Environmental Impact Assessment (Draft)

Project Number: 46078
June 2013

People's Republic of China: Anhui Huainan Urban Water Systems Integrated Rehabilitation Project

Prepared by the Huainan Municipal Government for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 6 May 2013)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.16129
$1.00	=	CNY6.2

In this report, "$" refers to US dollars.

ABBREVIATIONS

ADB	Asian Development Bank
APG	Anhui Provincial Government
AQG	Air Quality Guideline
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
BOD_5	5-day biochemical oxygen demand
C&D	Construction and demolition
$CaCO_3$	Calcium carbonate
Cd	Cadmium
CESFMT	Community Environmental Supervision & Flood Management Team
CH_3SH	Methylmercaptan
Cl^-	Chloride
CN	Cyanide
CNY	Chinese Yuan
Co	Cobalt
CO	Carbon monoxide
COD	Chemical oxygen demand
Cr	Chromium
Cr^{6+}	Hexavalent chromium
CSS	Combined sewer system
Cu	Copper
DDT	Dichlorodiphenyltrichloroethane
DEP	Department of Environmental Protection
DO	Dissolved oxygen
EA	Executing Agency
EIA	Environmental impact assessment
EIR	Environmental Impact Report
EIRF	Environmental Impact Registration Form
EIT	Environmental Impact Table
EMP	Environmental Management Plan
EPB	Environmental Protection Bureau
F^-	Fluoride
Fe	Iron
FSR	Feasibility Study Report
FYP	Five Year Plan
GDP	Gross domestic product
GHG	Greenhouse gas
GRM	Grievance redress mechanism
HDD	Horizontal directional drill
HEMS	Huainan Environmental Monitoring Station
HEPB	Huainan Environmental Protection Bureau
Hg	Mercury
HMAMB	Huainan Municipal Administration Management Bureau
HMG	Huainan Municipal Government
HMLMB	Huainan Municipal Landscaping Management Bureau
HMSC	Huainan Municipal Sewage Company
HPMO	Huainan Project Management Office
I^-	Iodide
I_{Mn}	Permanganate index
IA	Implementing Agency
IUCN	International Union for Conservation of Nature
LAS	Linear alkylbenzene sulfonate (= anionic surfactant)
LPG	Liquefied petroleum gas
Mn	Manganese
Mo	Molybdenum
MOE	Ministry of Environment
MSW	Municipal solid waste
MWR	Ministry of Water Resource
NH_3-N	Ammonia nitrogen
N	Nitrogen
NO_2	Nitrogen dioxide
NO_2^-	Nitrite
NO_3^-	Nitrate
P	Phosphorus
PO_4	Phosphate
PAM	Polyacrylamide
PAM	Project Administration Manual
Pb	Lead
pH	Measure of acidity (<7) and alkalinity (>7) based on hydrogen ion concentration

$PM_{2.5}$	Particulate matter with particle diameter ≤ 2.5 micron	SPS	Safeguard Policy Statement
		SS	Suspended solid
PM_{10}	Particulate matter with particle diameter ≤ 10 micron	SSS	Sanitary sewer system
		TDS	Total dissolved solids
PME	Power mechanical equipment	TN	Total nitrogen
PMO	Project Management Office	TP	Total phosphorus
PO_4^{2-}	Phosphate	TPH	Total petroleum hydrocarbon
PS	Pump station	TSP	Total suspended particulate
RP	Resettlement Plan	USEPA	United States Environmental Protection Agency
RSP	Respirable suspended particulate	WHO	World Health Organization
Se	Selenium	WRB	Water Resources Bureau
SO_2	Sulfur dioxide	WTP	Water Treatment Plant
SO_4^{2-}	Sulfate	WWTP	Wastewater Treatment Plant
SOE	State Owned Enterprise	Zn	Zinc

WEIGHTS AND MEASURES

^oC	degree centigrade
µ	micron
µg/L	microgram per liter
Bq/L	Bacquerel per liter
dB	decibel
HU	hazen unit
km	kilometer
km^2	square kilometer
km^3	cubic kilometer
kW	kilowatt
L	liter
L/s	liter per second
m	meter
m^2	square meter
m^3/a	cubic meter per annum
m^3/d	cubic meter per day
m^3/s	cubic meter per second
mg/kg	milligram per kilogram
mg/L	milligram per liter
mg/m^3	milligram per cubic meter
no./L	number per liter
NTU	nephelometric turbidity unit
t	metric ton
t/a	ton per annum
t/d	ton per day
t/y	ton per year

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

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I. EXECUTIVE SUMMARY

1. **Project design.** This environmental impact assessment (EIA) is for the Anhui Huainan Urban Water Systems Integrated Rehabilitation Project ('the project') in Huainan Municipality, Anhui Province, the People's Republic of China (PRC). It has been prepared in accordance with the PRC's regulatory requirements for EIA and the Asian Development (ADB) Safeguard Policy for the Environment (SPS, 2009). The project is classified 'Category A' under the SPS. The project has four components: (i) improved wastewater collection (construction of wastewater collection pipelines and wastewater pump stations); (ii) improved urban water channel environment and flood management (dredging six urban water channels and constructing storm water pump stations, embankments along these urban channels and the western shore of Gaotang Lake); (iii) improved urban lake environment (constructing wetlands in five urban lakes); and (iv) project management support. Non-structural measures include consulting services in water quality and lake and flood management: these components do not have adverse environmental implications and are not assessed in this EIA. Expected environmental and social benefits include a reduction in the volume of untreated wastewater that enters the Huai River, improved water quality and supply, and improved flood protection capacity. Overall, the project is expected to benefit over 962,000 people in the municipality.

2. **Baseline environmental conditions.** Baseline sampling was conducted by domestic environmental institutes and compared with applicable PRC standards and the World Bank Group environmental, health and safety (EHS) guidelines. For ambient air quality and noise levels, some parameters currently exceed PRC and/or EHS standards at some locations. For water quality, the project urban water channels are Category V (the lowest quality), due to high levels of nutrients and ammonia nitrogen. Of the five urban lakes, three have water quality worse than Category V and two, Gaotang and Shijian, are Category IV. Mercury is present in the five lakes, at levels equivalent to Category IV. Sediments in the six channels and five lakes possess high levels of nitrogen and phosphorus. Groundwater quality at the proposed disposal sites for dredge spoil is low (Category V) due to high levels of nitrate and total fecal coliform bacteria.

3. Vegetation communities and wetland habitats in the project area are largely modified and degraded by human use. Records for nine globally threatened species on the IUCN Red List are present for the project area: one mammal (*Arctonyx collaris*), five birds (Siberian Crane, Oriental White Stork, Hooded Crane, Great Bustard, Swan Goose), two freshwater turtles, and one frog. The five birds and both turtles are also listed on the PRC National Protection List, and additional species are listed on the Anhui Province Protection List (Sections IV.B.5-B.8). Waterbird communities (ducks, geese, swans, cranes, storks, shorebirds) are the key group of concern for this project. The project sites with the highest ecological values are Gaotang and Shijian Lakes, which retain a mosaic of wetland habitats (vegetation, shorelines, shallow and deep water). No physical cultural resources were recorded during surveys.

4. **Project impacts and mitigation measures.** Project impacts and mitigation are described in a project Environmental Management Plan (EMP; Attachment A). Channel dredging and construction of embankments, pipelines and embankments will result in impacts to air and water quality, noise, ecology, solid waste and potentially, occupational health and safety. Air

quality may be impacted by dust generated from construction. The use of powered mechanical equipment during construction and dredging activities will generate noise. Dredging will stir up sediment, releasing suspended solids and nutrients. The proposed 14.47 km embankment at Gaotang Lake may disturb feeding and/or roosting migrant and resident waterbirds. Construction works will produce construction and demolition wastes including earth cut materials, dredged sediment and channel soil, and worker wastewater. Workers may face occupational health and safety issues working on construction sites. The project will permanently utilize ~1,900 mu (127 ha) of land, mainly comprising farmland and land allocated for construction.

5. For the waterbirds, embankment construction at Gaotang Lake may cause noise and/or visual disturbance to feeding or roosting flocks. Direct loss of feeding or roosting habitats is not anticipated as the proposed embankment will be located 400-1,000 m inland from the lake shore. For all other species, the project is expected to have low or negligible impacts; at Shijian Lake, revetment will be only be implemented for eroded sections of the lake banks with few habitats, reducing the possibility that fish, turtle or frog feeding or breeding sites will be affected. No project activities involve works within the actual waterbodies of any of the project lakes.

6. Project operational impacts will include odor from the wastewater pump stations, noise from the wastewater and storm water pump stations, and wastewater and solid waste from the workers operating the pump stations.

7. Mitigation measures include dust and noise suppression, landscaping of completed sites, and staged construction works for embankments and pipelines, ensuring that impacts are managed in discrete sections. At the dredge sediment disposal sites, bottom liners will be placed to prevent pore water from seeping into groundwater. For physical cultural resources, discovery of buried artefacts during construction will be reported, recorded and handled in accordance with PRC regulations. A resettlement and compensation plan has been developed and meets the PRC and ADB applicable policies and requirements. During project operation, odor generated by the wastewater pump stations will be treated by odor removal systems. Pump stations will be designed with acoustic features to contain operational noise. Refuse and other solid waste will be collected and disposed at the Huainan Sanitary Landfill.

8. For waterbirds at Gaotang Lake, embankment construction activities will be suspended from December–February (the winter migration season), and at all other times of year, construction will be limited between 0900–1600 h to avoid dawn and dusk, when bird activity is usually highest. A waterbird monitoring program will be implemented under the EMP, to be conducted by a waterbird specialist (possibly from the Huainan Normal University, which conducted the project baseline bird survey), which will help identify potential impacts during construction.

9. **Information disclosure, consultation, and participation.** Details of the project were placed on the website of the Huainan Municipal Government (HMP) on 5 November 2012 and 25 February 2013. Two rounds of public consultation and participation were conducted during preparations of the domestic and project EIA. The first round was by questionnaire surveys of stakeholders and affected people at the beginning of the domestic EIA process in November

2012. The main public concerns recorded were of air, noise, and water quality, solid waste management, and impacts to ecology, during construction. The second round was by public forum on 27 February 2013, after completion of the draft domestic Environmental Impact Report (EIR). A key public concern raised was the need for a 'complaint center' to be established for the project. Explanations were given by the HPMO and the environmental design institute to all questions and concerns raised, and which subsequently guided the project design process.

10. **EMP implementation.** The HMG, through the Huainan Project Management Office (HPMO), will be responsible for overall implementation of the project EMP, including inspection, monitoring, reporting, and initiating corrective actions or measures. The HPMO will assign a qualified environment specialist on its staff to undertake the project environmental management activities. The EMP includes a Grievance Redress Mechanism (GRM) to document and resolve complaints from affected people. Multiple points of entry and modes of access for the public will be developed in the project pre-construction phase and details distributed to residents at project site, including face-to-face meetings, written complaints, telephone conversations, or e-mail.

11. **Risks and project assurances.** The key project environmental risk is low institutional capacity by the HPMO and IAs to fully implement the EMP as well as overall environmental activities of the loan components. These risks will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project implementation consultants, (iii) following the project implementation monitoring and mitigation arrangements, and (iv) ADB conducting project reviews. Loan covenants include four project-specific environmental assurances: (i) final engineering designs will be reviewed by a waterbird specialist to avoid impacts to waterbird communities recorded in some project sites; (ii) the suspension of Gaotang Lake embankment construction from December–February (see above); (iii) identification of five proposed disposal sites for excess soil generated from construction, and assessment of any potential environmental and social impacts (to be conducted in the detailed design phase); and (iv) HMG shall ensure that the existing and proposed WWTP treatment capacities will be able to accommodate the increased efficiency in supply of wastewater to WWTPs to be achieved by this project, including completion of the planned expansion to two existing plants.

12. **Conclusion.** Based on the information assessed in this EIA, it is concluded that the net environmental impacts from project construction and operation, assuming full and effective implementation of the project EMP, are in compliance with PRC regulations and the ADB Safeguard Policy Statement (2009).

II. INTRODUCTION

A. Background

1. This environmental impact assessment (EIA) is for the Anhui Huainan Urban Water Systems Integrated Rehabilitation Project, People's Republic of China (PRC). The project is classified 'Category A' for environment under the Asian Development Bank (ADB) Safeguard Policy (SPS, 2009), requiring preparation of an EIA. Under the PRC's national EIA regulation, the project is classified as 'Class I' (equivalent to ADB's Category 'A' for environment) and preparation of an Environmental Impact Report (EIR) is required.[1] This EIA has been prepared based on information in the EIR (Coal Industry Hefei Design and Research Academy, 2013) and Feasibility Study Report (FSR; Anhui Transport Consulting and Design Institute Co. Ltd., 2013). The EIR was approved by the Huainan Environment Protection Bureau on 5 May 2013.

2. Huainan is a prefecture-level city located in the northern-central part of Anhui Province (Figure I.1), 110 km north of the provincial capital, Hefei, at latitudes 116°21'21"–117°11'59"E and longitudes 32°32'45"–33°00"24"N. It is situated in the middle reach of the Huai River and spans both banks of this river. The municipality administers 6 districts (Panji, Bagongshan, Xiejiaji, Tianjia'an, Datong, Shannan, Maoji) and one county (Fengtai), over a total area of 2,585 km^2. In 2011 its population was 2.4 million, of which 55% was urban. Most of this population is located in an urban center of 520 km^2, bound by the Huai River in the north, Cao'an Township in the south, Bagongshan Scenic Region and Provincial Road 102 in the west, and Gaotang Lake in the east.

Figure I.1: Location of Huainan Municipality

[1] The PRC's *Directory for the Management of Different Categories of Construction Project Environmental Impact Assessment* classifies EIAs for construction projects into 3 categories with different reporting requirements: (i) Environmental Impact Report (EIR) – for projects with potentially significant environmental impacts; (ii) Environmental Impact Table (EIT) – for projects with less significant impacts; (iii) Environmental Impact Registration Form (EIRF) – for projects with the least environmental impacts.

B. The proposed project

3. The aim of the project is improved management of surface water resources in Huainan municipality. The project comprises four inter-linked components, which are intended to improve wastewater collection (by constructing wastewater pipelines and pump stations), the urban water environment and flood management (by dredging and embankment construction on urban water channels and Gaotang Lake to improve water flow and increase flood protection capacities), and the urban lake environment (by the creation of wetlands, including planting of native aquatic vegetation in five lakes, Gaotang, Shijian, Long, Caoling, and Dajiangou). The fourth component, project management, is to strengthen the capacity of the Huainan Project Management Office (HPMO) and Implementing Agencies (IAs) to implement the project.

C. Project rationale

4. Huainan municipality is a major national center for the production of coal, electricity, and chemicals. The Huainan Municipality Master Plan (2010–2020) describes it as having 'Three Bases': coal production, supplier of electrical power in eastern PRC, and production base for the chemical industry (e.g. ammonia, fertilizers). Intensive economic development has resulted in heavy pollution to the municipal urban water systems, including urban water channels and lakes, which are clogged with sludge and severely polluted. Flood control capacity of the urban water systems is insufficient and the municipality suffers flood damage once every two years on average. The Huainan municipal government (HMG) has been implementing various projects to improve the urban water systems, including improvement of wastewater treatment systems, annual dredging of urban water channels and lakes, public awareness raising to reduce garbage dumping in waterways, improvement of urban water channels and drains to increase flood flow capacity, preparedness for floods, and post-flood recovery. Although much improvement has been made, the municipality still has fundamental problems with its water systems, including (i) insufficient wastewater treatment systems, (ii) wastewater discharge into urban water channels and lakes without treatment, which causes sludge sedimentation and water quality deterioration, and (iii) insufficient flood control facilities and capacities of the urban water systems.

5. The Huainan Municipality Master Plan sets targets for 2020 for wastewater treatment (treatment rate of more than 90%), water environment (water quality in the urban water systems improved to class IV or above of the PRC water quality standards), and flood management (flood frequency in the urban area reduced from 1/2 years to 1/20 years). To implement components of the master plan related to the urban water systems, the HMG requested ADB to provide lending support for the current project. The project is included in ADB's country operations business plan, 2012–2014 and the ensuing loan is in ADB's 2013 lending pipeline for the PRC.

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

6. **Policy framework.** During the PRC 9th, 10th, and 11th Five-Year Plans (FYP) for National Environmental Protection (1995-2010), the Huai River was one of "Three Rivers and Three Lakes"[2] identified as a special priority for water pollution control. The PRC's 12th FYP (2011-2015) supports the long-term goal of building a harmonious and moderately prosperous (*xiaokang*) society through livelihood improvement and regionally balanced and environmentally sustainable growth. In Huainan Municipality, these goals are expressed through the Huainan Municipality National Economy and Social Development 12th FYP (2011-2015), which sets environmental, economic and social targets for 2015. The plan includes the current proposed project. Another key plan is the Huainan Municipality Urban Master Plan (2010-2020), approved by the State Council in October 2010, and which includes spatial planning and urban development targets for land use, industrial development, transport, landscaping, natural reserves, public facilities, disaster prevention and response, flood control, environmental protection, water supply, wastewater treatment, and power supply. These and additional relevant municipal plans are listed in Table III.1.

Table III.1: Huainan Municipal Government plans which involve water resources management

Plan	Targets relevant to project
National Economy and Social Development 12th FYP	● CNY 127 billion GDP; CNY 50,000 per capita GDP; 70% urbanization; urban and rural resident per capita disposable income targets of CNY30,600 and CNY10,800 CNY respectively; Promote urbanization in 3 areas: Eastern Urban Area (1st priority), Western Urban Area, Mountain South New Area. Eastern Urban Area focuses on development along Huai River and Gaotang Lake ● WWTPs at >80% capacity; 85% wastewater treatment rate; >250 mg/L COD removal; Combat climate change; build low carbon city; public education on low carbon living
Urban Master Plan (2010-2020)	● Water quality in urban water bodies Category IV or better; 90% centralized wastewater treatment rate; 30% wastewater reuse rate; Separation of storm and sanitary sewers; wastewater treatment capacity of 560,000 m3/d ● 100-year flood control standard; 20-year waterlogging[3] standard in urban area
Urban Water Supply Plan (2009-2020)	● Water supply capacity of 1.13 million m3/d
Special Plan for Sewerage Works in the Western Urban Area (2004-2020)	● Wastewater flow of 165,000 m3/d in Western urban area
Detailed Control Plan for the Binhe New District	● Wastewater flow of 50,000 m^3/d in the Binhe New District; Domestic wastewater to be treated at the No. 1 WWTP; Planned 50,000 m^3/d WWTP to treat industrial wastewater from the planned low-carbon industrial park and the Ancheng Economic Development Area
Special Plan for Drainage Works in the Gaotang Lake New District (2010-2030)	● Planned WWTP with 10,000 m3/d capacity in short term, and 40,000 m^3/d in long term
River System Rehabilitation Plan for the	● Focus on flood/waterlogging control and flood safety, with landscaping and

[2] Liao, Huai, and Hai rivers, and Tai, Chao, and Dianchi lakes.

[3] "Urban waterlogging" is a term used in the PRC to refer to flooding in urban areas where storm water runoff in excess of the urban drainage system capacity converges in low-lying areas, causing traffic disruption, and loss/damage of property and life.

Plan	Targets relevant to project
Eastern and Western Old Urban Areas	aesthetics as a secondary goal
Plan for Urban Drainage Works	● Rehabilitate 19 catchment areas incl. Longwang, Shijian, Donghua, Caozuizi
Plan for Municipal Infrastructure Upgrades in the Old Urban Area (2008-2011)	● Rehabilitate 14 catchment areas, including channel dredging and stabilization; Increase storm water discharge rates by 47 m^3/s; Rehabilitate / construct Longwang, Caozuizi and Dajiangou pump stations; Build 49.15 km new drainage channels; Increase storm water retention capacities by 0.29 km^3

7. ADB's country partnership strategy for the PRC (2011-2015) supports the government's overarching strategic goal of building a *xiaokang* society by focusing on three strategic pillars: inclusive growth, environmentally sustainable growth, and regional cooperation and integration. This project comes under pillar II, environmentally sustainable growth. ADB is assisting the PRC in enhancing environmental sustainability in urban areas through improvements in wastewater treatment and in storm water conveyance. The project includes two of the four ADB priority sectors, (i) natural resources and agriculture (i.e. flood management) and (ii) urban development (i.e. access to new and/or improved municipal services for wastewater treatment).

8. Overall, the project is consistent with the PRC's 12th FYP, Huainan's urban master plan, and ADB's country partnership strategy, by improving urban water environment, public health, and quality of life.

9. **Legal and administrative framework.** The administrative framework for EIA in the PRC comprises national, provincial and local (city) environmental protection authorities. The national authority is the Ministry of Environmental Protection (MEP), who promulgates laws, regulations and technical guidelines on EIA and pollution prevention and control, and which is represented at the provincial level by the Environment Protection Department (EPD). These are usually delegated authority by MEP to approve EIA reports for provincial construction projects, except for those with national interest and/or inter-provincial projects. Local or city-level Environmental Protection Bureaus (EPBs) enforce environmental laws and conduct environmental monitoring. In the project, the Huainan EPB has been delegated authority to approve the domestic EIA by the Anhui Provincial EPD.

10. The PRC has a wide range of laws, regulations, technical guidelines and standards that govern the way in which environmental protection and environmental impact assessment for construction projects must be implemented, including for pollution prevention and control on air, noise, water, ecology and solid waste, and technical guidelines on assessing atmospheric, noise, water and ecological impacts. The following national laws, regulations, guidelines, and standards, are relevant to the project:

- **Overall environmental protection:** Environmental Protection Law, December 26, 1989; Environmental Impact Assessment Law, September 1, 2003;
- **Protection of air, water, soil, and noise pollution:** Atmospheric Pollution Prevention and Control Law, September 1, 2000; Noise Pollution Prevention and Control Law, March 1, 1997; Water Pollution Prevention and Control Law, June 1, 2008; Solid Waste Environmental Pollution Prevention and Control Law, April 1, 2005; Environmental Quality Standard for Soils (GB 15618-1995); Water Law, October 1, 2002; Water and Soil

Conservation Law, June 29, 1991, amended December 25, 2010; Promotion of Clean Production Law, January 1 2003;

- **Energy efficiency:** Energy Conservation Law, January 1, 1998;
- **Flora, fauna, and cultural resources:** Wild Animal Protection Law, August, 2004; Cultural Relics Protection Law, 2002;
- **Preparation of EIAs:** Construction Project Environmental Protection and Management Regulation, (State Department Order No. 253), November 29, 1998; Directory for the Management of Different Categories of Construction Project Environmental Impact Assessment, (MEP Order No. 2), October 1, 2008; Environmental Impact Assessment Public Participation Interim Guideline, (MEP Announcement No. [2006]28); Circular on Strengthening the Management of Environmental Impact Assessment for Construction Projects Financed by International Financial Organizations, (MEP Announcement No. [1993]324); Technical Guidelines for Environmental Impact Assessment: General Program (HJ 2.1-2011); Guidelines for Environmental Impact Assessment: Atmospheric Environment (HJ 2.2-2008);
- **Technical guidelines for EIAs and environmental monitoring:** Technical Guidelines for Noise Impact Assessment (HJ 2.4-2009); Technical Guidelines for Environmental Impact Assessment: Surface Water Environment (HJ/T 2.3-93); Technical Guidelines for Environmental Impact Assessment: Ground Water Environment (HJ 610-2011); Technical Guideline for Environmental Impact Assessment: Ecological Impact (HJ 19-2011); Technical Guidelines for Environmental Impact Assessment: Public Participation (public comment version, January 2011); Technical Guideline on Environmental Monitoring Quality Management (HJ 630-2011).
- **Technical standards for air, water, soil, and noise pollution, and pollutants:** Technical Guideline for Construction Project Environmental Risk Assessment (HJ/T 169-2004); Ambient Air Quality Standard (GB 3095-1996); Ambient Air Quality Standards (GB 3095-2012) [to replace GB 3095-1996 on January 1, 2016] ; Air Pollutant Integrated Emission Standard (GB 16297-1996); Hygienic Standard for the Design of Industries and Enterprises (TJ 36-79); Hygienic Standard for Methylmercaptan in Air of Residential Area (GB 18056-2002); Environmental Quality Standard for Noise (GB 3096-2008); Technical Specifications to Determine the Suitable Areas for Environmental Noise of Urban Area, (GB/T 15190-94); Environmental Quality Standards for Surface Water (GB 3838-2002); Quality Standard for Ground Water (GB/T 14848-93); Control Standard for Pollutants in Sludges for Agricultural Use (GB 4284-84);
- **Technical standards for construction sites:** Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011);
- **Technical standards for wastewater management:** Integrated Wastewater Discharge Standard (GB 8978-1996); Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB 18918-2002); Classification and Assessment Standards for Municipal Solid Waste (CJJ/T 102-2004).

11. In October 2012, the HPMO appointed the Environmental Protection Institute of the Coal Industry Hefei Design and Research Academy to prepare a Construction Project Environmental Impact Report (EIR) for domestic approval, in accordance with PRC's Environmental Impact Assessment Law of 2003 and the Directory for the Management of Different Categories of

Construction Project Environmental Impact Assessment, (MEP Order No. 2), 1 October 2008. The HPMO also appointed the Huainan Environmental Monitoring Station (HEMS) under the Huainan Environmental Protection Bureau (HEPB) to carry out environmental baseline monitoring, and an expert from the Huainan Normal University to conduct bird surveys in the Gaotang Lake and Shijian Lake areas. The EIR was approved by the HEPB on 5 May 2013. This EIA is based on information and findings in the EIR and domestic FSR prepared by the Anhui Transport Consulting and Design Institute Co., Ltd., supplemented by additional desktop research, fieldwork, and public consultation by the PPTA team.

12. **International agreements.** The PRC is a signatory to the following international agreements relevant to the project:

- Convention on Biological Diversity, 29 December 1993. To develop national strategies for the conservation and sustainable use of biological diversity;
- Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 21 December 1975. To stem loss of wetlands, recognizing their ecological functions and economic, cultural, scientific, and recreational value;
- Kyoto Protocol to the United Nations Framework Convention on Climate Change, 23 February 2005. To further reduce greenhouse gas emissions, including by establishing percentage reduction targets for the developed countries;
- Montreal Protocol on Substances That Deplete the Ozone Layer, 1 January 1989. To protect the ozone layer by controlling emissions of substances that deplete it;
- United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, 26 December 1996. To combat desertification and mitigate the effects of drought through national programs that incorporate long-term strategies supported by international cooperation and partnership arrangements;
- United Nations Framework Convention on Climate Change, 21 March 1994. To stabilize greenhouse gas concentrations to prevent dangerous interference with the climate system.

13. **ADB environmental safeguard requirements.** The project is classified as Category A for environment on the basis of ADB's Rapid Environmental Assessment (REA), requiring a comprehensive EIA report. For the EIA, ADB's Safeguard Policy Statement (SPS, 2009) requires assessment of: (i) project risks (including to biodiversity, physical cultural resources, climate change, communities,) and mitigation measures and assurances; (ii) a Grievance Redress Mechanism; (iii) definition of the project area of influence (termed the 'assessment area' in the domestic EIR); (iv) climate change mitigation and/or adaptation; (v) meaningful consultation and participation; and (vi) preparation of an EMP, including implementation schedule and performance indicators.

IV. DESCRIPTION OF THE PROPOSED PROJECT

A. Project components

14. The proposed project comprises four components (Table IV.1). These aim to improve wastewater collection (by constructing wastewater pipelines and pump stations), the urban water environment and flood management (by dredging and embankment construction on urban water channels and Gaotang Lake to improve water flow and increase flood protection capacities), and the urban lake environment (by the creation of wetlands, including planting of native aquatic vegetation in five lakes, Gaotang, Shijian, Long, Caoling, and Dajiangou). The fourth component, project management, is to strengthen the capacity of the Huainan Project Management Office (HPMO) and Implementing Agencies (IAs) to implement the project. Project component 1 and sub-components 2-1, 2-2 and 3-1 are structural measures. Sub-components 2-3, 2-4, 3-2, and 4 are non-structural measures, which do not have adverse environmental implications and are not assessed in this report.

Table IV.1: Huainan Project Components and Sub-components.

Component	Sub-component	Content	IA
1-Improved wastewater collection		1-Installation of sewers in the eastern and western areas (191.796 km) 2-Construction of 1 pump station in eastern area (0.463 m^3/s) 3-Construction of 2 pump stations in western area (0.316 m^3/s & 0.576 m^3/s)	HSMC
2-Improved urban water environment and flood management	2-1: Improvement of urban water channels	1-Baogongshan Channel (7.578 km, for 1/20 years flood) 2-Xiejiaji Channel (7.157 km, for 1/20 years flood) 3-Donghua Channel (8.934 km, for 1/20 years flood) 4-Old Longwang Channel (8.040 km, for 1/20 years flood) 5-Longwang Channel (4.816 km, for 1/20 years flood) 6-Longwang Flood Diversion Channel (12.650 km out of which 9.6 km will be newly constructed, for 1/20 years flood)	HMAMB
	2-2. Improvement of flood control facilities	1-Shijian Lake pump station (reconstruct, 30.0 m^3/s for 1/20 year flood) 2-Long Lake pump station (10.8 m^3/s → 30.0 m^3/s for 1/20 year flood) 3-Dajianggou pump station (6.0 m^3/s → 26.0 m^3/s for 1/20 year flood) 4-Gaotang Lake pump station No. 1 (new, 9.5 m^3/s for 1/20 year flood) 5-Gaotang Lake pump station No. 2 (new, 14.5 m^3/s for 1/20 year flood) 6-Gaotang Lake pump station No. 3 (new, 2.8 m^3/s for 1/20 year flood) 7-Gaotang Lake pump station No. 4 (new, 1.2 m^3/s for 1/20 years flood) 8-Gaotang Lake embankment (new, 14.47 km for 1/50 year flood)	
	2-3. Sustainable urban water environment management	Consulting services; Procurement of equipment for sustainable water environment management	HPMO
	2-4. Urban flood management and forecasting and warning system	Consulting services; Procurement of equipment for flood forecasting and warning system	
3-Improved	3-1. Improvement	1-Water quality improvement by constructing sedimentation ponds and	HMLMB

Component	Sub-component	Content	IA
urban lake environment	of urban lake environment	planting aquatic vegetation: Gaotang Lake 570,000 m^2; Shijian Lake 212,400 m^2; Caoling Lake 6,100 m^2; Long Lake 40,000 m^2; Dajiangou 18,000 m^2 2-Dredging of unconsolidated sediment: Long Lake: area 60,000 m^2, volume 60,000 m^3	
	3-2. Sustainable urban lake environment management	Consulting services; Procurement of equipment for sustainable urban lake environment management	HPMO
4-Project management support		Consulting services for project management: support for environmental management and monitoring, land acquisition and resettlement, procurement, consultant recruitment, equipment, training, workshops, monitoring and evaluation	HPMO

Key: HMSC-Huainan Municipal Sewage Company; HMAMB-Huainan Municipal Administration Management Bureau; HPMO-Huainan Project Management Office; HMLMB-Huainan Municipal Landscaping Management Bureau; IA-Implementing agency. Sources: FSR; ADB Aide Memoir for Mid-term Review Mission.

15. **Component 1: improvement of wastewater collection.** Three types of improvements will be made in the existing urban areas under this project:

(i) New sanitary sewers will be installed to separate collection of wastewater and storm water in areas currently served by combined sewer systems (CSS). Buildings already connected will be disconnected from the existing CSS then reconnected to the new sanitary sewer system (SSS). In these areas, wastewater will be sent to a wastewater treatment plant (WWTP) through the new SSS and storm water will be discharged to drainage channels through the storm sewers (previously the combined sewers).

(ii) New intercepting sewers will be installed along open sections of drainage channels to prevent combined wastewater and storm water from directly discharging into the drainage channels. These intercepting sewers are designed to collect and deliver wastewater to the WWTP for treatment during dry periods, but will allow overflow into the drainage channels during wet periods when the combined wastewater and storm water flow exceeds a certain amount.

(iii) New sanitary sewers will be installed for sections of the existing urban area that are currently unsewered but marked for future development. These new sections will not have any CSS and will be served by separate sanitary and storm water systems.

(iv) Three wastewater pump stations will be built to deliver the wastewater collected by the sanitary sewers installed in this project to the WWTPs (Table IV.2; Figure IV.2).

(v) Household/Property Connection. This will include only sanitary sewers, manholes, and interceptors. For old urban areas, actual building and household connections to the sewers will be financed either by property/community management or by HMG and local district governments. Design, construction, and supervision of the work will be performed by contractors selected through the government's tender process.

