2,800	3,500
Lead	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cadmium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic	mg/L	0.0005	0.0008	0.0016	0.0007	0.0008	0.0003	0.0007	0.0007	0.0017	0.0027	0.0032	0.0029	0.0009	0.0011	0.0007	0.0012	0.0011	0.0011	0.0020	0.0022	0.0021
Copper	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Mercury	mg/L	0.00002	0.00003	0.00004	0.00002	0.00005	0.00003	0.00002	0.00004	0.00003	0.00001	0.00004	0.00003	0.00002	0.00004	0.00003	0.00001	0.00004	0.00003	0.00001	0.00004	0.00005
Benzene	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nickel	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

Source: EIA report

Table III-3: Surface water quality sampling at eleven sampling sites (con't)

Parameters	Unit	W8 (Left bank)			W8 (Mainstream)			W8 (Right bank)			W9 (Left bank)			W9 (Mainstream)			W10 (Left bank)			W10 (Mainstream)		
		21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5
Temperature	°C	26.1	26.3	26.6	26.0	26.3	26.2	26.2	26.4	26.0	26.1	26.3	26.0	26.2	26.4	25.9	26.2	26.2	26.1	26.2	26.2	26.1
pH	/	6.95	6.95	6.95	6.82	6.78	6.82	6.47	6.53	6.56	6.88	6.85	6.81	6.73	6.86	6.81	6.74	6.81	6.78	6.74	6.78	6.76

Dissolved Oxygen	mg/L	6.50	6.65	6.46	7.00	6.95	7.03	7.30	7.23	7.31	7.24	7.20	7.08	7.24	7.17	7.30	7.00	6.91	7.06	6.90	7.03	6.92
Sulphides	mg/L	0.009	0.009	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.007	0.008	0.007	0.006	0.006	0.008	0.008	0.007	0.006	0.007	0.009	0.008
Permanganate Index	mg/L	2.5	2.5	2.5	2.4	2.4	2.4	2.9	2.9	2.9	2.3	2.3	2.3	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.2	2.2
Suspended Solids	mg/L	6	6	5	5	5	4	6	4	6	7	4	8	5	6	6	4	5	5	6	6	4
Petroleum Hydrocarbons	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cyanide	mg/L	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Total Phosphorus	mg/L	0.07	0.08	0.08	0.10	0.11	0.07	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.07	0.09	0.09	0.10	0.08	0.08	0.09	0.07
Ammoniacal Nitrogen	mg/L	0.045	0.048	0.048	0.058	0.060	0.064	0.138	0.135	0.132	0.065	0.062	0.059	0.084	0.082	0.087	0.073	0.076	0.070	0.065	0.062	0.065
Anionic Surfactants	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Fluoride	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chromium (VI)	mg/L	0.007	0.007	0.005	0.009	0.006	0.005	0.007	0.007	0.006	0.008	0.007	0.007	0.006	0.006	0.005	0.005	0.004	0.006	0.007	0.006	0.007
COD	mg/L	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
BOD_5	mg/L	1.3	1.4	1.5	1.5	1.7	1.5	1.8	1.7	1.6	1.6	1.4	1.3	1.2	1.1	1.2	1.1	1.2	1.3	1.2	1.2	1.3
Faecal Coliforms	CFU/L	9,200	7,900	9,400	3,500	3,400	3,500	3,500	4,300	3,400	16,000	18,000	14,000	5,400	6,300	4,600	3,500	2,700	2,600	9,200	9,400	7,900
Lead	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cadmium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Arsenic	mg/L	0.0044	0.0045	0.0038	0.0044	0.0051	0.0045	0.0060	0.0059	0.0064	0.0057	0.0059	0.0057	0.0053	0.0053	0.0052	0.0067	0.0073	0.0051	0.0048	0.0053	0.0050
Copper	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Mercury	mg/L	0.00001	0.00004	0.00007	0.00001	0.00002	0.00007	0.00002	0.00002	0.00007	0.00003	0.00002	0.00006	0.00002	0.00002	0.00006	0.00001	0.00002	0.00007	0.00007	0.00006	0.00004
Benzene	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Nickel	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005

Source: EIA report

Table III-3: Surface water quality sampling at eleven sampling sites (con't)

Parameters	Unit	W10 (Right bank)			W11 (Left bank)			W11 (Mainstream)			W11 (Right bank)		
		21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5	21/5	22/5	23/5
Temperature	°C	26.4	26.2	26.2	26.3	26.2	26.2	26.3	26.1	26.2	26.2	26.2	26.3
pH	/	6.79	6.85	6.82	6.88	6.81	6.97	6.74	6.79	6.81	6.68	6.54	6.88
Dissolved Oxygen	mg/L	6.74	6.90	6.86	7.02	6.94	6.89	7.04	7.10	7.02	6.94	6.99	6.91
Sulphides	mg/L	0.007	0.006	0.010	0.006	0.007	0.007	0.007	0.008	0.006	0.007	0.007	0.008
Permanganate Index	mg/L	2.4	2.4	2.4	2.07	2.03	1.83	2.15	1.91	2.07	2.28	2.23	2.24
Suspended Solids	mg/L	5	6	4	4	4	5	5	6	4	4	5	4
Petroleum Hydrocarbons	mg/L	0.01	0.01	0.01	-	-	-	-	-	-	-	-	-
Cyanide	mg/L	0.004	0.004	0.004	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	0.08	0.08	0.09	0.08	0.07	0.08	0.07	0.07	0.09	0.07	0.09	0.08
Ammoniacal Nitrogen	mg/L	0.045	0.048	0.051	0.084	0.087	0.059	0.070	0.065	0.084	0.076	0.073	0.096
Anionic Surfactants	mg/L	0.05	0.05	0.05	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.05	0.05	0.05	-	-	-	-	-	-	-	-	-
Chromium (VI)	mg/L	0.005	0.004	0.005	-	-	-	-	-	-	-	-	-
COD	mg/L	10	10	10	10	10	10	10	10	10	10	10	10
BOD_5	mg/L	1.2	1.5	1.4	1.8	1.9	1.8	1.9	1.4	1.7	2.1	1.6	1.8
Faecal Coliforms	CFU/L	9,200	9,200	9,400	7,900	3,500	9,200	3,500	900	3,400	5,400	790	4,600
Lead	mg/L	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.05	0.05	0.05	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.0049	0.0051	0.0054	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.05	0.05	0.05	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.00006	0.00006	0.00005	-	-	-	-	-	-	-	-	-
Benzene	mg/L	0.005	0.005	0.005	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.005	0.005	0.005	-	-	-	-	-	-	-	-	-

Source: EIA report

Based on the results shown in Table III-3, water quality of W1- W3, W5, and W7-W9 meet Class III standard of Environmental Quality Standards for Surface Water (GB3838-2002). W4 and W6 are also able to meet Class IV standard of Environmental Quality Standards for Surface Water (GB3838-2002). All parameters, apart from faecal coliforms and mercury, for W10 meet Class II standard of Environmental Quality Standards for Surface Water (GB3838-2002). Other nearby industries (e.g. cement factory) possibly contributes to the exceedance of mercury includes the burning of fossil fuels, mining and other industrial activities. Since the concentration W10 includes the water from Huangyan creek, Kontang Creek, Guantianshui, and Beijiang altogether, the cummulated concentration of mercury is tend to be higher with 2 out of 3 sample exceedance. While for W11, all parameters apart from faecal coliforms meet Class II standard of Environmental Quality Standards for Surface Water (GB3838-2002).

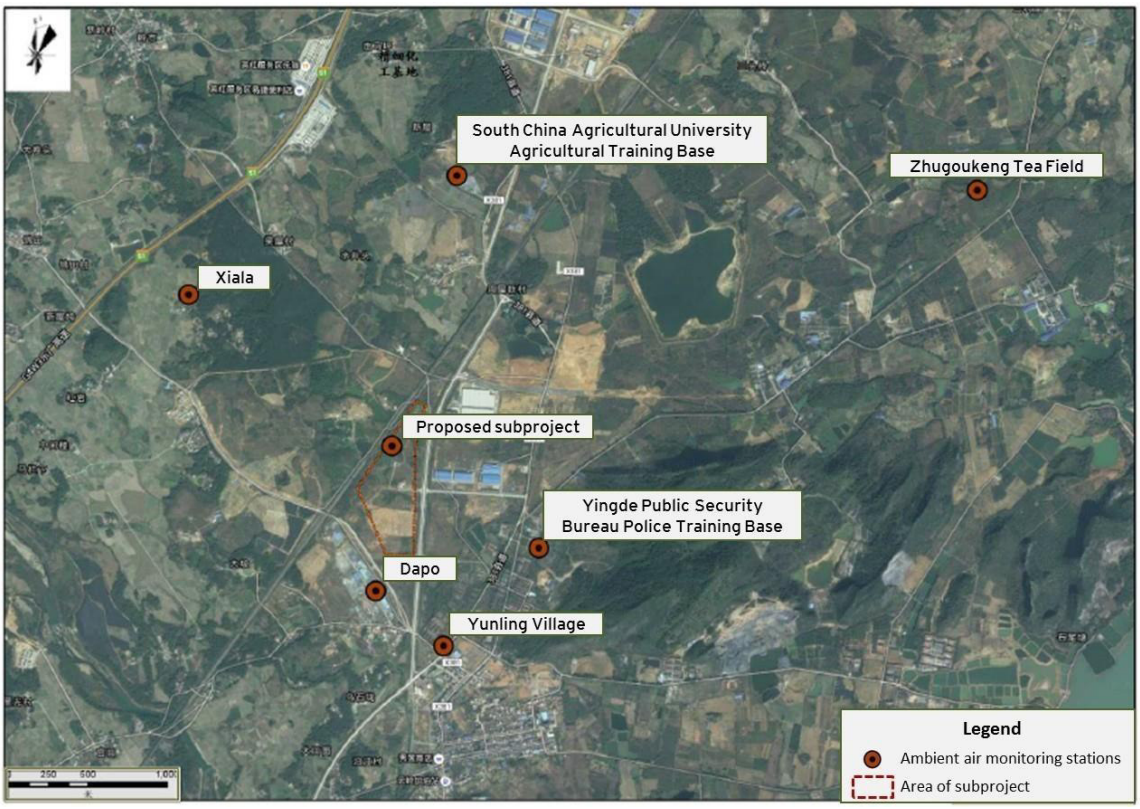
2. Ambient Air Quality

Ambient air quality sampling was conducted at seven locations by Guangzhou Hai Qin Tian Cheng Technical Testing Services Co., Ltd for 7 consecutive days from 21st to 28th May 2016.

Table III-4: Locations of ambient air quality monitoring stations, and respective parameters

Ref.	Monitoring stations	Monitoring parameters
A1	Yunling Village	H_2S, NH_3
A2	South China Agricultural University Agricultural Training Base	H_2S, NH_3, odor concentration
A3	Zhugoukeng Tea Field	PM_{10}, TSP, SO_2, NO_2, H_2S, NH_3
A4	Dapo	PM_{10}, TSP, SO_2, NO_2, H_2S, NH_3, odor concentration
A5	Xialai	PM_{10}, TSP, SO_2, NO_2, H_2S, NH_3
A6	Yingde Public Security Bureau Police Training Base	
A7	Proposed Subproject	

Figure III-7: Ambient air quality sampling sites



Source: EIA report

Table III-5: Ambient air quality sampling at 5 sampling sites (Unit: μg/m³)

Parameter		Sampling site	21-22/5	22-23/5	23-24/5	24-25/5	25-26/5	26-27/5	27-28/5
NO_2	Daily average	A3	0.09	0.010	0.010	0.010	0.009	0.010	0.009
		A4	0.020	0.018	0.014	0.014	0.015	0.014	0.011
		A5	0.013	0.008	0.009	0.009	0.012	0.008	0.010
		A6	0.019	0.014	0.013	0.015	0.012	0.010	0.007
		A7	0.027	0.020	0.018	0.019	0.018	0.017	0.014
SO_2	Daily average	A3	0.004	0.004	0.004	0.004	0.004	0.004	0.004
		A4	0.004	0.005	0.006	0.005	0.006	0.006	0.004
		A5	0.004	0.004	0.004	0.004	0.004	0.004	0.004
		A6	0.004	0.004	0.004	0.004	0.004	0.004	0.004
		A7	0.004	0.004	0.004	0.004	0.004	0.005	0.004
PM_{10}	Daily average	A3	0.047	0.043	0.048	0.050	0.044	0.045	0.041
		A4	0.054	0.051	0.055	0.045	0.053	0.048	0.049
		A5	0.038	0.039	0.043	0.046	0.044	0.039	0.038
		A6	0.048	0.043	0.044	0.044	0.044	0.041	0.048
		A7	0.045	0.050	0.042	0.047	0.051	0.044	0.043
TSP	Daily average	A3	0.063	0.061	0.070	0.069	0.062	0.065	0.056
		A4	0.076	0.073	0.076	0.066	0.074	0.070	0.072
		A5	0.062	0.058	0.065	0.066	0.062	0.058	0.056
		A6	0.064	0.060	0.062	0.058	0.062	0.063	0.069
		A7	0.066	0.068	0.061	0.067	0.073	0.064	0.063
H_2S	Hourly average	A1	0.003	0.003	0.003	-	-	-	-
		A2	0.002	0.002	0.001	-	-	-	-
		A3	0.002	0.001	0.001	-	-	-	-
		A4	0.001	0.002	0.003	-	-	-	-
		A5	0.001	0.001	0.001	-	-	-	-
		A6	0.002	0.001	0.002	-	-	-	-
		A7	0.002	0.002	0.002	-	-	-	-
NH_3	Hourly average	A1	0.04	0.02	0.03	-	-	-	-
		A2	0.01	0.01	0.01	-	-	-	-
		A3	0.01	0.01	0.01	-	-	-	-
		A4	0.02	0.02	0.02	-	-	-	-
		A5	0.01	0.01	0.01	-	-	-	-
		A6	0.01	0.01	0.01	-	-	-	-
		A7	0.04	0.02	0.02	-	-	-	-

Odor Conc.	Hourly average	A2	13	12	12	-	-	-	-
		A4	15	16	16	-	-	-	-

Source: EIA report

Table III-5 shows that SO_2, NO_2, PM_{10} and TSP satisfy Class II standards of Ambient Air Quality Standards (GB3095-2012). NH_3 and H_2S are able to meet one-time maximum allowable concentration of the Hygienic Standards for the Design of Industrial Enterprises (TJ36-79). Odor concentrations of the sampled sites are also able to meet Class II of Emission Standards for Odor Pollutants (GB14554-93).

In conclusion, all sampled parameters are able to meet the respective standards.

3. Groundwater Quality

Seven sites near the subproject area were selected for groundwater quality sampling by Shenzhen Sino Assessment Group and Yingde City Environmental Protection Monitoring Station. 22 water quality parameters were monitored. Parameters include Total dissolved solids and Total number of bacteria were sampled once on 1 June 2015 while other parameters were sampled once on 26 June 2015.

Table III-6: Groundwater Quality in 7 sampling sites near the subproject area
(Unit: mg/L, except for Total number of bacteria: CFU/L and pH)

Parameter	Sampling site							Standard
	#1	#2	#3	#4	#5	#6	#7	
pH	7.51	7.36	7.28	7.06	7.71	7.62	7.45	6.5-8.5
Ammonia nitrogen	0.087	0.025	0.025	0.025	0.027	0.025	0.025	≤0.2
Copper	0.015	0.008	0.008	0.008	0.008	0.008	0.008	≤1.0
Lead	0.0143	0.01	0.01	0.01	0.01	0.01	0.01	≤0.05
Cadmium	0.0015	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	≤0.01
Nickel	0.1031	0.005	0.005	0.005	0.005	0.005	0.005	≤0.05
Chromium-6	0.004	0.004	0.004	0.004	0.004	0.004	0.004	≤0.05
Volatile phenol	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	≤0.002
Arsenic	0.0013	0.001	0.0012	0.0012	0.0015	0.0013	0.0015	≤0.05
Mercury	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	≤0.001
COD_{Mn}	1.1	1.1	1.1	1	1	1	1	≤3.0
NO_2-N	0.127	0.003	0.003	0.003	0.003	0.003	0.003	≤0.02
Nitrogen	7.95	4.06	7.72	19.2	0.259	3.82	1.29	-
NO_3-N	0.65	0.6	0.58	0.69	0.55	0.69	0.66	≤20
Total Hardness	0.05	0.05	0.05	0.05	0.05	0.05	0.05	≤450
LAS	0.07	0.08	0.06	0.18	0.08	0.09	0.07	≤0.3
Fluoride	0.004	0.004	0.004	0.004	0.004	0.004	0.004	≤1.0
Cyanide	226	87	154	170	243	130	240	≤0.05
TDS	46	30	38	51	66	23	57	≤1,000
Total number of bacteria	0.018	0.01	0.022	0.01	0.011	0.092	0.017	≤100
Petroleum	7.51	7.36	7.28	7.06	7.71	7.62	7.45	-

Source: EIA report

The results indicate that apart from the nickel and NO_2-N concentration of sampling site #1, all other samplings are in compliance with the Class III standard of Quality standard for groundwater (GB/T14848-93).

4. Noise

Noise monitoring was conducted on 24-25 May 2016. A total of 5 monitoring points were set up at the boundaries of the subproject area. Monitoring was conducted twice a day, once in the 09:00-18:00 at daytime and once in 23:00-06:00 at night. The monitoring was conducted on a normal working day. There was no rain or thunderstorm, with wind speed less than 5 m/s.

According to the Environmental Quality Standard for Noise (GB3096-2008), the subproject area is classified as Class III while the boundary next to the Wuhan-Guangzhou High-speed railway line is classified as Class 4a. The monitoring results in Table III-5 below show that noise level at all monitoring locations meet the Class III and 4a requirements.

Table III-7: Noise level at boundaries of the Subproject (Unit: dB(A))

No.	Monitoring Location	Monitoring date	Day	Night

			Result	Standard	Result	Standard
N1	North Boundary	24 May 2016	56.2	65	47.1	55
		25 May 2016	53.3		47.8	
N2	West Boundary	24 May 2016	53.1		47.2	
		25 May 2016	50.9		46.6	
N3	West Boundary	24 May 2016	53.5		45.5	
		25 May 2016	54.0		46.1	
N4	South Boundary	24 May 2016	51.6		46.0	
		25 May 2016	52.8		46.5	
N5	East Boundary	24 May 2016	63.6	70	49.6	55
		25 May 2016	64.1		49.0	

Source: EIA report

Figure III-8: Noise monitoring sites

Source: EIA report

IV. Anticipated Environmental Impacts and Mitigation Measures

A. Assessment of Potential Impacts

This subproject will deliver significant positive environmental and social impacts to industrial enterprises and surrounding communities through the capacity to process 20,000m^3/day of industrial and domestic wastewater per day and supply 50,000m^3/day of water for industrial use.

The proposed wastewater treatment plant will collect and treat all wastewater generated from the industrial enterprises and households in the Hongxing zone of the Qingyuan Overseas Chinese Industrial Park Yinde Yinghong Industrial Park. After the treatment, the pollutants concentration in effluent will be significantly reduced to comply with the Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) and the Class I standard for the second time phase set out in Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB44/26-2001). After the completion of the proposed subproject, wastewater will be treated properly without direct discharge of wastewater to the surrounding water bodies, therefore potential surface water and groundwater pollution can be avoided.

Since 30% of the treated wastewater is designed to be redirected to the water supply plant for further treatment before being used by industrial enterprises as raw water, it can help conserve water resources and contribute to secure water supply for the industrial enterprises. The subproject will take an important role to serve and support the development of the industrial park and the surrounding communities.

In conclusion, it is anticipated that the two key components of this subproject: wastewater treatment plant and industrial water supply plant will contribute to the environmental protection, water conservation and support the sustainable development of the local economy.

B. Environmental Impacts and Mitigation Measures during Construction

1. Impacts on Biodiversity

Although the subproject area is within the industrial park, not all the land was cleared and will need to be cleared as part of the project. The clearing of grassland and scrubland for the project could cause vegetation loss which involves less amount of biomass comparing to woodlands. Top soil may be removed, buried, or compressed. The retained soil may lose fertility. All of these will lead to reduction in vegetation cover, flora, fauna, and biodiversity as a result.

During construction, trees and vegetation are preserved where possible. To minimise the impacts on biodiversity, selected species are relocated and planted to the alongside of the roads for around one-third of the construction site area. For another one-third of the area, vegetation cover was preserved to serve its function of noise insolation and deodorization.

The following mitigation measures can be implemented to minimise the impacts on biodiversity. The measures mainly focuses on planning of greening of the area.

- Conservation of top soil by storing the topsoil separately before excavation and utilize it for greening purpose;
- Timely implementation of greening and paving of roads after cut and fill to prevent further soil erosion due to explosion.
- Enhancement of greening effort using multi-layer greening of trees, shrubs, and grass for compensating the loss of habitat, increase biodiversity, biomass, and attract fauna especially birds;

Refer to section 7 of this chapter for measures to avoid soil erosion in order to reduce impacts on vegetation cover.

2. Impacts on surface water quality

Wastewater generated during the construction phase includes muddy water from excavation work, cooling water from construction machinery, water effluent from construction process and cleansing. All these wastewaters contain certain grease and sediments with high concentration of SS (1000-3000 mg/L) and petroleum (10-50 mg/L). In addition, domestic wastewater, which has a certain content of organic matter, bacteria and pathogenic microorganisms, will also be generated from workers' activities. The workforce during construction phase is estimated to be around 80. According to Guangdong Province Norm of Water Use (DB44/T 1461-2014), the average daily water consumption per worker is 50L. The construction

period of this subproject would be around 10 months. Assuming 25 working days per month, the total water consumption during the construction period would be around 1000m^3. According to the EIA report, wastewater discharge coefficient of this subproject, which is the ratio between amount of wastewater discharge and that of water usage, is 0.9, therefore the predicted total quantity of wastewater generated would be around 900m^3. Projections of total wastewater discharge and concentrations of effluent quality parameters are presented in Table IV-1.

Table IV-1: Pollutants in Domestic Wastewater Generated during the Construction Phase

Parameter	Discharge Concentration (mg/L)	Quantity Generated	
		Daily	Within the 10-month construction stage
Domestic wastewater (80 workers)	-	3.6 m^3	900 m^3
CODcr	350	1.26 kg	0.32 t
BOD_5	200	0.72 kg	0.18 t
SS	150	0.54 kg	0.14 t
Ammonia Nitrogen	30	0.11 kg	0.03 t

Source: EIA report

Settling ponids, silt fences and screens will be constructed to prevent sediment transport from construction activities. Onsite wastewater treatment facilities including gutter, sump pit, and grit remover will be built to treat both construction wastewater and domestic wastewater to ensure the quality of the effluent discharged meet the applicable standards. A septic tank will also be installed onsite to collect and treat the domestic wastewater. Part of the treated wastewater will be used for dust suppression via water spray and other will be discharged to the receiving water body. It is expected that the impacts on surface water quality would be minimal provided that the recommended mitigation measures are properly implemented.

3. Impacts on ground water quality

During the construction stage, groundwater would be pumped out for the lowering of groundwater level in foundation construction. The depth of most of the proposed semi-buried structures of this subproject including drainage grid, sump pit, lift pump station, coagulation reaction tank, primary and final sedimentation tanks, and aerated reactor are shallow, except V-shape filters, backwash pumps and disinfection pool with burial depth of just more than 1m below the surface. As the Groundwater table was found at a depth of approximately 2m below the surface at the subproject area, it is anticipated that the impact on groundwater during foundation construction would not be significant. The following preventive and mitigation measures will also be implemented to protect groundwater quality.

- Install temporary diversion ditches and drains. Surface runoff will be diverted to sedimentation tank for removal of SS and then reused for dust suppression; and
- During the construction stage, wastewater and solid waste will be treated on-time, temporary storage site should also be covered accordingly to reduce the impacts on ground water quality due to surface runoff.

4. Impacts on ambient air quality

Anticipated sources of air pollution from construction activities include: i) dust generated from excavation and backfilling works; ii) dust generated from loading, unloading, transport, piling of construction materials such as cement and gravel, iii) dust generated by the vehicles movement and operation of construction machineries; and iv) emissions from construction vehicles and construction machineries such as sulfur oxides, nitrous oxides and particular matter.

The information about the closest sensitive receivers are listed in the table below.