(vi) Design specifications for Component 1 are summarized in Table IV.3.

Table IV.2: Summary of Wastewater Pump Stations.

Pump Station	Flow Rate		Lift (m)	Floor Area (m^2)	Installed Capacity (kW)	Associated Collection System
	(L/s)	(m^3/d)				
Shiyaowan	463	40,003	18	1792.8	165	Binhe New District
Western No. 4	316	27,302	17	1755	135	W2
Western No. 5	576	49,766	19.1	1755	220	W3

16. For new developments and districts, individual property developers will be responsible for connecting new developments to the sewer lines as stipulated in local regulations.

17. **Component 2: Improvement of Urban Water Environment and Flood Management (4 sub-components).** Sub-components 2-1 and 2-2 involve structural interventions to improve water channels and flood control facilities such as storm water pump stations and embankment (Figure IV.3). Sub-components 2-3 and 2-4 involve non-structural measures such as consulting services and procuring equipment for water quality and flood management. Sub-component 2-1 will improve six urban water channels (Figure IV.3) totaling 49.175 km. These channels will be dredged to increase their drainage capacities to meet the design standards for 1-in-20 year storms (Table IV.1). An additional benefit will be the removal of pollutants in the channel sediment. Dredged material will comprise two parts, which will be handled differently: the top layer of unconsolidated sediment will be disposed at three proposed sites (Figure IV.3), while the underlying channel soil (which is expected to be less polluted) will be disposed in designated low-lying areas near the urban channels. The project EIR states that dredging depth for the top sediment layer ranges from 0.5–0.9 m and 0.1–0.5 m for the bottom channel soil layer.

Table IV.3: Summary of Wastewater Collection Improvements under Component 1.

Collection System	Service Area (km^2)	Planned Population	Design WW Flow (m^3/d)	% CSS	% SSS	Length of Sewer (km)			Pipe Diameter	Associated Pump Station
						Branch	Trunk	Total		
Western Urban Area (Served by the Western WWTP)										
W1	1.309	13,090	4,200	30%	70%	1.7	3.58	5.28	D500~D800	No. 5 (**New**) No. 1 (Existing)
W2	4.452	44,520	14,300	40%	60%	21.1	6.3	27.4	D500~D800	No. 2 (Existing) No. 4 (**New**)
W3	3.85	38,500	12,320	80%	20%	20.5	2.4	22.9	D500~D800	No. 6 (Existing)
W4	0.435	4,350	1,390	30%	70%	1.4	0.4	1.8	D500~D800	No. 3 (Existing)
Subtotal (West)	*10.046*	*100,4600*	*32,2100*	*54%*	*46%*	*44.7*	*12.68*	*57.38*		
Eastern Urban Area (Primarily served by the Eastern WWTP[1])										
E1	1.566	15,660	4,990	60%	40%	3.1	4.9	8	D500~D800	Tianshou Rd. (Existing)
E2	0.184	1,840	590	65%	35%	0.9	0	0.9	D500	Dongshan Rd. (Existing)
E3	7.29	72,900	23,350	60%	40%	15.15	18.2	33.35	D500~D800	Park Heliu (Existing)
E4	8.506	85,060	27,210	30%	70%	15.11	10.12	25.23	D500~D800	Changwai (Existing) Jiulonggang (Existing)
Subtotal (Existing Urban Area-East)	*17.546*	*175,4600*	*56,1400*	*45%*	*54%*	*34.26*	*33.22*	*67.48*		
Binhe New District	2.116	21,160	6,770	100%	0%	1.7	15.6	17.3	D500~D800	Shiyaowan (**New**)
Gaotang Lake New District[1]	6.938	69,380	22,150	100%	0%	14.84	12.59	27.43	D300~D1200	Entirely gravity fed
Subtotal (East)	*26.6*	*266,000*	*85,060*	*64%*	*36%*	*50.8*	*61.4*	*112.2*		
Total:	**36.646**	**366,460**	**117,270**	**61%**	**39%**	**95.5**	**74.09**	**169.59**		

Source: FSR. Note: SSS = sanitary sewer system; CSS = combined sewer system. The Gaotang Lake New District is also known as Binhu (Lake-side) New District and will be served by the future Gaotang Lake WWTP.

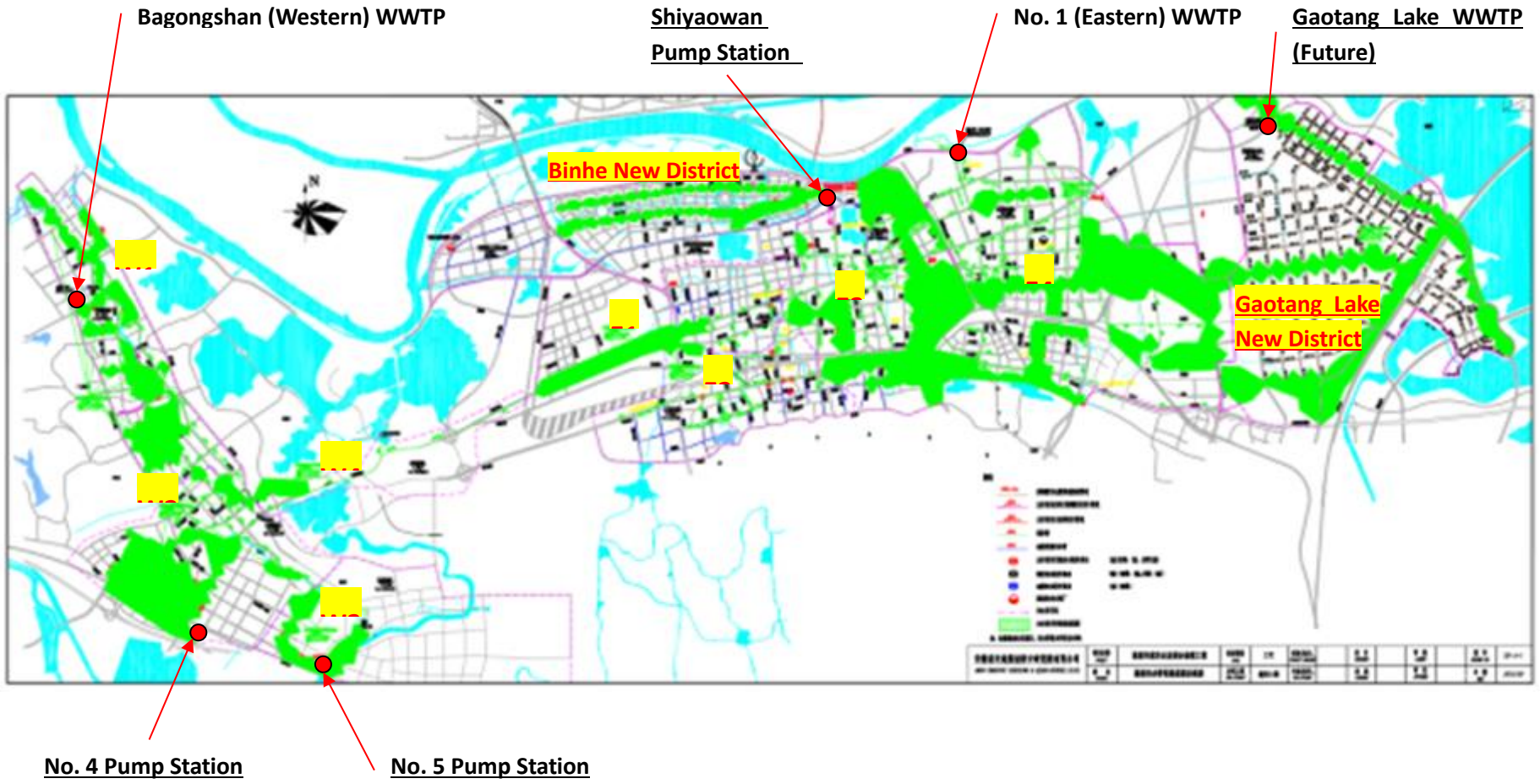


Figure IV.2: Improvement of Wastewater Collection in Eastern and Western Urban Areas

Note: WWTPs are not part of this component but are included in the figure for showing their locations.

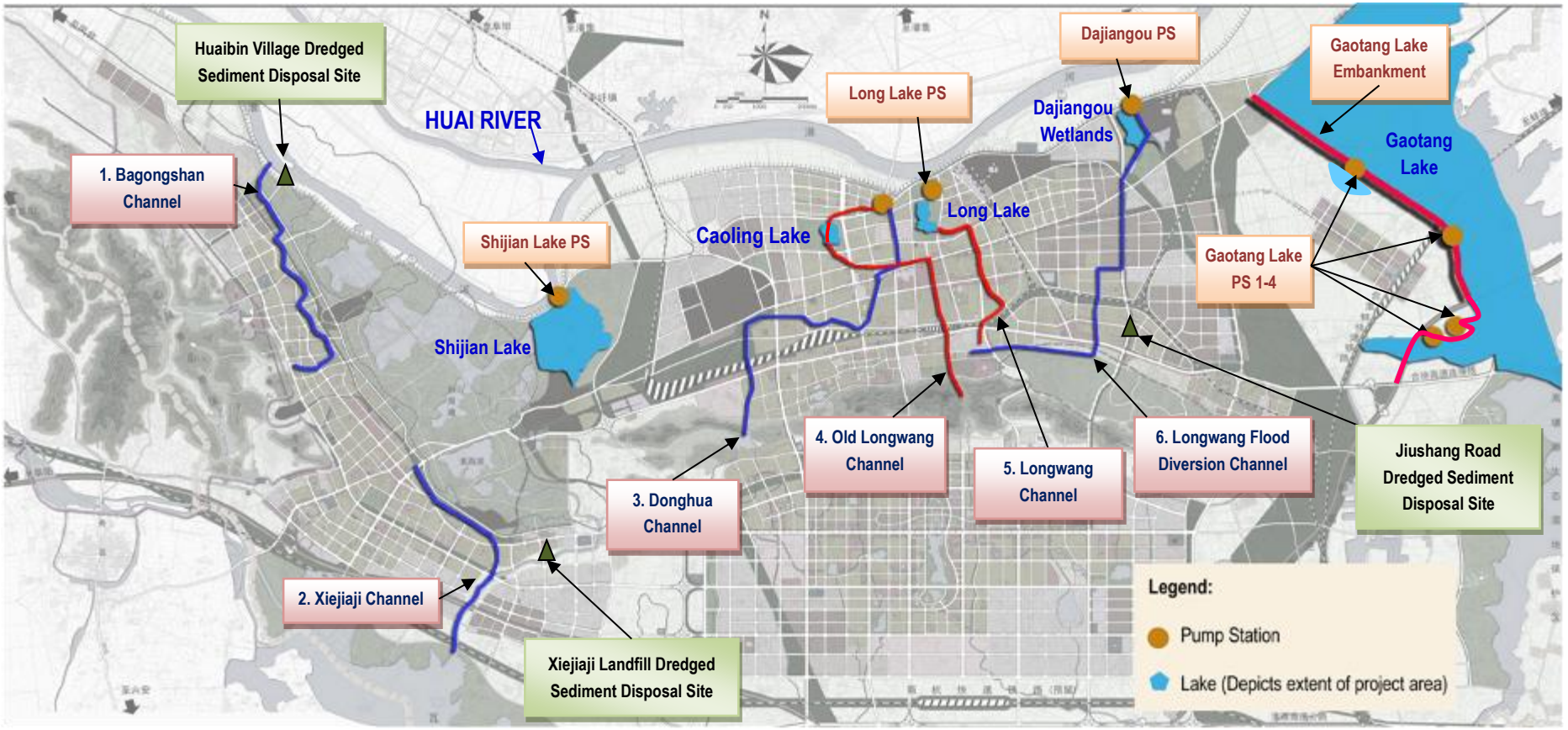


Figure IV.3: Locations of Urban Water Channels, Dredged Sediment Disposal Sites, Storm Water Pump Stations, Embankment and Lakes

Table IV.4: Summary of Urban Water Channel Improvements

No.	Drainage Channel	Catchment	Catchment Area (km^2)	Length (m)	Design Flow (m^3/s)	% Culvert	% Open Channel	Embankment Length (km)[1]	Pump Station
1	Bagongshan	Nantang	26.16	7,578	18.7 – 68.5	10%	90%	13.61	
2	Xiejiaji	Shijiahu	19.57	7,157	5 – 40	29%	71%	10.11	
3	Donghua	Dongshan Channel	13.69	8,934	33.6 – 62.4	37%	63%	11.23	Caozuizi
4	Old Longwang	Caozuizi	14.75	8,040	38.6 – 125	59%	42%	6.68	Caozuizi
5	Longwang	Longwang Channel	7.74	4,816	38.6 – 49.7	68%	32%	3.10	Long Lake
6	Longwang Flood	Dajiangou	25.1	12650*	18.3 – 65.0	33%	68%	17.08	Dajiangou
		Total:	107.01	49,175		37%	63%	61.81	

Source: FSR; EIR. Note: Embankment length = the length of open channel x 2 (left and right banks). *9,609 m of new channel.

18. Approximately 153,148 m^3 of unconsolidated sediment and 754,847 m^3 channel soil will be removed from the six urban water channels (Table IV.5; the channel portion includes soil from channel widening). Temporary land take for these sites totals 362,620 m^2. The disposal sites for the dredged channel soil and unconsolidated sediment (Table IV.6) are vacant land alongside the urban channels so as to minimize transport distance. These vacant sites total 443,404 m^2 consisting of 197,731 m^2 (45%) dry land, 84,986 m^2 (19%) ponds, 76,100 m^2 (17%) paddy plots, 65,631 m^2 (15%) wasteland, 12,231 m^2 (3%) vegetable plots, and 6,725 m^2 (2%) reed fields.

Table IV.5: Urban Water Channel Dredging Volumes. Source: EIR.

Channel Name	Dredging Volume (m^3)		
	Top Unconsolidated Sediment Layer	Bottom Channel Soil Layer	Total Volume
Bagongshan Channel	33,106	166,055	199,161
Xiejiaji Channel	49,362	283,600	332,962
Donghua Channel	29,482	37,191	66,673
Old Longwang Channel	12,898	209,600	222,498
Longwang Channel	2,700	17,491	20,191
Longwang Flood Diversion Channel	25,600	40,910	66,510
Total:	153,148	754,847	907,995

Table IV.6: Dredged Material Disposal Sites. Source: EIR.

Disposal material	Site Name / Location		Area (m^2)	Capacity (m^3)
Unconsolidated sediment	Jiushang Road		28,499	88,300
	Xiejiaji Landfill		20,609	62,300
	Huaibin Village		21,792	62,600
	Total for unconsolidated sediment:		**70,900**	**213,200**
Channel soil	Bagongshan Channel	Site 1	28,678	61,735
		Site 2	2,331	7,900
		Site 3	1,477	1,470
		Site 4	12,231	18,350
		Site 5	38,311	76,600
		Subtotal:	*83,028*	*166,055*
	Xiejiaji Channel	Site 1	7,400	11,000
		Site 2	22,600	22,000
		Site 3	5,500	11,000
		Site 4	32,200	96,600
		Site 5	27,600	50,000
		Site 6	13,000	13,000

Disposal material	Site Name / Location		Area (m^2)	Capacity (m^3)
		Site 7	35,500	80,000
		Subtotal:	*143,800*	*283,600*
	Donghua Channel	Site 1	11,871	19,080
		Site 2	6,725	18,111
		Subtotal:	*18,596*	*37,191*
	Old Longwang Channel	Site 1	5,565	10,800
		Site 2	14,890	30,110
		Subtotal:	*20,455*	*40,910*
	Longwang Channel	Site 1	8,745	17,491
	Longwang Flood Diversion Channel	Site 1	2,400	5,670
		Site 2	2,650	5,160
		Site 3	5,090	10,000
		Site 4	17,000	33,800
		Site 5	5,100	10,100
		Site 6	2,150	4,050
		Site 7	77,590	46,950
		Site 8	56,800	93,870
		Subtotal:	*168,780*	*209,600*
	Total for channel soil:		**443,404**	**754,847**

19. Around 61.81 km of embankment and revetment will be constructed along the water channels (Table IV.4). An embankment is a ridge of earth or stone that confines a waterway. A revetment is a facing used to protect and support an embankment against erosion by moving water (i.e. flowing or wave action). For embankment, narrow channel sections will have vertical embankments while wider channel sections will have a composite of vertical and sloped embankments (Table IV.7). Hard revetments will be used in submerged areas and narrow channel sections to prevent erosion of the embankment, and soft or vegetated revetment will be used for areas above the typical water level. Materials for the ecological protection slope in the upper part of the composite revetment will be selected based on comparison of permeability, stability, safety, ease of construction, and vegetation growth of the alternative materials.

Table IV.7: Proposed embankments and revetments for the urban water channels.

Channel	Chainage	Type of Revetment and Embankment							
		Reinforced concrete BC	Pipe culvert	Concrete protective layer	Ecological block RW	Small ecological block RW	Gabion mat RW	Ecological bag slope protection	VB
Bagongshan Channel	0+000~0+184	√							
	0+184~0+613				√				
	0+700~1+285						√	√	√
	1+291~2+146				√				√
	2+146~2+309	√							
	2+309~2+500						√	√	√
	2+500~2+875	√							
	2+875~3+080				√				
	3+080~7+525						√	√	√
Xiejiaji Channel	0+000~0+570	√							
	0+570~0+280	√							
	0+820~1+020					√			
	1+020~1+083	√							
	1+083~1+750					√			

Channel	Chainage	Type of Revetment and Embankment							
		Reinforced concrete BC	Pipe culvert	Concrete protective layer	Ecological block RW	Small ecological block RW	Gabion mat RW	Ecological bag slope protection	VB
	1+750~2+050					√			
	2+050~2+720	√							
	2+720~2+850				√			√	
	2+850~2+977	√							
	2+977~3+070				√			√	
	3+070~3+177	√							
	3+177~3+450				√			√	
	3+450~3+763	√							
	3+763~6+100						√		√
	6+100~7+157					√			
Old Longwang Channel	0+000~4+530	√							
	4+530~6+000							√	√
	6+000~8+040				√				
Longwang Diversion Channel	0+000~1+100		√						
	1+100~1+400		√						
	1+400~1+700		√						
	1+700~2+980	√							
	2+980~5+110			√					
	5+110~5+270	√							
	5+270~6+210							√	√
	6+210~6+560	√							
	6+ 560~7+390						√	√	√
	7+390~7+990	√							
	7+990~11+20				√				
	11+200~12+6						√	√	√
Donghua Channel	0+000~1+560				√				
	1+560~1+820	√							
	1+820~2+350				√				
	2+350~2+450	√							
	2+450~3+850						√	√	√
	3+850~5+200	√							
	5+200~5+420				√				
	5+420~7+100	√							
	7+100~8+934						√	√	√
Longwang	0+000~4+816	√							

Source: FSR. Note: Vegetation blanket may be of sourced coconut shred, natural palm fiber or turf. RW=retaining wall. BC=box culvert. VB = vegetation blanket.

20. **Sub-component 2-2: Improvement of Flood Control Facilities.** This comprises reconstructing one existing stormwater pump station (SPP; Shijian Lake), upgrading two SPPs (Long and Dajiangou Lakes) and constructing four new SPPs (Gaotang Lake No. 1-4) and a 14.47 km embankment along the western bank of Gaotang Lake (Tables IV.1, I.8; Figure IV.3).

Table IV.8: Summary of Storm Water Pump Stations. Source: FSR.

Pump Station	Status	Catchment Area (km^2)	Total Flow (m^3/s)		No. of Pumps	Lift (m)	Receiving Water Body
			Current	Design			
Shijian Lake	Reconstruction	37.71	-	30	5	5.9	Huai River
Long Lake	Existing	14.77	10.8	30	4	6.2	Huai River

Dajiangou	Existing	25.1	6	26	4	6.2	Huai River
Gaotang Lake #1	New	4.13	-	9.5	3	2.5	Gaotang Lake
Gaotang Lake #2	New	6.3	-	14.5	4	2.5	Gaotang Lake
Gaotang Lake #3	New	0.65	-	2.8	4	2.5	Gaotang Lake
Gaotang Lake #4	New	0.4	-	1.2	4	2.5	Gaotang Lake

21. The pump stations will transfer water from the urban water channels and Shijian Lake to the Huai River or Gaotang Lake. They are designed to allow drainage by gravity when river levels are low, and pumping when river levels are high and the sluice gates closed. Pump sizes are based on modeling of the expected hydraulic flow. The pump station structure is sized to contain and support the equipment. Elevation of the operating floor is selected to reduce flood damage to pumping equipment. The typical design of this type of station is wet-pit (sump) using vertical axial-flow or submersible pumps. Axial flow pumps are suitable for large flows and a head of $\leq$10 m. Centrifugal pumps are usually selected for a head range of 20-30 m. Mixed-flow pumps are selected for conditions in between. Tubular pumps are suitable for head range of 3-5 m. Small submersible pumps, with an integrated pump and motor body, do not require housing in a pump station, but large submersible pumps require a building to support the lifting equipment.

22. The proposed 14.47 km Gaotang Lake embankment is designed to protect the planned Gaotang Lake New District, to be developed by 2020, from a 50 year flood. The embankment will be 8 m wide and 7 m above lake level (25 m above sea level), which is 1.6 m higher than the 50 year flood elevation. A 6 m-wide road will be built on the embankment for flood and emergency response. Construction will result in three small lakes on the landward size of the embankment, near Gaotang Lake Pump Stations 1, 3 and 4 (Figure IV.3). These lakes will be connected to the main lake through sluice gates. Embankment and revetment types will be similar to those described for the water channels, i.e. hard revetments in submerged areas to prevent erosion of the embankment, and soft or vegetated revetment for areas above the typical water level.

23. **Sub-component 2-3: Sustainable Urban Water Environment Management.** This non-structural intervention includes formation of Community Environmental Supervision and Flood Management Teams (CESFMT) to address litter and solid waste in urban water channels.

24. **Component 3: Improvement of Urban Lake Environment.** Sub-component 3-1 (improvement of urban lake environment) is the design and installation of constructed wetlands in Gaotang, Shijian, Caoling, Long, and Dajiangou Lakes, for improving water quality. No dredging will be undertaken except Long Lake, where 40,000 m^2 will be dredged to remove 60,000 m^3 of polluted unconsolidated sediment. Constructed wetlands will be located at the influent of drainage ditches and streams entering the lakes, and are designed to remove nutrients and COD. Designs include a combination of screens to remove coarse particles and garbage, sedimentation ponds, wetlands with surface flow or submerged flow to remove nutrients and COD, and ecological ponds (Table IV.9; Figure IV.4). Sub-component 3-2 (sustainable urban lake environment management) is a non-structural component and includes water quality monitoring.

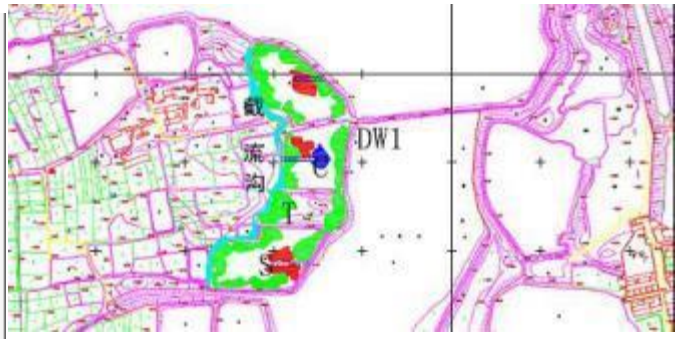
Table IV.9: Summary of Design Information for the Constructed Wetlands in Urban Lakes

Lake	Location	Design type	Size (m^2)	Incoming Water		Water Retention Time (day)			Water Depth (m)	Types of Aquatic Plants (areal %)	Outgoing Water Quality
				Quantity (m^3/a)	Quality (mg/L)	Submerged Flow	Surface Flow	Ecological Ponds			
Gaotang	GW1	Sedimentation pond + 2 ecological ponds	400,000	175,000	COD–88.0, TN–21.5, NH_3-N– 18.5, TP–0.93	---	---	5	2	66% T, 24% C, 6% P, 4% F	COD: 39.6, TN: 10.3, NH_3-N: 5.18, TP: 0.37
	GW3	Sedimentation pond + 3 ecological ponds	170000	120,000	COD–88.0, TN–21.5, NH_3-N –18.5, TP–0.93	---	---	5	2		COD: 39.6, TN: 10.3, NH_3-N: 5.18, TP: 0.37
Shijian	SW1	Screen + sedimentation pond + submerged treatment unit + ecological pond	120,000	185,000	COD–116, TN– 30.7, NH_3-N –27.8, TP–2.28	3	---	5	0.5~1	47% T, 17% S, 13% F, 12% P, 11% C	COD: 20.8, TN: 6.63, NH_3-N: 1.55, TP: 0.17
	SW2	Screen + sedimentation ditch + 3-level ecological pond	66,000	201,000	COD–120, TN– 32.0, NH_3-N –27.2, TP–2.41	---	---	5	0.5~1		COD: 54.0, TN: 15.4, NH_3-N: 7.62, TP: 0.72
	SW5	Screen + sedimentation ditch + surface flow wetland	30,000	177,000	COD–121, TN–32.0, NH_3-N – 27.8, TP–2.38	---	4	5	0.5~1		COD: 20.8, TN: 6.14, NH_3-N: 1.94, TP: 0.25
Caoling	CW1	Screen + sedimentation ditch + ecological pond	6,100	241,000	COD–121, TN –34.4, NH_3-N – 31.5, TP–2.43	---	---	5	1	66% T, 22% C, 11% F, 0.9% S, 0.1% P	COD: 54.4, TN: 16.5, NH_3-N: 8.82, TP: 0.73
Long	LW1	Screen + sedimentation pond + 3 ecological ponds	40,000	4,053,000	COD–110, TN– 27.0, NH_3-N –24.0, TP–2.12	---	---	5	1	40% T, 28.9% F, 16% C, 15% S, 0.1% P	COD: 49.5, TN: 13.0, NH_3-N: 6.72, TP: 0.64
Dajiangou	DW1	Interception ditch + 3 ecological ponds	18,000	142,000	COD–64.0, TN – 15.0, NH_3-N –11.0, TP–2.34	---	---	5	1	63% T, 27% S, 5.9% P, 4% F, 0.1% C	COD: 28.8, TN: 7.20, NH_3-N: 3.08, TP: 0.70

Notes: T = emergent plants such as *Scirpus tabernaemontani*, *Lythrum salicaria, Phragmites australis, Acorus calamus*; F = floating leave plants such as *Herba spirodelae* ; C = submergent plants such as *Hydrilla verticillata, Vallisneria natans* ; S = aquatic herbaceous plants such as *Canna indica, Iris tectorum* ; P = floating plants.

Constructed Wetlands GW1 and GW3 in Gaotang Lake

Constructed Wetlands SW1, SW2 and SW3 in Shijian Lake



Constructed Wetland CW1 in Caoling Lake **Constructed Wetland LW1 in Long Lake** **Constructed Wetland DW1 in Dajiangou**

Figure IV.4: Layouts of Constructed Wetlands in Urban Lakes

B. Expected environmental and social benefits

25. The expected project benefits include improved flood control, reduced incidence of flooding and waterlogging, and improved water quality, for over 962,000 people (39% of Huainan's population), comprising 884,000 urban population (of which 60,000, or 6.2%, are poverty-stricken) and 78,000 rural population (of which 5,000, or 6.4%, are poverty stricken) (PPTA Interim Report 2012) (Table IV.10).

Table IV.10: Summary of expected project benefits

Component / Sub-component	Benefits
Dredging of urban water channels	(i) Removal of 153,148 m^3 of nutrient laden sediment in the 6 project channels including c.70 t TN and 70 t TP. (ii) Deepening and widening these channels will achieve flood control to 20-year return period, reducing the risk of waterlogging and damage and/or loss of life and property.
Storm water pump stations	The 7 pump stations will improve flood control to 20-year return period, thus reducing the risk of waterlogging and damage and/or loss of life and property.
Embankment construction	(i) 62 km of embankment on the urban water channels and 14.47 km of embankment along the western shoreline of Gaotang Lake will no longer suffer from soil erosion. (ii) Flood control at Gaotang Lake will be improved to 50-year return period.
Wastewater collection	170 km of pipelines installed will collect 43 million m^3 of wastewater per year from the eastern and western urban areas for treatment, improving the Huai River water quality by removing this quantity of untreated wastewater from going into the Huai River
Constructed wetlands in urban lakes	Constructed wetland in the 5 urban lakes will (i) remove ~329 t COD, 78 t TN, 104 t NH_3-N and 8 t TP each year from these lakes, (ii) provide habitats for flora and fauna

26. Under Component 1, 43 million tons of untreated wastewater per year (equivalent to 37% of the projected production in 2020) will no longer be discharged into the Huai River. This is estimated to remove 23,476 t COD, 14,665 t BOD_5, 19,564 t suspended solids (SS), 978 t NH_3-N and 244 t phosphate per year from the Huai River system (Table IV.11).

Table IV.11: Estimated reduction of untreated wastewater and pollutants discharging into Huai River as a result of the project. Source: FSR

Location	Untreated Wastewater (m^3/a)	Water Quality Pollutant (t/a)				
		COD	BOD_5	SS	NH_3-N	PO_4 (as P)
Eastern urban area	31,046,900	14,716	9,190	12,264	613	153
Western urban area	11,756,650	8,760	5,475	7,300	365	91
Total:	**42,803,550**	**23,476**	**14,665**	**19,564**	**978**	**244**

27. Dredging of the six project urban water channels will remove accumulated pollutants. Using the baseline sediment quality data collected (Section V.F.5), and assuming that (i) the averages for each of the channels is representative of the whole channel and (ii) that river sediment density is on average 1.3 g/ml (for converting dredged quantity from m^3 to kg; based on a recent AECOM study in the Shenzhen River), it is estimated that dredging will remove 153,148 m^3 of sediment containing 70 t TN and 70 t TP (Table IV.12). Channel works will also increase flood protection to 1-in-20 year storm events. At Gaotang Lake, the proposed embankment will result in flood protection for 1 in 50 year flood events.

Table IV.12: Estimated TN and TP removal from urban water channels by dredging. Source: PPTA.

Water Channel	Average Moisture Content	mg/kg Dry Weight		mg/kg Wet Weight		Dredged Quantity		Removal Quantity (t)	
		TN	TP	TN	TP	in m^3	in kg	TN	TP
Bagongshan	0.830	1449	1813	246.33	308.21	33,106	43,037,800	10.6	13.3
Xiejiaji	0.845	1859	1945	288.15	301.48	49,362	64,170,600	12.4	13.0
Donghua	0.825	2093	1213	366.28	212.28	29,482	38,326,600	15.8	9.1
Old Longwang	0.875	1850	2377	231.25	297.13	12,898	16,767,400	10.0	12.8
Longwang	0.870	1855	2191	241.15	284.83	2,700	3,510,000	10.4	12.3
Longwang Flood Diversion	0.835	1608	1195	265.32	197.18	25,600	33,280,000	11.4	8.5
							Total:	70.6	69.0

28. Water quality entering the five urban lakes is currently worse than category V due to high nutrient levels. Based on documented inflow and outflow volumes and water quality (Section IV.B), it is estimated the constructed wetlands will remove 330 t COD, 78 t TN, 104 t NH_3-N and 8 t TP from these lakes each year (Table IV.13). The constructed wetlands will be built using only native species, and will also provide new habitats for aquatic flora and fauna.

Table IV.13: Predicted reduction of pollutants (tons/year) by constructed wetlands. Source: EIR

Lake	Constructed wetland	COD	TN	NH_3-N	TP
Gaotang	GW1	8.47	1.96	2.33	0..11
	GW3	5.81	1.34	1.60	0.08
	Subtotal	*14.28*	*3.30*	*3.93*	*0.19*
Shijian	SW1	17.52	4.45	4.85	0.39
	SW2	13.28	3.34	3.94	0.34
	SW5	17.80	4.58	4.57	0.38
	Subtotal	*48.60*	*12.37*	*13.36*	*1.11*
Caoling	CW1	16.04	4.31	5.47	0.41
Long	LW1	245.20	56.90	70.04	5.99
Dajiangou	DW1	5.00	1.11	11.25	0.23
	Total Reduction	**329.12**	**77.99**	**104.05**	**7.93**

V. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Introduction

29. The environmental data described in this EIA is largely from information in the domestic EIR, which was prepared based on PRC requirements. In the PRC, environmental baseline monitoring data are collected by a certified institute or individual. This is often the local Environmental Monitoring Station (EMS), which is usually a subsidiary or division of the local Environmental Protection Bureau (EPB), except for specialized fields beyond the mandate of the EMS (e.g. ecology, for which a local university may be certified). For this project, the Huainan EMS (HEMS) undertook baseline sampling of the quality of air, noise, surface and ground water, and soil and sediment quality. Ecological surveys were conducted by Anhui University except for the bird survey, conducted by an ornithologist from Huainan Normal University. Sensitive receptors comprised residential areas, schools, and clinics (Table V.20). Sampling for environmental parameters was conducted at some or all sensitive receptors as well as the project sites.