Table IV-2: Key air sensitive receivers near the subproject area

Name	Direction	Nearest Distance from the Project (m)	Type	Scale
Zhouwu Xincun	North	515	Village	90 residents from 30 households
Dapo	Southwest	583	Village	22 residents from 22 households
Yunling Community	Southeast	620	Village	1080 residents from 360 households
Yanjiangcun	South	640	Village	145 residents from 42 households
Shuijingtou	North	748	Village	145 residents from 40 households
Yunling Kindergarten	Southeast	769	School	-

Wushilong	South	840	Village	160 residents from 45 households
Liangwucun	North	1147	Village	25 residents from 7 households
The Third Health Centre of Yinghong Town Yunling Community Committee	South	1200	Hospital	-
Pingan Clinic	South	1300	Hospital	-
The First Health Centre of Yinghong Town Yunling Community Committee	South	1400	Hospital	-
The Second Health Station of Yunling Street	South	1400	Hospital	-
The Second Health Centre of Yinghong Town Yunling Community Committee	South	1400	Hospital	-
Xinhuo Kindergarten	Southeast	1400	School	-
Zhongjianlou	West	1555	Village	45 residents from 12 households
Hongyan	Northwest	1652	Village	90 residents from 30 households
Zhangjiapai	South	1700	Village	250 residents from 80 households
Yunling Primary School of Yinghong Town	Southeast	1700	School	-
Manlanxia	West	1702	Village	20 residents from 5 households
Tianjiangcun	South	1802	Village	80 residents from 26 households
Guantian	Southwest	1853	Village	200 residents from 67 households
Huangwu	South	1900	Village	64 residents from 16 households
Xinwukua	Northwest	1923	Village	132 residents from 44 households
Jintian	Northwest	1987	Village	400 residents from 100 households
Hujingcun	North	2069	Village	230 residents from 46 households
Xingguangcun	Southwest	2102	Village	156 residents from 52 households
Jintian Primary School	Northwest	2400	School	-
Lingshi	Northwest	2560	Village	170 residents from 38 households
Dajuantou	Northwest	2592	Village	9 residents from 3 households

To minimise the impact on air quality, the following mitigation measures should be implemented:

- Spray water on construction site to reduce dust from earthwork excavation, transport, loading and loading;
- Dust fence shall be installed around the construction site and be maintained in good condition;
- Cover construction materials if they are temporarily stacked outdoor;
- No earthworks, and other construction activities during strong windy days;
- Excess construction materials and construction waste should be removed from sites regularly;
- Vehicle transporting construction materials and soil should be installed with anti-spill devices. Loading should be carried out carefully to ensure that there will be no spilling during transportation;
- Routing and schedule of construction vehicles should be carefully planned without passing through sensitive zones such as residential areas;
- The speed of the vehicles within the construction site should be controlled at 20kph;
- All construction vehicles should be covered with tarpaulin. Vehicle cleaning facilities will be provided. All vehicles will be cleaned properly before they enter or leave the construction sites to prevent soil, mud and other dirt being deposited on access roads;
- Spills of soil, mud or other materials on the road should be cleared;
- Use of environmentally-friendly decoration materials, e.g. materials of low VOCs emission and odor such as cement paint. Maintain good ventilation in places where painting and other activities that could release volatile organic compounds (VOC) or toxic gas are undertaken;
- Burning of construction and demolition waste as fuel is not allowed will be prohibited and
- Replanting and rehabilitation of the area will be conducted once the construction work is finished

With the above mitigation measures, no significant impacts on ambient air quality are anticipated to occur during construction stage. The impacts will be only short-term and localised.

5. Noise pollution

Construction activities that contribute to noise impact include 1) operation of construction machineries and equipment such as excavators, bulldozers, dredgers, and concrete mixers, and 2) transportation. The noise impacts will be sudden and localized.

Predicted noise impacts from construction machinery at different distance are calculated based on the Technical Guidelines for Noise Impact Assessment (HJ2.4-2009). Assessment parameters include weather information of Yingde City such as annual average temperature and annual average relative humidity (Table IV-3).

Table IV-3: Predicted Noise Levels of Construction Machinery at different distances (Unit: dB(A))

Noise Source	Predicted noise levels at distance (m) from source										
	5m	10m	20m	30m	40m	50m	100m	150m	200m	300n	400n
Excavator	82	76	70	66	64	62	55	52	49	45	42
Pipelayer	88	82	76	72	70	68	61	58	55	51	48
Vibrator	95	89	83	79	77	75	68	65	62	58	55
Loader	90	84	78	74	72	70	63	60	57	53	50
Bulldozer	76	70	64	60	58	56	49	46	43	39	36
Truck	91	85	79	75	73	71	64	61	58	54	51
Mobile crane	86	80	74	70	68	66	59	56	53	49	46
Air compressor	93	87	81	77	75	73	66	63	60	56	53
Cutting machine	94	88	82	78	76	74	67	64	61	57	54
Welding machine	92	86	80	76	74	72	65	62	59	55	52
Pile driver	103	97	91	87	85	83	76	73	70	66	63

Source: EIA report

Assuming there will be five different types of machine operating simultaneously, the cumulative effect of noise from combined sources at different distances is also estimated (Table IV-4).

Table IV-4: Cumulative noise level at different distances

Distance	5m	10m	20m	40m	50m	100m	150m	200m	300m	400m
dB(A)	93	87	81	78	75	73	67	63	60	56

Source: EIA report

According to the cumulative construction noise prediction results presented in Table x, construction activities within approximately 100m of the site boundaries during the daytime, and approximately 400m during the nighttime, could be close to being non-compliant with the Emission Standard of Environmental Noise for Boundary of Construction Site (GB12523-2011) which specifies the noise level limit at construction site boundaries as 70dB(A) during the daytime and 55db(A) during the nighttime.

There is no school, hospital or residential area within 200m from the construction site. The nearest noise sensitive receiver is Zhouwuxin village, which is 515m away from the subproject area with less than 100 residents. Therefore no significant noise impact to the residents is anticipated during the construction stage.

To ensure that the construction activities would be in compliance with the requirements of the Emission Standard of Environmental Noise for Boundary of Construction Site (GB12523-2011), and to protect on-site workers who will be exposed to noisy work environment, the following measures should be implemented accordingly:

- Install 2m tall noise barriers along the construction site boundary and movable noise barriers to block construction noise from heavy machinery;
- Adopt advanced construction method, for example using hydraulic pile driver instead of diesel hammer pile driver, to minimise noise impacts;
- Develop proper construction schedule, minimise each construction equipment's time of operation as practical as possible. Equipment with high noise shall be avoided for being used simultaneously as practical as possible. Construction activities shall not take place at night if they are close to environmental sensitives sites such as residential area ;
- Low noise equipment will be chosen as practical as possible. Location shall be fixed for earth excavation equipment, machinery and transportation. Noise shall be reduced by exhaust muffler and insulating the vibration part of the engine. Idle equipment shall be turned off. Speed of vehicles and horning shall be reduced while entering the site;
- Noisy construction activities will be avoided during lunch break and the night time as practical as possible. No pile driving will be allowed during the nightime. Avoid transportation at night as practical as possible. Maintain lower speed for heavy vehicles as possible, especially when entering into environmental sensitive areas;
- Minimise the number of construction machines running in the same place and at the same time as practical as possible;
- Training shall be provided to construction workers. Construction materials shall be transported by crane or manually while throwing down from vehicles is not allowed. Loud noise should be avoided when piling up steel materials.
- PPE for hearing protection such as earplugs/earmuffs, noise-cancelling headphones will be provided to workers who will work around heavy machinery.
- Limit the noisy activities (e.g. pile driving) during daytime and
- Communities which may be affected by construction noise shall be informed prior to construction activities. During construction, they shall be informed with construction progress and noise reduction practices, certain compensation shall be provided to those parties which are under significant impact.

6. Solid Waste

Major solid waste generated during the construction stage includes construction waste such as excess excavated earth/soil, debris, gravel, sand, scrap metal, glass, scrap plastic, broken brick, cement bags, and municipal solid waste from workers activities. Based on a waste generation rate of 0.5 kg per worker per day, 10-month construction period, 25 working days per month, and 80 workers during the construction stage, it is estimated that a total of 10 tonnes of municipals solid waste will be generated. Improper waste management and disposal could cause odour, health and sanitation problems, visual impact, and threaten the surrounding environment including soil, surface water and groundwater resources.

The following mitigation measures to minimise impacts from waste generation during the construction stage should be implemented:

- Excavated earth/soil will be backfilled and debris, gravel, broken brick will also be reused to the extent possible;
- Municipal solid waste will be properly segregated. Construction solid waste such as reinforced steel should be reused to the extent possible;
- Construction waste, including hazardous construction waste, will be disposed of at the designated areas only;
- Sufficient garbage collection bins and dumpsters will be installed at the construction site. Waste will be collected on a regular basis by the local sanitation departments and delivered to a licensed landfill for disposal;
- Granular materials and waste will be properly sealed, wrapped, secured and covered on transport vehicles, which will follow a specified route only; and
- Contractor will be required to remove all temporary facilities, construction waste and muck accordingly once the construction phase is complete.

7. Soil Erosion

Construction works such as excavation and backfilling will have the potential to remove or disturb existing vegetation and soil characteristics, which could result in severe soil erosion. To prevent this from happening, the following mitigation measures will be implemented:

- Avoid carrying out construction activities such as excavation during rainy season and windy period;
- Excavation and backfilling will be balanced to the extent possible so as to minimise the need for fill transportation;
- When excavation is conducted, remove and store topsoil at a designated area for future use in landscaping;
- Properly revegetate disturbed areas as quickly as possible;

- Geotextiles, plastic covers, erosion control blankets and mats shall be used to stabilise and protect soil from erosion by wind or water and
- Use settling ponds, silt fences and screens to prevent sediment transport.

8. Impacts on Socio-Economic Resources

The subproject will create job opportunities to nearby communities, causing lower unemployment rate of the areas and higher average income of the local residents. During the construction phase, around 80 workers will be employed.

9. Impacts on Physical Cultural Resources

There is no historical and archaeological site within or near the subproject area. However, in case of unknown archaeological resources and cultural relics discovered during construction, all construction activities will be suspended to keep the scene intact and the relevant personnel will report to the local administrative department in charge of cultural relics in accordance with the requirements of Law of the PRC on Protection of Cultural Relics. The construction activities will be only resumed once the investigation is completed and formal permission is obtained from the local administrative department in charge of cultural relics.

10. Impacts on Community Health and Safety and Risks to Public Utilities

The subproject's construction works could cause undesirable disturbance and temporary inconvenience to traffic, villagers, industrial enterprises, and institutions. The increase in construction traffic and use of heavy machinery on existing roads can lead to traffic congestion and road accidents, particularly in urban areas. Some construction sites (e.g. pipeline network) will be located close to sensitive areas like villages and schools, posing the potential for adverse impacts to public health and safety. Meanwhile, construction of the subproject could accidentally damage above-ground or underground public utilities assets such as pipelines for the supply of water, gas, heating as well as drains, power cables and communication cables.

- A traffic control and operation plan will be prepared by the contractor and discussed with the relevant local traffic management authority before construction. The plan will include provisions for diverting or scheduling construction traffic to avoid sensitive areas and peak traffic hours, controlling traffic at road crossings with an emphasis on public safety through clear signs, selecting transport routes to reduce disturbance to regular traffic, including alternative routes strategy for emergency traffic management, reinstating roads, and opening them to traffic as soon as the construction is completed;
- An assessment of underground facilities will be conducted before pipeline construction where appropriate.
- ☐Villagers, residents, institutions and other affected parties will be informed in advance schedule and duration of construction works, and expected traffic and other disruptions;
- Warning signs will be placed along roads to indicate potential dangers such as moving vehicles, open-cut trenches and excavations. Safety flags will be used if appropriate;
- ☐Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential areas, schools and hospitals.
- ☐Construction warning lights will be used at night;
- ☐Roadside earthworks should be completed and spoil should be backfilled or removed as quickly as possible; and
- Fencing shall be used to prevent unauthorised people accessing the construction sites

11. Impacts on Occupational Health and Safety

Construction activities may cause harm and danger to the workers. Potential hazards for workers in construction include falls from heights, machinery accidents, vehicle accidents, falling materials or objects, slips, trips and falls, electrocute, failures to use PPE, repetitive motion injuries, heat strokes, and fires and explosions, Contractors will be required to implement adequate precautions to protect the health and safety of their construction workers. The following measures will be implemented by CTEG and the contractors:

- All workers will be provided with basic sanitation and safety training, including identification of specific hazards of their works. Implement HIV/AIDS and other communicable disease awareness and prevention, proper use of PPE, and emergency response training programme prior to the start of construction;
- Garbage collection bins will be cleared regularly. All domestic waste will be collected by local government's sanitation department daily to prevent outbreak of diseases;
- Provide adequate sanitation facilities such as latrines and lavatory at construction sites and workers camp following the requirements set forth by international best practices (e.g. OSHA) for a given number of workers;
- Provide clean and sufficient supply of fresh water for construction sites and for all camps, offices and workshops;

- Sufficient health and safety signage and warnings will be provided around the site;
- Ensure material stockpiles or stacks are stable to avoid collapse and possible injuries to construction workers;
- Workers will be provided with instruction and training in the use and maintenance of PPE. They will be required to wear PPE like helmet, safety gloves, safety shoes, and ear mufflers at all times when they are in the construction area. The condition of the PPE will be checked on a regularly basis;
- Provide medical insurance coverage and pre-employment physical examination for all workers;
- Ensure first aid kits are always accessible to the construction workers;
- Avoid scheduling labour intensive and outdoor works for a time when the temperature is extremely high and the weather is in bad condition;
- An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies associated with hazardous material spills and similar events and
- A record management system will be implemented to maintain records of health and safety performance during construction phase. It will include documentation and reports of occupational diseases and incidents. The records will be reviewed during compliance monitoring and auditing.