B. Location and setting

30. The project sites are located in the urban area south of the Huai River, within the districts of Datong, Tianjia'an, Xiejiaji and Bagongshan (Figures V.2-V.3). These four urban districts have a total administrative area of 976.4 km^2 and a total population of 1.237 million. The layout of the urban area of Huainan is related to the development of its traditional coal industry and determined by the water transport advantage of the Huai River and the location of coal mining sites. The spatial industrial layout is that existing coal mines are located mainly north of the Huai River, while thermal power plants and other energy dependent enterprises such as chemical manufacturing are located mainly south of the River. Figure V.1 shows the layout of the developed area, bounded by Shungenshan to the south and Bagongshan to the west.

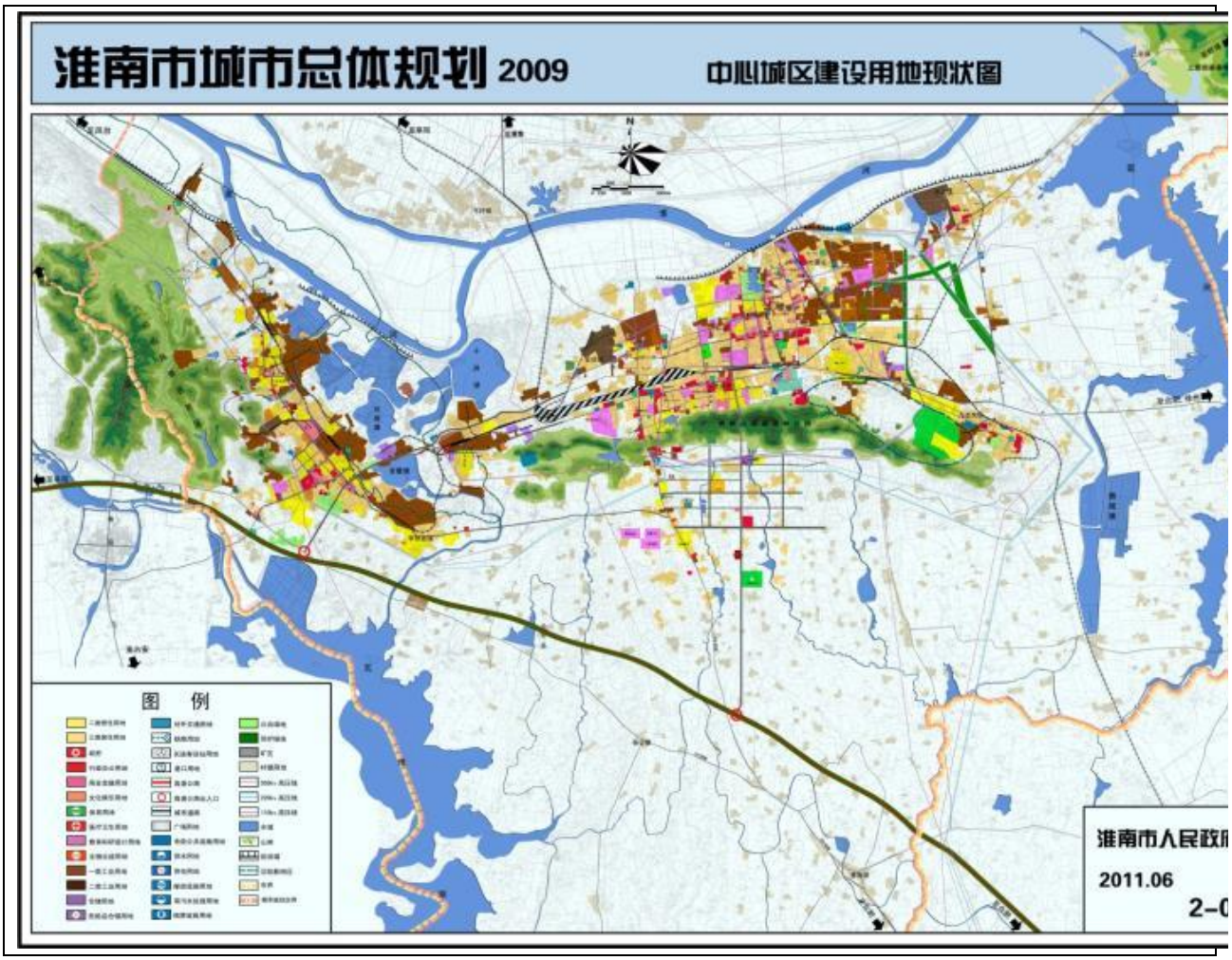


Figure V.1: Map of Developed Area in Huainan Municipality

C. Topography, geology and soils

31. The topography slopes from northeast to southwest, at elevations of 20-24 m above sea level (asl). South of the Huai River, the terrain is hilly and is part of the Jianghuai Hill Region. Low hills extend from east to west, including Shungengshan Hill and Bagongshan Hill, with slopes of ~10^{o} gradient at 40–75 m asl. Below the hill slopes are interlacing and connecting flood alluvial terraces with approximately 2^{o} gradient at 30–40 m asl. North of Shungengshan and the flood alluvial terraces are the Huai River alluvial terraces, below 25 m asl. Further north is the Huai River High Flood Plain, at 17–20 m asl, then the Huai River riverfront shoal. Below Shungengshan are Gaotang Lake flood alluvial terraces to the east and Wabu Lake flood alluvial terraces to the west. North of the Huai River, the terrain is flat and part of the Huaibei Plain, with low-lying plains. Storm water runoff from the hills in the south flows north through the urban area to the Huai River and into the lakes along the west, north and east of the urban area.

32. Soils in the Huainan region are mainly yellow-brown and paddy soils. Yellow-brown soils evolved from Late Pleistocene loess-like sediments. These soils are fertile and are the major rain fed soils used for cultivation of dry crops such as vegetables. Paddy soils evolved from the fertile alluvial plains, with thick fertile layers suitable for growing rice and wheat.

D. Climate

33. Huainan belongs to the warm temperate semi-humid monsoon climate zone with mild temperature, moderate rainfall, distinctive seasons and long frost-free period. Wind direction shows apparent regularity in seasonal changes, with south-southeast wind in the summer and east-northeast wind in the winter (Table V.1).

Table V.1: Huainan's Weather Statistics. Source: EIR.

Parameter	Value
Annual average temperature	15.2 ^{o}C
Extreme highest temperature	41.1 ^{o}C (on August 24, 1959)
Extreme lowest temperature	-21.7 ^{o}C (on January 31, 1969)
Annual average precipitation	980.9 mm
Highest annual precipitation	1,522.6 mm
Lowest annual precipitation	450.3 mm
Frost free period in a year	220 days
Annual average wind speed	2.3 m/s
Highest wind speed	22 m/s
Maximum frozen soil depth	0.3 ~ 0.6 m

E. Water resources

1. Overview

34. Huainan Municipality is located in the Huai River basin. The Huai River is located mid-way between the Yellow and Yangtze Rivers and is 1,078 km long, of which 430 km (43%) are in Anhui Province. The river originates in the Tongbai Mountains in Henan Province and flows from west to east through southern Henan, northern Anhui, and northern Jiangsu provinces, entering the Yangtze via Lake Hongze. The river basin (Figure V.2) covers 270,000 km^2 in four provinces (Henan, Anhui, Jiangsu, Shandong) and a human population of 165 million. The basin produces one-sixth of the PRC's food, including a quarter of its cash crops. Major tributaries in Huainan include the Xifei, Jia, Nihei, Yao, Dongfei, and Yongxing. Major lakes include Jiaogang, Gaotang, Wabu and Shijian. The Huai River and Wabu and Gaotang Lakes are the key sources of drinking water for Huainan Municipality.

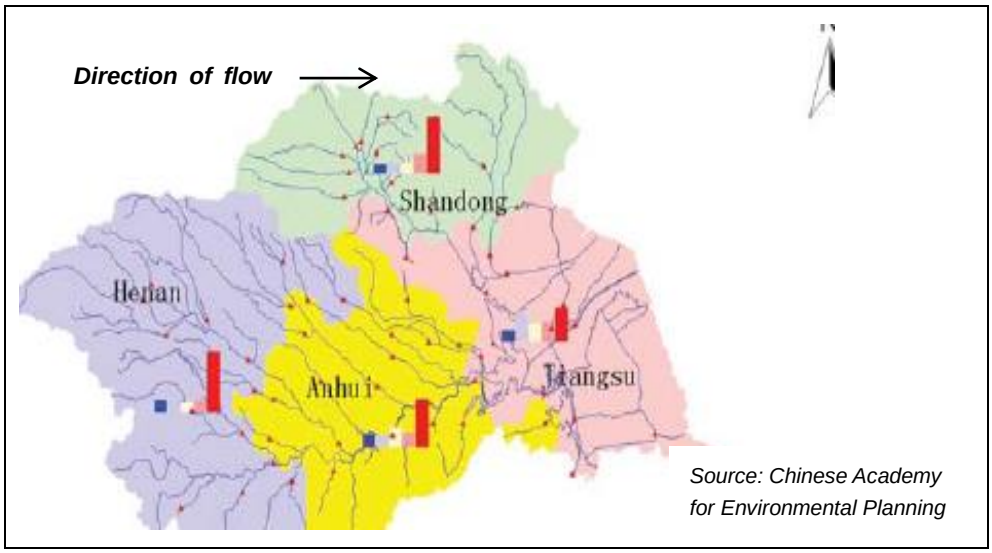


Figure V.2: The Huai River basin

35. The Huai River is the major water source for agriculture, industries and households in Huainan Municipality. The length of the river in the municipality is 87 km (8% of its total length), with average width of 400 m (250–300 m and 400-800 m in the dry and wet seasons respectively). Its net water surface area is 21.5 km^2. In the municipality there are eight major sub-catchments (Table V.2), nine major rivers (Table V.3) and 10 large lakes (Table V.4). In 2011 the municipal water resource was 696 million m^3 and the volume of Huai River flowing through Huainan was 7.69 billion m^3, much less than the multi-year annual average of 20.87 billion m^3.

Table V.2: Catchment Basins of the Main Urban Area in Huainan. Source: FSR

Area	Basin Name	Basin Area (km^2)
Western	Shijian Lake	37.71
	Nantang Catchment Area	26.16
	Shijia Lake Catchment Area	19.57
Eastern	Caozuizi Catchment Area	14.75
	Dongshan Channel Catchment Area	13.69
	Longwang Channel Catchment Area	7.74
	Dajiangou Catchment Area	25.10
	Gaotang Lake	1500

Table V.3: Major Huai River Tributaries in Huainan Municipality

Name	Origin	Basin Area (km^2)	Total length (km)	Length in municipality (km)
Xifei	Henan Province Zhoukou City	1,700	178	41.2
Dongfei	Feixi County Zipeng Mountain	4,200	122	8.7
Jia	Fengtai County Zhouzhuang Village	188	29.5	27
Ni	Fengtai County Zhuji Village	720	62	62
Yao	Dingyuan County Langwo Mountain	650	62.7	17.7
Gang	Lixin County Hong River Danfengji	---	53.6	35
Hei	Fengtai County Zhouji Village	---	62	44.9
Cihuai	Cihepu	---	133.2	31.5
Yongxin	Fengtai County Sunweizi Village	---	44.5	44.5

Source: *Huainan Area Water Resources Protection and Usage Plan*

Table V.4: Major Lakes in Huainan Municipality

Name	Location	Surface Area (km^2)	Water System
Shijian Lake	Xiejiaji District Wangfenggang Town	8.25	Huai River
Huajia Lake	Fengtai County Maoji Town	16.8	Huai River
Jiaogang Lake	Fengtai County Maoji Town	28.6	Xifei River
Daijia Lake	Panji District Luji Village	0.64	Huai River
Qianjia Lake	Bagongshan District Xinzhuangzi Mine	0.21	Huai River
Hudajian	Datong District Luohe Town	0.59	Huai River
Gaotang Lake	Datong District Shangyao Town	21.6	Yao River
Caicheng Lake	Datong District Shangyao Town	3.04	Gaotang Lake
Wabu Lake	Xiejiaji District Liyingzi Town	1.80	Dongfei River
Shijia Lake	Xiejiaji District Liyingzi Town Yingzi Village	2.34	Wabu Lake

Source: *Huainan Area Water Resources Protection and Usage Plan*

36. In 2011, industries and agricultural irrigation accounted for 87% of water use (Table V.5).

Table V.5: Huainan Municipality Water Resources, Supply and Consumption in 2011

Description	Quantity
Total water resources	696 million m^3
Surface water resources	514 million m^3 (74%)
Ground water resources	182 million m^3 (26%)
Huai River flowing through Huainan	7690 million m^3
Total water supply	1957 million m^3
Surface water supply	1802 million m^3 (92%)
Ground water supply	155 million m^3 (8%)
Total water use	1957 million m^3
Agriculture irrigation use	619 million m^3 (32%)
Forestry, animal husbandry, fisheries and livestock use	21 million m^3 (1%)
Industrial use	1079 million m^3 (55%)
Domestic use	187 million m^3 (9%)
Other uses (public facilities & scenic water)	51 million m^3 (3%)
City-wide per capita water use	543.4 m^3
Domestic per capita use	53.0 m^3
Total water consumption	773 million m^3 (39% of water use)
Agriculture irrigation consumption	497 million m^3 (80% of water use)
Forestry, animal husbandry, fisheries and livestock consumption	20 million m^3 (95% of water use)
Industrial consumption	99 million m^3 (9% of water use)
Domestic consumption	67 million m^3 (36% of water use)
Other consumptions (public facilities & scenic water)	30 million m^3 (59% of water use)

Source: Huainan Water Resources Bureau. 2012. *2011 Huainan Municipality water resources report*.

2. Water quality, pollution, treatment, and supply

37. **Water quality.** Water quality in most of the lakes and channels of Huainan Municipality is low. Most urban channels are lower than PRC's national Class V, the lowest possible, due to high levels of organic nutrients. Gaotang and Shijian Lakes range from Class III-IV. The municipality has two designated water sources used to supply potable water to the municipality's population,

the Huai River and Wabu Lake. In 2011, the source at Huai River had eight discharge points showing 100% compliance with the discharge standard, while the one in Wabu Lake with one discharge point did not comply with the discharge standard. The Gaotang Lake discharge point had a compliance rate of only 1.1% (Table V.6).

Table V.6: Pollutants discharged in Water Functional Areas, Huainan Municipality, 2011

Site	WFA	Discharge Point No.	WW received (t/y)	Pollutant Quantity Received (t/y)						Comply with GB 8978-1996		
				COD_{Cr}	BOD_5	NH_3-N	Volatile Phenol	TP	TN	Discharge Point No.	WW quantity (t/y)	Compliance Rate
Huai River	Fengtai industrial water use area	7	1,300,600	257.497	83.501	51.653	0.035	4.99	59.85	1	14,400	1.1%
	Fengtai Bagongshan transitional area	7	11,286,500	492.925	180.697	26.921	0.041	6.81	151.98	5	10,989,500	97.4%
	Huainan drinking water source area	8	5,208,200	139.855	53.366	2.845	0.015	2.90	32.09	4	5,208,200	100%
	Huainan effluent discharge control area	9	125,145,000	4419.844	1728.980	2311.605	0.528	92.76	5760.07	6	57,708,000	46.1%
	Huainan Bengbu transitional area	4	7,219,700	786.930	264.988	161.683	0.030	15.58	191.83	4	2,218,900	30.7%
Xifei River	Lixin Fengtai agri-fisheries water use area	8	7,879,500	257.150	90.211	10.480	0.024	3.10	35.94	8	7,879,500	100%
Gaotang Lake	Huainan water use area	2	2,693,800	460.500	131.627	36.738	0.096	8.06	51.66	1	30,400	1.1%
Wabu Lake	Water diversion and source protection area	1	287,600	35.383	12.070	8.828	0.007	0.82	11.82	0	0	0%
Total		46	161,021,000	6,850.08	2,545.44	2,610.75	0.78	135.01	6,295.24	29	84,048,800	52.2%

Note: Compliance based on COD_{Cr} and NH_3-N in *Integrated Wastewater Discharge Standard* (GB 8978-1996). Compliance rate based on amount of wastewater achieving compliance with COD_{Cr} and NH_3-N, over the total wastewater quantity. Source: Huainan WRB. 2012. *2011 Huainan Municipality water resources report*. WFA-Water Functional Area; WW-wastewater.

38. **Water treatment and supply.** Potable water is presently supplied to 99.75% of the urban area of the municipality, by seven water treatment plants (WTPs). These have a total capacity of 550,000 m^3/d (Table V.7). Five WTPs are along the Huai River and two are at Wabu Lake. Huai River is the major water source for the Eastern urban area and Wabu Lake is the backup. Wabu Lake is the major water source for the Western urban area and Huai River is the backup.

Table V.7: Water Treatment Plants in Huainan Municipality. Source: FSR.

Water Supply Area	WTP	Source	Treatment Capacity (m^3/d)	Total Capacity (m^3/d)
Eastern Urban Area	City No. 1 WTP	Huai River	70,000	270,000
	City No. 3 WTP	Huai River	100,000	
	City No. 4 WTP	Huai River	100,000	
Central Urban Area	Huaihua Group WTP	Huai River	30,000	30,000
Western Urban Area	Zhaijiawa WTP	Wabu Lake	70,000	250,000
	Lizuizi WTP	Huai River	80,000	
	City No. 5 WTP	Wabu Lake	100,000	
Total:			550,000	

39. **Water pollution and wastewater treatment.** In 2011, over 161 million tons of wastewater was discharged into the Huai River through its tributaries in Huainan Municipality, averaging >0.5 million tons/day (Table V.8). According to the Huainan Statistical Year Book 2012, the municipality's wastewater treatment rate in 2011 was 96.8%. Table V.9 shows the quantities of pollutants produced by the wastewater and discharged into rivers, showing that only 52% on average complied with PRC's Integrated Wastewater Discharge Standard (GB 8978-1996) [based on the number of times with COD and NH3-N compliance only].

Table V.8: Wastewater discharged into the Huai River, Huainan Municipality in 2011

Location		Daily Wastewater Quantity Discharged into Rivers (t)				Total quantity (t)
		Industry	Domestic	Mixed	Daily Total	
North of Huai River	Fengtai County	20,948	15,464	27.634	64,046	20,014,300
	Panji District	6,003	2,807	14,293	23,103	7,219,700
	Maoji District	914	533	0	1,447	452,200
South of Huai River	Urban Huainan	8,620	1,627	416,423	88,596	133,334,600
Total		36,485	20,431	458,350	515,266	161,021,000

Source: Huainan Water Resources Bureau. 2012. 2011 Huainan Municipality water resources report.

Table V.9: Pollutants Discharged into the Huai River in Huainan Municipality in 2011

Location	Discharge Point No.	WW quantity (t/y)	Quantity of Pollutant Discharged into Rivers (t/y)						Comply with GB 8978-1996		
			COD_{Cr}	BOD_5	NH_3-N	Volatile Phenol	TP	TN	Discharge Point No.	WW quantity (t/y)	Compliance Rate
Fengtai	20	20,014,300	996.529	350.733	88.588	0.099	14.751	246.595	12	18,431,100	92.1%
Panji District	8	7,219,700	786.930	264.988	161.683	0.030	15.581	191.829	4	2,218,900	30.7%
Maoji District	2	452,200	11.043	3.676	0.466	0.002	0.143	1.179	2	452,200	100%
Urban	16	133,334,600	5,055.58	1,926.04	2,360.01	0.646	104.539	5,855.63	11	62,946,600	47.2%
Total	46	161,021,000	6,850.08	2,545.44	2,610.75	0.78	135.01	6,295.24	29	84,048,800	52.2%

Source: Huainan Water Resources Bureau. 2012. 2011 Huainan Municipality water resources report. Note: compliance was based on CODCr and NH_3-N in Integrated Wastewater Discharge Standard (GB 8978-1996). WW – wastewater.

40. Huainan Municipality has two wastewater treatment plants (WWTPs), the No. 1 (Eastern) and Bagongshan (Western) WWTPs (Table V.10). Both are operated by the Huainan Capital Water Company. In September 2012, HMG and this company signed the 'Agreement on the Expansion of Urban Wastewater Treatment Plant' for: (i) expansion of the No. 1 WWTP from 100,000 m^3/d to 150,000 m^3/d (starting in 2013; to be completed by 2014), then a second expansion to 200,000 m^3/d (starting in 2018; to be completed by 2019), and (ii) expansion of Bagongshan WWTP, from 100,000 m3/d to 150,000 m3/d (starting in 2017; to be completed by 2018). These expansions will occur adjacent to the boundaries of the current facilities and on empty land owned by the municipal Land Bureau, so there will be no land acquisition or resettlement impacts. The proposed WWTP expansions will be sufficient to handle the increased flow from the wastewater pipelines installed under this project. According to the 'Special Plan for Drainage Works in the Gaotang Lake New District of Huainan Municipality (2010-2030)', a third WWTP will be built, with a capacity of 10,000 m^3/d in the short term and 40,000 m^3/d in the long term, to be located at the north end of the new district (Figure IV.2).

Table V.10: Existing and planned wastewater treatment plants, Huainan Municipality. Source: FSR

WWTP	Status	Current Design Capacity (m^3/d)	2012 Average Flow (m^3/d)	Remaining Capacity (m^3/d)	Future Design Capacity (m^3/d)	2020 Projected Flow (m^3/d)
No. 1 (Eastern)	Existing	100,000	90,000	10,000	150,000 (2014) 200,000 (2019)	210,311
Bagongshan (Western)	Existing	100,000	73,000	27,000	150,000 (2018)	110,709
Gaotang Lake	Planned	10,000	-	-	40,000 (2030)	40,000 (2030)

41. Wastewater discharge standard for the No. 1 and Bagongshan WWTPs is presently Class 1B, under the PRC Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB 18918-2002). After expansion, the treatment standard for both WWTPs will meet Class 1A. The planned Gaotang Lake WWTP will also be designed to meet Class 1A standard. Table V.11 compares Class 1A and Class 1B effluent quality standards.

Table V.11: Comparison of GB 18918-2002 Class 1A and Class 1B Effluent Quality Standards

Control parameter	Class 1A Standard	Class 1B Standard
pH		
SS (mg/L) ≤	10	20
Color (dilution factor) ≤	30	30
BOD_5 (mg/L) ≤	10	20
COD (mg/L) ≤	50	60
NH_3-N (as N mg/L) ≤	5(8)[(1)]	8(15) [(1)]
TN (as N mg/L) ≤	15	20
TP (as P mg/L) ≤	0.5	1
Oil & grease (mg/L) ≤	1	3
Total petroleum hydrocarbon (mg/L) ≤	1	3
Anionic surfactant (mg/L) ≤	0.5	1
Fecal coliform bacteria (count/L) ≤	1000	10000

Note 1: For NH_3-N, value outside the bracket is for water temp. >12°C; value inside the bracket is for water temp. ≤12°C.

42. Although water quality in the lakes and Huai River is better than in the drainage channels, the channels drain into the lakes and river, causing water quality deterioration. Tables V.6 and V.12 shows the volume of pollutants and wastewater respectively which entered the municipality's major waterbodies in 2011.

Table V.12: Wastewater discharged in water functional areas, Huainan Municipality, 2011

Site	Water Functional Area	Daily Wastewater Received (t)				Annual Wastewater Received (t)
		Industry	Domestic	Mixed	Total	
Huai River	Fengtai industrial water use area	0	3,505	657	4,162	1,300,600
	Fengtai Bagongshan transitional area	9,032	540	26,545	36,117	11,286,500
	Huainan drinking water source area	0	0	16,666	16,666	5,208,200
	Huainan effluent discharge control area	0	1,627	398,837	400,464	125,145,000
	Huainan Bengbu transitional area	6,003	2,807	14,293	23,103	7,219,700
Xifei River	Lixin Fengtai agri-fisheries-water use area	12,830	11,952	432	25,214	7,879,500
Gaotang Lake	Chuzhou Hefei agriculture water use area	8,620	0	0	8,620	2,693,800
Wabu Lake	Huainan water source protection area	0	0	920	920	287,600
	Total	36,485	20,431	458,350	515,266	161,021,000

Source: Huainan Water Resources Bureau. 2012. *2011 Huainan Municipality water resources report*.

3. Flooding and waterlogging

43. **Flooding.** Urban drainage networks, waterlogging prevention, and urban flood control are closely related. The river channel of a city usually serves as the outlet of the urban drainage network. When the river level is too high, urban storm water cannot easily discharge because outlets are submerged, causing overflow into urban areas. Relevant to Huainan are (i) inundation from the Huai River and (ii) urban waterlogging from inadequate storm water drainage and overflow of interior drainage channels. Flooding and waterlogging occur frequently in Huainan due to its geographic location and meteorological and hydrological conditions (Figure V.3). Floods in the Huai River can be divided into: (i) flash floods, caused by a few large storm events (e.g. 1968, 1975); and (ii) prolonged basin floods, caused by torrential rain over a large area and ≥one month (e.g. 1954, 1991, 1996, 2003). In general, floods in the Huai River are the type that rise and fall slowly, with long lasting flood peaks and large volumes of water. This has significant impacts on flood drainage along the river. Since 1950 there have been at least 20 flood and/or waterlogging events, averaging one every three years, with at least eight major floods (Table V.13). The highest and lowest recorded river flow rates are 12,700 m^3/s (25 July 1954) and 0.5 m^3/s (1978) respectively; the highest and lowest recorded water levels were 24.03 m (27 July 1954) and 12.36 m (1953) respectively. The 1991 flood affected the most people and caused the most damage.

Figure V.3: Waterlogging in Huainan

Table V.13: Details of major flood events in Huainan Municipality

Year	1954	1991	2003	2005	2007	2011
Dates	July 8-27	Jun 18, Jul 14	July 1-15	July 10-26	Jul 7-16	Aug 26-27
Affected population	No data	1,113,000	960,000	370,000	704,800	506,800
Crop area affected (mu)	2,070,000*	1,200,000	1,151,000	370,000	821,700	1,100,000
Number of buildings collapsed	239,000*	171,000	56,000	6,333	16,314	702
Direct economic loss (million CNY)	No data	1,760	1,330	320	891.5	304
Agricultural economic loss (million CNY)	No data	No data	650	230	619.2	247
Water infrastructure damage (million CNY)	No data	No data	366	34	106.2	No data
Flood rescue cost (million CNY)	No data	No data	69.35	No data	97.2683	No data

Source: Huainan Water Resources Bureau. Note: 15 mu = 1 hectare = 10,000 m^2.*Fengtai County.

44. One of the new development areas described in the Huainan Municipality Urban Master Plan (2010-2020) is the Binhu (lake-side) New District, also known as the Gaotang Lake New District, which will be located west of the western bank of Gaotang Lake and will be subject to flooding risk from Gaotang Lake. This area, ranging between 17.5 to 21.5 m in elevation, currently starts flooding whenever the level of Gaotang Lake rises too high. When levels rise above 20 m, 65–135 km^2 of land is flooded, affecting agriculture, industrial activity, transportation, and commercial activity. Flooding has occurred in 18 of the last 60 years, or approximately once every 3-4 years (Table V.14). This project includes embankment and pump station construction along the western bank of Gaotang Lake to protect this new development area against 1-in-50 year storm events.

Table V.14: Major Gaotang Lake Flood Events

Year	1991	2003	2007
Maximum water level (m)	23.27	22.7	21.5
Flooded farmland (km^2)	137	106	87
Affected population	130,000	102,000	-
No. of buildings collapsed	43,000	12,000	-
Direct economic losses (CNY)	300 million	360 million	220 million

Source: Anhui Survey and Design Institute for Water Conservancy and Hydropower. 2010. *Huainan Municipality Gaotang Lake New District Flood Protection Feasibility Study.*

45. **Waterlogging.** The main issues causing waterlogging in the city are the reduced capacity of urban drainage channels due to siltation and garbage accumulation, as well as the insufficient pumping capacity of the storm water pumps, both of which will be addressed in this project. Table V.15 summarizes the existing problems in the project drainage channels; Figure V.4 shows the existing poor environmental and sanitary conditions of some of these water channels.

Table V.15: Project drainage channels and their existing problems. Source: FSR

Name	Description	Existing Problem
Bagongshan Channel	Part of the 26.16 km^2 Nantang Channel Catchment area; collects runoff from hill slopes >30 m elevation; drains into Huai River	Mostly a soil nullah; severe siltation, garbage dumping and illegal construction, which reduce the cross-sectional area resulting in insufficient flood discharge capacity
Xiejiaji Channel	Part of the 19.57 km^2 Shijia Lake Catchment Area; collects runoff from hill slopes >30 m elevation; drains into Shijian Lake	Mostly a stone ditch except one section that is still a soil nullah; the ditch is poorly maintained with severe siltation (1+ m thick), reducing the cross-sectional area for flood discharge; soil nullah section has even worse maintenance and siltation, garbage dumping, weeds and irregular cross-sectional areas resulting in insufficient flood discharge capacity
Dongshan Channel	Part of the 13.69 km^2 Dongshan Channel Catchment Area; drains into the Huai River by gravity most of the time due to higher elevation	Floor elevation of the sluice gate is 21.30 m - when water level in the Huai River is >23.80 m, the sluice gate has to be closed, and the terrain dictates that the water must be diverted to Caozuizi water system, putting added pressure on it; numerous illegal structures in middle and lower reaches of channel; low water quality due to the

Name	Description	Existing Problem
		discharge of untreated domestic wastewater and garbage
Longwang Channel	Part of the 14.77 km^2 Longwang Channel Catchment Area; located in the urban center; drains through East Lake into the pond in front of the Long Lake pump station	Waterlogging occurs in front of the No. 24 Secondary School due to serious siltation resulting in reduced cross-sectional area; the 2 km^2 area upstream of the bridge culvert was originally agricultural land but is now covered with constructed structures, resulting in substantial increase in the runoff coefficient exceeding the flow capacity of the culvert; storm water retention capacity of East Lake is decreasing due to urban development, resulting in lake water backing up the flow from upstream during the storm season, causing a large area of waterlogging; numerous illegal structures, with combined storm water and wastewater flows and accumulation of garbage, resulting in ponds with methane accumulation, creating potential safety problems
Longwang Flood Diversion Channel	Part of the 25.10 km^2 Dajiangou Catchment Area; drains into Dajiangou	The outflow section Dajiangou has no mechanical drainage equipment and depends totally on the self-regulating ability of Dajiangou when Huai River water level rises. Yet insufficient water retention capacity of Dajiangou has resulted in 'closed flood'; construction of Chaoyang East Road and Beer Factory Road did not construct the bridge culverts connecting to the drainage channel at the same time, resulting in the complete loss of drainage ability of that section of the drainage channel. This combining with serious siltation problems along the Jianshe Road ditch has resulted in large areas of waterlogging since the storm water upstream has no way to drain.
Old Longwang Channel	Part of the 14.75 km^2 Caozuizi Catchment Area; drains into Huai River through the Huai River embankment with nearby Caoling Lake and low-lying areas suitable for storm water retention	When the sluice gate at Dongshan Channel has to be closed due to high Huai River water level as mentioned above, the Dongshan Channel water drains into the Caozuizi Catchment Area. Therefore, control of waterlogging has to consider the relationships between these two catchment areas. Presently, the outflow area of Caozuizi water system is mostly agricultural land - loss from waterlogging is less than the urban area. However this area could become the next urban development area and waterlogging control must be planned for such future.

Bagongshan Channel

Xiejiaji Channel

Figure V.4: Existing Conditions of some of the project water channels

46. **Flood management.** The Huai River basin is one of seven national river basins for which the Ministry of Water Resources has established a River Basin Commission, to assist overall management. The Huainan Water Resources Bureau (HWRB) is responsible for planning and emergency response for flooding from the Huai River, and controls the sluice gates between drainage channels and the river. Sluice gates are open when river levels are low, allowing drainage by gravity, and closed when river levels are high to prevent backflow into the city. The Drainage Division under the Huainan Municipal Administration Management Department (HMAMD) is responsible for storm water management in the city, including combined sewers, storm sewers, drainage channels and storm water pump stations. It also provides emergency response to waterlogging events. Huai River flood events are officially recorded by HWRB, but waterlogging events are not officially recorded by HMAMD. Localized flooding occurs in most years. Figures V.5-6 show the areas with waterlogging risk in a 1-in-20 year storm event in the Eastern and Western urban areas respectively.