C. Environmental Impacts and Mitigation Measures during Operations

1. Impacts on surface water quality

Wastewater generated during the operational phase includes effluent from water treatment system, domestic sewage from workers living on-site, and effluent form canteen and oil separator. All industrial and domestic wastewater collected will be treated in the subproject by using a 3-stage wastewater treatment process. Around 70% (56000m^3/d, 14,000m^3/d in Phase 1) of effluent will be discharged to Guantianshui Creek. The other 30% (24000m^3/d, 6,000m^3/d in Phase 1) will be for water reuse purpose.

Projections of pollutants concentrations of effluent quality parameters are presented in Table IV-4. The results show that the effluent will meet Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) and the stricter standard in the Class I standard for the second time phase set out in Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB44/26-2001).

According to the Law of the People's Republic of China on Prevention and Control of Water Pollution, no discharge point can be built at the tapping point for drinking water, scenic spot, and places where fishing activities take place, and water for other uses of special eco-cultural values. Protection zone has been set up in areas of Classes of I, II, and III stated in GB18918-2002. The discharge point is not located in a protection zone.

Table IV-5: Projections of Wastewater Pollutants Generated during the Operational Phase

Parameter	Inflow	Effluent	Applicable Standard		IFC EHS standards
	Concentration mg/L or MPNb / 100 ml	Concentration mg/L or MPNb / 100 ml	Class IA standard, GB18918-2002 (mg/L)	Class I standard for the second time phase, DB44/26-2001	
pH			6 – 9	6 - 9	6 - 9
COD_{Cr}	1000	40	50	40	125
BOD_5	300	10	10	20	30
Total Nitrogen			15		10
Total phosphorous			0,5		2
Oil and Grease			1		10
Coliform			10^3/L		
SS	300	10	10	20	50
Ammonia Nitrogen	30	5	5	10	
Petroleum	5	0.05	1	5	
Mercury	ND	ND	0.001	0.05	
Cadmium	ND	ND	0.01	0.1	
Chromium	ND	ND	0.05	1.5	
Arsenic	ND	ND	0.1	0.5	
Lead	ND	ND	0.1	1.0	
Nickel	ND	ND	0.05	1.0	
Anionic Surfactant	ND	ND	0.5	5.0	
Chroma	ND	ND	30	50	

Source: EIA report
ND-no data

There are a number of design initiatives to minimise the impacts in case of heavy rainfall.

- Separation of storm drain and waste sewer to prevent storm water from entering the pipelines of the wastewater treatment plant;
- Seepage control measures are implemented to the surroundings of tanks and roads to minimise the possibility of sewers overflow;
- Sludge dewatering room and chemical feed house should be built with water and moisture proof materials and built at elevated land. The floor should be paved with cement layer. For chemical feed house, additional wooden frame should also be built to avoid direct contact between chemicals and the ground; and
- Implementation of enhanced housekeeping measures including keeping the storm drains in good condition.

In order to ensure the water quality of the discharge after wastewater treatment, CTEG has certain requirements on influent quality and quantity for corporates that is new to the industrial park. Such requirements will be clearly stated in the contract or agreement signed between CTEG and the corporate. Other control measures will be implemented to ensure the influent quality and quantity will be within the design capacity.

CTEG will ensure the influent quality through the following design, measures and control.

- The design of the wastewater treatment plant is for integrated treatment targeting at a mixture of different types of sewage and has high tolerance to different influent quality;
- Pre-treatment will be carried out to ensure influent quality is up to certain standard before entering the wastewater treatment process;
- Sampling of discharge from corporates will be carried out by CTEG at the discharge point. In case of exceedance of limits, CTEG will carry out investigation or supervision; and
- Sampling and testing will be carried out to the inflowing mixed sewage. In case of deviation from expected limits for parameters, relevant mitigation measures will be adopted. The source of deviation will also be chased.

CTEG will ensure the influent quantity through the following design, measures and control.

- Design processes for diversion and buffering using adjustment tank and emergency tank in order to prepare for changes in water level;
- Conclusion of actual discharge from corporates will be made at the end of each month with discussing with and adjustment for corporates under situation that does not exceed the quantity limit; and
- The wastewater treatment capacity can be expanded upon request from corporates for technological upgrades, production expansion which could potentially lead to increase in influent volume.

2. Impacts on ground water quality

According to the EIA report, wastewater from companies in the industrial park will be collected through pipes and treated by the subproject. Approximately 70% of the treated wastewater, which will meet Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) and the stricter standard in the Class I standard for the second time phase set out in Discharge Limits of Water Pollutants of local standard in Guangdong Province (DB44/26-2001), will be discharged to the designated water bodies while the remaining 30% will be diverted into the industrial water supply plant for further treatment before it can be reused as raw water by other industrial enterprises. Under normal situation, this subproject will not have impact on groundwater quality.

Occasions which the subproject may have adverse effect on groundwater quality include leachate from pipes or structural damage of the structure and improper management of solid waste. The following mitigations and prevention measures can be implemented.

- Construction to be carried out in strict accordance with latest design and relevant regulatory requirements;
- Proper quality control at completion and final acceptance of construction of the project;
- Selection of suitable materials for pipework to avoid corrosion of pipes, in particular, iron pipes should be avoided;
- Proper implementation of day-to-day management, enhanced supervision and investigation of the project facilities during operational stage;
- Proper solid waste management practices as recommended in Section C5 of Chapter IV and
- Clay layer (50cm thick) and HDPE (2mm) geomembrane will be laid under the sewer and structures where may have the risk of seepage so that the potential of pollution to groundwater is limited.

Proper design, construction, management, and maintenance during operational stage will prevent negative impact on groundwater quality.

3. Impacts on ambient air quality

Anticipated sources of air pollution from operation activities include odour from sewage, odour from anaerobic sewage treatment processes, canteen cooking fume, and exhaust from laboratory.

The major of odour sources are HN_3 and H_2S from sewage and wastewater treatment processes. Health protection zone will be set up 100m from the project boundary for meeting the atmospheric environment protection distance requirements in accordance with Guidelines for Environmental Impact Assessment Atmospheric Environment (HJ2.2-2008) and Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Waste (GB18599- 2001). There is no resident within the health protection zone. Biofilter deodorization is also adopted to meet the maximum allowable concentration of 4.9kg/h for NH_3 and 0.33 kg/h for H2S according to Emission Standards for Odour Pollutants (GB14554-93).

The maximum ground level concentration of these NH3 is estimated at 0.08 to 0.17 at the nearest sensitive receptors while the standard of maximum allowable concentration at residence as stated in TJ36-79 is 0.2mg/m3.

The modelling methodology for H2S and Nh3 are similar.\The top 10 result of 1-hour mean concentration within 300m of the sources were calculated based on distance, direction, and meteorically information. And at the air sensitive receivers are calculated based on the baseline situation and cumulative result from the modelling.

The maximum ground level concentration of these H2S is estimated at 0.001 to 0.004 at the nearest sensitive receptors while the standard of maximum allowable concentration at residence as stated in TJ36-79 is 0.01mg/m3.

Emission from Canteen cooking fume is anticipated at NO_2: 0.133kg/a, SO_2: 0.022kg/a, and Dust: 0.010kg/a. With installation of a fume purification system of 6000m3/h that will operate for 5 hours per day, small-scale emission standard as stated in Emission Standard of Cooking Fume (GB18483-2001) can be met. .

Table IV-6 Emission Standard of Cooking Fume

Scale	Small	Middle	Large
Maximum Allowable Emission Concentration (mg/m^3)	2.0		
Minimum removal efficiency of purification facilities	60	75	85

Exhaust from laboratory may include volatile organic compounds including NMHC. Due to the low frequency of laboratory test anticipated, emission of NMHC is far below the maximum allowable emission concentration and maximum allowable emission rate as stated in Table 2 of the Integrated Emission Standard of Air Pollutants (GB16297-1996). No mitigation measures are required.

4. Noise pollution

The sources of fixed noise during the operational phase are the operation of mechanical equipment including suction machine, sewage pumps, sludge pumps, and fans. The noise impacts will be localized and the noise level will be 80-105 dB(A).

The methodology for prediction and assessment of noise impacts during operation is based on the noise attenuation effect from the distance between noise sources and project boundaries and certain distance from the sources. The effects from superimposition of noise sources, reflection from obstacles, absorption are also considered. The source of information about the distance is from the approved project layout and construction units. The boundary distance, noise attenuation at different distances and at project boundaries are listed in the tables below.

Table IV-7: Distance between noise sources and the project boundaries (m)

	Distance between noise sources and the project boundaries (m)			
Noise Source	North Boundary	Southwest Boundary	South Boundary	East Boundary
#2 Lift pump station	69.1	27.6	175.9	256.1
Coagulation reaction tank, primary sedimentation tank	69.1	30	161.9	191.6

#1 Lift pump station	84.9	100.9	159.5	169.1
Aeration tank	109.8	128.4	84.3	81.2
Secondary sedimentation tank	110.3	183.8	83.6	48.6
Blower room	123.1	79.5	124.6	168.3
Aerated reactor, Final sedimentation tank	111.1	193.7	83.2	11
Backwash pump station	85.9	216	157.8	45.2
Sludge thickening pool	11.6	58.1	199.6	212.2
Sludge dewatering room	10.8	20.1	200.4	268.5
Biofilter	70.1	126	173	133.8

Table IV-8: Predicted noise levels at different distances from noise source

Noise Source	Noise level at 1m distance from the noise source	Predicted noise levels at distance from noise source (Unit: dB)									
		ΔL	10	20	40	80	100	120	150	180	200
#2 Lift pump station	85	20	45	39	33	26.9	25	23.4	21.5	19.9	19.1
Coagulation reaction tank, primary sedimentation tank	85	22	43	37	31	24.9	23	21.4	19.5	17.9	17
#1 Lift pump station	90.4	23	47.4	41.4	35.4	29.3	27.4	25.8	23.9	22.3	21.4
Aeration tank	85	25	40	34	28	21.9	20	18.4	16.5	14.9	14
Secondary sedimentation tank	90	20	50	44	38	31.9	30	28.4	26.5	24.9	24
Blower room	100	28	52	46	40	33.9	32	30.4	28.5	26.9	26
Aerated reactor, Final sedimentation tank	100.8	30	50.8	44.8	38.8	32.7	30.8	29.2	27.3	25.7	24.8
Backwash pump station	91.5	25	46.5	40.5	34.5	28.4	26.5	24.9	23	21.4	20.5
Sludge thickening pool	91.2	20	51.2	45.2	39.2	33.1	31.2	29.6	27.7	26.1	25.2
Sludge dewatering room	90.8	30	40.8	34.8	28.8	22.7	20.8	19.2	17.3	15.7	14.8
Biofilter	95	20	55	49	43	36.9	35	33.4	31.5	29.9	29

Source: EIA report

Table IV-9: Predicted Noise Levels at Boundaries (Unit: dB(A)) *(to be confirmed with CTEG)*

Location	Daytime			Standard	Nighttime			Standard
	Background value	Contribution value	Cumulative value*		Background value	Contribution value	Cumulative value	
North Boundary	62.3	23.8	62.3	65	47.4	23.8	23.8	55
Southwest Boundary	63.1	31.2	63.1	70	47.2	31.2	47.2	60
South Boundary	59.3	23.5	59.3	65	46.9	23.5	46.9	55
East Boundary	58.5	41.9	58.5	65	47.6	41.9	48.6	55

Source: EIA report
* Standard refers to Category III standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)

To ensure that the operation would be in compliance with the Category III standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008), noise mitigation measures as follows should be implemented.

- Lowering of noise level for major noises such as blower room and fan inlet of pumping room by means of noise isolation and installation of silencer;
- Plantation of landscape noise buffers within the subproject area;
- Application of noise insulation measures by adoption of building materials with noise absorption characteristics for noise sources such as pumping room and blowers and
- Noise protection will be provided to workers to minimise exposure to noise sources and ensure that their exposure is within the industrial good practices (i.e. OSHA's permissible exposure limit for noise exposure is 85 dB(A) for an 8-hour.

With proper mitigation measures in place, the contribution value during daytime and nighttime can be reduced to 23.5-41.9dB(A). The proposed mitigation measures are expected to be effective in keeping noise impact to acceptable level according to the Category III standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008).