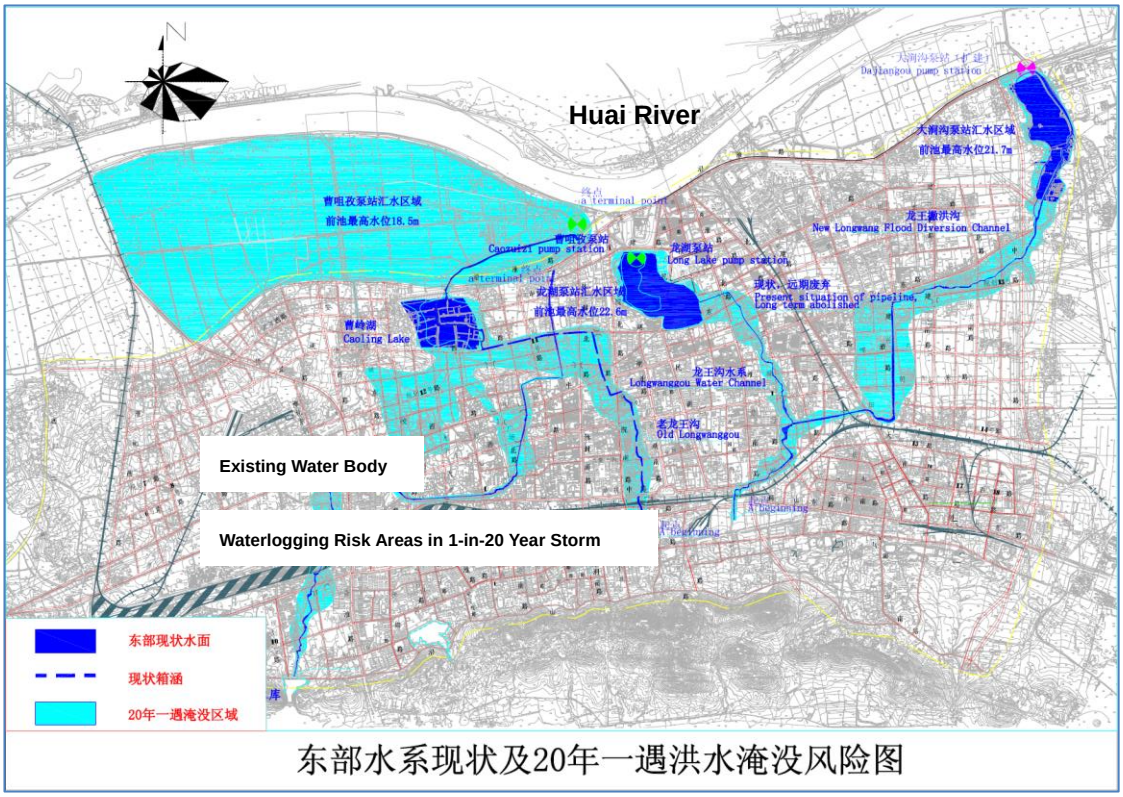


Figure V.5: Areas with Waterlogging Risk in Eastern Urban Area

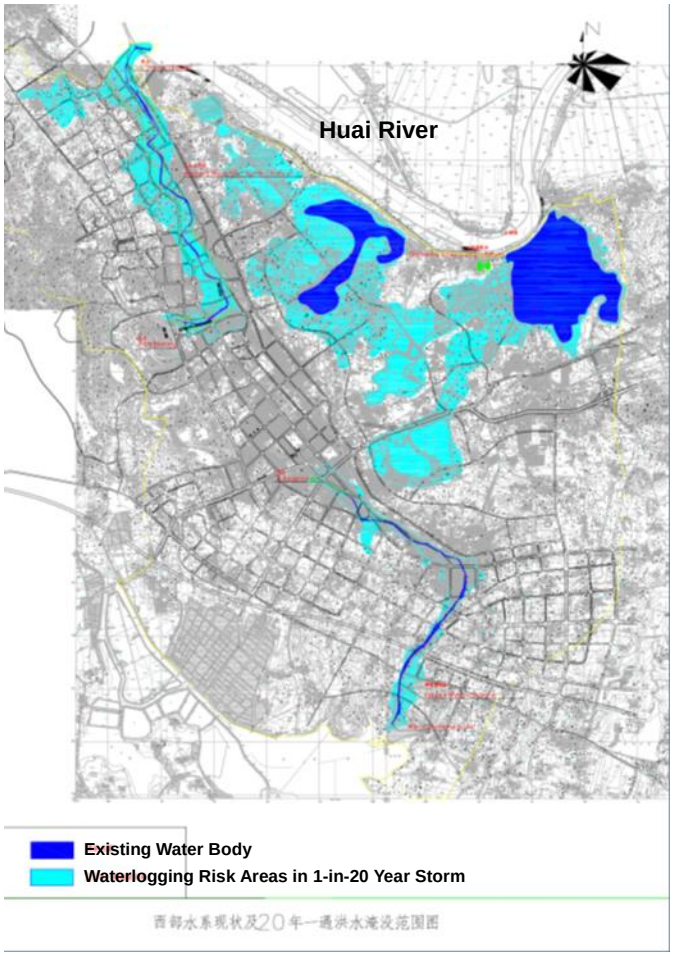


Figure V.6: Areas with Waterlogging Risk in Western Urban Area

47. According to the Huainan Municipality Urban Master Plan (2010-2020), the flood control standard for the main urban area should be 1-in-100 year return period, with checking against storm water flow of 1-in-200 year return period; and the flood control standard for Fengtai County and Panji District should be 1-in-50 year return period. The control standards for waterlogging events are 1-in-20 year return period for the main urban area, 1-in-10 year return period for Fengtai County and Panji District, and 1-in-5 to 10 year return period for other towns.

F. Environmental quality (baseline sampling)

1. Assessment areas (project zone of influence) and evaluation standards

48. The assessment areas for air, noise, surface water and ecological impacts are defined by the technical guidelines for environmental impact assessment in the PRC, based on the environmental sensitivity of the project areas and vicinity as well as the nature of the project and its components. The EIR followed these guidelines in defining the assessment areas (Table V.16), with the physical cultural resource and occupational and community health and safety assessment areas added for this project.

Table V.16: Assessment areas (project zone of influence)

Environmental Media	Assessment Area
Air	Within 200 m from the construction site boundary
Noise	Within 200 m from the construction site boundary
Surface water	Urban water channels and lakes in which construction + operation will occur
Ground water	Within the dredged sediment disposal site boundary
Ecology	Within 200 m from the construction site boundary
Soil	Within the dredged sediment disposal site boundary
Physical cultural resource	Within the construction site boundary
Occupational health & safety	Within the construction site boundary
Community health & safety	Within 200 m from the construction site boundary

49. Under PRC EIA regulations, the ambient conditions of air, noise and water quality in the project area determine the appropriate category of emissions and effluent standards for the construction and operational phases of built infrastructure. PRC evaluation standards adopted for this project in the domestic EIR were set by the Huainan EPB (Table V.17).

Table V.17: PRC Evaluation Standards Adopted for this Project. Source: EIR

Parameter	PRC Evaluation Standard	Remark
Ambient air quality	*Ambient Air Quality Standard* (GB 3095-1996) and its revision: Class II standard	Daily average: SO_2: 0.15 mg/m^3, NO_2: 0.08 mg/m^3, TSP: 0.30 mg/m^3, PM_{10}: 0.15 mg/m^3 Hourly average: SO_2: 0.50 mg/m^3, NO_2: 0.20 mg/m^3
Construction air pollutant emission	*Air Pollutant Integrated Emission Standard* (GB 16297-1996)	Maximum allowable emission concentration: Particulate matter (PM_{10}): 120 mg/m^3 Limits for fugitive emission: PM_{10}: ≤1.0 mg/m^3 outside construction site boundary
	Hygienic Standard for the Design of Industries and Enterprises (TJ 36-79)	Maximum allowable concentration in residential area: NH_3: 0.2 mg/m^3, H_2S 0.01 mg/m^3
	Hygienic Standard for Methylmercaptan in Air of Residential Area (GB 18056-2002)	Maximum allowable concentration in residential area: CH_3SH: 0.0007 mg/m^3
Environmental noise (Operational noise)	*Environmental Quality Standard for Noise* (GB 3096-2008): Functional Area Category 2	Day time: 60 dB(A); Night time: 50 dB(A)
Construction noise	*Emission Standard of Environmental Noise for Boundary of Construction Site* (GB 12523-2011)	Noise level at construction site boundary: Day time: 70 dB(A); Night time: 55 dB(A)
Surface water quality	*Environmental Quality Standards for Surface Water* (GB 3838-2002): Class III: Huai River, and Wabu, Gaotang, Shijian, and Dajaingou Lakes. Class IV: Long and Caoling Lakes, Longwang Flood Diversion Channel, and Longwang,	See **Table V.24**

Parameter	PRC Evaluation Standard	Remark
	Old Longwang, Donghua, and Bagongshan Channels	
Ground water quality	*Quality Standard for Ground Water* (GB/T 14848-93)	See **Table V.28**
Wastewater discharge from construction sites and dredged sediment disposal sites	*Integrated Wastewater Discharge Standard* (GB 8978-1996)	See **Table V.25**
Dredged sediment for land disposal	*Environmental Quality Standard for Soils* (GB 15618-1995): Class 2 standard according to the soil pH at disposal site	See **Tables V.31, 32**

2. Air

50. **Sampling methods.** Monitoring of ambient air quality for EIA in the PRC usually consists of measuring the hourly and/or daily average concentration levels of total suspended particulates (TSP) and/or PM10 (known as respirable suspended particulates, RSP), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) on seven consecutive days. This sampling effort, although limited, complies with national standards for baseline air quality monitoring for a Class I ranked EIA. Due to potential odor impacts from dredging, disposal of channel sediment, and operation of wastewater pump stations, the odorous chemicals ammonia (NH_3), hydrogen sulfide (H_2S) and methylmercaptan (CH_3SH) were included in the baseline monitoring. For this project, the monitoring of TSP (daily average), PM_{10} (daily average), SO_2 (hourly and daily average), NO_2 (hourly and daily average), NH_3 (hourly average), H_2S (hourly average) and CH_3SH (hourly average) was conducted on 1-7 December 2012 at 13 locations (Table V.18; Fig. V.13). Locations were selected by HEMS to represent sensitive receptor and project activity locations.

Table V.18: Baseline Air Quality Monitoring Locations

No.	Location	No.	Location
1	Huaibin Village Dredged Sediment Disposal Site	7	Juren Village 居仁村
		8	Jiushang Road Dredged Sediment Disposal Site
2	Jiannan Village 建南村		
3	Xinzhuang Third Village 新庄三村	9	Hudayingzi 胡大郢孜
4	Xiejiaji Dredged Sediment Disposal Site	10	Xingfu Village Dairy Product Company
		11	Shangyao Medical Clinic 上窑卫生院
5	Xiaodonggang 小东岗	12	Long Lake Pump Station 龙湖泵站
6	Sunyingzi 孙郢子	13	Gaotang Lake Pump Station 高塘湖泵站

51. **Standards set for this project.** The PRC ranks air quality into three classes (Ambient Air Quality Standard GB 3095-1996 and amendment in 2000), with Class I the best air quality and Class III the worst. Ambient air quality in the project area meets Class II standard. In 2012, a new national standard was issued (GB 3095-2012; effective 1 January 2016) and will replace GB 3095-1996. The new standard combines Classes II and III, and will only have two classes, I and II. It also introduces PM2.5 standards and relaxes the 1-hour NO2 standard to match the World

Health Organization (WHO)[4] Air Quality Guideline (AQG) standard. The World Bank Group adopted the WHO standards for its EHS standards for air quality. Recognizing that progressive actions are needed to achieve these standards, the WHO also established interim targets towards achieving the AQG. Table V.19 compares the PRC's GB 3095-1996 Class II standards with the GB 3095-2012 Class II standards and the World Bank Group's EHS standards.

Table V.19: Comparison of the PRC's GB 3095-1996, GB 3095-2012, and World Bank Group EHS Ambient Air Quality Standards

Air Quality Parameter	Averaging Period	GB 3095-1996 Class II (mg/m^3)	GB 3095-2012 Class II (mg/m^3)	World Bank Group EHS[5] (mg/m^3)	
				Interim Targets	AQG
SO_2	1-year	0.06	0.060	n/a	n/a
	24-hour	0.15	0.150	0.050-0.125	0.020
	1-hour	0.50	0.500	n/a	n/a
TSP	1-year	0.20	0.200	n/a	n/a
	24-hour	0.30	0.300	n/a	n/a
PM_{10}	1-year	0.10	0.100	0.030-0.070	0.020
	24-hour	0.15	0.150	0.075-0.150	0.050
$PM_{2.5}$	1-year	n/a	n/a	0.015-0.035	0.010
	24-hr	n/a	0.150	0.0375-0.075	0.025
	1-hour	n/a	0.350	n/a	n/a
NO_2	1-year	0.04	0.040	n/a	0.040
	24-hour	0.08	0.080	n/a	n/a
	1-hour	0.12	0.200	n/a	0.200
CO	24-hour	4.00	4	n/a	n/a
	1-hour	10.00	10	n/a	n/a

52. Longer averaging period such as 1-year as shown in Table V.19 is more applicable to assessing impacts from multiple as well as regional sources; while shorter averaging periods such as 24-hour and 1-hour are more applicable to assessing short term impacts from project related activities, such as from peak hour traffic or daily or peak construction activities. Comparing the PRC's GB 3095-1996 Class II standards with the World Bank Group's EHS standards, the PRC's 24-hour SO_2 standard (0.15 mg/m^3) is higher than the upper limit of World Bank Group's interim target (0.125 mg/m^3); the 1-hour NO_2 standard (0.120 mg/m^3) is more stringent than the World Bank Group's AQG (0.200 mg/m^3) (which will be relaxed to match the AQG in GB 3095-2012); and, the 24-hour PM10 standard (0.15 mg/m^3) is the same as the upper limit of the World Bank Group's interim target (Table V.19). When GB 3095-2012 replaces GB 3095-1996 on 1 January 2016, Class II standards of 24-hour SO_2 (0.15 mg/m^3) and $PM_{2.5}$ (0.15 mg/m^3) will be higher than the upper limit of the World Bank Group's interim targets (0.125 mg/m^3 and 0.075 mg/m3 respectively); while 24-hour PM_{10} (0.15 mg/m^3) and 1-hour NO_2 (0.20 mg/m^3) are the same as the World Bank Group's upper limit of interim target and AQG, respectively.

[4] World Health Organization. 2005. WHO air quality guidelines global update 2005. Report on a Working Group meeting, Bonn, Germany, 18-20 October 2005.

[5] World Bank Group 2007, ibid.

53. The PRC's Air Pollutant Integrated Emission Standard (GB 16297-1996) regulates the emission of particulate matter into the air, with a maximum allowable concentration of 120 mg/m^3 at source and for fugitive emission the highest concentration outside site boundary of 1.0 mg/m^3. Both GB 3095-1996 and GB 3095-2012 do not have ambient standards for odorous chemicals such as ammonia (NH_3), hydrogen sulfide (H_2S) and methylmercaptan (CH_3SH), which could be potential air pollutants during dredging and dredged sediment transport and disposal. Based on requirements specified by the Huainan EPB, this project adopts NH_3 (0.2 mg/m^3) and H_2S (0.01 mg/m^3) standards from PRC's Hygienic Standard for the Design of Industries and Enterprises (TJ 36-79) and methylmercaptan (0.0007 mg/m^3) standard from Hygienic Standard for Methylmercaptan in Air of Residential Area (GB 18056-2002), as the one time maximum allowable concentrations in nearby residential areas.

54. **Sampling results.** Ambient air quality baseline monitoring data indicates that particulate matter (represented by TSP and PM_{10}) was the main air quality problem at the 13 locations monitored from 1-7 December 2012 (Table V.19). Of the 91 survey points, 30% exceeded both GB 3095-1996 and GB 3095-2012 Class II standards for TSP, and 36% exceeded GB 3095-1996 and GB 3095-2012 Class II standards for PM_{10}, as well as World Bank Group EHS Interim Target. A further 37% exceeded the more stringent EHS Air Quality Guideline (AQG) limit. The source of particulate matter is probably coal mining and burning in Huainan Municipality. Of the 13 sites monitored, seven (Bagongshan dredged sediment disposal site, Jiannan Village, Xinzhuang Third Village, Xiaodonggang and Sunyingzi residential areas, and Long Lake and Gaotang Lake pump station locations) showed higher levels of TSP and PM_{10} than the others.

Table V.19: Ambient Air Quality Monitoring Data (unit: mg/m^3). Limits of Class II standards set (from Table V.17): Daily average: SO_2: 0.15 mg/m^3; NO_2: 0.08 mg/m^3; TSP: 0.30 mg/m^3; PM_{10}: 0.15 mg/m^3. Hourly average: SO_2: 0.50 mg/m^3; NO_2: 0.20 mg/m^3. Limits set for the remaining parameters (see text): NH_3: 0.2 mg/m^3; H_2S: 0.01 mg/m^3; methylmercaptan: 0.0007 mg/m^3. Grey-shaded values exceed the GB 3095-1996 and GB 3095-2012 Class II standards, and EHS interim target (where applicable). Pink-shaded values exceed the EHS AQG.

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average
1	Huaibin Village Dredged Sediment Disposal Site 淮滨村淤泥堆场	Dec 1	0.410	0.251	0.009	0.010	0.083	<0.006	0.506	0.005	<0.0002
		Dec 2	0.361	0.262	0.010	0.012	0.108	0.008	0.276	0.012	<0.0002
		Dec 3	0.423	0.291	0.011	0.015	0.096	0.010	0.501	0.010	<0.0002
		Dec 4	0.297	0.218	0.011	0.007	0.108	0.013	0.373	0.004	<0.0002
		Dec 5	0.354	0.230	0.011	0.007	0.108	0.038	0.233	0.005	<0.0002
		Dec 6	0.378	0.247	0.009	0.011	0.087	0.038	0.604	0.010	<0.0002
		Dec 7	0.354	0.265	0.010	0.014	0.104	0.056	0.558	0.009	<0.0002
2	Jiannan Village 建南村	Dec 1	0.483	0.387	0.008	0.016	0.076	0.039	0.162	0.010	<0.0002
		Dec 2	0.473	0.337	0.012	0.012	0.096	0.016	0.531	0.014	<0.0002
		Dec 3	0.522	0.160	0.010	0.012	0.106	0.018	0.274	0.014	<0.0002
		Dec 4	0.447	0.274	0.012	0.009	0.082	0.020	0.418	0.009	<0.0002
		Dec 5	0.492	0.254	0.008	0.007	0.114	0.012	0.307	0.006	<0.0002
		Dec 6	0.442	0.217	0.011	0.009	0.110	0.038	0.432	0.005	<0.0002
		Dec 7	0.575	0.267	0.010	0.012	0.111	0.047	0.177	0.006	<0.0002
3	Xinzhuang	Dec 1	0.455	0.283	0.011	0.007	0.097	0.023	0.987	0.010	<0.0002

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average
	Third Village 新庄三村	Dec 2	0.539	0.343	0.010	0.009	0.098	0.038	0.343	0.017	<0.0002
		Dec 3	0.498	0.155	0.009	0.007	0.115	0.030	0.376	0.009	<0.0002
		Dec 4	0.518	0.259	0.010	0.007	0.076	0.018	0.812	0.003	<0.0002
		Dec 5	0.487	0.189	0.010	0.010	0.106	0.054	0.793	0.006	<0.0002
		Dec 6	0.457	0.193	0.010	0.009	0.106	0.039	0.410	0.005	<0.0002
		Dec 7	0.564	0.283	0.007	0.009	0.092	0.014	0.159	0.004	<0.0002
4	Xiejiaji Dredged Sediment Disposal Site 谢家集淤泥堆场	Dec 1	0.299	0.230	0.010	0.012	0.092	0.018	0.663	0.006	<0.0002
		Dec 2	0.271	0.244	0.012	0.014	0.087	0.056	0.123	0.012	<0.0002
		Dec 3	0.278	0.142	0.011	0.015	0.099	0.015	0.470	0.004	<0.0002
		Dec 4	0.249	0.165	0.008	0.009	0.093	0.034	0.139	0.006	<0.0002
		Dec 5	0.263	0.176	0.010	0.008	0.094	0.014	0.449	0.006	<0.0002
		Dec 6	0.318	0.184	0.011	0.011	0.067	0.036	0.188	0.004	<0.0002
		Dec 7	0.288	0.219	0.012	0.007	0.096	0.026	0.196	0.006	<0.0002
5	Xiaodonggang 小东岗	Dec 1	0.512	0.349	0.012	0.010	0.100	0.056	0.579	0.011	<0.0002
		Dec 2	0.545	0.362	0.013	0.009	0.108	0.024	0.936	0.013	<0.0002
		Dec 3	0.632	0.146	0.010	0.014	0.102	0.027	0.522	0.006	<0.0002
		Dec 4	0.518	0.226	0.014	0.011	0.095	0.050	0.851	0.009	<0.0002
		Dec 5	0.515	0.240	0.010	0.007	0.093	0.024	0.794	0.007	<0.0002
		Dec 6	0.511	0.214	0.009	0.009	0.100	0.043	0.752	0.003	<0.0002
		Dec 7	0.519	0.283	0.009	0.008	0.110	0.041	0.834	0.005	<0.0002
6	Sunyingzi 孙郢子	Dec 1	0.397	0.314	0.011	0.012	0.087	0.030	0.463	0.003	<0.0002
		Dec 2	0.349	0.303	0.009	0.011	0.113	0.052	0.188	0.003	<0.0002
		Dec 3	0.436	0.179	0.012	0.014	0.068	0.057	0.135	0.003	<0.0002
		Dec 4	0.359	0.229	0.010	0.013	0.080	0.041	0.210	0.003	<0.0002
		Dec 5	0.316	0.217	0.010	0.011	0.059	0.029	0.226	0.003	<0.0002
		Dec 6	0.379	0.220	0.012	0.010	0.117	0.026	0.114	0.003	<0.0002
		Dec 7	0.403	0.278	0.009	0.007	0.086	0.052	0.196	0.002	<0.0002
7	Juren Village 居仁村	Dec 1	0.133	0.067	0.012	0.011	0.110	0.051	0.294	0.011	<0.0002
		Dec 2	0.077	0.054	0.009	0.008	0.111	0.055	0.183	0.010	<0.0002
		Dec 3	0.114	0.057	0.011	0.008	0.103	0.011	0.278	0.006	<0.0002
		Dec 4	0.107	0.080	0.010	0.012	0.112	0.059	0.283	0.006	<0.0002
		Dec 5	0.107	0.086	0.013	0.013	0.111	0.018	0.151	0.004	<0.0002
		Dec 6	0.111	0.085	0.011	0.009	0.112	0.060	0.123	0.006	<0.0002
		Dec 7	0.125	0.097	0.009	0.007	0.098	0.020	0.248	0.006	<0.0002
8	Jiushang Road Dredged Sediment Disposal Site 九上路污泥堆场	Dec 1	0.205	0.064	0.010	0.014	0.114	0.050	0.327	0.010	<0.0002
		Dec 2	0.090	0.075	0.008	0.014	0.102	0.014	0.697	0.009	<0.0002
		Dec 3	0.095	0.036	0.010	0.014	0.098	0.010	0.337	0.009	<0.0002
		Dec 4	0.122	0.057	0.010	0.011	0.102	0.024	0.198	0.006	<0.0002
		Dec 5	0.146	0.077	0.011	0.007	0.113	0.043	0.319	0.006	<0.0002
		Dec 6	0.139	0.061	0.011	0.012	0.110	0.012	0.368	0.007	<0.0002
		Dec 7	0.164	0.056	0.010	0.013	0.096	0.060	0.225	0.005	<0.0002
9	Hudayingzi 胡大郢孜	Dec 1	0.241	0.156	0.011	0.017	0.085	0.008	0.939	0.009	<0.0002
		Dec 2	0.066	0.059	0.011	0.011	0.096	0.028	0.371	0.010	<0.0002
		Dec 3	0.093	0.061	0.011	0.016	0.086	0.033	0.194	0.005	<0.0002
		Dec 4	0.128	0.081	0.010	0.010	0.109	0.018	0.816	0.003	<0.0002
		Dec 5	0.149	0.094	0.010	0.012	0.091	0.016	0.144	0.005	<0.0002

No.	Location	Date (2012)	TSP	PM_{10}	SO_2		NO_2		NH_3	H_2S	CH_3SH
			Daily Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Hourly Average	Hourly Average
		Dec 6	0.160	0.102	0.010	0.013	0.118	0.031	0.180	0.004	<0.0002
		Dec 7	0.128	0.094	0.011	0.015	0.108	0.051	0.477	0.004	<0.0002
10	Xingfu Village Dairy Product Company 乳品公司幸福村	Dec 1	0.286	0.161	0.011	0.013	0.070	0.007	0.397	0.009	<0.0002
		Dec 2	0.109	0.057	0.010	0.014	0.113	0.061	0.767	0.010	<0.0002
		Dec 3	0.144	0.075	0.009	0.013	0.094	0.048	0.379	0.005	<0.0002
		Dec 4	0.136	0.083	0.011	0.015	0.089	0.037	0.681	0.004	<0.0002
		Dec 5	0.157	0.089	0.008	0.010	0.104	0.030	0.375	0.003	<0.0002
		Dec 6	0.169	0.102	0.011	0.009	0.097	<0.006	0.656	0.005	<0.0002
		Dec 7	0.181	0.115	0.012	0.014	0.114	0.009	0.477	0.003	<0.0002
11	Shangyao Medical Clinic 上窑卫生院	Dec 1	0.272	0.111	0.009	0.017	0.104	0.019	0.864	0.009	<0.0002
		Dec 2	0.182	0.050	0.011	0.011	0.111	0.053	0.534	0.008	<0.0002
		Dec 3	0.218	0.066	0.012	0.012	0.114	0.049	0.795	0.004	<0.0002
		Dec 4	0.221	0.074	0.008	0.010	0.110	0.006	0.585	0.006	<0.0002
		Dec 5	0.204	0.079	0.011	0.012	0.104	0.034	0.769	0.004	<0.0002
		Dec 6	0.242	0.102	0.009	0.016	0.080	0.018	0.371	0.004	<0.0002
		Dec 7	0.219	0.069	0.011	0.014	0.104	0.045	0.477	0.004	<0.0002
12	Long Lake Pump Station 龙湖泵站	Dec 1	0.343	0.230	0.011	0.009	0.081	0.006	0.667	0.004	<0.0002
		Dec 2	0.335	0.250	0.010	0.007	0.087	0.028	0.157	0.010	<0.0002
		Dec 3	0.341	0.141	0.009	0.011	0.100	0.034	0.596	0.008	<0.0002
		Dec 4	0.303	0.157	0.009	0.006	0.089	0.026	0.160	0.005	<0.0002
		Dec 5	0.356	0.197	0.010	0.012	0.096	0.008	0.792	0.004	<0.0002
		Dec 6	0.331	0.206	0.012	0.009	0.112	0.058	0.570	0.004	<0.0002
		Dec 7	0.349	0.225	0.010	0.011	0.092	0.022	0.172	0.005	<0.0002
13	Gaotang Lake Pump Station 高塘湖泵站	Dec 1	0.365	0.286	0.011	0.010	0.115	0.054	0.974	0.009	<0.0002
		Dec 2	0.309	0.236	0.009	0.009	0.066	0.042	0.048	0.011	<0.0002
		Dec 3	0.286	0.208	0.010	0.009	0.114	0.049	0.818	0.005	<0.0002
		Dec 4	0.272	0.206	0.011	0.008	0.106	0.026	0.157	0.003	<0.0002
		Dec 5	0.321	0.258	0.010	0.007	0.099	0.044	0.302	0.004	<0.0002
		Dec 6	0.331	0.259	0.009	0.013	0.113	0.012	0.692	0.003	<0.0002
		Dec 7	0.342	0.245	0.009	0.009	0.108	0.022	0.084	0.005	<0.0002
GB 3095-1996 Class II Standards			0.30	0.15	0.50	0.15	0.12	0.08	---	---	---
GB 3095-2012 Class II Standards			0.300	0.150	0.500	0.150	0.200	0.080	---	---	---
GB 14554-93 Class II Standards			---	---	---	---	---	---	1.5	0.06	0.007
World Bank Group EHS Standards											
		Interim Target	---	0.150	---	0.125	---	---	---	---	---
		AQG	---	0.050	---	0.020	0.200	---	---	---	---

Source: HEMS. Note: Hourly averages were taken in 4 one-hour intervals. Only the highest hourly average presented in this table.

3. Noise

55. **Sampling methods.** Baseline noise monitoring (LAeq) for EIA in the PRC typically consists of monitoring of day time and night time noise. Monitoring for this project was conducted for two consecutive days at 41 locations (Table V.20; Figure V.13) between 1 and 9 December 2012. This sampling effort, although limited, complies with national standards for baseline noise monitoring for a Class I ranked EIA. Locations were selected by HEMS to be representative of noise sensitive receptors and project activities.

Table V.20: Project sensitive receptors and baseline noise monitoring locations

No.	Location	No.	Location
1	Shangyou Village 上游村	22	Mazhuang 马庄
2	Ligenglouzi 李更楼子	23	Hudayingzi 胡大郢孜
3	Jiannan Village 建南村	24	Luohe Hospital 洛河医院
4	Jiannan Village 建南村	25	Xingfu Village Dairy Product Company 乳品公司幸福村
5	Xinjian No. 2 Village 新建二村	26	Xinjiantang 新建塘
6	Xinzhuang No. 3 Village 新庄三村	27	Yaohe Secondary School 窑河中学
7	Xie No. 2 Mine Hospital 谢二矿医院	28	Shangyao Medical Clinic 上窑卫生院
8	City No. 16 Secondary School 市十六中	29	Yehangzi 余巷子
9	Mine Northwest Village 矿北西村	30	Houwu 后吴
10	Caizhuang 蔡庄	31	Huaibin Village Dredged Sediment Disposal Site
11	Xiaodonggang 小东岗	32	Xiejiaji Landfill Dredged Sediment Disposal Site 谢家集填埋场淤泥堆场
12	Huajian Primary and Secondary School		
13	Yu'an Community 裕安小区	33	Jiushang Road Dredged Sediment Disposal Site
14	Huainan Teachers College 淮南师专	34	Shijian Lake Pump Station 十涧湖泵站
15	Sunyingzi 孙郢子	35	Caozuizi Pump Station 曹嘴孜泵站
16	Huainan Bureau of Mine 淮南矿务局	36	Long Lake Pump Station 龙湖泵站
17	Huainan No. 7 Secondary School 淮南七中	37	Dajian Channel Pumping Station 大涧沟泵站
18	Shangri-La Community 香格里拉小区	38	Gaotang Lake No. 1 Pump Station 高塘湖一号泵站
19	Zhangdatang 张大塘	39	Gaotang Lake No. 2 Pump Station 高塘湖二号泵站
20	Juren Village 居仁村	40	Gaotang Lake No. 3 Pump Station 高塘湖三号泵站
21	Linhang Primary School 林巷小学	41	Gaotang Lake No. 4 Pump Station 高塘湖四号泵站

56. **Standards set for this project.** GB 3096-2008 identifies five categories based on tolerance to noise pollution: Category 0 – areas with convalescent facilities (least tolerant to noise; stringent day and night noise standards); 1 - residential areas, hospitals and clinics, educational institutions and research centers; 2 – mixed residential and commercial areas; 3 – areas with industrial production, storage and logistics functions; 4 – areas adjacent to traffic noise sources such as major roads and highways, and is subdivided into 4a (road and marine traffic noise) and 4b (rail noise). Comparison with World Bank Group EHS guidelines show that the EHS guidelines have lower noise limits for residential, commercial and industrial mixed areas but higher noise limits for industrial areas and night time noise near trunk roads (Table V.21).

Table V.21: Environmental Quality Standards for Noise (Equivalent Sound Level L_{Aeq}: dB)

Noise Category	Applicable Area	GB 3096-2008		World Bank Group EHS[6]	
		Day 06:00-22:00	Night 22:00-06:00	Day 07:00-22:00	Night 22:00-07:00
0	Areas needing extreme quiet e.g. convalescence areas	50	40	55	45

[6] World Bank Group 2007, ibid.

1	Areas mainly for residence, hospitals, cultural and	55	45		
2	Residential, commercial and industrial mixed areas	60	50		
3	Industrial areas, warehouses and logistic parks	65	55	70	70
4a	Area on both sides of urban trunk road	70	55		

Note: Functional Area 4 is divided into 4a for trunk roads and 4b for railway lines.

57. PRC's Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011) regulates construction noise, limiting construction noise levels at the construction site boundary to 70 dB(A) in the day time (06:00–22:00) and 55 dB(A) at night (22:00–06:00). The World Bank Group does not have standards for construction noise per se, but applies the same noise standards listed in Table III.6 to the receptors during construction activities.

58. **Sampling results.** The project areas are designated 'functional area category 2' under the Environmental Quality Standard for Noise (GB 3096-2008) (i.e. areas with mixed residential-commercial-industrial functions). Baseline noise monitoring at 41 locations revealed that day and night time noise levels complied with category 2 standards on the days of monitoring, but when compared against the more stringent World Bank Group EHS standards, six locations exceeded the day time standard and nine locations exceeded the night time (Table V.22). Some exceedances occurred at educational institutions and pump station locations, indicating the need to mitigate construction noise near these sites, and to adopt noise reduction measures to suppress pump station operational noise.

Table V.22: Noise Monitoring Data, 1–9 December 2012 (unit = L_{Aeq}dB). Limits of Category 2 standards set (see Table V.17): Day– 60 dB(A); Night–50 dB(A). Limits of World Bank Group EHS standard set: Day–55 dB(A); Night–45 dB(A). Grey-shaded values exceed the EHS limits.

No.	Monitoring Location	Day Time		Night Time	
		Day 1	Day 2	Day 1	Day 2
1	Shangyou Village 上游村	48.6	48.9	42.5	42.1
2	Ligenglouzi 李更楼子	47.9	47.7	41.6	41.4
3	Jiannan Village 建南村	51.7	51.4	44.5	44.7
4	City No. 2 Hospital 市二医院	56.6	56.8	45.5	45.3
5	Xinjian No. 2 Village 新建二村	52.0	52.2	44.7	44.3
6	Xinzhuang No. 3 Village 新庄三村	52.6	52.3	44.3	44.0
7	Xie No. 2 Mine Hospital 谢二矿医院	56.1	56.5	45.0	45.1
8	City No. 16 Secondary School 市十六中	53.2	53.7	42.3	42.5
9	Quarry Northwest Village 矿北西村	51.3	51.5	43.8	43.6
10	Caizhuang 蔡庄	47.6	47.4	42.0	42.2
11	Xiaodonggang 小东岗	48.5	48.9	42.1	42.4
12	Huajian Primary and Secondary School 化建中小学	55.4	55.7	43.4	43.7
13	Yu'an Community 裕安小区	53.1	53.4	44.6	44.3
14	Huainan Teachers College 淮南师专	53.7	53.1	45.3	45.6
15	Sunyingzi 孙郢子	49.1	49.5	43.5	43.1
16	Huainan Bureau of Mine 淮南矿务局	57.0	57.3	46.4	46.7
17	Huainan No. 7 Secondary School 淮南七中	55.1	55.5	44.7	44.5
18	Shangri-La Community 香格里拉小区	53.7	53.2	45.5	45.1
19	Zhangdatang 张大塘	47.5	47.7	42.9	42.5

No.	Monitoring Location	Day Time		Night Time	
		Day 1	Day 2	Day 1	Day 2
20	Juren Village 居仁村	53.9	53.5	44.7	44.6
21	Linhang Primary School 林巷小学	53.3	53.8	42.0	42.5
22	Mazhuang 马庄	49.3	49.6	42.7	42.5
23	Hudayingzi 胡大郢孜	50.9	51.1	43.9	43.7
24	Luohe Hospital 洛河医院	54.6	54.4	43.5	43.8
25	Xingfu Village Dairy Product Company 乳品公司幸福村	51.5	51.9	44.1	44.3
26	Xinjiantang 新建塘	48.0	47.6	42.4	42.6
27	Yaohe Secondary School 窑河中学	53.3	53.5	42.6	42.3
28	Shangyao Medical Clinic 上窑卫生院	54.9	54.6	43.8	43.5
29	Yehangzi 余巷子	49.0	49.4	42.5	42.3
30	Houwu 后吴	48.4	48.6	42.3	42.7
31	Huaibin Village Dredged Sediment Disposal Site	45.6	45.3	40.5	40.3
32	Xiejiaji Landfill Dredged Sediment Disposal Site	46.1	46.5	40.3	40.9
33	Jiushang Road Dredged Sediment Disposal Site	46.3	46.7	40.1	40.4
34	Shijian Lake Pump Station 十涧湖泵站	52.9	52.7	45.3	45.6
35	Caozuizi Pump Station 曹嘴孜泵站	53.6	53.2	45.6	45.1
36	Long Lake Pump Station 龙湖泵站	54.5	54.3	46.1	46.4
37	Dajian Channel Pumping Station 大涧沟泵站	55.8	55.5	46.3	46.7
38	Gaotang Lake No. 1 Pump Station 高塘湖泵站一号	47.6	47.9	41.6	41.4
39	Gaotang Lake No. 2 Pump Station 高塘湖泵站二号	47.3	47.5	41.3	41.5
40	Gaotang Lake No. 3 Pump Station 高塘湖泵站三号	48.1	48.5	41.9	41.6
41	Gaotang Lake No. 4 Pump Station 高塘湖泵站四号	47.1	47.6	41.5	41.7
GB 3096-2008 Functional Area Category 2 Standards		60		50	
World Bank Group EHS Standards		55		45	

Source: HEMS

4. Water

59. **Surface water quality – sampling methods.** Baseline surface water quality monitoring for EIA in the PRC typically consists of sampling at selected sensitive receptors on two days. This sampling effort, although limited, complies with national standards for baseline water quality monitoring for a Class I ranked EIA. Baseline surface water quality monitoring was conducted between 1 and 8 December 2012 at 42 locations. These locations were selected by HEMS to be representative of the surface water quality of water bodies in the project area (Table V.23, Figures V.7-12). Monitoring parameters selected by HEMS included water temperature, pH, dissolved oxygen (DO), chemical oxygen demand (COD), 5-day biochemical oxygen demand (BOD5), ammonium nitrogen (NH3-N), total nitrogen (TN), total phosphorus (TP) and fecal coliform bacteria for channel and lake water, and in addition, fluoride (F-), silicate (Si), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr6+), lead (Pb) and anionic surfactant for lake water.

Table V.23: Surface Water Quality Monitoring Locations

Water Body	Monitoring Location	Description of Location
Bagongshan Channel	BG-01	500 m upstream of the project area
	BG-02	Channel mouth entering Huai River

Water Body	Monitoring Location	Description of Location
Xiejiaji Channel	XJ-01	Channel section within the project area
	XJ-02	Channel mouth entering Wabu Lake
Donghua Channel	DH-01	500 m upstream of the project area
	DH-02	Channel section before entering Caozuizi PS
Old Longwang Channel	LLW-01	Channel section within the project area
	LLW-02	Channel mouth entering Caoling Lake
Longwang Channel	LW-01	Channel section within the project area
Longwang Flood Diversion Channel	LWP-01	500 m upstream of the project area
	LWP-02	Channel section within the project area
	LWP-03	Channel mouth entering Dajiangou wetland
Huai River	HH-01	500 m upstream of Bagongshan Channel confluence
	HH-02	500 m downstream of Bagongshan Channel confluence
	HH-03	500 m upstream of No. 4 WTP intake
	HH-04	500 m upstream of No. 3 WTP intake
	HH-05	500 m downstream of Caozuizi PS confluence
	HH-06	500 m upstream of No. 1 WTP intake
	HH-07	500 m downstream of Long Lake PS confluence
Wabu Lake	WP-01	Within 500 m downstream of Xiejiaji Channel mouth
	WP-02	Within 200 m of the planned Southern WTP intake
Shijian Lake	S1-S6	See **Figure V.8**
Long Lake	L1-L4	See **Figure V.9**
Diajiangou	D1-D5	See **Figure V.10**
Caoling Lake	C1-C3	See **Figure V.11**
Gaotang Lake	G1-G3	See **Figure V.12**

Source: HEMS.

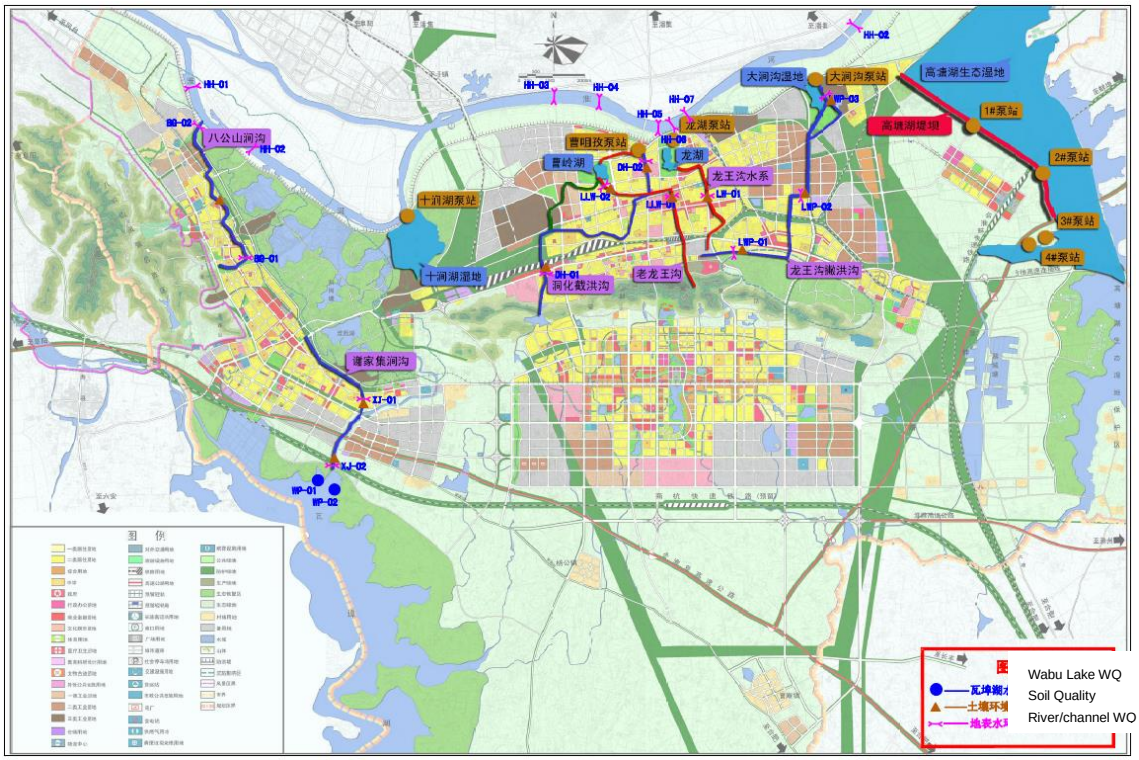
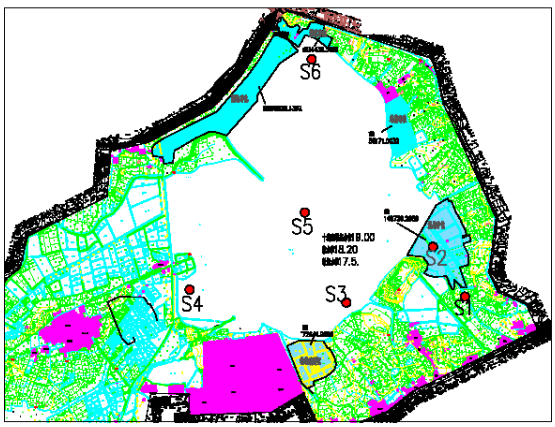
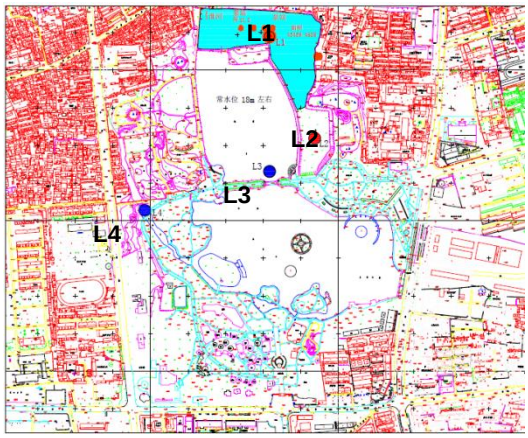
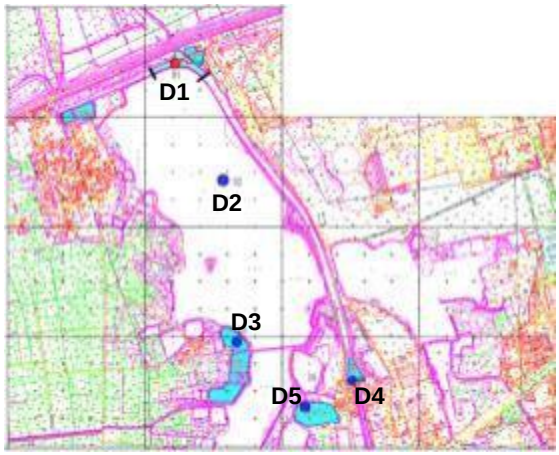


Figure V.7: River and Channel Monitoring Locations







Figures V.8-11: Monitoring locations at Shijian Lake (Fig. V.8, upper left), Long Lake (Fig. V.9, upper right), Dajiangou (Fig. V.10, lower left), and Caoling Lake (Fig. V.11, lower right).

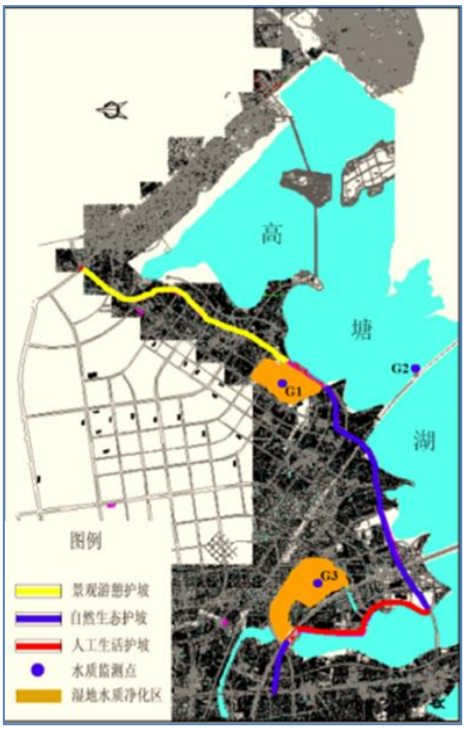


Figure V.12: Gaotang Lake Monitoring Locations

60. **Surface water quality – standards set for this project.** The determining standard is PRC's Environmental Quality Standards for Surface Water (GB 3838-2002). This defines five categories reflecting different environmental functions: I – highest water quality, for headwaters and National Nature Reserves; II – drinking water sources in Class I protection areas, habitats for rare aquatic organisms, breeding grounds for fish and crustaceans, and feeding grounds for fish fry; III – drinking water sources in Class II protection areas, wintering grounds for fish and crustaceans, migration routes, water bodies for aquaculture and capture fishery, and swimming; IV – general industrial use and non-contact recreational activities; V – lowest quality, suitable only for agricultural and scenic water uses (Table V.24). The World Bank Group has guidelines on effluent quality standards but not ambient water quality, and recognizes the use of local criteria for EHS purpose.

Table V.24: Environmental Quality Standards for Surface Water GB 3838-2002

Parameter	Category				
	I	II	III	IV	V
pH	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9
Dissolved oxygen (DO) [mg/L]	90% saturation or ≥7.5	≥6	≥5	≥3	≥2
Permanganate index (I_{Mn}) [mg/L]	≤2	≤4	≤6	≤10	≤15
Chemical oxygen demand (COD) [mg/L]	≤15	≤15	≤20	≤30	≤40
5-day Biochemical oxygen demand (BOD_5) [mg/L]	≤3	≤3	≤4	≤6	≤10
Ammonia nitrogen (NH_3-N) [mg/L]	≤0.15	≤0.5	≤1.0	≤1.5	≤2.0
Total phosphorus (as P) [mg/L]	≤0.02	≤0.1	≤0.2	≤0.3	≤0.4
Lakes & reservoirs	≤0.01	≤0.025	≤0.05	≤0.1	≤0.2
Total nitrogen (lakes, reservoirs, as N) [mg/L]	≤0.2	≤0.5	≤1.0	≤1.5	≤2.0

Parameter	Category				
	I	II	III	IV	V
Copper (Cu) [mg/L]	≤0.01	≤1.0	≤1.0	≤1.0	≤1.0
Zinc (Zn) [mg/L]	≤0.05	≤1.0	≤1.0	≤2.0	≤2.0
Fluoride (as F^-) [mg/L]	≤1.0	≤1.0	≤1.0	≤1.5	≤1.5
Selenium (Se) [mg/L]	≤0.01	≤0.01	≤0.01	≤0.02	≤0.02
Arsenic (As) [mg/L]	≤0.05	≤0.05	≤0.05	≤0.1	≤0.1
Mercury (Hg) [mg/L]	≤0.0005	≤0.0005	≤0.0001	≤0.001	≤0.001
Cadmium (Cd) [mg/L]	≤0.001	≤0.005	≤0.005	≤0.005	≤0.01
Chromium (Cr, hexavalent) [mg/L]	≤0.01	≤0.05	≤0.05	≤0.05	≤0.1
Lead (Pb) [mg/L]	≤0.01	≤0.01	≤0.05	≤0.05	≤0.1
Cyanide (CN) [mg/L]	≤0.005	≤0.05	≤0.2	≤0.2	≤0.2
Volatile phenol [mg/L]	≤0.002	≤0.002	≤0.005	≤0.01	≤0.1
Total petroleum hydrocarbon (TPH) [mg/l]	≤0.05	≤0.05	≤0.05	≤0.5	≤1.0
Anionic surfactant [mg/L]	≤0.2	≤0.2	≤0.2	≤0.3	≤0.3
Sulfide [mg/L]	≤0.05	≤0.1	≤0.2	≤0.5	≤1.0
Fecal coliform bacteria [number/L]	≤200	≤2000	≤10000	≤20000	≤40000

61. Discharge of wastewater from construction sites and supernatant water from the dredged sediment disposal sites is regulated under PRC's Integrated Wastewater Discharge Standard (GB 8978-1996). Class I standards apply to discharges into Category III water bodies under GB 3838-2002. Class II standards apply to discharges into Categories IV and V water bodies. Class III standards apply to discharges into municipal sewers going to municipal WWTPs with secondary treatment (Table V.25).

Table V.25: Wastewater Discharge Standards for Construction Sites and Dredged Sediment Disposal Sites according to GB 8978-1996

Parameter		Class I (for discharging into Category III water body)	Class II (for discharging into Categories IV & V water body)	Class III (for discharging into municipal sewer)
pH		6 ~ 9	6 ~ 9	6 ~ 9
SS	mg/L	70	150	400
BOD_5	mg/L	20	30	300
COD	mg/L	100	150	500
TPH	mg/L	5	10	20
Volatile phenol	mg/L	0.5	0.5	2.0
NH_3-N	mg/L	15	25	---
PO_4^{2-} (as P)	mg/L	0.5	1.0	---
LAS (= anionic surfactant)	mg/L	5.0	10	20

62. **Surface water quality – sampling results.** Surface water quality classifications for various water bodies in Huainan Municipality reported by the Huainan Water Resources Bureau (HWRB), their designated functions, and intended water quality categories, are in Table V.26. Project baseline surface water quality monitoring in the project channels and lakes and Huai River are in Table V.27. GB 3838-2002 applies more stringent TP standards to lakes and

reservoirs. Water quality category designation for the water body is based on the worst water quality parameter. Data in Tables V.26-27 indicate the following.

(i) Water quality was better in the dry than wet season.

(ii) Water quality in the Huai River, except the section designated as the Huainan effluent discharge control area, is targeted for categories II~III, but the 2011 water quality showed mostly categories III~IV. Monitoring along the Huai River 500 m upstream of the intakes of No. 4 WTP (HH-03), No. 3 WTP (HH-04) and No. 1 WTP (HH-06) all showed Category V (fecal coliform) and worse (NH_3-N and TN) water quality.

(iii) The Huainan Huai River drinking water source area, one of two drinking water sources for the municipality, showed categories III~IV in both wet and dry seasons, compared to category targets of II~III. Under GB 3838-2002, only category III or above water quality is suitable for use as centralized drinking water sources.

(iv) Wabu Lake, the other drinking water source for the municipality, achieved categories II~III in the dry season but category III only 60% of the time in the wet season. According to the Huainan WRB, Wabu Lake showed mild eutrophic state year round based on levels of TP, TN and permanganate index. Baseline monitoring in this lake near the planned Southern WTP intake showed Category IV water quality due to fecal coliform, TP and TN levels.

(v) Water quality in Gaotang Lake was mostly category IV (80% in wet season and 71% in dry season), with better water quality in the dry season (categories II~III) compared to the wet season (categories III~IV). According to the Huainan WRB, Gaotang Lake showed mild eutrophic state in the wet season and moderate eutrophic state in the dry season. The monitoring data showed that Gaotang Lake had the best water quality (Category IV due to TP levels) among the five project lakes (Shijian, Long, Dajiangou, Caoling, Gaotang). The other lakes showed Category V water quality (Shijian due to TP levels) or worse (Long, Dajiangou and Caoling due to NH_3-N, TP and TN levels). Such data indicate eutrophic conditions in these lakes.

(vi) Mercury (Hg) in all five project lakes showed Category IV levels. It is likely this has come from airborne sources related to coal mining and burning in the municipality.

(vii) All six project urban drainage channels had worse than Category V water quality due to high levels of NH_3-N, TP and TN, indicative of anthropogenic pollution. According to the USEPA[7], NH_3-N includes both the ionized (ammonium, NH_4^+) and unionized (ammonia, NH_3) form. The unionized form (NH_3) is more toxic than the ionized form and is a common cause of fish kills. An increase in pH favors formation of the unionized form, while a decrease favors the ionized form. Xiejiaji Channel, Donghua Channel, Old Longwang Channel and Longwang Channel in particular had very high levels of NH_3-N.

(viii) Xiejiaji Channel, Donghua Channel, Old Longwang Channel and Longwang Channel showed high levels of COD; the latter two also had high levels of BOD_5, all exceeding Category V standards.

(ix) Xiejiaji Channel flows into Wabu Lake. Monitoring at the channel mouth (XJ-02) showed Category V (fecal coliform) and worse (COD, NH3-N, TP, TN) water quality, directly affecting the water quality in Wabu Lake, a drinking water source for Huainan Municipality.

[7] http://www.epa.gov/caddis/ssr_amm_int.html

Monitoring in Wabu Lake near the Xiejiaji Channel mouth showed Category IV water quality due to fecal coliform, TP and TN levels.

(x) Old Longwang Channel and Longwang Channel had DO levels that were <0.20 mg/L, unlikely to sustain aquatic life. Bagongshan Channel flows into the Huai River. Monitoring at the channel mouth (BG-02) showed Category V (fecal coliform and TN) and worse (TP) water quality, thus directly affecting the Huai River water quality. Monitoring data at HH-02 in Huai River 500 m downstream of the Bagongshan Channel mouth showed Category III water quality, indicating assimilation and dispersion by Huai River water.

63. Water quality in the project drainage channels is poor as they are used to convey both wastewater and storm water. Since there is no established program for channel maintenance, sludge, sediment and solid waste have accumulated in the drainage channels over time, causing increasing deterioration of the urban water environment.

Table V.26: Huainan Municipality Surface Water Quality in 2011

Site	Water Functional Area Designation	Monitoring Cross-section	GB 3838-2002 Category Target	Wet Season (Jun–Sep) % Occurrence in quality category of GB 3838-2002					Dry Season (Oct–May) % Occurrence in quality category of GB 3838-2002				
				II	III	IV	V	>V	II	III	IV	V	>V
Huai River	Huai River Fuyang Lu'an agriculture water use area	Lutaizi	II ~ III		20%	80%				71%	29%		
	Huai River Fengtai industrial water use area	Fengtai Bridge	III		60%	40%				71%	29%		
	Huai River Fengtai Bagongshan transitional area	Lizuizi (upper)	III		80%	20%				86%	14%		
	Huai River Huainan drinking water source area	Huainan Huai River Gongtie Bridge	II ~ III		60%	40%				57%	43%		
	Huai River Huainan effluent discharge control area	Tianjia'an	none			60%		40%		14%	57%		29%
	Huai River Huainan Bengbu transitional area	Dajiangou	III			100%				43%	43%		14%
Xifei River	Lixin Fengtai agriculture fisheries water use area	Xifei River flood gate	III		20%	80%			57%		43%		
Gaotang Lake	Chuzhou Hefei agriculture water use area	Yao River flood gate	II ~ III			80%	20%			29%	71%		
Wabu Lake	Water diversion and water source protection area	Lake area near Zhuji Station	II ~ III		60%	40%			100%				

Source: Huainan Water Resources Bureau. 2012. *2011 Huainan Municipality water resources report*.

Table V.27: Surface Water Quality Monitoring Data, December 2012. Source: HEMS.

No.	Site	Location	Date	Water Temp °C	pH	DO (mg/L)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	TP (mg/L)	TN (mg/L)	Fecal Coliform (no./L)	F^- (mg/L)	Si (mg/L)	Hg (mg/L)	Cd (mg/L)	Cr^{6+} (mg/L)	Pb (mg/L)	Anionic Surfactant (mg/L)
Rivers / Channels																			
1	Bagongshan Channel 八公山涧沟	BG-01	Dec 1	11.4	7.97	9.22	30	6.08	6.50	0.63	7.14	>24196							
			Dec 2	11.6	7.94	9.48	35	6.00	6.20	0.65	7.31	>24196							
		BG-02	Dec 1	13.1	8.17	12.0	22	2.23	0.95	0.93	1.65	>24196							
			Dec 2	13.2	8.16	12.1	21	2.41	0.94	0.95	1.73	>24196							
2	Xiejiaji Channel 谢家集涧沟	XJ-01	Dec 1	12.8	7.64	1.84	155	1.45	43.8	1.19	46.4	>24196							
			Dec 2	12.7	7.68	2.02	152	1.52	39.2	1.18	45.4	>24196							
		XJ-02	Dec 1	12.7	7.76	2.23	200	1.77	11.5	1.22	13.0	>24196							
			Dec 2	12.7	7.84	2.17	225	1.63	9.53	1.21	12.7	>24196							
3	Donghua Channel	DH-01	Dec 1	17.0	9.29	11.4	93	1.71	74.9	0.93	77.3	>24196							

No.	Site	Location	Date	Water Temp °C	pH	DO (mg/L)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	TP (mg/L)	TN (mg/L)	Fecal Coliform (no./L)	F^- (mg/L)	Si (mg/L)	Hg (mg/L)	Cd (mg/L)	Cr^{6+} (mg/L)	Pb (mg/L)	Anionic Surfactant (mg/L)
	洞化截洪沟		Dec 2	17.1	9.17	11.7	91	1.79	73.8	0.95	76.5	>24196							
		DH-02	Dec 1	16.8	8.93	11.6	88	2.15	71.8	0.93	78.4	>24196							
			Dec 2	17.0	8.64	11.4	83	2.06	69.3	0.92	74.6	>24196							
4	Old Longwang Channel 老龙王沟	LLW-01	Dec 1	11.2	8.17	<0.20	118	35.0	30.0	2.39	33.8	>24196							
			Dec 2	11.0	8.16	<0.20	112	40.0	29.3	2.33	33.3	>24196							
		LLW-02	Dec 1	12.3	8.86	<0.20	121	45.0	31.5	2.43	34.4	>24196							
			Dec 2	12.1	8.84	<0.20	127	50.0	31.0	2.42	34.0	>24196							
5	Longwang Channel 龙王沟水系	LW-01	Dec 1	11.4	8.18	<0.20	118	40.0	31.5	2.40	34.3	>24196							
			Dec 2	11.3	8.17	<0.20	125	30.0	29.8	2.41	35.9	>24196							
6	Longwang Flood Diversion Channel 龙王沟撇洪沟	LWP-01	Dec 1	10.5	8.52	9.81	12	5.65	17.9	0.67	18.7	>24196							
			Dec 2	10.8	8.47	9.67	14	5.48	16.7	0.67	17.5	>24196							
		LWP-02	Dec 1	10.8	8.17	10.0	17	3.77	17.0	0.87	17.3	>24196							
			Dec 2	10.6	8.18	9.86	19	3.18	16.1	0.81	16.5	>24196							
		LWP-03	Dec 1	10.7	8.36	9.75	11	5.01	15.1	0.93	16.1	>24196							
			Dec 2	10.3	8.26	9.98	10	5.13	14.7	0.91	15.8	>24196							
7	Huai River 淮河	HH-01	Dec 3	11.9	8.49	10.9	12	2.13	0.24	0.13	0.47	24196							
			Dec 4	11.8	8.37	10.6	14	1.71	0.23	0.13	0.45	19863							
		HH-02	Dec 3	12.1	8.56	9.63	15	3.26	0.56	0.14	0.74	2382							
			Dec 4	12.3	8.47	9.40	18	3.54	0.55	0.13	0.72	2603							
		HH-03	Dec 3	11.3	8.18	10.3	11	2.17	2.96	0.21	3.35	>24196							
			Dec 4	11.6	8.21	10.8	12	2.94	2.90	0.21	3.36	>24196							
		HH-04	Dec 3	11.6	8.07	10.5	14	3.23	2.73	0.21	3.39	>24196							
			Dec 4	11.4	8.17	10.3	15	2.76	2.65	0.21	3.32	>24196							
		HH-05	Dec 3	11.8	8.36	9.78	15	2.40	2.68	0.20	4.94	>24196							
			Dec 4	11.8	8.24	9.36	14	2.64	2.41	0.20	4.92	>24196							
		HH-06	Dec 3	11.3	8.21	10.1	14	2.95	2.82	0.21	5.86	>24196							
			Dec 4	11.5	8.16	9.20	18	2.83	2.68	0.21	5.78	>24196							
		HH-07	Dec 3	11.8	8.52	10.2	12	3.03	3.04	0.19	4.84	>24196							
			Dec 4	11.7	8.42	9.92	11	2.93	2.96	0.19	4.35	>24196							
8	Wabu Lake	WP-01	Dec 3	9.5	8.53	9.94	18	2.91	0.27	0.08	1.07	11199							