There will not be significant noise impacts from transportation of the project. The main entrance in the eastern side of the industrial park will be used for employee commuting and general vehicles uses. The side entrance to the western side of the industrial park will be used for transportation of raw materials for factories and waste including sludge. Both entrances are located at least 500m from any residence, schools, and hospitals. Also, since the vehicle flows of the main roads in proximity such as Zhanye Avenue will be increased during daytime, the noise impacts will not be significant.

5. Solid and Hazardous Waste

Major solid waste generated during the operational stage includes municipal solid waste, screenings and sludge. Screenings comprises mainly everyday chemicals, synthetic materials, granular materials, and suspended solids.

Table IV-10: Solid and Hazardous Waste Management

Solid Waste	**Source**	**Description**	**Estimated Amount (t/a)**	**Disposal Process**
Entrained solid wastes and particulates	Screening and grit chamber	Plastic, rugs, glass, Sand, and particulate matter, flocculants	2002.29	Entrained solid wastes and particulates will be managed and collected by relevant environmental and hygiene department
Municipal solid waste	Building operations	Office wastes, and food leftovers/ biodegradble	24.45	MSW will be managed and collected by relevant environmental and hygiene department
Hazardous Waste	**Source**	**Description**	**Estimated Amount (t/a)**	**Disposal Process**
Sludge	(1) generated from the wastewater treatment process and water supply treatment plant (2) activated sludge which will be disposed after a reasonable amount of time	Dewatered sludge (hazardous) (Please include description of the content of sludge, such as inorganic component, heavy metals from industrial wastewater, water content)	38686.72 (60% water content)	Sludge will be transported to CTEG's subsidiary Qingyuan Lvyou Environmental Protection Technology limited for brick production. Sludge will be delivered by vehicles that are rain-proof, seepage proof, and leakage-proof. The vehicles will be also equipped with GPS vehicle tracking device.
Hazardous waste	Process reagents, flocculants, etc)	Hazardous chemicals	Chemicals will be emitted in the form of air emission. Refer to impacts on air quality part for details. Reagents enter the wastewater treatment system.	Refer to odour mitigation measures in the impacts on air quality part

The following mitigation measures to minimise impacts from waste generation during the operational stage should be implemented:

- Timely removal of municipal solid waste produced with the use of sanitation landfill;
- Dewatering of screenings and sludge from sewage treatment processes, the wastewater removed from this process will be sent to the coagulation reaction tank for treatment;
- Timely removal of dewatered screenings and sludge;
- Sludge will be removed by CTEG's qualified sludge handling subsidiary every day and it will be transported to the Qingyuan Solid Waste Disposal and Resource Utilisation Centre for brick production;
- At least one special vehicle for sludge transportation will be stationed in the industrial park to ensure the timely removal of sludge;
- In case the designated subsidiary fail to collect the sludge on the agreed timeframe, other qualified sludge handling subsidiaries will be assigned to collect the sludge;
- High designed storage capacity of sludge to prevent improper storage, the onsite storage capacity for sludge is 100 tonnes while the daily production can reach 12-18 tonnes (80% water content) when the subproject is in full production capacity;
- Careful planning of transport of waste with measures to prevent leakage; and
- Off-site reuse of sludge according to relevant environmental requirements.

The sludge disposed will be transported to Qingyuan Lvyou's Solid waste Disposal and Resource Utilisation Centre for brick production. CTEG has acquired 100% equity interest in Qingyuan Lvyou in 2014. Qingyuan Lvyou has been holding relevant valid sludge handling license before the acquisition. CTEG has internal management system for ensuring all subsidiaries have proper license to engage in principal activities.

6. Occupational Health and Safety

Workers in the wastewater treatment may be exposed to a range of work hazards. This includes electric shocks, fall from height, chemical-related hazards, confined space related hazards such as drowning and explosions, and other hazards such as slips, trips, falls, cuts, and manual handling operations.

The following preventive and mitigation measures can be adopted to minimise the threat from workplace hazards

- use of suitable PPE that will protect the workers from workplace hazard while maintaining their comfort at work such as safety shoes, breathing apparatus chemical resistant clothing, safety googles, mask, safety ear plugs, safety gloves etc. to avoid direct/ over exposure to harmful chemicals, emissions, liquids, hazardous waste etc.;
- Prevention of electricity-related hazard includes periodic checking of equipment by qualified personnel, procurement of safe equipment that is free from fault or defect, proper maintenance of equipment and cables;
- Prevention of hazard related to storage, transport, handling, management, and disposal of chemicals include keeping and updating a logbook on chemicals, lock-out system, providing safe handling procedures, education of relevant personnel etc;
- Workplace management including site management such as proper storage and careful use of sharp tools, having correct postures when doing manual operations, keeping things away from floors to avoid tripping etc;
- Measures against confined space related hazards include use of explosion-proof equipment, installation, and appliances, use of breathing apparatus for certain workspace, registration system for entering certain space, atmospheric monitoring, railings to avoid fall from height into and drowning in a confined space etc;
- An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies;
- A records management system will be implemented to store and maintain records of health and safety performance. It will include documenting and reporting of occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits;
- Periodic health check-up for targeted workers; and
- Implementation of internal safety management systems with rules, regulations, safety production guidelines, and workplace health and safety trainings etc.

7. Impacts on Biodiversity and Water Users

If the wastewater discharged to Guantianshui creek exceeds the pollution concentration limits set by the national standards and stipulated in the concession agreement, it could pose direct impacts on the biodiversity of aquatic ecosystems near the discharge point, potential threats include fish mortality, eutrophication, and biological diversity loss.

To protect the aquatic resources adjacent to the discharge points, the following preventive measures will be adopted:

- Install an online monitoring system at each industrial enterprise's onsite wastewater pretreatment system, influent pump room and effluent discharge point at the WWTP to monitor the quality of influent and effluent;
- if the influent pollution concentration exceeds the requirements, the relevant enterprise will be asked to divert the wastewater to its emergency tank and stop discharging wastewater to the WWTP, while the WWTP will immediately close the valve and prevent non-compliant influent from entering to the WWTP and divert the non-compliant influent which have entered to the WWTP to the emergency tank for further treatment.

According to the Qingyuan City Water Resources Bulletin 2015, approximately 22.549 billion m^3 water entering the middle and lower course of Beijiang river (where the subproject City is located) annually. During the operation of the subproject, 140,000 m^3/d (maximum) of river water will be extracted from Beijiang river, so the intake will account for 0.23% of the total annual volume of incoming water resources.

Therefore, under the normal operations and proper monitoring of the quality of influent and effluent, the impacts from the subproject on aquatic ecosystems and other water user are expected to be minimal.

V. Analysis of Alternatives

Alternatives analysis was conducted to determine the most financially and technically feasible way of achieving the subproject objectives while minimising environmental and social impacts. Three types of alternatives were assessed: 1) "no-project scenario", ii) alternatives for secondary wastewater treatment process", and iii) alternative for odour control.

A. No-Project Scenario

Under the no-project scenario, there would be no wastewater treatment plant in the northern part of the Qingyuan Overseas Chinese Industrial Park Yinde Yinghong Industrial Park (Hongxing Zone). As there are more and more industrial enterprises moving to the industrial park and the population of the surrounding communities is growing, it is expected that there would be even larger volume of domestic and industrial wastewater to be generated and the demand for wastewater treatment facilities and water for industrial use would be getting bigger. The wastewater treatment plant located at the southern boundary of the Hongxing zone would be under great pressure to serve all industrial enterprises in the industrial park.

Without sufficient wastewater treatment facilities and stable water for industrial, industrial enterprises would have no choice but to limit their scale of production or even directly discharge the untreated wastewater directly to the surrounding water bodies illegally. Insufficient wastewater treatment and water supply infrastructure would make the industrial park more difficult to attract enterprises to move into, and eventually hinder the local economic development.

B. Alternatives for Secondary Wastewater Treatment Process

Two secondary wastewater treatment processes: Conventional aeration process and anaerobic oxidation process were evaluated. Considering the safety factor, reliability, technology maturity and energy efficiency, the anaerobic oxidation process has been adopted for secondary wastewater treatment process. Table V-1 below shows the characteristics of these two processes.

Table V-1: Comparison of Two Wastewater Treatment Process Alternatives

	Conventional aeration process	Anaerobic oxidation process
Building structures	Aerating pool and other related structure, and secondary sedimentation tank	A/O tank (Hydrolysis acidification + Aerobic) and secondary sedimentation tank
Tolerance level	Relatively high tolerance to the change in wastewater volume, quality and temperature; operation is relatively flexible;	High tolerance to the change in wastewater volume, quality and temperature
Maintenance management	Moderate level of automation, strong technical staff is required. Difficult to operate and manage.	High level of automation. Easy to maintain and manage.
Land occupied	Large floor area is required.	Floor area is small.
Amount of sludge generated	Generate small amount of sludge.	Generate small amount of sludge.
Treatment effects	BOD concentration in effluents can comply with the discharge standards but SS concentration exceeds the limit. Sludge with poor settling characteristics.	Both COD and SS concentration in effluents can comply with the discharge standards. Activated sludge with good settling properties.
Operation cost	High energy consumption and operation cost.	Low energy consumption and operation cost.

C. Alternatives for Odour Control

Three deodourisation processes were assessed: 1) Ion deodourisation, 2) Plants liquid deodourisation, and 3) Biofiltration deodourisation. Considering the scale of this subproject, investment costs, land required and other factors, CTEG has decided to select the biofiltration deodourisation process as it is the most efficient and stable. Table V-2 below presents the characteristics of the three deodourisation processes.

Table V-2: Comparison of Three Odour Control Alternatives

	Ion deodourisation	Plants liquid deodourisation	Biofiltration deodourisation
Applicability	Low to medium odour concentration. Suitable for small-medium sized of facilities.	Low to medium odour concentration. Suitable for facilities of any size.	High odour concentration. Suitable for facilities of any size.
Cost	Low	Depend on the level of chemicals used	Moderate investment and operating costs
Advantages	High odour removal efficiency; require less floor area; energy efficient; low maintenance cost; simple operation;	Only simple equipment is required; low maintenance cost; require less floor area; economic; easy to operate; intermittent operation mode is available	High operational flexibility; safety; stable operation; highly reliable with 95-99% odour removal rate; no secondary pollution.

	intermittent operation mode is available.		
Disadvantages	Only suitable for small air volume.	Removal efficiency is not stable.	Require large floor area; Relatively high investment and operating costs as compared with the other two alternatives; Need to run 24/7 otherwise recovery or cultivation of microorganisms is required.

VI. Information Disclosure, Consultation, and Participation

A. Legislative Framework for Public Consultation and Information Disclosure

Relevant provisions of the PRC Environmental Impact Assessment Law (2003) and the Regulations on the Administration of Construction Project Environment Protection (No. 253 Order of the State Council, 1998) require that an Environmental Impact Assessment (EIA) shall solicit opinions from concerned stakeholders of the proposed project, including affected residents.

Further, the Safeguard Policy Statement (2009) from the ADB outlines the requirements for a meaningful public consultation with affected people and information disclosure.

The public consultation process for this subproject, therefore, follows both the PRC requirements and the ADB requirements.

B. Information Disclosure and Public Consultation to Date

Following the requirements from both the PRC and ADB, the public consultant of this proposed subproject is divided into three phases, including:

1. Initial public consultation - Information of the proposed subproject will be disclosed to public for the first time within seven days after the organisation who is responsible for preparing the EIA report is confirmed;
2. Second public consultation – environment characteristics and preliminary findings of the proposed subproject, together with the comments collected during the initial public consultation stage (if any), will be disclosed to public after the completion of the EIA report; and
3. Public survey – Collect views of the proposed subproject from units and individuals of the sensitive areas during the second consultation

The scope of the information and public consultation includes administrative village committee such as Liangwu village, Jintian village, Xinguang village, and Tianjiang village, affected areas such as Xinhuo kindergarten, Yunling kindergarten, and Jintian primary school, and the neighborhood.

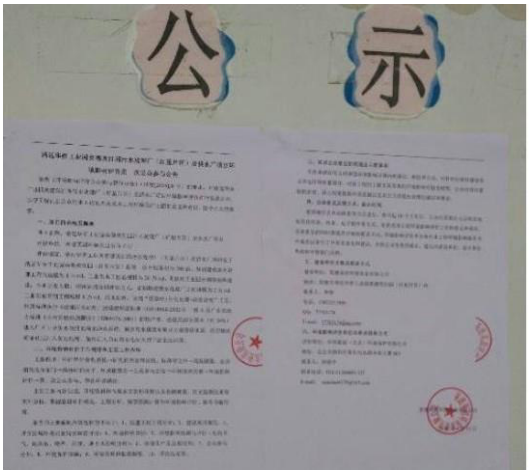
At the time of the preparation of the IEE, all the phases of consultation has been completed.