No.	Site	Location	Date	Water Temp °C	pH	DO (mg/L)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	TP (mg/L)	TN (mg/L)	Fecal Coliform (no./L)	F^- (mg/L)	Si (mg/L)	Hg (mg/L)	Cd (mg/L)	Cr^{6+} (mg/L)	Pb (mg/L)	Anionic Surfactant (mg/L)
	瓦埠湖		Dec 4	9.4	8.47	10.1	19	3.19	0.24	0.08	1.05	9804							
		WP-02	Dec 3	9.4	8.47	10.4	26	3.65	0.31	0.07	1.11	12033							
			Dec 4	9.2	8.41	10.2	23	3.38	0.27	0.08	1.08	10642							
Lakes *(where more stringent TP standards apply)*																			
9	Shijian Lake	S1	Dec 5	6.2	8.12	8.89	13	1.43	0.55	0.12	0.92	98	0.61	0.0007	0.00021	<0.0001	0.005	0.0029	<0.05
	十涧湖		Dec 7	6.0	8.03	9.46	13	1.77	0.54	0.12	0.93	97	0.65	0.0007	0.00022	<0.0001	0.005	0.0029	<0.05
		S2	Dec 5	6.3	8.02	9.05	11	1.48	0.49	0.11	0.89	110	0.62	0.0013	0.00017	<0.0001	<0.004	0.0024	<0.05
			Dec 7	6.1	8.12	9.26	14	1.61	0.48	0.11	0.91	121	0.61	0.0014	0.00018	<0.0001	<0.004	0.0024	<0.05
		S3	Dec 5	6.1	8.11	11.6	10	4.00	0.50	0.14	0.84	185	0.60	0.0018	0.00030	0.0002	<0.004	0.0019	<0.05
			Dec 7	6.0	8.22	11.4	12	4.29	0.47	0.14	0.80	211	0.59	0.0020	0.00029	0.0002	<0.004	0.0020	<0.05
		S4	Dec 5	6.0	8.12	11.3	15	4.31	0.43	0.14	0.78	359	0.64	0.0020	0.00038	0.0014	<0.004	0.0022	<0.05
			Dec 7	6.3	8.14	11.2	16	4.02	0.40	0.13	0.80	336	0.69	0.0021	0.00036	0.0013	<0.004	0.0021	<0.05
		S5	Dec 5	6.3	8.17	11.4	14	4.04	0.46	0.12	0.92	189	0.58	0.0018	0.00031	0.0004	<0.004	0.0016	<0.05
			Dec 7	6.2	8.21	11.5	12	4.23	0.41	0.11	0.95	203	0.56	0.0018	0.00030	0.0004	<0.004	0.0016	<0.05
		S6	Dec 5	6.0	8.14	11.5	11	3.85	0.53	0.11	0.88	262	0.63	0.0007	0.00018	0.0002	<0.004	0.0016	<0.05
			Dec 7	6.0	8.04	11.1	12	3.67	0.48	0.11	0.85	246	0.65	0.0006	0.00016	0.0002	<0.004	0.0016	<0.05
10	Long Lake	L1	Dec 6	14.2	7.82	8.58	19	6.25	28.5	1.79	32.3	>24196	0.45	0.0016	0.00029	<0.0001	0.005	0.0035	2.08
	龙湖		Dec 8	14.2	7.96	9.48	21	5.79	26.1	1.71	31.9	>24196	0.46	0.0020	0.00028	<0.0001	0.005	0.0027	2.05
		L2	Dec 6	8.9	8.04	9.82	18	6.09	0.45	0.16	1.00	>24196	0.46	0.0020	0.00028	<0.0001	0.004	0.0014	0.12
			Dec 8	8.7	8.12	9.98	15	5.88	0.39	0.19	1.03	>24196	0.40	0.0020	0.00026	<0.0001	0.005	0.0031	0.11
		L3	Dec 6	9.7	8.28	7.92	15	1.16	0.33	0.09	1.24	226	0.41	0.0027	0.00033	<0.0001	<0.004	<0.000	0.07
			Dec 8	9.8	8.17	8.04	16	1.63	0.30	0.12	1.22	223	0.44	0.0026	0.00029	<0.0001	0.004	<0.000	0.08
		L4	Dec 6	11.5	8.04	11.5	14	4.66	0.92	0.12	1.27	2987	0.40	0.0025	0.00029	<0.0001	<0.004	0.0017	<0.05
			Dec 8	10.4	8.12	11.1	12	4.94	0.86	0.11	1.32	2310	0.46	0.0023	0.00024	<0.0001	<0.004	0.0011	<0.05
11	Dajiangou	D1	Dec 6	8.5	8.51	10.9	23	5.67	3.37	0.27	7.01	12033	0.37	0.0027	0.00024	<0.0001	0.015	0.0014	0.10
	大涧沟		Dec 8	8.3	8.52	10.6	27	5.48	3.02	0.28	6.88	14136	0.19	0.0028	0.00024	<0.0001	0.014	0.0014	0.11
		D2	Dec 6	8.3	8.41	11.2	30	7.20	3.61	0.30	6.22	24196	0.22	0.0027	0.00022	<0.0001	0.007	0.0013	0.11
			Dec 8	8.4	8.41	11.0	32	6.76	3.36	0.29	6.19	19863	0.37	0.0025	0.00023	<0.0001	0.005	0.0013	0.10
		D3	Dec 6	8.3	8.42	10.8	30	5.77	3.32	0.27	5.09	19863	0.29	0.0021	0.00023	<0.0001	0.005	0.0013	0.13
			Dec 8	8.2	8.17	11.3	25	5.98	2.93	0.28	5.11	12997	0.24	0.0022	0.00023	<0.0001	0.005	0.0013	0.12

No.	Site	Location	Date	Water Temp °C	pH	DO (mg/L)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N (mg/L)	TP (mg/L)	TN (mg/L)	Fecal Coliform (no./L)	F^- (mg/L)	Si (mg/L)	Hg (mg/L)	Cd (mg/L)	Cr^{6+} (mg/L)	Pb (mg/L)	Anionic Surfactant (mg/L)
		D4	Dec 6	8.3	7.96	11.0	27	6.17	3.50	0.26	3.66	7270	0.37	0.0025	0.00020	<0.0001	<0.004	0.0011	0.09
			Dec 8	8.4	7.96	11.1	22	5.50	3.10	0.27	3.70	8164	0.35	0.0023	0.00021	<0.0001	0.004	0.0011	0.09
		D5	Dec 6	8.5	8.61	11.4	22	5.77	3.26	0.21	3.81	<10	0.15	0.0023	0.00021	<0.0001	0.004	0.0013	0.10
			Dec 8	8.3	8.62	10.5	24	6.13	2.64	0.22	2.94	10	0.36	0.0021	0.00023	<0.0001	0.004	0.0013	0.09
12	Chaoling Lake 曹岭湖	C1	Dec 6	6.1	7.50	2.33	15	0.66	3.11	0.23	4.01	9208	0.46	0.0014	0.00025	<0.0001	0.010	<0.000	0.13
			Dec 8	6.0	7.62	2.48	16	1.08	2.85	0.23	3.97	9804	0.49	0.0014	0.00023	<0.0001	0.009	<0.000	0.12
		C2	Dec 6	6.0	7.62	2.82	21	0.72	3.10	0.23	3.82	11199	0.48	0.0019	0.00025	<0.0001	0.005	<0.000	0.12
			Dec 8	6.3	7.71	2.95	24	1.13	2.90	0.23	3.38	10462	0.48	0.0019	0.00023	<0.0001	0.005	<0.000	0.11
		C3	Dec 6	6.1	7.47	2.35	13	0.45	3.32	0.23	3.93	10462	0.47	0.0022	0.00022	<0.0001	0.005	<0.000	0.17
			Dec 8	6.1	7.51	2.68	14	0.97	3.18	0.23	3.55	8664	0.44	0.0022	0.00022	<0.0001	0.005	<0.000	0.16
13	Gaotang Lake 高塘湖	G1	Dec 5	7.4	8.33	12.1	14	1.54	0.43	0.07	0.78	749	0.35	0.0011	0.00021	<0.0001	0.011	0.0011	<0.05
			Dec 7	7.3	8.27	11.7	15	1.63	0.40	0.07	0.80	691	0.37	0.0013	0.00021	<0.0001	0.009	0.0011	<0.05
		G2	Dec 5	7.6	8.17	9.03	14	1.26	0.59	0.08	0.89	576	0.35	0.0008	0.00010	<0.0001	0.004	0.0016	<0.05
			Dec 7	7.4	8.16	9.36	12	1.38	0.60	0.08	0.87	624	0.36	0.0008	0.00014	<0.0001	0.005	<0.000	<0.05
		G3	Dec 5	7.4	8.26	10.5	12	2.95	0.57	0.06	0.72	1019	0.36	0.0015	0.00035	<0.0001	0.005	0.0012	<0.05
			Dec 7	7.4	8.22	10.8	11	3.26	0.60	0.05	0.73	905	0.33	0.0016	0..,0003	<0.0001	0.005	0.0020	<0.05
GB 3838-2002 Standards		II		Man-made temperature change ≤-2 to ≤+1 weekly average	6~9	≥6	≤15	≤3	≤0.5	≤0.1	≤0.5	≤2000	≤1.0	≤0.01	≤0.00005	≤0.005	≤0.05	≤0.01	≤0.2
		Lakes & Reservoirs								≤0.025									
		III			6~9	≥5	≤20	≤4	≤1.0	≤0.2	≤1.0	≤10000	≤1.0	≤0.01	≤0.0001	≤0.005	≤0.05	≤0.05	≤0.2
		Lakes & Reservoirs								≤0.05									
		IV			6~9	≥3	≤30	≤6	≤1.5	≤0.3	≤1.5	≤20000	≤1.5	≤0.02	≤0.001	≤0.005	≤0.05	≤0.05	≤0.3
		Lakes & Reservoirs								≤0.1									
		V			6~9	≥2	≤40	≤10	≤2.0	≤0.4	≤2.0	≤40000	≤1.5	≤0.02	≤0.001	≤0.01	≤0.1	≤0.1	≤0.3
		Lakes & Reservoirs								≤0.2									
		Worse than V																	

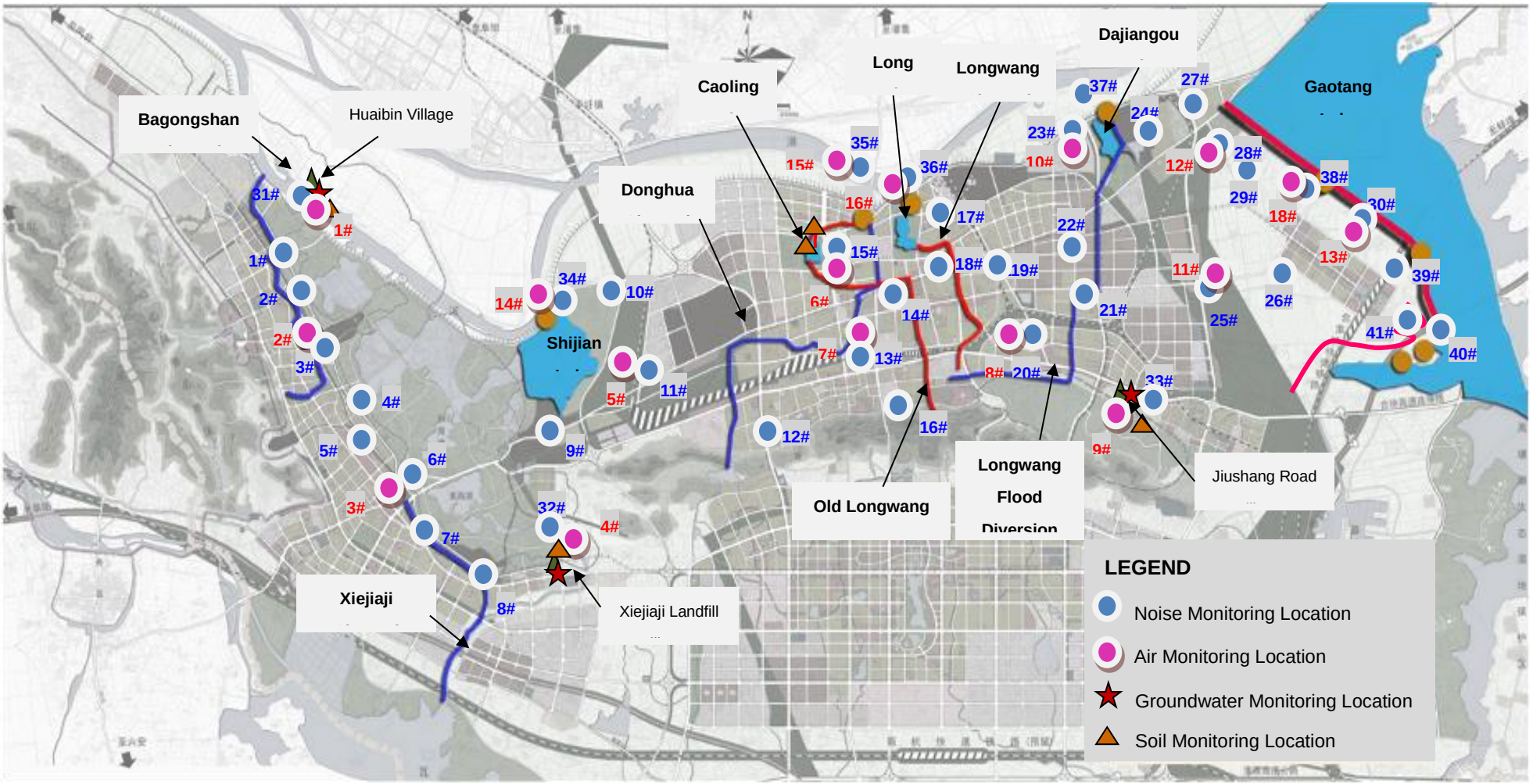


Figure V.13: Locations of baseline sampling locations for noise, air, ground water and soil quality. See Tables V.18 and V.20 for details of air and noise sampling locations respectively.

64. **Ground water quality – sampling methods.** Ground water monitoring for EIA in the PRC typically consists of sampling at selected locations on two days. Baseline monitoring was conducted on 9-10 December 2012 at the 3 dredged sediment disposal sites: Huaibin Village Site, Xiejiaji Landfill Site, Jiushang Road Site (Figure IV.3). These locations were selected by HEMS since there may be potential leachate impact to ground water. Monitoring parameters selected by HEMS were water temperature, pH, total hardness, total dissolved solid, ammonium nitrogen (NH_3-N), permanganate index (IMn), sulfate (SO_4-), nitrate (NO_3-), nitrite (NO_2-), volatile phenol, chloride (Cl-), arsenic (As), mercury (Hg), hexavalent chromium (Cr6+), lead (Pb), fluoride (F-), cadmium (Cd) and total coliform bacteria.

65. **Ground water quality – standards set for this project.** In the PRC this is divided into five categories according to the Quality Standard for Ground Water (GB/T 14848-93) (Table V.28). Category III or above is suitable as drinking water. Category IV can only be used for drinking water after treatment.

Table V.28: Ground Water Quality Standards according to GB/T 14848-93

Parameter	Unit	Category				
		I	II	III	IV	V
Color	HU	≤5	≤5	≤15	≤25	>25
Odor and taste	---	none	none	none	none	none
Turbidity	NTU	≤3	≤3	≤3	≤10	>10
Visible object	---	none	none	none	none	none
pH	---	6.5~8.5	6.5~8.5	6.5~8.5	5.5~6.5, 8.5~9	<5.5, >9
Total hardness (as $CaCO_3$)	mg/L	≤150	≤300	≤450	≤550	>550
Total dissolved solid (TDS)	mg/L	≤300	≤500	≤1000	≤2000	>2000
Sulfate (SO_4^{2-})	mg/L	≤50	≤150	≤250	≤350	>350
Chloride (Cl^-)	mg/L	≤50	≤150	≤250	≤350	>350
Iron (Fe)	mg/L	≤0.1	≤0.2	≤0.3	≤1.5	>1.5
Manganese (Mn)	mg/L	≤0.05	≤0.05	≤0.1	≤1.0	>1.0
Copper (Cu)	mg/L	≤0.01	≤0.05	≤1.0	≤1.5	>1.5
Zinc (Zn)	mg/L	≤0.05	≤0.5	≤1.0	≤5.0	>5.0
Molybdenum (Mo)	mg/L	≤0.001	≤0.01	≤0.1	≤0.5	>0.5
Cobalt (Co)	mg/L	≤0.005	≤0.05	≤0.05	≤1.0	>1.0
Volatile phenol	mg/L	≤0.001	≤0.001	≤0.002	≤0.01	>0.01
Anionic surfactant	mg/L	non-detected	≤0.1	≤0.3	≤0.3	>0.3
Permanganate index (I_{Mn})	mg/L	≤1.0	≤2.0	≤3.0	≤10	>10
Nitrate (NO_3^-, as N)	mg/L	≤2.0	≤5.0	≤20	≤30	>30
Nitrite (NO_2^-, as N)	mg/L	≤0.001	≤0.01	≤0.02	≤0.1	>0.1
Ammonia nitrogen (NH_3-N)	mg/L	≤0.02	≤0.02	≤0.2	≤0.5	>0.5
Fluoride (F^-)	mg/L	≤1.0	≤1.0	≤1.0	≤2.0	>2.0
Iodide (I^-)	mg/L	≤0.1	≤0.1	≤0.2	≤1.0	>1.0
Cyanide (CN)	mg/L	≤0.001	≤0.01	≤0.05	≤0.1	>0.1
Mercury (Hg)	mg/L	≤0.00005	≤0.00005	≤0.001	≤0.001	>0.001
Arsenic (As)	mg/L	≤0.005	≤0.01	≤0.05	≤0.05	>0.05
Selenium (Se)	mg/L	≤0.01	≤0.01	≤0.01	≤0.1	>0.1
Cadmium (Cd)	mg/L	≤0.0001	≤0.001	≤0.01	≤0.01	>0.01
Hexavalent chromium (Cr^{6+})	mg/L	≤0.005	≤0.01	≤0.05	≤0.1	>0.1

Parameter	Unit	Category				
		I	II	III	IV	V
Lead (Pb)	mg/L	≤0.005	≤0.01	≤0.05	≤0.1	>0.1
Beryllium (Be)	mg/L	≤0.00002	≤0.0001	≤0.0002	≤0.001	>0.001
Barium (Ba)	mg/L	≤0.01	≤0.1	≤1.0	≤4.0	>4.0
Nickel (Ni)	mg/L	≤0.005	≤0.05	≤0.05	≤0.1	>0.1
Dichlorodiphenyltrichloroethane (DDT)	µg/L	non-detected	≤0.005	≤1.0	≤1.0	>1.0
Lindane (666)	µg/L	≤0.005	≤0.05	≤5.0	≤5.0	>5.0
Total coliform bacteria	no./L	≤3.0	≤3.0	≤3.0	≤100	>100
Total bacteria	no./L	≤100	≤100	≤100	≤1000	>1000
Total alpha (α) radioactivity	Bq/L	≤0.1	≤0.1	≤0.1	>0.1	>0.1
Total beta (β) radioactivity	Bq/L	≤0.1	≤1.0	≤1.0	>1.0	>1.0

66. **Ground water quality – sampling results.** Water sources in Huainan are mainly from quaternary strata, distributed in an area bounded by Cihuaixin River in the north, Xifei River in the west, Huai River in the south and Xingnian Sluice Gate in the east, as well as in low-lying areas of flood alluvial Class I terraces along the Huai River. The estimated total ground water storage capacity is 3.7 billion m^3, of which 300 million m^3/year are extractable with water quality suitable for production and domestic uses. Groundwater accounts for 26% of Huainan Municipality's total water resource and 8% of its total water supply (Table V.5). Groundwater is mainly used by the mining sector and industrial enterprises. Baseline groundwater quality monitoring results (Table V.29) showed that ground water quality was category V, due to high levels of nitrate (NO3-) and total coliform bacteria on the days of monitoring at all three sites, indicative of anthropogenic pollution.

5. Soil and sediments

67. **Sampling methods.** For soil quality, baseline monitoring was conducted on two days, 21-23 November 2013, at each of the three dredged sediment disposal sites (Huaibin Village Site, Xiejiaji Landfill Site, Jiushang Road Site) and Caoling Lake (Figure V.13), which was dry at the time and had been used for bottom ash storage. Locations were selected by HEMS to assess whether the soil quality at these sites was suitable for the disposal of dredged sediment and whether such disposal would impact on the soil quality. Monitoring parameters selected by HEMS included Cd, Hg, As, copper (Cu), Pb, zinc (Zn), nickel (Ni), chromium (Cr), Lindane, and DDT. For sediment quality, baseline monitoring in the urban channels and lakes was conducted on two days at each of the surface water quality monitoring locations (Table V.27; Figures V.7-12) from 19-23 November 2012. Parameters selected by HEMS were moisture content, pH, organic content, total nitrogen (TN), total phosphorus (TP), Cd, Hg, As, Cu, Pb, Zn, Ni, Cr, Lindane and DDT. Sampling effort, although limited, complies with national standards for baseline soil monitoring for a Class I ranked EIA.

68. **Standards used for this project.** Soil quality in the PRC is divided into three classes according to Environmental Quality Standard for Soils (GB 15618-1995), with 1 the best and 3 the worst. The PRC does not have quality standards for sediments in waterways (rivers, lakes, reservoirs, the sea), and GB 15618-1995 is commonly applied to assess sediment quality as sediment is often disposed on land and used for agriculture or planting. Some EIRs in the PRC

have also used the Control Standards for Pollutants in Sludges from Agricultural Use (GB 4284-84) for assessing sediment quality (the rationale being that river sediment is similar to sludge). GB 15618-1995 standards are more stringent than GB 4284-84 standards (Table V.30). Therefore GB 15618-1995 is used in this project for assessing sediment quality. The World Bank Group does not have EHS standards for soil and sediment quality.

Table V.30: Comparison of Environmental Quality Standards for Soil and Control Standards for Pollutants in Sludge for Agricultural Use

Parameter		Maximum Allowable Concentration in mg/kg dry weight						
		GB 15618-1995 (Soil)					GB 4284-84 (Sludge for Agricultural Use)	
		Class 1	Class 2			Class 3		
	Soil pH	Background	<6.5	6.5~7.5	>7.5	>6.5	<6.5	≥6.5
Cadmium (Cd)		0.20	0.30	0.30	0.60	1.0	5	20
Mercury (Hg)		0.15	0.30	0.50	1.0	1.5	5	15
Arsenic (As)	Paddy	15	30	25	20	30	75	75
	Dry land	15	40	30	25	40		
Copper (Cu)	Farm land	35	50	100	100	400	250	500
	Orchard	---	150	200	200	400		
Lead (Pb)		35	250	300	350	500	300	1000
Chromium (Cr)	Paddy	90	250	300	350	400	600	1000
	Dry land	90	150	200	250	300		
Zinc (Zn)		100	200	250	300	500	500	1000
Nickel (Ni)		40	40	50	60	200	100	200
Boron (B, soluble)		---	---	---	---	---	150	150
DDT		0.05	0.50			1.0	---	---
666 (Lindane)		0.05	0.50			1.0	---	---
Mineral oil		---	---	---	---	---	3000	3000
Benzo(a)pyrene		---	---	---	---	---	3	3

69. **Sampling results.** Baseline soil quality monitoring results (Table V.31) indicate that Hg level at the proposed Bagongshan dredged sediment disposal site exceeds GB 15618-1995 Class 2 standard. Baseline sediment quality monitoring results (Table V.32) indicated that sediment quality at these locations met GB 15618-1995 Class 2 standard and the dredged sediment is therefore suitable for land disposal and planting use. Though not regulated, high levels of TN (range 590~2192 mg/kg) and TP (range 615~2396 mg/kg) were found in the sediment, indicative of the eutrophic potential of the sediment especially in all drainage channels and near shore locations of the lakes (G3 in Gaotang Lake, S1 and S2 in Shijian Lake, and L1 in Long Lake). Dredging of sediment in the drainage channels will remove nutrients from the water system and together with wastewater interception, will contribute to eventual water quality improvement in these water bodies.

Table V.29: Groundwater quality monitoring data at the dredged sediment disposal sites in 2012. Source: HEMS.

No.	Location	Date	Water Depth (m)	Water Temp (°C)	pH	Total Hardnes (mg/L)	Total Dissolved Solid (mg/L)	NH_4-N (mg/L)	I_{Mn} (mg/L)	SO_4^- (mg/L)	NO_3^- (mg/L)	NO_2^- (mg/L)	Volatile Phenol (mg/L)	Cl^- (mg/L)	As (mg/L)	Hg (mg/L)	Cr^{6+} (mg/L)	Pb (mg/L)	F^- (mg/L)	Cd (mg/L)	Total Coliform Bacteria (no./L)
1	Huaibin Village Site	Dec 9	12	16.2	7.17	519	510	0.090	<0.50	138	225	0.010	<0.001	57.3	<0.0003	<0.00005	<0.004	<0.0001	0.290	<0.0001	399
		Dec 10		16.3	7.21	529	498	0.087	0.53	139	235	0.013	<0.001	57.5	<0.0003	<0.00005	<0.004	<0.0001	0.301	<0.0001	379
2	Xiejiaji Landfill Site	Dec 9	6	15.8	7.03	551	1034	0.084	0.81	141	240	0.013	<0.001	57.2	<0.0003	<0.00005	<0.004	<0.0001	0.354	<0.0001	315
		Dec 10		15.6	7.08	559	1004	0.083	0.76	142	241	0.007	<0.001	57.5	<0.0003	<0.00005	<0.004	<0.0001	0.337	<0.0001	332
3	Jiushang Road Site	Dec 9	15	17.0	7.48	557	876	0.095	1.16	107	38.1	0.363	<0.001	66.6	<0.0003	<0.00005	<0.004	<0.0001	0.507	<0.0001	246
		Dec 10		17.1	7.47	569	840	0.097	1.10	108	38.8	0.330	<0.001	66.3	<0.0003	<0.00005	<0.004	<0.0001	0.515	<0.0001	243
GB/T 14848-93 Standards		II			6.5~ 8.5	≤300	≤500	≤0.02	≤2.0	≤150	≤5.0	≤0.01	≤0.001	≤150	≤0.01	≤0.0005	≤0.01	≤0.01	≤1.0	≤0.001	≤3.0
		III				≤450	≤1000	≤0.2	≤3.0	≤250	≤20	≤0.02	≤0.002	≤250	≤0.05	≤0.001	≤0.05	≤0.05	≤1.0	≤0.01	≤3.0
		IV		5.5~6.5, 8.5~9		≤550	≤2000	≤0.5	≤10	≤350	≤30	≤0.1	≤0.01	≤350	≤0.05	≤0.001	≤0.1	≤0.1	≤2.0	≤0.01	≤100
		V		<5.5, >9		>550	>2000	>0.5	>10	>350	>30	>0.1	>0.01	>350	>0.05	>0.001	>0.1	>0.1	>2.0	>0.01	>100

Table V.31: Soil Quality Monitoring Data in 2012. Values shaded in grey exceed the Class II standard of GB 15618-1995 (see Table V.30).

No.	Location		Date	Metals								Pesticides	
				Cd (mg/kg)	Hg (mg/kg)	As (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Ni (mg/kg)	Cr (mg/kg)	Lindane (mg/kg)	DDT (mg/kg)
1	Huaibin Village Dredged Sediment Disposal Site		Nov 22	0.066	0.825	7.76	23.0	29.7	91.5	24.3	49.4	<0.002	0.0039
			Nov 23	0.051	0.857	7.54	20.3	28.3	65.5	34.5	41.8	<0.002	0.0047
2	Xiejiaji Landfill Dredged Sediment Disposal Site		Nov 22	0.020	0.107	6.24	25.0	29.3	78.6	37.5	41.9	<0.002	0.0061
			Nov 23	0.009	0.330	6.03	24.7	32.9	72.9	37.6	41.3	0.0043	0.0063
3	Jiushang Road Dredged Sediment Disposal Site		Nov 20	0.039	0.136	10.6	22.7	31.1	74.1	33.6	33.8	0.0039	0.0059
			Nov 21	0.028	0.135	10.5	25.3	27.4	74.7	40.8	34.2	<0.002	0.0047
4	Caoling Lake	1	Nov 22	0.053	0.215	10.1	22.8	23.8	76.0	46.6	30.5	0.0037	<0.003
			Nov 23	0.067	0.210	9.77	21.6	24.6	70.4	44.4	31.4	0.0048	<0.003
		2	Nov 22	0.038	0.133	10.0	24.5	25.5	58.6	36.3	36.4	0.0035	<0.003
			Nov 23	0.116	0.178	9.87	20.9	19.9	74.5	32.9	40.3	0.0032	<0.003
GB 15618-1995 Class 2 Standards (pH 6.5~7.5)				0.30	0.50	30	100	300	250	50	200	0.5	0.5

Source: HEMS.

Table V.32: Sediment Quality Monitoring Data in 2012. Source: HEMS

No	Location	Location	Date	Sediment depth (cm)	Moisture Content %	pH	Organic Content	Nutrients		Metals								Pesticides	
								TN (mg/kg)	TP (mg/kg)	As (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Ni (mg/kg)	Lindane (mg/kg)	DDT (mg/kg)
1	Gaotang Lake 高塘湖	G1	Nov 20	40-60	87	7.74	2.12	840	918	6.39	0.271	39.4	39.7	128	40.9	0.057	28.5	<0.002	<0.003
			Nov 21			7.70	2.78	828	890	6.02	0.277	39.2	32.7	129	44.7	0.041	26.7	<0.002	<0.003
		G2	Nov 20	40-60	86	7.69	2.87	832	913	6.42	0.241	39.1	31.6	252	48.4	0.029	27.1	<0.002	<0.003
			Nov 21			7.66	3.00	817	898	6.20	0.222	39.8	30.7	129	56.4	0.035	28.5	<0.002	<0.003
		G3	Nov 20	40-60	88	7.77	1.56	1124	1233	8.73	0.164	42.3	22.4	144	53.6	0.032	23.9	<0.002	<0.003
			Nov 21			7.74	1.42	1110	1217	9.89	0.153	38.7	27.3	127	44.9	0.042	27.3	<0.002	<0.003
2	Shijian Lake 十涧湖	S1	Nov 20	60-70	83	8.05	1.87	1316	849	11.7	0.186	19.0	14.9	56.6	55.7	0.050	30.3	<0.002	<0.003
			Nov 21			8.07	1.95	1300	834	10.8	0.181	23.6	17.3	68.7	66.1	0.051	32.8	<0.002	<0.003
		S2	Nov 20	60-70	84	8.12	2.15	1204	957	10.3	0.167	17.9	16.4	54.7	57.6	0.058	34.6	<0.002	<0.003
			Nov 21			8.18	2.02	1199	937	10.1	0.171	19.1	21.6	58.4	70.2	0.049	47.5	<0.002	<0.003
		S3	Nov 20	30-50	84	8.20	1.86	678	758	12.0	0.157	33.7	21.4	53.3	73.2	0.042	52.2	<0.002	<0.003
			Nov 21			8.17	1.10	668	749	11.7	0.161	39.7	21.1	60.8	85.9	0.033	52.2	<0.002	<0.003
		S4	Nov 20	30-50	83	8.09	1.68	612	728	11.8	0.167	35.7	14.6	46.9	78.9	0.039	35.5	<0.002	<0.003
			Nov 21			8.11	1.60	594	707	11.9	0.159	28.9	17.6	52.7	57.0	0.048	37.7	<0.002	<0.003
		S5	Nov 20	30-50	82	8.17	1.78	603	703	3.83	0.080	33.0	20.1	57.1	42.9	0.062	39.5	<0.002	<0.003
			Nov 21			8.10	1.60	590	689	3.88	0.087	26.9	19.9	52.3	43.4	0.054	43.4	<0.002	<0.003
		S6	Nov 20	30-50	85	8.07	1.89	649	754	7.28	0.621	34.9	20.1	57.1	77.5	0.048	48.9	<0.002	<0.003
			Nov 21			8.10	1.82	637	741	7.49	0.609	32.1	16.1	52.9	69.9	0.058	34.8	<0.002	<0.003
3	Long Lake 龙湖	L1	Nov 20	120-150	83	8.20	1.88	1724	2065	9.80	0.118	35.2	27.7	90.1	62.9	0.035	26.8	<0.002	<0.003
			Nov 21			8.23	1.78	1692	2003	9.06	0.123	29.6	26.0	69.1	43.4	0.041	27.8	<0.002	<0.003
		L2	Nov 20	40-50	89	8.24	1.34	756	1041	11.8	0.151	26.2	24.1	58.6	45.0	0.037	28.8	<0.002	<0.003
			Nov 21			8.21	1.22	750	1029	11.3	0.105	26.0	16.8	61.5	40.5	0.046	38.2	<0.002	<0.003
		L3	Nov 20	10-30	86	8.16	1.51	549	624	9.93	0.093	26.2	15.9	66.4	34.6	0.052	35.9	<0.002	<0.003
			Nov 21			8.20	1.55	542	615	9.62	0.094	31.5	20.9	75.4	47.6	0.042	36.2	<0.002	<0.003
		L4	Nov 20	10-30	84	8.22	1.67	459	643	9.01	0.172	34.7	25.4	76.6	57.3	0.039	32.7	<0.002	<0.003
			Nov 21			8.25	1.55	459	639	8.65	0.176	34.6	18.3	42.9	45.0	0.056	33.2	<0.002	<0.003
4	Caoling Lake 曹岭湖	C1	Nov 20	No Data	79	7.84	1.86	834	966	8.12	0.260	36.4	34.2	271	51.4	0.109	47.6	<0.002	<0.003
			Nov 21			7.88	1.89	829	937	7.97	0.260	29.9	25.4	205	34.3	0.282	30.9	<0.002	<0.003
		C2	Nov 20	No Data	81	7.79	2.28	869	977	8.84	0.275	32.5	28.0	273	41.2	0.111	37.7	<0.002	<0.003
			Nov 21			7.83	2.13	870	972	8.70	0.269	26.3	27.3	118	42.2	0.276	26.5	<0.002	<0.003
		C3	Nov 20	No Data	83	7.86	1.44	865	946	11.8	0.257	25.3	34.8	117	31.5	0.345	24.7	<0.002	<0.003
			Nov 21			7.89	1.22	849	937	10.7	0.229	29.3	27.7	141	33.9	0.244	24.6	<0.002	<0.003
5	Dajiangou	D1	Nov 19	50-80	89	7.78	3.09	1652	1065	5.37	0.070	19.0	26.8	52.1	80.7	0.042	44.2	0.0037	0.0067