C. Initial Public Consultation

Initial public consultation was conducted on 15 April 2016. Notices were posted on Yinghong Town official website (http://yingde.gdcct.net/yinghong/bulletin/201604/t20160415_844133.html) and in major affected locations nearby the proposed subproject site. The following information was mentioned in the notice:

- Name and summary of proposed subproject;
- Work process and major aspects of the EIA;
- The scope and major items of public consultation;
- Channels and time frame for public feedback; and
- Name and contact method of the construction unit and EIA consultant.

Figure VI-1: Public notice at affected areas during initial public consultation



Yunling Kindergarten

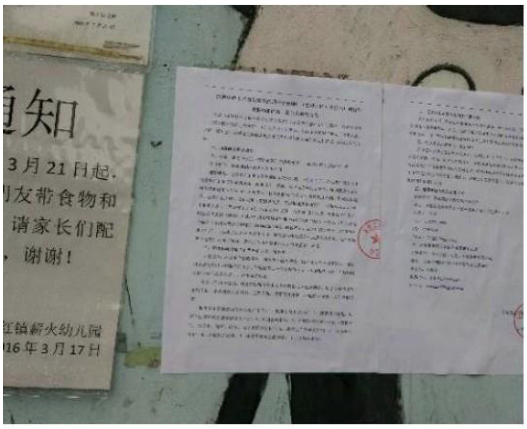
Yunling Kindergarten

Yunling Community Service Centre

Yunling Community Service Centre

Jintian Village

Yunling Third Health Station



Xinhuo Kindergarten

Xinhuo Kindergarten

Yunling Primary School

Yunling First Health Station

Yunling Second Health Station

Xinguang Village

Figure VI-2: Information disclosure on Yinghong Town official website

No feedback or opinions on the notice were received from stakeholders during initial consultation.

D. Second Public Consultation

The second consultation was started on 31 May, 2016 on the foundation of the initial consultation and the preliminary conclusions of environmental characteristics analysis of the proposed subproject. Notices and the summary of the EIA report were posted on Yinghong Town official website (http://yingde.gdcct.net/yinghong/bulletin/201605/t20160531_845711.html) and in major affected locations nearby the proposed subproject site. The following information was mentioned in the notice:

- Summary of the progress of the proposed subproject;
- Potential environmental impacts during the construction and operation stages;
- Prevention and mitigation policies and measures of the potential environmental impacts during the construction and operation stages;
- Major conclusions of the EIA;
- Channels and time frame for public access of the summary of EIA report;
- The scope and major items of public consultation;
- Detailed format of public consultation;
- Channels and time frame for public feedback; and
- Name and contact method of the construction unit and EIA consultant.

Figure VI-3: Public notice outside of Yunling Second Health Station during second consultation

Jintian Village

Tianjiang Village

Xinhuo Kindergarten

Xinguang Village

Yunling Third Health Station

Yunling Second Health Station

Yunling First Health Station

Yunling Kindergarten

Figure VI-4: Information disclosure on Yinghong town official website

E. Public Survey

During the third stage, questionnaires have been distributed to village committee, villagers and units nearby the subproject site on 14 June, 2016. The questionnaires, both individual and group versions, are used to analyse interviewers understanding on the subproject and the potential environmental impacts to the neighbourhood, as well as to obtain their feedback on the environmental prevention measures for the subproject.

Questionnaires were distributed to all 19 affected units (100%) within the affected area, which complies with the "Temporary Methods of Public Consultation for EIA". Of these, 19 valid questionnaires were received, with a validity rate of 100%. The background information of questionnaire respondents and the results of the questionnaires are shown in table VI-1 and table VI-2.

Table VI-1: Background Information of Questionnaire Respondents (Group)

#	Name of unit	Attitude towards proposed subproject	Comment and recommendation
1	Yinghong Town Jintian Village Committee	Agree	-
2	Yinghong Town Hujing Village Committee	Agree	-

3	Yinghong Town Xinling Village Committee	Agree	-
4	Yinghong Town Tianjiang Village Committee	Agree	-
5	Yinghong Town Yunling Village Committee	Agree	-
6	Yinghong Town Xingguang Village Committee	Agree	-
7	Yinghong Town People's Government	Agree	-
8	Yingde City Water Authority	Agree	-
9	Yingde City Environmental Protection Bureau	Agree	All components of the proposed project should strictly follows "Three-Simultaneity" system
10	Qingyuan Overseas Chinese Industrial Park Yingde Yinghong Management Committee	Agree	-
11	Yinghong Town Yunling First Health Station	Agree	-
12	Yinghong Town Jintainjiang First Health Station	Agree	-
13	Yinghong Town Yunling Second Health Station	Agree	-
14	Yinghong Town Yunling Third Health Station	Agree	-
15	Yinghong Yunling Primary School	Agree	-
16	Yinghong Town Jintian Primary School	Agree	-
17	Yinghong Zhongxin Primary School	Agree	-
18	Yinhong Town Yunling Kindergarten	Agree	-
19	Yinghong Town Xinhuo Kindergarten	Agree	-

Table VI-2: Results of the Questionnaires (Group)

#	Questions	Options	No. of respondents	%
1	What does your unit think about the environmental quality of the area?	Very Good	0	0.00
		Good	12	63.16
		Neutral	7	36.84
		Poor	0	0.00
		Very poor	0	0.00
2	How well does your unit know about CT Environmental Group Limited?	Very comprehensive	3	15.79
		Heard about it	11	57.89
		Not familiar	5	26.32
3	How well does your unit know about the proposed subproject?	Very comprehensive	4	21.05
		Heard about it	11	57.89
		Not familiar	4	21.05
4	Does your unit think the proposed project has positive impacts to the environment?	Yes, significantly	9	47.37
		Yes	10	52.63
		No impact	0	0.00
		Unsure	0	0.00
5	Which of the following does your unit think will be the major environmental issues during the construction phase?	Air pollution	11	57.89
		Water pollution	10	52.63
		Noise	2	10.53
		Waste	3	15.79
		Dust from transport	11	57.89
		Landscaping	3	15.79
6	Which of the following pollution control measures does your unit think should be improved?	Wastewater management	13	68.42
		Air pollution management	11	57.89
		Noise pollution management	3	15.79
		Solid waste management	8	42.11
		Others (please specify)	0	0.00
7	If all the mitigation measures are implemented effectively, what is your attitude towards the project?	Support	19	100.00
		Don't mind	0	0.00
		Not support (please provide reason)	0	0.00

For individuals, questionnaires were distributed to affected areas including Jintian Village, Xinguang Village, Tianjiang Village, Yunling Village and the communities near the discharge point. A total of 85 questionnaires were distributed. Of these, 82 valid questionnaires were received, with a return rate and validity rate of 96% and 100% respectively. The results are summarized in table VI-3 and VI-4.

Table VI-3: Background Information of Questionnaire Respondents (Individuals)

Basic information		No. of respondents	%
Gender	Male	62	75.61
	Female	20	24.39
Age Group	16-30	6	7.32
	31-40	23	28.05
	41-50	16	19.51
	51-60	28	34.15
	61 or above	9	10.98

Educational background	College degree or above	2	2.44
	High school	20	24.39
	Secondary or below	60	73.17
Occupation	Farmer	71	86.59
	Worker	1	1.22
	Education	1	1.22
	Government	1	1.22
	Business	4	4.88
	Social work	0	0.00
	Others	4	4.88
Residency	Local residents	82	100.00
	Foreign tenants	0	0.00
	Others	0	0.00

Table VI-4: Results of the Questionnaires (Individuals)

#	Questions	Options	No. of respondents	%
1	What do you think about the environmental quality of the area?	Very Good	2	2.44
		Good	2	2.44
		Neutral	73	89.02
		Poor	5	6.10
		Very poor	0	0.00
2	How well do you know about CT Environmental Group Limited?	Very comprehensive	1	1.22
		Heard about it	44	53.66
		Not familiar	37	45.12
3	How well do you know about the proposed subproject?	Very comprehensive	1	1.22
		Heard about it	45	54.88
		Not familiar	36	43.90
4	Do you think the proposed project has positive impacts to the environment?	Yes, significantly	15	18.29
		Yes	49	59.76
		No impact	4	4.88
		Unsure	14	17.07
5	Which of the following does your unit think will be the major environmental issues during the construction phase?	Air pollution	38	46.34
		Water pollution	45	54.88
		Noise	9	10.98
		Waste	27	32.93
		Dust from transport	38	46.34
		Landscaping	9	10.98
6	Which of the following pollution control measures do you think should be improved?	Wastewater management	73	89.02
		Air pollution management	61	74.39
		Noise pollution management	9	10.98
		Solid waste management	38	46.34
		Others (please specify)	0	0.00
7	If all the mitigation measures are implemented effectively, what is your attitude towards the project?	Support	50	60.98
		Don't mind	32	39.02
		Not support (please provide reason)	0	0.00

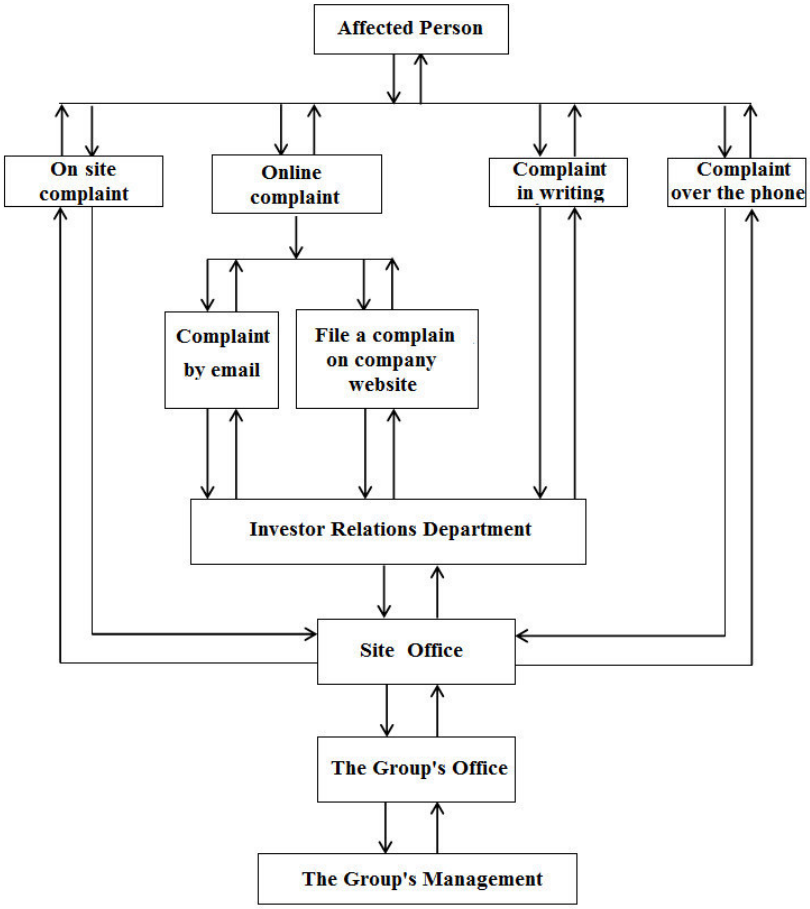
No opposition is received from unit or individual during all the three stages of public consultation. Of all 101 questionnaires received, 68.32% of the respondents show support to the subproject, while the remaining 31.68% of the respondents are neutral towards the subproject.

VII. Grievance Redress Mechanism

CTEG will establish a grievance redress mechanism (GRM) on site for handling environmental and social complaints, including complaint recording, consultation, issue investigation, mitigation action, follow-up, general timeframe for resolution and delegation of responsibilities. The GRM will address any possible concerns and dissatisfaction of affected groups regarding the social and environmental impact of its subprojects, and seek a proper solution. It should be able to promptly respond to the affected groups, be transparent and free of gender discrimination, and adapt to the cultural traditions of the affected groups and communities. Moreover, it should enable different affected groups to express their opinions, with no fear of reprisal. The E&S General Manager will be responsible for (i) resolving appeals, complaints, and disputes concerning the environmental and social impacts of subprojects which have not been resolved by the plant managers at the subproject level, and (ii) for coordinating, guiding and supervising the subproject companies in handling appeals, complaints, and disputes.

Letters and Calls office will be established to receive and handling complaints during the construction stage. A bulletin board will be set up onsite to show the location of the Letters and Calls office and complaint handling hotline so that general public will be informed with the way of lodging their the complaints. During the operation stage, site office will take the responsibility to handle stakeholder complaints and grievances. The target response time is 2 weeks from receipt of the complaints.