No	Location	Location	Date	Sediment depth (cm)	Moisture Content %	pH	Organic Content	Nutrients		Metals								Pesticides	
								TN (mg/kg)	TP (mg/kg)	As (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Ni (mg/kg)	Lindane (mg/kg)	DDT (mg/kg)
	大涧沟		Nov 20			7.70	3.49	1621	1045	4.67	0.061	18.6	23.7	35.9	67.9	0.056	37.6	0.0044	0.0070
		D2	Nov 19	30-50	87	7.90	2.72	1166	1032	4.56	0.064	25.6	27.6	80.0	64.2	0.036	42.1	0.0146	0.0260
			Nov 20			7.95	2.97	1140	1010	4.38	0.061	22.6	21.3	58.1	57.5	0.035	38.6	0.0184	0.0301
		D3	Nov 19	30-50	84	7.88	1.74	1205	1033	4.23	0.660	20.0	18.6	60.9	58.8	0.033	36.4	0.0079	0.0113
			Nov 20			7.83	1.81	1178	1011	4.45	0.199	23.5	29.4	52.1	55.5	0.048	37.1	0.0096	0.0132
		D4	Nov 19	30-50	84	7.80	1.82	1643	1046	3.92	0.181	34.2	28.8	64.9	70.2	0.031	40.5	0.0043	0.0043
			Nov 20			7.75	1.94	1612	1031	4.29	0.180	30.8	26.1	55.9	58.8	0.019	38.0	0.0043	0.0047
		D5	Nov 19	30-50	82	7.82	1.74	924	1015	4.25	0.164	29.0	24.1	73.0	49.5	0.028	46.9	0.0104	0.0182
			Nov 20			7.84	1.83	914	992	4.22	0.107	43.7	20.4	50.6	47.2	0.024	40.8	0.0117	0.0202
6	Bagongshan Channel	Midstream section	Nov 22	50-90	83	7.68	1.56	1465	1204	7.75	0.096	29.7	29.7	112	45.1	0.205	25.5	0.0102	0.0079
			Nov 23			7.69	1.97	1433	1217	7.47	0.081	31.4	37.8	142	45.7	0.201	26.7	0.0114	0.0081
7	Xiejiaji Channel 谢家集涧沟	Midstream section	Nov 22	50-90	84	7.66	1.92	1856	1915	6.48	0.479	37.3	25.1	172	53.0	0.032	49.7	0.0031	0.0086
			Nov 23			7.68	2.06	1830	1879	6.58	0.566	31.4	26.4	76.8	49.0	0.048	50.4	0.0038	0.0098
		Downstream section	Nov 22	50-90	85	7.62	2.09	1891	2014	8.37	0.315	40.1	27.7	78.7	66.3	0.021	55.2	0.0028	0.0079
			Nov 23			7.68	2.31	1860	1970	7.96	0.271	45.5	24.6	58.7	76.2	0.023	52.2	0.0036	0.0088
8	Donghua Channel	Upstream section	Nov 21	50-90	83	7.94	1.21	2122	1205	7.03	0.084	32.9	20.5	46.9	61.9	0.202	43.9	0.0028	0.0062
			Nov 22			8.00	1.27	2192	1270	6.94	0.072	40.5	21.4	49.2	51.1	0.237	43.6	0.0048	0.0061
		Downstream section	Nov 21	50-90	82	7.92	1.77	2044	1154	7.12	0.078	37.0	38.6	47.7	49.7	0.214	39.4	0.0034	0.0074
			Nov 22			7.88	1.82	2012	1221	7.45	0.082	37.3	34.7	61.9	48.5	0.218	45.8	0.0039	0.0081
9	Old Longwang Channel	Midstream section	Nov 21	50-90	86	7.69	2.12	1865	2388	5.84	0.105	28.9	32.0	63.6	48.0	0.064	50.0	0.0037	0.0128
			Nov 22			7.72	2.17	1828	2345	4.28	0.106	22.1	23.9	57.4	49.2	0.155	35.5	0.0039	0.0351
		Downstream section	Nov 21	50-90	89	7.76	3.34	1869	2396	6.93	0.105	27.7	24.7	63.4	54.4	0.074	28.5	0.0037	0.0034
			Nov 22			7.74	3.70	1839	2379	6.87	0.100	30.8	16.7	67.2	52.9	0.103	25.5	0.0039	0.0040
10	Longwang Channel	Midstream section	Nov 21	50-90	87	7.88	2.21	1848	2213	5.37	0.145	34.4	21.4	111	59.0	0.099	21.9	0.0033	0.0091
			Nov 22			7.82	2.47	1861	2168	5.05	0.155	35.3	25.4	72.9	54.7	0.116	18.7	0.0049	0.0138
11	Longwang Flood Diversion Channel	Midstream section	Nov 21	50-90	84	7.23	1.81	1687	1176	3.49	0.056	17.8	15.9	42.5	49.7	0.034	17.9	0.0027	<0.003
			Nov 22			7.41	1.14	1655	1154	3.21	0.063	18.4	16.5	46.1	50.1	0.047	14.7	0.0037	<0.003
		Downstream section	Nov 21	50-90	83	7.35	1.59	1563	1234	3.47	0.057	16.4	16.9	45.6	48.7	0.053	16.8	0.0027	<0.003
			Nov 22			7.54	1.02	1528	1215	3.62	0.071	17.3	17.1	47.4	51.2	0.062	17.3	0.0027	<0.003
GB 15618-1995 Class 2 Standards						<6.5	---	---	---	40	0.30	250	50	200	150	0.30	40	0.50	0.50
						6.5-7.5	---	---	---	30	0.50	300	100	250	200	0.30	50		
						>7.5	---	---	---	25	1.0	350	100	300	250	0.60	60		

6. Flora, fauna and protected areas

70. **Survey methods.** The Coal Industry Hefei Design and Research Academy deployed ecologists from Anhui University to undertake baseline ecological survey and review of relevant literature on flora and fauna (except birds) in the project area. Surveys were conducted in July and November 2012, for vegetation, planktonic flora and flora (Fig. V.14), benthic fauna (Fig. V.15), fish and crustaceans (crabs, shellfish and shrimp). Other aquatic invertebrates (e.g. dragonflies, mayflies) were not surveyed. Information on mammals, amphibians and reptiles for the Huai River and Gaotang Lake areas was obtained from desktop review.

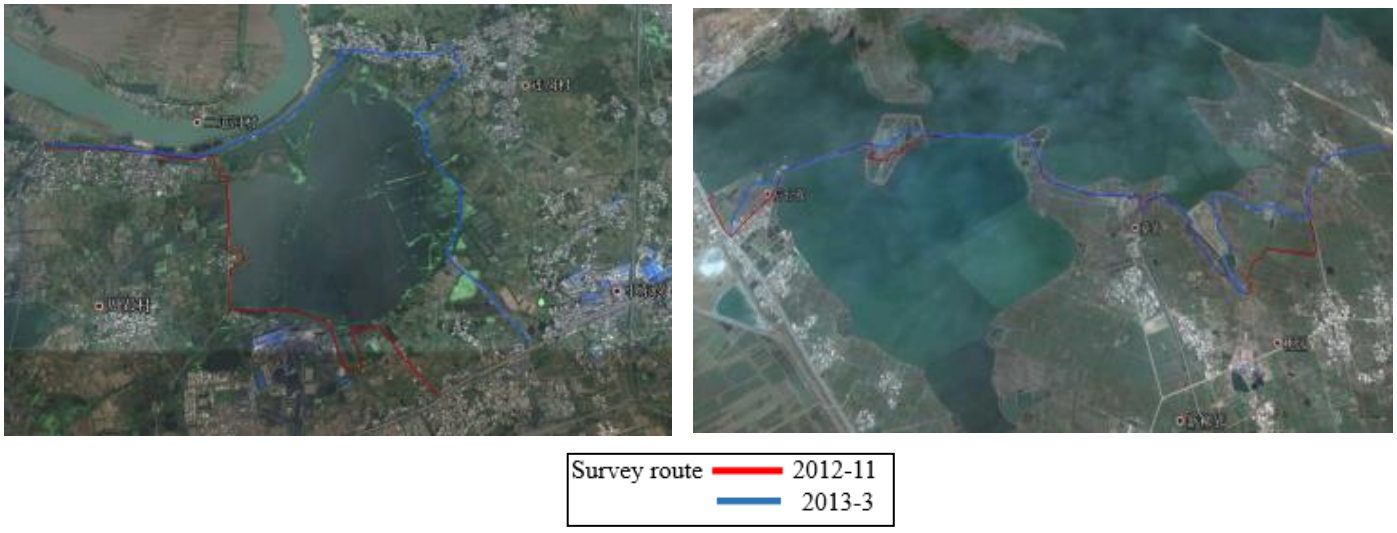
No.	Sampling Location	Water Body
1	Gaotang 1	Gaotang Lake
2	Gaotang 2	
3	Gaotang 3	
4	Gaotang 4	
5	Shijian 1	Shijian Lake
6	Shijian 2	
7	Shijian 3	
8	Wabu 1	Wabu Lake
9	Wabu 2	
10	Dajiangou Wetland	Dajiangou Wetland
11	Dajiangou	Dajiangou
12	Long Lake 1	Long Lake Park
13	Long Lake 2	
14	Long Lake 3	
15	Huai River 1	Huai River Huainan Section
16	Huai River 2	
17	Longwang Channel	Longwang PS
18	Donghua Channel	Donghua Pond

Figure V.14: Sampling Locations for Phytoplankton and Zooplankton

No.	Monitoring Location	Sampling Location
1	Lu River mouth at Huai River	Lu River 1
2	Shijian Lake	Shijian 1
		Shijian 2
		Shijian 3
3	Gaotang Lake	Gaotang 1
		Gaotang 2
		Gaotang 3
		Gaotang 4
4	Wabu Lake	Wabu 1
		Wabu 2

Figure V.15: Benthic Fauna Monitoring Locations

71. Birds were surveyed 10-17 November (winter migration period) 2012 and 17-26 March (summer migration) 2013. Surveys were conducted on foot in the morning (Figure V.16) at a walking pace of 1.5–2 km/h at Shijian and Gaotang Lakes and the Huai River floodplain near Caozuizi and Long Lake pump stations. Birds observed within 100 m each side of the walking route were recorded and habitats noted. Additional data was obtained from desktop review.



Shijian Lake **Gaotang Lake**

Figure V.16: Bird Survey Routes along Shijian Lake and Gaotang Lake in November 2012 and March 2013

Vegetation and flora

72. Terrestrial and aquatic flora in the project sites recorded from field surveys and desktop review are in Tables V.33 and V.34. The terrestrial flora typify communities of the North China warm temperate deciduous broad-leaved woodlands, and include common and ubiquitous species (e.g. *Ailanthus altissima, Broussonetia papyrifera, Melia azedarach, Populus davidiana, Pterocarya stenoptera, Ulmus pumila, Imperata cylindrical, Trifolium repens*). Agricultural species, especially Soybean (*Glycine max*) and Maize (*Zea mays*) form a dominant part of the project landscape. Records include introduced populations of four species which are globally threatened and/or included on the PRC National Wild Plant Protection List (two trees *Metasequoia glyptostroboides* and *Ginkgo biloba*, a shrub *Cinnamomum camphora*, and an aquatic plant *Nelumbo nucifera*), but none have conservation significance: the two trees do not occur naturally in Anhui Province, and the other two species are commonly and widely planted in Huainan.

Table V.33: Terrestrial Plant Species recorded in the Project Area. Source: EIR

Type	Scientific Name	English Name	Location								
			Gaotang Lake	Shijian Lake	Wabu Lake	Dajiangou	Dajiangou Wetland	Long Lake	Longwang Channel	Donghua Channel	Huai River
Tree	*Acer buergerianum*	Trident Maple		√				√			
	Ailanthus altissima	Tree of Heaven	√		√	√				√	√
	Albizia julibrissin	Persian Silk Tree									√
	Arundo donax	Giant Cane									√
	Bischofia polycarpa	Chinese Bishopwood		√				√			

Type	Scientific Name	English Name	Location								
			Gaotang Lake	Shijian Lake	Wabu Lake	Dajiangou	Dajiangou Wetland	Long Lake	Longwang Channel	Donghua Channel	Huai River
	Broussonetia papyrifera	Paper Mulberry	√		√	√	√			√	√
	Buxus mollicula	Box Tree	√								
	Buxus sinica	Korean Boxwood	√		√						
	Celtis sinensis	Chinese Hackberry					√				
	Chaenomeles speciosa	Flowering Quince		√				√			
	Cinnamomum camphora	Camphor Tree									√
	Diospyros kaki	Persimmon								√	√
	Ginkgo biloba	Ginkgo Tree		√				√			
	Juniperus formosana	Formosan Juniper		√				√			
	Ligustrum lucidum	Glossy Privet		√				√			
	Liquidambar formosana	Formosa Sweetgum		√				√			
	Magnolia denudate	Yulan Magnoli		√				√			
	Magnolia grandiflora	Southern Magnolia						√			√
	Malus halliana	Hall Crabapple						√			
	Melia azedarach	Chinaberry	√			√	√		√	√	√
	Metasequoia glyptostroboides	Dawn Redwood		√				√			√
	Morus alba	White Mulberry				√				√	√
	Nerium orleander	Orleande									√
	Paulownia elongata	Royal Empress	√		√						
	Paulownia tomentosa	Empress Tree	√				√				
	Pistacia chinensis	Chinese Pistache	√		√						
	Platanus acerifolia	London Plane		√				√	√		
	Populus davidiana	Korean Aspen		√		√		√	√		√
	Prunus ceraifera	Cherry Plum									√
	Pterocarya stenoptera	Chinese Wingnut		√	√	√		√	√		√
	Quercus acutissima	Sawtooth Oak	√		√						
	Robinia pseudoacacia	Black Locust				√	√		√		√
	Salix babylonica	Weeping Willow		√				√		√	√
	Sapium sebiferum	Chinese Tallow			√		√		√		√
	Sophora japonica	Japanese Pagoda	√	√	√			√			
	Toona sinensis	Chinese Cedar				√					√
	Trachycarpus fortunei	Chusan Palm						√			
	Ulmus parvifolia	Chinese Elm	√		√						
	Ulmus pumila	Siberian Elm	√	√	√		√		√		
Shrub	*Acer palmatum*	Japanese Maple					√		√	√	
	Amorpha fruticosa	False Indigo								√	
	Aucuba japonica	Gold-dust Plant						√			
	Broussonetia papyrifera	Paper Mulberry				√	√				
	Coriaria sinica	水马桑					√			√	
	Crataegi cuneatae	Chinese Hawthorn	√		√						
	Cudrania tricuspidata	Silkworm Thorn	√		√						
	Cyperus alternifolius	Umbrella Palm		√			√	√			
	Euonymus japonicus	Japanese Spindle		√			√		√		
	Glochidion puberum	Needlebush	√		√						
	Hibiscus syriacus	Rose of Sharon							√		
	Jasminum nudiflorum	Winter Jasmine		√				√			

Type	Scientific Name	English Name	Location								
			Gaotang Lake	Shijian Lake	Wabu Lake	Dajiangou	Dajiangou Wetland	Long Lake	Longwang Channel	Donghua Channel	Huai River
	Lespedeza bicolor	Shrubby Bushclover	√		√						
	Ligustrum quihoui	Waxyleaf Privet	√		√						
	Ligustrum sinense	Chinese Privet		√				√			
	Lonicera japonica	Japanese Honeysuckle								√	
	Lorpetalum chinense	Chinese Fringe Flower		√							
	Lycium chinense	Chinese Boxhorn	√		√						
	Nandina domestica	Sacred Bamboo							√		
	Osmanthus fragrans	Sweet Olive	√		√						
	Photinia serrulata	Chinese Photinia		√					√	√	
	Poncirus trifoliata	Bitter Orange								√	√
	Sapium sebiferum	Chinese Tallow	√								
	Tetrapanax papyrifer	Rice-paper Plant		√				√		√	
	Vitex negundo	Five-leaved Chaste	√		√				√		
	Ziziphus jujube	Sour Chinese Date	√		√						
	Rhododendron spp	Rhododendron		√				√			
Grass / Vine	*Achyranthes bidentata*	Ox Knee							√	√	
	Artemisia vulgaris	Mugwort	√		√						
	Bothriochloa ischaemum	Yellow Bluestem	√		√						
	Cirsium japonicum	Japanese Thistle		√				√			√
	Cirsium setosum	Small Thistle							√	√	
	Crypsis aculeate	Pricklegrass	√		√						
	Cynanchum auriculatum	Heart-leaf Swallow-wort		√			√	√			
	Cynodon dactylon	Bermuda Grass					√		√		
	Daucus carota	Wild Carrot					√				
	Digitaria sanguinalis	Hairy Crabgrass	√		√						
	Elymus kamoji	鹅观草		√			√	√			
	Erigeron annuus	Eastern Daisy Fleabane					√		√		
	Hemerocallis citrina	Citron Daylily									√
	Humulus scandens	Hop					√	√		√	
	Imperata cylindrica	Cogon Grass	√	√	√	√	√	√	√	√	
	Kummerowia striata	Japanese Clover	√		√						
	Liriope platyphylla	Liriope Grass					√				
	Miscanthus floridulu	Giant Silver Grass								√	
	Oxalis corniculata	Creeping Wood Sorrel								√	
	Phlegmariurus	Coarse Tassel Fern	√		√						
	Phragmites australis	Common Reed		√		√		√			√
	Rumex dentatus	Toothed Dock								√	
	Setaira viridis	Green Foxtail	√		√						
	Themeda triandra	Red Grass	√		√						
	Trifolium repens	White Clover		√		√	√	√			√
	Xanthium sibiricum	Siberian Cocklebur									√

Table V.34: Occurrence of Aquatic Vascular Plants in the Project Area. Source: EIR

Scientific Name	Common Name	Location								
		Gaotang Lake	Shijian Lake	Wabu Lake	Dajiangou	Dajiangou Wetland	Long Lake	Longwang Channel	Donghua Channel	Huai River
Acorus calamus	Sweet Flag						√			
Alternanthera philoxeroides	Alligator Weed	√	√	√	√	√	√	√	√	√
Amaranthus ascendens	Wild Blite				√					
Aster subulatus	Wild Aster Wild Aster		√							
Ceratophyllum demersum	Hornwort	√								
Conyza canadensis	Canadian Horseweed					√		√		
Cyperus alternifolius	Umbrella Papyrus						√			
Cyperus microiria	Asian Flat-sedge		√							
Echinochloa crusgalli	Barnyard Grass				√					
Erigeron annuus	Eastern Daisy Fleabane					√				
Herba spirodelae (Spirodela	Common Duckweed		√	√						
Hydrilla verticillata	Hydrilla			√						
Hydrocharis dubia	Frogbit		√							
Miscanthus purpurascens	Flame Grass				√					
Myriophyllum spicatum	Eurasian Watermilfoil	√		√						
Nelumbo nucifera	Lotus	√	√				√			
Nymphoides peltatum	Yellow Floating Heart			√						
Paspalum distichum	Knotgrass		√							
Phragmites australis	Common Reed	√	√	√	√	√	√	√		
Poa annua	Annual Meadow Grass					√				
Polygonum amphibium	Water Knotweed					√				
Polygonum orientale	Princess Feather	√			√					√
Potamogeton crispus	Curly-leaf Pondweed	√		√						
Potamogeton distinctus	Round-leaf Pondweed	√								
Potamogeton malaianus	Curly Pondweed	√		√						
Potamogeton pectinatus	Fennel Pondweed	√		√						
Rumex dentatus	Toothed Dock				√	√				
Setaira viridis	Green Foxtail		√							
Sonchus oleraceus	Common Sowthistle				√					
Spirogyra intorta	水绵		√							
Trapa maximowiczii	Fine Fruit Wild Edge	√								
Typha angustifolia	Lesser Bulrush		√				√			
Vallisneria natans	Tape Grass	√		√						

Phytoplankton and zooplankton

73. Baseline monitoring (Gaotang, Shijian, Wabu, Dajiangou, and Long Lakes, Dajiangou wetland, Longwang channel, Donghua channel, Huai river) of phytoplankton recorded 218 species of eight classes (Table V.35). Green algae and diatoms accounted for 72.5% of all species recorded.

Table V.35: Phytoplankton Species recorded at sampling locations. Source: EIR

Sampling sites	Number of Phytoplankton Species								Total spp.
	Cyanophyta (blue-green algae)	Chlorophyta (green algae)	Bacillariophyta (diatom)	Euglenophyta (euglenoid)	Phrrophyta (dinoflagellate)	Cryptophyta (cryptomonid)	Chrysophyta (golden-brown algae)	Xanthophyta (yellow-brown algae)	
Gaotang 1	10	32	20	4	3	1	3	1	74
Gaotang 2	9	32	21	3	3	0	9	1	78
Gaotang 3	8	34	22	3	2	1	1	0	71
Gaotang 4	6	29	15	3	3	1	3	0	60
Shijian 1	3	12	5	4	3	0	5	0	32
Shijian 2	3	16	8	2	3	0	3	0	35
Shijian 3	2	25	8	3	3	0	3	0	44
Dajiangou wetland	4	4	13	1	2	0	0	0	24
Dajiangou	5	10	10	1	0	0	1	0	27
Long Lake 1,2, 3	6	17	4	1	3	0	5	0	36
Huai River 1	1	8	4	1	1	0	0	0	15
Huai River 2	4	3	2	1	0	0	3	0	13
Longwang Channel	4	9	10	1	1	0	1	0	26
Donghua Channel	11	1	5	1	0	0	1	0	19
Wabu 1	1	5	9	0	1	0	0	0	16
Wabu 2	3	9	5	0	2	0	3	0	22
Total species	28	81	77	13	3	2	13	1	218
Percentage of total:	12.8%	37.2%	35.3%	6.0%	1.4%	0.9%	6.0%	0.4%	100%

74. Numerical abundance (based on cell density) of phytoplankton averaged 2,240,000 cells/L. Dajiangou had the highest abundance (5,943,850 cells/L). The Huai River site had the lowest abundance (545,400 cells/L) (Figure V.17). Blue-green algae were the most abundant species in Dajiangou, Longwang and Donghua Channels, Long Lake, and Dajiangou Wetland, but not in Shijian, Gaotang, or Wabu Lakes (Table V.36). Dominance of blue-green algae indicates polluted, eutrophic water (e.g. at Chao Lake in Anhui Province, frequent blue-green algal blooms occur due to its eutrophic state). This is consistent with poor water quality, especially high nutrient levels, in Dajiangou, Longwang and Donghua Channels, and Long Lake.

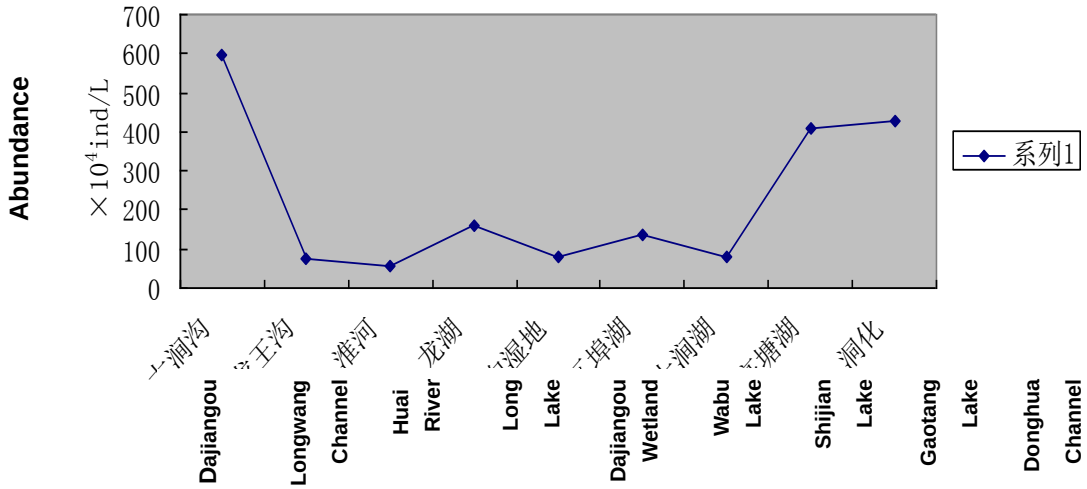


Figure V.17: Comparison of Phytoplankton Abundance. Source: EIR

Table V.36: Distribution of Dominant Phytoplankton Species. Source: EIR

Phytoplankton Species	Most abundant recorded species							
	Dajiangou	Longwang Channel	Long Lake	Dajiangou Wetland	Shijian Lake	Gaotang Lake	Donghua Channel	Wabu Lake
Cyanophyta (blue-green algae)								
Anabaena spp.				√				
Cyanobium parvum		√						
Leptolyngbya foveolara							√	
Planktolyngbya subtilis	√		√				√	
Chlorophyta (green algae)								
Ankistrodesmus angustus								√
Ankistrodesmus convolutes			√					√
Ankistrodesmus falcatus			√			√		√
Chlorella vulgaris				√	√			
Scenedesmus bijuga					√			
Schroederia nitzschioides	√							
Bacillariophyta (diatom)								
Cymbella naviculiformis						√		
Fragilaria capucina						√		
Navicula exigua				√		√		
Synedra acus		√						
Synedra tabulate						√		
Cryptophyta (cryptomonid)								
Chroomonas acuta			√					
Cryptomons erosa			√					
Cryptomonas ovate					√	√		

75. Baseline monitoring of zooplankton recorded Rotifera (rotifer, or wheel animal), crustaceans Cladocera (cladoceran, or water flea) and Copepoda (copepod), and larval forms of various invertebrates. Rotifers dominated the zooplankton community in both numbers of species and numerical abundance (Table V.37). Abundant zooplankton implies food abundance for higher trophic levels e.g. fish and shellfish. Gaotang and Shijian Lakes had the highest zooplankton abundance (Table V.37). Rotifers are tolerant to some water pollution and the abundance of rotifers indicates the polluted and eutrophic state of the project sites.

Table V.37: List of Zooplankton Species at the Monitoring Locations. Source: EIR

Zooplankton Taxa	Mean abundance (individuals/L)	Dominant Species (√) and Abundance (individuals/L) at Locations							
		Dajiangou	Longwang Channel	Long Lake	Dajiangou Wetland	Shijian Lake	Gaotang Lake	Donghua Channel	Wabu Lake
Larval Forms	9.89 (22.4%)	0	0.43	1.49	3.30	7.58	8.90	0.03	2.03
Rotifera	22.0 (49.8%)	1.20	2.30	1.87	0.67	12.8	30.2	0.33	1.48
Asplanchnidae									
Asplanchna priodonta		√	√	√	√	√	√	√	√
Brachionidae									
Brachionus angularis				√		√	√		
Brachionus							√		√
Brachionus calyciflorus			√			√	√		
Brachionus capsuliflorus									
Brachionus urcens		√				√			

Zooplankton Taxa	Mean abundance (individuals/L)	Dominant Species (√) and Abundance (individuals/L) at Locations							
		Dajiangou	Longwang Channel	Long Lake	Dajiangou Wetland	Shijian Lake	Gaotang Lake	Donghua Channel	Wabu Lake
Euchlanis ditatata									√
Euchlanis pellucida									
Keratella cochlearis									
Keratella valga									
Mytilina wentralis									
Notholca acuminata				√					
Notholca labis									
Platyias militaris									
Platyias quadricornis									
Schizocerca diversicornis		√							
Conochilidae									
Conochilus unicornis									
Gastropodidae									
Gastropus hyptopus									
Gastropus minor									
Lecanidae									
Lecane ungulata									
Monostyla elacis									
Monostyla lunaris									
Synchaetidae									
Polyarthra euryptera									
Polyarthra trigla				√			√		
Testudinellidae									
Filinia longiseta							√		
Trichocercidae									
Diurella sp.									
Trichocerca cylindrica							√		
Trichocerca elongata									
Trichocerca longiseta									
Trichocerca lophoessa									
Crustacea									
Cladocera	5.2 (11.9%)	0.03	0.96	0	0.53	5.59	0.60	0	3.85
Bosminidae									
Bosina sp.									
Chydoridae									
Alona sp.									
Alonella sp.					√	√			
Chydorys sphaericus									
Graptoleberis testudinaria									√
Daphniidae									
Daphnia cucullata									
Daphnia sp.									
Moinidae									
Moina sp.									
Sididae									
Diaphanosoma sp.									
Copepoda	7.1 (22.4%)	0.07	0.77	0.87	2.00	4.27	5.79	0.40	1.48

Zooplankton Taxa	Mean abundance (individuals/L)	Dominant Species (√) and Abundance (individuals/L) at Locations							
		Dajiangou	Longwang Channel	Long Lake	Dajiangou Wetland	Shijian Lake	Gaotang Lake	Donghua Channel	Wabu Lake
Centropagidae								√	√
Cyclopidae		√	√	√	√	√	√	√	
Harpacticidae						√		√	
Zooplankton Abundance (individuals/L):	44.2 (100%)	1.30	3.50	5.18	6.50	30.3	45.5	0.77	8.85

Benthic fauna

76. Benthic fauna are animals that live on the surface (epi-fauna) or within (in-fauna) the bottom sediment of water bodies. Among the monitoring locations, more species were found at the Lu River mouth entering Huai River than the three lakes (Table V.38). Chironomids (larvae of midges or gnats) and mollusks (including both bivalves [clams] and gastropods [snails]) showed the most number of species at these locations. Chironmids are generally amount the most common and abundant benthic species in lotic systems. They feed on detrital organic matter and their dominance generally indicates rich organic content of the sediment.

Table V.38: Distribution of Benthic Species recorded at sampling locations. Source: EIR

Benthic Taxa	Occurrence at sampling locations			
	Gaotang Lake	Shijian Lake	Wabu Lake	Lu River mouth
Annelida				
Oligochaeta				
Limnodrilus sp.	√	√	√	√
Nais sp.				√
Tubifex sp.	√	√		√
Polychaeta				
Nephthys sp.				√
Crustacea				
Branchiura sp.	√	√	√	√
Amphipoda				
Gammarus sp.	√	√		√
Hirudinea				
Glossiphonia sp.	√			√
Insecta				
Ephemera sp.	√	√		√
Chironomidae				
Chironomus sp.	√	√		√
Cryptochironomus sp.	√			√
Endochironomus nigricans	√			√
Endochironomus sp.		√		√
Pelopia sp.		√	√	√
Polypedilum scalaenum	√	√	√	√
Polypedilum sp.				√
Procladius sp.	√	√	√	√
Propsilocerus akamusi	√			√
Saetheria sp.			√	√
Trissopelopia sp.		√		√
Mollusca				
Bivalvia				
Acuticosta chinensis	√	√	√	√

Benthic Taxa	Occurrence at sampling locations			
	Gaotang Lake	Shijian Lake	Wabu Lake	Lu River mouth
Corbicula fluminea	√	√	√	√
Cuneopsis heudei	√		√	√
Limnoperna lacustris	√	√	√	√
Novaculina chinensis			√	√
Sphaerium lacustre			√	
Unio douglasiae		√	√	√
Gastropoda				
Bellamya aeruginosa	√	√	√	√
Bellamya purificata	√	√	√	√
Semisulcospira cancellata		√	√	√
Nematoda				
Nematoda spp.				√

Vertebrate fauna

77. **Fish.** Eighteen fish species were recorded from the sampling locations (Huainan Municipality section of the Huai River, Gaotang Lake, Wabu Lake) and from the information of local fishermen and fisheries management authorities (Table V.39). All are common species with wide distribution and no rare, threatened, protected or endangered fish species were recorded. Any movements between Gaotang Lake and the Huai River are probably regulated by a flood control sluice gate which spans the north end of the lake; fish are presumably able to move between these locations when the gate is open.