Figure VII-1: Grievance Redress Mechanism



For subprojects with involuntary resettlement impacts, the CTEG subproject companies will establish local level complaints and grievance procedures in each RP. The grievances will be redressed at the village level in a consultative manner and with full participation of the affected households, or their representatives, along with CTEG subproject staff and local government representatives. The basic grievance procedures include the following steps.

Stage 1. If any AP is aggrieved by any aspect of the land acquisition and resettlement, he/she can state his/her grievance and appeal to the village committee or in oral or in written form. If an oral appeal is made, the village will record it on paper and process it. Village committee will make decision on or resolve it in two weeks. The AP will be informed of the result via written notice.

Stage 2. If the aggrieved AP is not satisfied with the decision in Stage 1, he/she can appeal to the subproject local office after receiving the decision; the subproject local office will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 3. If the aggrieved AP is still not satisfied with the decision of CTEG subproject local office, he/she will appeal to the CTEG E&S General Manager and/or relevant municipal land resources bureau (LRB) after receiving the decision. CTEG E&S General Manager and/or municipal LRB will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 4. If the aggrieved AP is still unsatisfied with the decision of CTEG E&S General Manager or LRB, he/she will appeal to the provincial LRB after receiving the decision. The provincial LRB will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 5. If the AP is still dissatisfied with the decision of the provincial LRB, he/she will appeal to the civil division of a people's court according to the civil procedural law after receiving the decision from the provincial LRB. The AP will be informed of the result via written notice.

Alternatively, the aggrieved person(s) may submit a complaint to the ADB's Project Team to try to resolve the problem. If good faith efforts are still unsuccessful, they may submit their complaint to ADB's Accountability Mechanism, which is a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures.

Each subproject company will inform the local community and the AP of the grievance and appeal procedure through public information meetings, the resettlement information brochure and other media, so that they can fully understand their rights for grievance and appeal.

If a subproject affects indigenous peoples or ethnic minority communities, a grievance mechanism will be established that will promptly respond to the concerns and dissatisfaction of the affected indigenous peoples. It should also adopt an easy-to-understand and transparent procedure, be free of gender discrimination, and adapt to the cultural traditions of the affected indigenous people. News of the system's establishment should be promptly sent to the affected indigenous people and community.

VIII. Environmental Management Plan

A. Objectives

An EMP has been prepared for this subproject to address the potential impacts and risks identified by the environmental assessment. This section deals with the set of mitigation and management measures to be taken during the subproject's construction and operation stages to avoid, reduce, mitigate, or compensate for adverse environmental impacts.

The key objective of the EMP is to ensure all activities associated in the subproject will not cause any significant adverse environmental and social impacts as well as comply with all applicable laws, standards and regulations in the PRC and ADB's SPS. Institutional arrangements and responsibilities are also discussed in this section.

B. Institutional Arrangements and Responsibilities for EMP Implementation

The E&S General Manager reports to CTEG's senior management. The General Manager has oversight for environmental and social issues, ensures that resources are made available for environmental and social management, and should sign and submit the annual environmental and social performance report to ADB. S/he should ensure that ADB is notified if and when there is material environmental or social safeguards non-compliance. S/he should ensure that ADB is notified if and when the responsible staff has been changed or replaced with new staff.

At the corporate office, an E&S officer will assist the E&S General Manager in effective safeguards planning and implementation. During subprojects preparation and implementation period, the safeguards team at the corporate office will be responsible for the environment and social issues, and will prepare IEE, IPP, and RP, supervise the effective implementation of the EMP; coordinate periodic environmental and social impact monitoring according to the approved monitoring plan; coordinate the project level GRM; prepare annual environment progress reports and submit them to ADB; conduct public consultation and inspect implementation of mitigation measures. Implement the ESMS system at both the holding company and subproject company levels.

In each subproject company, an E&S Manager is appointed to implement the environment and social safeguards at subproject company and prepare and submit the annual environment and social impact monitoring report to the E&S General Manager.

C. Summary of Potential Impacts and Mitigation Measures

Potential environmental impacts during construction and operation phases as well as their mitigation measures are summarised in Table VIII-1. The effectiveness of the mitigation measures will be reviewed on a regular basis to determine if further improvement and adjustment are required.

Table VIII-1: Potential Impacts and Mitigation Measures during Construction Phase

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
Biodiversity	Vegetation loss, change of the condition of the habitat.	Mainly focus on planning of greening of the area: • Conservation of top soil by storing the topsoil separately before excavation and utilize it for greening purpose; • Timely implementation of greening and paving of roads after cut and fill to prevent further soil erosion due to explosion. • Enhancement of greening effort using multi-layer greening of trees, shrubs, and grass for compensating the loss of habitat, increase biodiversity, biomass, and attract fauna especially birds;	Contractors	CTEG, Project company
Water Quality	Muddy water from excavation work, cooling water from construction machinery, water effluent from construction process and cleansing, and domestic wastewater from the workforce	• Install temporary diversion ditches and drains. Surface runoff will be diverted to sedimentation tank for removal of SS and then reused for dust suppression; and • During the construction stage, wastewater and solid waste will be treated on-time, temporary storage site should also be covered accordingly to reduce the impacts on ground water quality due to surface runoff.	Contractors	CTEG, Project company
Ambient Air	Dust and emission generated by construction activities	• Spray water on construction site to reduce dust from earthwork excavation, transport, loading and loading; • Dust fence shall be installed around the construction site and be maintained in good condition; • Cover construction materials if they are temporarily stacked outdoor; • No earthworks, and other construction activities during strong windy days; • Excess construction materials and construction waste should be removed from sites regularly; • Vehicle transporting construction materials and soil should be installed with anti-spill devices. Loading should be carried out carefully to ensure that there will be no spilling during transportation; • Routing and schedule of construction vehicles should be carefully planned without passing through sensitive zones such as residential areas; • The speed of the vehicles within the construction site should be controlled at 20kph; • All construction vehicles should be covered with tarpaulin. Vehicle cleaning facilities will be provided. All vehicles will be cleaned properly before they enter or leave the construction sites to prevent soil, mud and other dirt being deposited on access roads;	Contractors	CTEG, Project company, local environmental authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		• Spills of soil, mud or other materials on the road should be cleared; • Use of environmentally-friendly decoration materials. Maintain good ventilation in places where painting and other activities that could release volatile organic compounds (VOC) or toxic gas are undertaken; • Burning of construction and demolition waste as fuel is not allowed will be prohibited and • Replanting and rehabilitation of the area will be conducted once the construction work is finished.		
Noise	Noise generated from construction activities	• Install 2m tall noise barriers along the construction site boundary and movable noise barriers to block construction noise from heavy machinery; • Adopt advanced construction method, for example using hydraulic pile driver instead of diesel hammer pile driver, to minimise noise impacts; • Develop proper construction schedule, minimise each construction equipment's time of operation as practical as possible. Equipment with high noise shall be avoided for being used simultaneously as practical as possible. Construction activities shall not take place at night if they are close to environmental sensitives sites such as residential area; • Low noise equipment will be chosen as practical as possible. Location shall be fixed for earth excavation equipment, machinery and transportation. Noise shall be reduced by exhaust muffler and insulating the vibration part of the engine. Idle equipment shall be turned off. Speed of vehicles and horning shall be reduced while entering the site; • Noisy construction activities will be avoided during lunch break and the night time as practical as possible. No pile driving will be allowed during the nightime. Avoid transportation at night as practical as possible. Maintain lower speed for heavy vehicles as possible, especially when entering into environmental sensitive areas; • Minimise the number of construction machines running in the same place and at the same time as practical as possible; • Training shall be provided to construction workers. Construction materials shall be transported by crane or manually while throwing down from vehicles is not allowed. Loud noise should be avoided when piling up steel materials. • PPE for hearing protection such as earplugs/earmuffs, noise-cancelling headphones will be provided to workers who will work around heavy machinery. • Limit the noisy activities (e.g. pile driving) during daytime and • Communities which may be affected by construction noise shall be informed prior to construction activities. During construction,	Contractors	CTEG, Project company, local environmental authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		they shall be informed with construction progress and noise reduction practices, certain compensation shall be provided to those parties which are under significant impact.		
Solid Waste	Solid waste generated from construction activities and workers	• Excavated earth/soil will be backfilled and debris, gravel, broken brick will also be reused to the extent possible; • Municipal solid waste will be properly segregated. Construction solid waste such as reinforced steel should be reused to the extent possible; • Construction waste, including hazardous construction waste, will be disposed of at the designated areas only; • Sufficient garbage collection bins and dumpsters will be installed at the construction site. Waste will be collected on a regular basis by the local sanitation departments and delivered to a licensed landfill for disposal; • Granular materials and waste will be properly sealed, wrapped, secured and covered on transport vehicles, which will follow a specified route only; and • Contractor will be required to remove all temporary facilities, construction waste and muck accordingly once the construction phase is complete. •	Contractors	CTEG, Project company, local environmental authorities
Soil	Soil erosion	• Avoid carrying out construction activities such as excavation during rainy season and windy period; • Excavation and backfilling will be balanced to the extent possible so as to minimise the need for fill transportation; • When excavation is conducted, remove and store topsoil at a designated area for future use in landscaping; • Properly revegetate disturbed areas as quickly as possible; • Geotextiles, plastic covers, erosion control blankets and mats shall be used to stabilise and protect soil from erosion by wind or water and • Use settling ponds, silt fences and screens to prevent sediment transport.	Contractors	CTEG, Project company, local environmental authorities
Physical cultural resources	Unknown archaeological resources and cultural relics could be destroyed.	Contractors are required to comply with the Law of the PRC on Protection of Cultural Relics. When unknown archaeological resources and cultural relics are discovered during construction, all construction activities will be suspended immediately and the relevant personnel will report to the local administrative department in charge of cultural relics. The construction activities will be only resumed once the investigation is completed and formal permission is obtained from the relevant government authorities.	Contractor	CTEG, Project company, local environmental authorities, local government authorities in charge of cultural relics.
Community Health and Safety	Temporary traffic disturbance and interruptions of public utility services.	• A traffic control and operation plan will be prepared by the contractor and discussed with the relevant local traffic management authority before construction. The plan will include provisions for diverting or scheduling construction traffic to	Contractor	CTEG, Project company, local transport, health authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		avoid sensitive areas and peak traffic hours, controlling traffic at road crossings with an emphasis on public safety through clear signs, selecting transport routes to reduce disturbance to regular traffic, including alternative routes strategy for emergency traffic management, reinstating roads, and opening them to traffic as soon as the construction is completed; • An assessment of underground facilities will be conducted before pipeline construction where appropriate. • · Villagers, residents, institutions and other affected parties will be informed in advance schedule and duration of construction works, and expected traffic and other disruptions; • Warning signs will be placed along roads to indicate potential dangers such as moving vehicles, open-cut trenches and excavations. Safety flags will be used if appropriate; • · Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential areas, schools and hospitals. • · Construction warning lights will be used at night; • · Roadside earthworks should be completed and spoil should be backfilled or removed as quickly as possible; and • Fencing shall be used to prevent unauthorised people accessing the construction sites		
Occupational Health and Safety	Health and safety of workers on construction sites.	• All workers will be provided with basic sanitation and safety training, including identification of specific hazards of their works. Implement HIV/AIDS and other communicable disease awareness and prevention, proper use of PPE, and emergency response training programme prior to the start of construction; • Garbage collection bins will be cleared regularly by local sanitation departments to prevent outbreak of diseases; • Provide adequate sanitation facilities such as latrines and lavatory at construction sites and workers camp following the requirements set forth by international best practices (e.g. OSHA) for a given number of workers; • Provide clean and sufficient supply of fresh water for construction sites and for all camps, offices and workshops; • Sufficient health and safety signage and warnings will be provided around the site; • Ensure material stockpiles or stacks are stable to avoid collapse and possible injuries to construction workers; • Workers will be provided with instruction and training in the use and maintenance of PPE. They will be required to wear PPE like helmet, safety gloves, safety shoes, and ear mufflers at all times	Contractors	CTEG, Project company

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		when they are in the construction area. The condition of the PPE will be checked on a regularly basis; • Provide medical insurance coverage and pre-employment physical examination for all workers; • Ensure first aid kits are always accessible to the construction workers; • Avoid scheduling labour intensive and outdoor works for a time when the temperature is extremely high and the weather is in bad condition; • An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies associated with hazardous material spills and similar events and • A record management system will be implemented to maintain records of health and safety performance during construction phase. It will include documentation and reports of occupational diseases and incidents. The records will be reviewed during compliance monitoring and auditing.		

Table VIII-2: Potential Impacts and Mitigation Measures during Operation Phase

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
Groundwater	Groundwater pollution due to leachate from pipes and structural damage of the structure.	• Construction to be carried out in strict accordance with latest design and relevant regulatory requirements; • Proper quality control at completion and final acceptance of construction of the project; • Selection of suitable materials for pipework to avoid corrosion of pipes, in particular, iron pipes should be avoided; • Proper implementation of day-to-day management, enhanced supervision and investigation of the project facilities during operational stage;	Operator	CTEG, Project company, local environmental authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		• Proper solid waste management practices as recommended in Section C5 of Chapter IV and • Clay layer (50cm thick) and HDPE (2mm) geomembrane will be laid under the sewer and structures where may have the risk of seepage so that the potential of pollution to groundwater is limited.		
Noise	Excessive noise level	• Lowering of noise level for major noises such as blower room and fan inlet of pumping room by means of noise isolation and installation of silencer; • Plantation of landscape noise buffers within the subproject area; • Application of noise insulation measures by adoption of building materials with noise absorption characteristics for noise sources such as pumping room and blowers and • Noise protection will be provided to workers to minimise exposure to noise sources and ensure that their exposure is within the industrial good practices (i.e. OSHA's permissible exposure limit for noise exposure is 85 dB(A) for an 8-hour.	Operator	CTEG, Project company, local environmental authorities
Solid and Hazardous Waste	Improper disposal of municipal solid waste and sludge management	• Timely removal of municipal solid waste produced with the use of sanitation landfill; • Dewatering of screenings and sludge from sewage treatment processes; • Timely removal of dewatered screenings and sludge; • Remove sludge every day. It will be transported to a Solid Waste Disposal and Resource Utilisation Centre for brick production; • At least one special vehicle for sludge transportation will be stationed in the industrial park to ensure the timely removal of sludge; • High designed storage capacity of sludge to prevent improper storage, the in-site storage capacity for sludge is 100 tonnes while the daily production can reach 12-18 tonnes (80% water content)when the project is in full production capacity; • Careful planning of transport of waste with measures to prevent leakage; and • Off-site reuse of sludge according to relevant environmental requirements.	Operator	CTEG, Project company, local environmental authorities
Occupational Health and Safety	Pose severe risk on health and safety of staff	• use of suitable PPE that will protect the workers from workplace hazard while maintaining their comfort at work such as safety shoes, breathing apparatus chemical resistant clothing, safety googles, mask, safety ear plugs, safety gloves etc. to avoid direct/ over exposure to harmful chemicals, emissions, liquids, hazardous waste etc.;	Operator	CTEG, Project company, local health and safety authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		• Prevention of electricity-related hazard includes periodic checking of equipment by qualified personnel, procurement of safe equipment that is free from fault or defect, proper maintenance of equipment and cables; • Prevention of hazard related to storage, transport, handling, management, and disposal of chemicals include keeping and updating a logbook on chemicals, lock-out system, providing safe handling procedures, education of relevant personnel etc; • Workplace management including site management such as proper storage and careful use of sharp tools, having correct postures when doing manual operations, keeping things away from floors to avoid tripping etc; • Measures against confined space related hazards include use of explosion-proof equipment, installation, and appliances, use of breathing apparatus for certain workspace, registration system for entering certain space, atmospheric monitoring, railings to avoid fall from height into and drowning in a confined space etc; • An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies; • A records management system will be implemented to store and maintain records of health and safety performance. It will include documenting and reporting of occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits; • Periodic health check-up for targeted workers; and • Implementation of internal safety management systems with rules, regulations, safety production guidelines, and workplace health and safety trainings etc.		

Mitigation measures are designed to minimise the potential impacts of the subproject in construction and operational stages. Table VIII-3 summarizes the designed mitigation measures of various aspects, as well as the costs of implementing these measures. The budgets for implementation these measures in this subproject amount to 2.55% of the total investment in this subproject.

Table VIII-3: Environmental Mitigation Measures Implementation Cost Estimates

Aspects	Locations	Mitigation measures	Estimated Costs (unit: 1,000 CNY)
Air	Grills, sludge dewatering zone	Atmoise and spray biological deodourant liquid	45
	Hydrolysis acidification tank, sludge thickening tank, coagulation reaction tank	Installation of concrete lids. Use of biofilter	900
	Gas fumes in canteens	Fume purification device	10
Wastewater	Sedimentation tank (during construction phase)	-	50
	Rainwater and sewage systems	Separation of rainwater and sewage system	100
	Disinfection tank	disinfection	228
Noise	Construction site	Barrier, fence	50
	Pumping station	Vibration isolation of foundations, install noise insulation windows and doors	60
	Blower room	Sound proofing walls and ceilings, silencer at fan inlets and outlets	120
	Other noisy equipment	Vibration isolation of foundations, regular maintenance	20
Underground water	Various tanks	Seepage control	180
	Ground and roads	Ground and roads hardening	150
Solid water	-	Transportation of screenings and municipal solid waste	30.4
	-	Sludge treatment	7869
Monitoring	Influent intake point and effluent discharge point	Installation of online influent and effluent quality monitoring systems (One set each, inspection scope include COD, ammoniacal nitrogen, and flow)	300
Greening	Subproject area	At least 30% green coverage	300
	Boundary of the subproject area	5m green belt along the boundary of the subproject area	300
		Total investment	10,712.40

D. Environmental Monitoring and Reporting

Environmental and social performance will be evaluated on an annual basis. The benchmark for performance will be the ongoing compliance against the applicable environmental and social safeguards requirements. CTEG will ensure that the subproject company prepares and submits an annual environmental and social performance monitoring report and will review and assess the compliance performance on environmental and social safeguard issues, including issues related to gender and development and core labour standards.

The E&S General Manager will i) communicates with the subproject company and confirms from time to time the that subproject company is undertaking the obligations of compliance with all applicable environmental and social safeguards requirements; and ii) visit the site to monitor the implementation of EMP or RP. CTEG will promptly report to ADB any actual or potential breach of the compliance requirements after becoming aware of it.

The E&S General Manager will review the annual monitoring report of this subproject prepared by the subproject company. The E&S General Manager will prepare an annual environmental and social performance report (AESPR) covering all subprojects using ADB funds.

In order to reduce the negative environmental impacts during the construction phase, a unit of 2 to 3 people will be set up responsible for managing and monitoring the environmental impacts.

- The contractor and construction unit have agreed to include environmental monitoring measures during construction phase into the contract, which the construction unit should strictly follow. Rewards and punishments system applies;
- Construction unit will follow and implement the agreements in the contracts, as well as relevant environmental regulations and rules of National and local government;
- Prepare an environmental monitoring plan for construction phase on the basis on this IEE, including a detailed description of the construction location, environmental impacts, monitoring measures and responsible unit/person. The environmental monitoring plan will be distributed to related personnel for implementation;

- Construction unit should appoint a person in charge of at each construction site responsible for monitoring all types of pollutions at sites, particularly on noise and vibrating works;
- Construction unit should proactively follow the guidance of the environmental management department;
- Construction unit should set up a hotline for complaints from the public. The complaints should be handled properly on a timely basis.

Table VIII-x shows the environmental impact monitoring plan specifically designed for this subproject at the construction site, which includes the scope, source, measures, and frequency of monitoring during operation phase.

Table VIII-4: Environment Monitoring Plan during operation

Type	Monitoring location	Monitoring items	Monitoring frequency
Water	Inlets and outlets	Influent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma, Coliform, and Heavy Metals (Cr. Cd, Hg. Ar, Pb,Ni) Effluent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma and Coliform and Heavy Metals (Cr. Cd, Hg. Ar, Pb,Ni)	Once a week
Groundwater	Monitoring wells at the both sides of the sludge dewatering tank	pH, Ammonical Nitrogen, sulphate, NO_2-N, sulfate, permanganate index, Faecal Coliforms, and total amount of bacteria etc	One every six months
Ambient air	Downwind of the odour source, exhaust pipes and various spots at boundary of the subproject area	H_2S, NH_3, and odour concentration	Quarterly
Noise	1m away from the boundary of the subproject area	Noise level	Quarterly
Surrounding environment	Plant surrounding and sensitive areas	N2S, NH3, and odour concentration in air, water quality of Kongtang Creek, and noise	N/A
Occupational Health and Safety	Spot with significant work hazards identified in a risk assessment upon the start of operation	• Work process which involves the use of appliances • housekeeping • confined space • evacuation • implementation of internal safety management systems	Once a week/ month

Table VIII-5: "Three-Simultaneity" Environmental Protection Inspection Checklist of the Proposed Subproject

No.	Item	Treatment	Inspection scope	Requirements
1	Wastewater treatment system	Grills, coagulation sedimentation, hydrolysis acidification, oxidation, secondary sedimentation, V-shaped filter, and disinfection process	Influent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma Coliform, and Heavy Metals (Cr. Cd, Hg. Ar, Pb,Ni)	▪ Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) ▪ Class I standard for the second time phase (DB44/26-2001)

			Effluent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma Coliform and Heavy Metals (Cr. Cd, Hg. Ar, Pb,Ni).	
2	Industrial water supply system	Coagulation reaction, inclined-tube sedimentation, v-shaped filter, and disinfection process	Chroma, SS, total dissolved solids	▪ Urban Water Supply Quality Standards (CJ/T206-2005) ▪ Standards for Drinking Water Quality (GB5749-2006)
3	Odour	▪ Add cover and seal to wastewater pre-treatment and sludge treatment plant ▪ Introduce deodorize bio-filter device and a 15m high exhaust pipe ▪ Extend the boundary outward of the fine mesh screen, rotary mesh screen, primary sedimentation tank, and the sludge dewatering machine by 100m	NH_3, H_2S	▪ Table one level 2 - Expansion of plant boundary of the Emission Standards for Odor Pollutants (GB14554-93) ▪ Table 2 of the Emission Standards for Odor Pollutants (GB14554-93)
4	Noise	▪ Prioritize the use of low noise emission equipment ▪ Introduce noise insulation, elimination, and reduction and vibration reduction measures where necessary	Equivalent continuous A sound level	▪ Emission Standard of Environment Noise for Boundary of Construction Site (GB12348-2008)
5	Solid waste	▪ Waste is transported to landfill for disposal ▪ Sludge and waste from screening is handled by an authorised external unit	Water content	-
6	Greening of plant area	Plantation of trees, flowers and grass	-	-
7	Others	Install monitoring devices at inlets and outlets	(online) pH, COD_{Cr}, NH_3-N (laboratory testing) Influent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma, Coliform, and Heavy Metals (Cr. Cd, Hg, Ar, Pb,Ni) Effluent: pH, COD_{Cr}, SS, BOD_5, NH_3-N, Petroleum, Oil and Grease, Anionic Surfactants, Total Nitrogen, Total Phosphorous, Chroma, Coliform and Heavy Metals (Cr. Cd, Hg, Ar, Pb,Ni)	-
		Install CCTVs at	-	-
		Set up environmental mechanisms and policies	-	-
		Introduce monitoring analysis system	-	-
		Introduce seepage and corrosion prevention measures	-	-
		Introduce groundwater monitoring system	-	-

IX. Conclusion and Recommendation

During the preparation of the FSR, domestic EIA and project IEE, potential environmental impacts were carefully assessed and addressed. The EIA was prepared by New ACEF (Beijing) Environmental Protection Co. Ltd. in April 2016.

This IEE provides the background and the details of the two major components of the subproject, wastewater treatment plant and an industrial water supply plant. It describes the purpose of the subproject, the geographic location of the subproject, major processes of the two components, and the relevant physical, biological, and socioeconomic conditions within the area.

Major safeguard issues during construction phase include biodiversity, surface water quality, ground water quality, ambient air quality, noise pollution, solid waste, soil erosion, socio-economic resources, physical cultural resources, community health and safety and risks to public utilities, and occupational health and safety. There are no historical and archaeological sites within or near the subproject area. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the application of good construction and housekeeping practices. Appropriate monitoring programs have also been developed to address these issues.

The main potential adverse impacts during the operation phase include surface water quality, ground water quality, ambient air quality, noise pollution, solid and hazardous waste, and occupational health and safety. It is expected that the effluent from this subproject will meet the national effluent standards under normal operation and the impact on surface water is minimal. Proper design, construction, management and maintenance of the subproject will also prevent negative impact on groundwater quality. Further, mitigation measures such as the installation of fume purification system and the plantation of landscape noise buffers, will reduce the impacts on ambient air quality and noise pollution. Careful management of solid and hazardous waste is required to minimise the impacts from waste generation.

Mitigation measures and monitoring program are defined for all identified impacts and are included in the EMP of the project IEE. The EMP sets out the procedures and plants to carry out mitigation measures and monitoring during construction and operational stage. For each aspects, appropriate mitigation measures are described and monitoring programme will be undertaken to ensure that the environmental impacts will be minimised to appropriate levels, referencing to respective standards and requirements.

The subproject IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimised to an acceptable level. The subproject is feasible from an environment safeguards point of view.

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