Table V.39: Fish Species Recorded in Huai River, Gaotang Lake and Wabu Lake. Source: EIR

Fish Taxa	Common Name
Cypriniformes	
Cyprinidae	
Abbottina rivularis	Chinese False Gudgeon 棒花鱼
Carassius cuvieri	Crusian Carp 鲫鱼
Ctenopharyngodon idellus	Grass Carp 草鱼
Cyprinus carpio	Common Carp 鲤鱼
Erythroculter ilishaeformis	White Fish 翘嘴红鲌
Erythroculter mongolicus	Mongolian Redfin 蒙古红鲌
Hemiculter leucisculus	Sharp Belly 餐条
Hypophthalmichthys molitrix	Silver Carp 鲢鱼
Hypophthalmichthys nobilis	Bighead Carp 鳙鱼
Magalobrame tarminalis	Black Amur Bream 三角鲂
Misgurnus anguillicaudatus	Amur Mud Loach 泥鳅
Mylopharyngodon piceus	Black Carp 青鱼
Opsariichthys bidens	Chinese Hook Snout Carp 马口鱼
Pseudorasbora parva	Topmouth Minnow 麦穗鱼
Perciformes	
Bagridae	
Pelteobagrus fulvidraco	Yellow Catfish 黄颡鱼
Channidae	
Ophicephalus argus	Snakehead 乌鳢
Ictaluridae	
Ictalurus punctatus	Channel Catfish 斑点叉尾鮰

Fish Taxa			Common Name
	Siluridae		
		Silurus asotus	Chinese Catfish 鲶鱼

78. **Mammals, amphibians and reptiles.** Based on desktop review (no fieldwork), the project EIR lists 15 species of mammmals, 4 amphibians and 11 reptiles for the project area (Table V.40). Of these, one species is categorized on the IUCN Red List as Endangered (Chinese Pond Turtle *Chinemys reevesii;* reported to occur in Gaotang and Shijian Lake areas), one species is Vulnerable (Chinese Soft-shell Turtle *Pelodiscus sinensis*) and two are Near-threatened (Hog Badger *Arctonyx collaris* and Black Spotted Pond Frog *Pelophylax nigromaculatus*). Six species are on the Anhui Province protection list: Class I protection status - Leopard Cat (*Prionailurus bengalensis*) (despite 'Least Concern' status on the IUCN Red List); Class II protection status - European Badger (*Meles meles*), Siberian Weasel (*Mustela sibirica*), Asian Toad (*Bufo gargarizans*), Beauty Rat Snake (*Elaphe taeniura*) and Garter Snake (*Zaocys dhumnades*).

Table V.40. Mammals, amphibians and reptiles in Gaotang and Shijian Lake areas. Source: EIR

	Scientific Name	Common Name	IUCN Red List	Anhui Province	Gaotang Lake	Shijian Lake
Mammal	*Erinaceidae*	猬科				
	Erinaceus europaeus	Common Hedgehog	LC		√	
	Erinaceus amurensis	Manchurian Hedgehog	LC		√	√
	Felidae	猫科				
	Prionailurus bengalensis	Leopard Cat	LC	I		√
	Leporidae	兔科				
	Lepus capensis	Brown Hare	LC		√	√
	Muridae	鼠科				
	Apodemus agrarius	Striped Field Mouse	LC		√	√
	Cricetulus griseus	Chinese Hamster				√
	Micromys minutus	Harvest Mouse	LC		√	
	Mus musculus	House Mouse	LC		√	√
	Rattus norvegicus	Brown Rat	LC		√	
	Rattus tanezumi	Asian House Rat	LC		√	√
	Tscherskia triton	Greater Long-tailed Hamster	LC		√	√
	Mustelidae	鼬科				
	Arctonyx collaris	Hog Badger	NT			√
	Meles meles	European Badger	LC	II		√
	Mustela sibirica	Siberian Weasel	LC	II		√
	Soricidae	鼩鼱科				
	Crocidura shantungensis	Asian Lesser White-toothed Shrew	LC			√
Frogs	*Bufonidae*	蟾蜍科				
	Bufo gargarizans	Asian Toad	LC	II	√	√
	Ranidae	蛙科				
	Fejervarya limnocharis	Cricket Frog	LC			√
	Pelophylax nigromaculatus	Black Spotted Pond Frog	NT		√	√
	Pelophylax plancyi	Eastern Golden Frog	LC		√	√
Reptile	*Geoemydidae*	龟科				
	Chinemys reevesii	Chinese Pond Turtle	EN		√	√
	Pelodiscus sinensis	Chinese Soft-shell Turtle	VU		√	√

	Scientific Name	Common Name	IUCN Red List	Anhui Province	Gaotang Lake	Shijian Lake
	Colubridae	游蛇科				
	Dinodon rufozonatum	Red Banded Snake			√	√
	Elaphe bimaculata	Twin Spotted Rat Snake	LC		√	√
	Elaphe rufodorsata	Frog Eating Rat Snake	LC		√	√
	Elaphe taeniura	Beauty Rat Snake		II	√	√
	Rhabdophis tigrinus	Tiger Keelback			√	√
	Zaocys dhumnades	Garter Snake		II	√	√
	Gekkonidae	壁虎科				
	Sphinomorphus indicus	Indian Forest Skink				√
	Lacertian	蜥蜴科				
	Takydromus septentrionalis	Grass Lizard			√	
	Scincidae	石龙子科				
	Eumeces chinensis	Chinese Skink				√
Note: ICUN = International Union for Conservation of Nature; LC = least concern; NT = near threatened; VU = vulnerable; EN = endangered; (see http://www.iucnredlist.org). Anhui Province protection list: I = Class I; II = Class II						

79. **Birds.** One hundred and nineteen species were recorded during fieldwork and desktop review in the November 2012 and March 2013 surveys in the Gaotang and Shijian Lake areas (Table V.41).[8] Five bird habitats in the project area of influence were identified (Table V.42). The following observations are made based on these data.

(i) Of these 119 species, 38 (32%) are winter migrants and 26 (22%) are summer migrants.

(ii) One species is IUCN Red Listed as Critically Endangered (Siberian Crane), one is Endangered (Oriental White Stork), and three are Vulnerable (Hooded Crane, Great Bustard, Swan Goose). During the November 2012 bird survey, 180 Swan Goose were observed at Gaotang Lake. This species is on the Anhui Province protection list but not on PRC's national protection list of wild animals.

(iii) Five species are on PRC's Class I protection list of wild animals (Oriental White Stork, Black Stork, Hooded Crane, Siberian Crane, Great Bustard) and 11 species are on the Class II protection list (White Eurasian Spoonbill, Bean Goose, Great White-fronted Goose, Tundra Swan, Black Kite, Japanese Sparrow Hawk, Common Buzzard, Common Kestrel, Koklass Pheasant, Common Crane, Lesser Coucal). None of those on the Class I protection list was observed in either November 2012 or March 2013 bird surveys. Of those on the Class II protection list, only the White Eurasian Spoonbill, a winter migrant, and Common Kestrel, a resident species, were observed (at Gaotang Lake) and only during the November 2012 survey.

(iv) Another 41 bird species are on the Anhui Province protection list. Of these, 10 were observed during the November 2012 survey and 6 were observed during the March 2013 survey at both Gaotang Lake and Shijian Lake.

(v) Of the 119 species, 49 were recorded during both surveys with a total count of 1,559 individuals dominated numerically by Little Grebe, White Eurasian Spoonbill, Swan Goose, Common Moorhen, Pied Avocet, Oriental Turtle Dove, Ashy Starling, Sparrow, and

[8] Chen J. Y. 2013. Bird Survey Report for the Anhui Huainan Urban Water Systems Integrated Rehabilitation Project. Huainan Normal University. March 2013.

Black-tailed Hawfinch. The November 2012 survey recorded 33 species totaling 1,083 individuals dominated by White Eurasian Spoonbill, Swan Goose, Common Moorhen, Pied Avocet, Ashy Starling, Sparrow, and Black-tailed Hawfinch. The March 2013 survey recorded 34 species totaling 476 individuals dominated by Little Grebe, Common Moorhen, Oriental Turtle Dove and Sparrow. Although the number of bird species was similar in November 2012 and March 2013, the winter bird counts were considerably higher than the spring bird counts.

(vi) At Gaotang Lake, 46 species and 1,284 individuals were recorded: 33 species and 942 individuals in November 2012, and 30 species and 342 individuals in March 2013, showing more individuals were using the lake during winter time. November 2012 counts were dominated by White Eurasian Spoonbill, Swan Goose and Ashy Starling, all winter migrants. March 2013 counts were dominated by Sparrow.

(vii) At Shijian Lake, 20 species and 275 individuals were recorded. The November 2012 survey recorded 8 species and 141 individuals, dominated by Common Moorhen and Sparrow, both resident species. The March 2013 survey recorded 14 species and 134 individuals. Dominant species included Common Moorhen, Oriental Turtle Dove and House Swallow, all resident species. This indicates that the extent of using Shijian Lake by wintering migrants may be less than Gaotang Lake.

Table V.41: Bird species and counts recorded at Gaotang and Shijian Lakes. Source: Chen (2013)

No.	Scientific name	Common name	Seasonal type	PRC Protection status	IUCN Red List	Shijian Lake		Gaotang Lake	
						Nov	Mar	Nov	Mar
Podiciediformes 䴙䴘目									
1	*Tachybaptus ruficollis*	Little Grebe	W		LC	6	6	19	33
2	*Podiceps cristatus*	Great-crested Grebe	W			2	0	10	2
Pelecaniformes 鹈形目									
3	*Phalacrocorax carbo*	Great Cormorant	W	P	LC	0	0	6	0
Ciconiformes 鹳形目									
4	*Ardea cinerea*	Grey Heron 苍鹭	R	P	LC	0	0	0	1
5	*Ardea purpurea*	Purple Heron 草鹭	R	P	LC				
6	*Butorides striatus*	Striated Heron 绿鹭	S	P	LC				
7	*Ardeola bacchus*	Chinese Pond Heron	S	P	LC				
8	*Bubulcus ibis*	Cattle Egret **牛背**鹭		P					
9	*Egretta alba*	Eastern Great Egret	W	P					
10	*Egretta garzetta*	Little Egret **小白**鹭	S	P	LC	0	0	0	1
11	*Egretta intermedia*	Intermediate Egret	S						
12	*Nyticorax nyticorax*	Night Heron **夜**鹭	S		LC				
13	*Ixobrychus sinensis*	Little Bittern	S		LC				
14	*Ixobrychus cinnamomcus*	Cinnamon Bittern			LC				
15	*Dupetor flavicollis*	Black Bittern **黑**苇鸦	S	P	LC				
16	*Botaurus stellaris*	Eurasian Bittern **大麻**鸦	W	P	LC				
17	*Ciconia boyciana*	Oriental White Stork	W	I	EN				
18	*Ciconia nigra*	Black Stork **黑**鹳	W	I	LC				
19	*Platalea leucorodia*	White Eurasian Spoonbil	W	II	LC	0	0	90	0
Anseriformes 雁形目									
20	*Anser cygnoides*	Swan Goose 鸿雁	W	P	VU	0	0	180	0
21	*Anser fabalis*	Bean Goose **豆雁**	W	II	LC				

22	*Anser albifrons*	Great White-fronted Goose	W	II	LC				
23	*Cygnus columbianus*	Tundra Swan **小天**鹅		II	LC				
24	*Tadorna ferruginea*	Ruddy Shelduck **赤麻**鸭	W	P	LC	0	0	2	0
25	*Anas acuta*	Northern Pintail 针尾鸭	W	P	LC				
26	*Anas crecca*	Common Teal 绿翅鸭	W	P	LC	8	0	22	0
27	*Anas falcate*	Falcated Duck 罗纹鸭	W						
28	*Anas platyrhynchos*	Mallard 绿头鸭	W	P	LC	0	0	3	0
29	*Anas poecilorhyncha*	Spot-billed Duck **斑嘴**鸭	R		LC	0	0	0	2
30	*Anas querquedula*	Garganey **白眉**鸭	R	P	LC				
31	*Mergus merganser*	Goosander **普通秋沙**鸭	W	P	LC				
Falconiformes 隼形目									
32	*Milvus migrans*	Black Kite **黑**鸢	W	II	LC				
33	*Accipiter gularis*	Japanese Sparrow Hawk		II	LC				
34	*Accipiter buteo*	Common Buzzard **普通鵟**	W	II	LC				
35	*Falco tinnunculus*	Common Kestrel 红隼	R	II	LC	0	0	1	0
Galliformes 鸡形目									
36	*Bambusicola thoracica*	Chinese Bamboo Partridge		P					
37	*Pucrasia macrolopha*	Koklass Pheasant		II	LC				
38	*Phasanus colchicus*	Ring-necked Pheasant	R	P		0	0	18	0
Gruiformes 鹤形目									
39	*Grus grus*	Common Crane **灰**鹤	W	II	LC				
40	*Grus monacha*	Hooded Crane **白**头鹤	W	I	VU				
41	*Grus leucogeranus*	Siberian Crane **白**鹤	W	I	CR				
42	*Rallus aquqticus*	Water Rail **普通秧**鸡	S		LC				
43	*Amaurornis akool*	Brown Crake 红脚苦恶鸟	S		LC				
44	*Amaurornis pheonicurus*	White-breasted Waterhen	S		LC				
45	*Gallinula chloropus*	Common Moorhen **黑水**鸡	R		LC	25	65	50	28
46	*Fulica atra*	Common Coot **白骨**顶	W		LC				
47	*Otis tarda*	Great Bustard **大**鸨	W	I	VU				
Charadriiformes 鸻形目									
48	*Phasianus chirurgus*	Pheasant-tailed Jacana **水雉**	S	P	LC				
49	*Vanellus vanellus*	Northern Lapwing 凤头麦鸡	W	P	LC				
50	*Vanellus cinereus*	Grey-headed Lapwing	S	P	LC	0	0	0	1
51	*Charadrius hiaticula*	Long-billed Ringed Plover			LC				
52	*Charadrius dubius*	Little Ringed Plover **金眶**鸻	R		LC	0	0	0	2
53	*Charadrius alexandrinus*	Kentish Plover 环颈鸻	W		LC				
54	*Charadrius leschenaultia*	Great Sand Plover			LC				
55	*Tringa erthropus*	Spotted Redshank 鹤鹬	W		LC	0	2	3	0
56	*Tringa totanus*	Common Redshank	W		LC				
57	*Tringa stagnatilis*	Marsh Sandpiper 泽鹬			LC				
58	*Tringa nebularia*	Common Greenshank	W		LC				
59	*Tringa ochropus*	Green Sandpiper	W		LC	0	0	1	2
60	*Gallinago* spp.	Snipe **沙**锥	W		LC	0	0	0	1
61	*Calidris alpina*	Dunlin **黑腹**滨鹬	W						
62	*Recurvirostra avosetta*	Pied Avocet **反嘴**鹬	W	P	LC	0	0	60	0
Lariformes 鸥形目									
63	*Larus ridibundus*	Black-headed Gull 红嘴鸥	W		LC				
64	*Chlidonias hybrid*	Whiskered Tern 须浮鸥	W			0	0	5	0
Columbiformes 鸽形目						0	2	2	5
65	*Streptopelia orientalis*	Oriental Turtle Dove	R	P	LC	0	16	22	26

66	*Sterna chinensis*	Spot-necked Dove	R	P	LC				
Cuculiformes 鹃形目									
67	*Cuculus sparverioides*	Large Hawk Cuckoo		P	LC				
68	*Cuculus micropterus*	Short-winged Cuckoo	S	P	LC				
69	*Cuculus canorus*	Common Cuckoo	S	P	LC				
70	*Cuculus saturates*	Oriental Cuckoo	S	P	LC				
71	*Cuculus poliocephalus*	Lesser Cuckoo		P	LC				
72	*Eudynamys scolopaceus*	Common Koel		P	LC				
73	*Centropus bengalesis*	Lesser Coucal	S	II	LC				
Caprimulgiformes 夜鹰目									
74	*Caprimulgus indicus*	Grey Nightjar	S		LC				
Coraciiformes 佛法僧目									
75	*Megaceryle lugubris*	Crested Kingfisher			LC				
76	*Ceryle rudis*	Lesser Pied Kingfisher	R		LC	0	0	2	0
77	*Alcedo atthis*	Common Kingfisher	R	P	LC	0	0	1	0
Upupiformes 戴胜目									
78	*Upupa epops*	Eurasian Hoopoe **戴**胜	R	P	LC	0	1	0	0
Piciformes 鴷形目									
79	*Megalaima virens*	Great Barbet **大**拟啄木鸟		P	LC				
80	*Picus canus*	Grey-headed Woodpecker		P	LC				
81	*Dendrocopos major*	Greater Pied Woodpecker		P	LC				
Passeriformes 雀形目									
82	*Alauda gulgula*	Oriental Lesser Skylark	R			0	0	1	2
83	*Hirundo rustica*	House Swallow 家燕	S	P	LC	0	16	0	0
84	*Hirundo daurica*	Red-rumped Swallow 金腰燕	S	P	LC				
85	*Dendroanthus indicus*	Forest Wagtail 山鹡鸰	R		LC				
86	*Motacilla alba*	White Wagtail 白鹡鸰	R		LC	0	4	4	2
87	*Motacilla lugens*	Black-backed Wagtail			LC				
88	*Anthus novaeseelandiae*	Paddy-field Pipit 田鹨	S		LC	0	2	1	1
89	*Anthus hodgsoni*	Oriental Tree Pipit 树鹨	S		LC	0	0	0	2
90	*Anthus rubescens*	Buff-bellied Pipit 黄腹鹨	S		LC	0	0	0	1
91	*Spizixos sermitorques*	Collared Finch-billed Bulbul	S		LC	0	4	0	0
92	*Pycnonotus sinensis*	Chinese Bulbul 白头鹎	R		LC	0	0	15	18
93	*Lanius schach*	Rufous-backed Shrike	R	P	LC	0	0	6	0
94	*Oriolus chinensis*	Black-naped Oriole	S	P	LC				
95	*Dicrurus marcocercus*	Black Drongo 黑卷尾	S	P	LC				
96	*Sturndus sericeus*	Silky Starling 丝光椋鸟	S		LC				
97	*Sturnus cineraceus*	Ashy Starling 灰椋鸟	W		LC	0	0	230	15
98	*Acridotheres cristaltellus*	Crested Myna 普通八哥	R		LC	3	0	6	0
99	*Cyanopica cyanal*	Grey Tree Magpie 灰喜鹊			LC	0	0	10	30
100	*Pica pica*	Magpie 喜鹊			LC	12	2	26	6
101	*Corvus torquatus*	Collared Crow 白颈鸦	W		LC	0	0	0	2
102	*Rhyacornis fuliginosus*	Plumbeous Water Redstart	W						
103	*Turdus merula*	Blackbird 乌鶇	R		LC	6	0	24	8
104	*Turdus hortulorum*	Grey-backed Thrush			LC	0	0	0	2
105	*Turdus eunomus*	Dusky Thrush **斑點鶇**				0	8	0	2
106	*Paradoxornis webbianus*	Rufous-headed Crowtit	R		LC				
107	*Paradoxornis heudei*	Chinese Crowtit 震旦鸦雀			NT				
108	*Cettia diphone*	Japanese Bush Warbler	S		LC				
109	*Cettia fortipes*	Strong-footed Bush Warbler			LC				

110	*Acrocephalus orientalis*	Oriental Great Reed Warbler							
111	*Parus major*	Great Tit 大山雀			LC	3	0	5	2
112	*Aegithalos caudatus*	Long-tailed Tit 银喉山雀			LC				
113	*Aegithalos concinnus*	Red-headed Tit 红头山雀			LC				
114	*Passer montanus*	Sparrow 麻雀			LC	84	0	36	110
115	*Lonchura striata*	White-rumped Munia			LC				
116	*Carduelis sinica*	Greenfinch 金翅雀			LC	0	0	11	0
117	*Eophona migratoria*	Black-tailed Hawfinch			LC	0	0	70	30
118	*Emberiza spodocephala*	Masked Bunting 灰头鹀			LC	0	2	0	4
119	*Emberiza chrysophrys*	Yellow-browed Bunting			LC	0	4	0	1

Notes: No abundance data means that the species have been recorded in literature but not observed during the surveys. Seasonal Type: R = resident; S = summer migrant; W = winter migrant. Protection Status: P = provincial protection list; I = national grade I protected wild animal; II = national grade II protected wild animal. ICUN = International Union for Conservation of Nature; LC = least concern; NT = near threatened; VU = vulnerable; EN = endangered; CR = critically endangered (see http://www.iucnredlist.org)

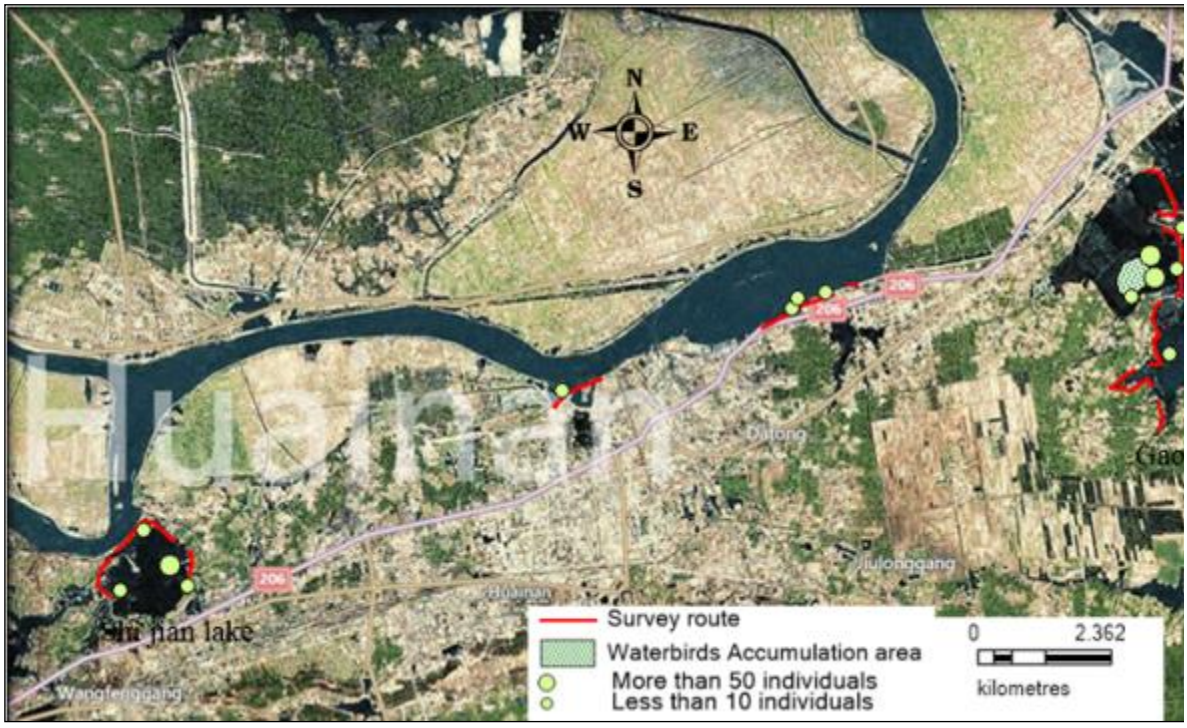


Figure V.18: Locations of waterbird observations at Gaotang and Shijian Lakes

Table V.42: Description of Bird Habitats in the Project Area of Influence. Source: Chen (2013)

Habitat	Characteristics	Birds
Planted woodland	Trees, shrubs transitioning to marshy areas and artificial wetlands, open water, providing feeding and nesting grounds for waterbirds.	Waterfowl, falcons, cuckoos
Exposed water front	Little vegetation. Benthic organisms comparatively abundant. Feeding/resting sites for waterbirds.	Waders e.g. egrets, herons, plovers
Grass meadow, reed bed	Thick reed beds provide feeding, resting and nesting grounds for many swimmers and waders.	Waterfowl, gulls, storks, cranes, some shorebirds
Shallow water area	Mudflats and grass meadows with abundant food sources. Provide feeding, resting, nesting and breeding grounds for waterbirds.	Waterfowl, wading birds, some shorebirds
Deep water area	Feeding and resting grounds for swimmers	As above

80. Bao et al. (2011)[9] investigated the distribution of waterbirds at lakes along the Anhui section of the Huai River from June 2008 to May 2009. They recorded 61 species, of which winter migrants dominated (32 species; 52.5%), followed by summer migrants (23.0%), passing migrants (21.3%) and residents (3.3%). Winter migrants in the Anhui section of the Huai River basin were mostly Anseriformes (ducks, geese), dominated by the Ruddy Shelduck and Mallard. Summer migrants were mostly breeding species dominated by the Little Egret. Waterbird abundance was the highest in winter, followed by spring, fall and summer. Their survey recorded 14,787 waterbird individuals in the winter and 8,981 individuals in the summer.

81. All of the protected and/or threatened species recorded in the current project fieldwork were recorded by these authors elsewhere in the Huai river basin and/or Anhui province (Table V.43), except for White Eurasian Spoonbill, Great White-fronted Goose, Common Crane and Hooded Crane. The Oriental White Stork (not observed in the project survey), was encountered at all five lakes. The Swan Goose (one of the dominant waterbird species observed at Gaotang Lake in the project survey), was encountered at three of the five lakes (Bao et al. 2011). Limited comparisons can be made from these data, due to (i) the limited information from the project area and (ii) unequal survey effort between surveys and sites, but which suggest that Gaotang Lake is potentially an important (if only occasional) wintering site for some waterbirds, although these species also utilize a range of other waterbodies in the Huai river basin.

Table V.43: Regional occurrence in Huai river basin, Anhui Province, of the threatened and/or protected waterbird species recorded in the current fieldwork, from the findings of Bao et al. (2011)

Species	Abundance	Occurrence (√)				
		Dongxi Lake	Wabu Lake	Longzi Lake	Tuo Lake	Nv'shan Lake
Ciconia boyciana (Oriental White Stork)	+	√	√	√	√	√
Platalea leucorodia (White Eurasian Spoonbill)	+	√				
Anser cygnoides (Swan Goose 鸿雁)	+	√			√	√
Anser fabalis (Bean Goose 豆雁)	++	√	√	√	√	√
Anser albifrons (Great White-fronted Goose)	+				√	
Cygnus columbianus (Tundra Swan)	+	√		√		√
Tadorna ferruginea (Ruddy Shelduck)	+++	√	√	√	√	√
Anas acuta (Northern Pintail 针尾鸭)	++	√	√	√	√	√
Anas crecca (Common Teal 绿翅鸭)	++	√			√	
Anas falcate (Falcated Duck 罗纹鸭)	++	√	√	√	√	√
Anas platyrhynchos (Mallard 绿头鸭)	+++	√	√		√	
Anas poecilorhyncha (Spot-billed Duck)	++	√	√	√	√	√
Anas querquedula (Garganey)	+	√				√
Mergus merganser (Goosander)	++	√			√	√
Grus grus (Common Crane)	+					√
Grus monacha (Hooded Crane)	+		√			
Total number of waterbird species:		27	28	24	39	36
Waterbird species as a percentage of all bird species:		44%	46%	39%	64%	59%
Shannon-Wiener diversity index (H'):		2.457	2.043	1.698	3.652	2.688

[9] Bao F. Y., S. Wang, M. Wang and W. Zheng. 2011. Field survey on wetland waterbird in Huaihe River Basin in Anhui, China. China Journal of Zoology, 46(4): 117-125.

Species	Abundance	Occurrence (√)				
		Dongxi Lake	Wabu Lake	Longzi Lake	Tuo Lake	Nv'shan Lake
Note: Abundance based on Frequency Index calculation i.e.: % number of days encountering the species / total number of survey days x the average daily count of the species. Based on such calculation: **+** = <200 individuals; **++** = 200 ~ 500 individuals; **+++** = >500 individuals						

82. The size of regional populations of ducks, geese and swans in East Asia and the eastern PRC (including the Huai River basin) was estimated by Cao et al. (2008)[10]. Their estimates, where available, for the selected waterbird species in Table V.43 and in comparison with the bird counts at Gaotang Lake in this project, are in Table V.44. The numbers of individuals recorded in two visits to Gaotang Lake comprise a very small proportion of the documented populations from the eastern PRC, although this is based on limited data. Although few conclusions can be drawn from the limited survey data in the project area, the project surveys confirmed that (i) some species protected under the national and/or Anhui provincial protection lists occur at Gaotang Lake, (ii) some species listed as globally threatened under the IUCN Red List occur at Gaotang Lake, (iii) the conservation importance of Gaotang Lake for waterbirds is unclear but the lake may support regionally significant numbers of some waterbird species.

Table V.44: Counts for some Waterbird Species Recorded during project fieldwork at Gaotang Lake compared with Regional Population Estimates

Species of ducks, geese and swans	Cao *et al*. (2008) Population Estimates		1% East Asia Flyway Non-breeding Population	Counts at Gaotang Lake
	East Asia	Eastern PRC		
Anser cygnoides (Swan Goose 鸿雁)	78,000	78,000	No data	180
*Anser fabalis (*Bean Goose 豆雁)	190,000	150,000	No data	0
Anser albifrons (Great White-fronted Goose 白额	130,000	33,000	No data	0
Cygnus columbianus (Tundra Swan 小天鹅)	110,000	81,000	No data	0
Tadorna ferruginea (Ruddy Shelduck 赤麻鸭)	No data	5,500	500~1,000	2
Anas acuta (Northern Pintail 针尾鸭)	250,000	46,000	2,000~3,000	0
Anas crecca (Common Teal 绿翅鸭)	360,000	146,000	6,000~10,000	22
Anas falcate (Falcated Duck 罗纹鸭)	89,000	78,000	No data	0
Anas platyrhynchos (Mallard 绿头鸭)	810,000	73,000	15,000	3
Anas poecilorhyncha (Spot-billed Duck 斑嘴鸭)	390,000	100,000	No data	0
Mergus merganser (Goosander 普通秋沙鸭)	39,000	29,000	No data	0

Sources: Cao *et al*. (2008); Chen (2012), http://wpe.wetlands.org/

83. In the project bird survey report (Chen 2013), the conservation importance of Gaotang and/or Shijian Lakes was assessed against criteria for Wetlands of International importance (Ramsar Convention). At least two Ramsar criteria were applied: (i) "a wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds"; and (ii) a wetland should be considered internationally important if it regularly supports 1% of the individuals in a population (non-breeding) of one species or subspecies of waterbird". The

[10] Cao L., M. Barter and G. Lei. 2008. New Anatidae population estimates for eastern China: Implications for current flyway estimates. Biological Conservation, 141 (2008): 2301-2309.

assessment concluded that although literature (Shi 2003)[11] indicated that Gaotang Lake was on the winter migration and resting path for waterbirds where the 1% population criterion was applicable to Swan Goose, Oriental White Stork, White Eurasian Spoonbill and Tundra Swan, the wetlands in the project area were unlikely to be of international importance. On this basis, it is concluded that the project area does not support 'critical habitat' for waterbirds or other fauna.

Protected areas

84. The 12th FYP (2011-2015) for Huainan describes the plan to construct wetland parks, one in Gaotang Lake and one in Shijian Lake. At Gaotang Lake, the shoreline south of the proposed 14.47 km embankment is proposed as an 'ecological protection area'. These plans are in early conceptual stages and no details or designated protection status is available. There is presently no protected area or nature reserve within the assessment area.

7. Socio-economic conditions

85. Baseline socio-economic data, including municipal population and demography and industry, are summarized in Table V.45.

Table V.45: Socio-economic Conditions of Huainan Municipality

Item	Unit	2011 Data
Total population at year-end	million people	2.4564
Male population	million people	1.2777
Female population	million people	1.1787
Population of permanent residents	million people	2.3339
Population density	no. people/km^2	950
Total households	number	781,000
Village households	number	360,000
Registered unemployment	%	4.10
Gross Domestic Product (GDP)	billion CNY	70.953
Primary industry	billion CNY	5.590
Secondary industry	billion CNY	46.144
Tertiary industry	billion CNY	19.220
Per capita GDP	CNY	30,400
Total government revenue/income	billion CNY	13.885
Total government expenditure	billion CNY	10.964
Urban per capita disposable income	CNY	18,219
Rural per capita net income	CNY	6,795
Urban per capita average living area	m^2	25.87
Rural per capita average living area	m^2	37.23
Electricity consumption	billion kW-hour	6.569
Water supply pipeline	km	1,579
Total water supplied	million t	118.88
Total natural gas supplied	million m^3	91.56
Total LPG supplied	t	23,910

[11] Shi, K. C. 2003. Anhui wetlands. Published by the Hefei Industrial University Press.

Item	Unit	2011 Data
Drainage pipeline	km	679
Wastewater pipeline	km	147
Wastewater discharge volume	million t	102.98
Wastewater treatment volume	million t	99.58
Wastewater treatment rate	%	96.7
Wastewater treatment capacity	m^3/d	225,000
Municipal solid waste collection	t	350,000
Flood protection embankment	km	202
Park area	ha	627
Greenery area	ha	4,457
Landscaped area in constructed area	%	40.5

Source: Huainan Municipality 2012 Year Book

86. Shijian and Gaotang Lakes are used for aquaculture and fishing. The area of aquaculture in these two lakes is unknown, but the average yield of enclosed aquaculture is reported to be 20,000 *jin* from 500 mu [=300 kg/ha].[12] Fish culture is partly fed with nightsoil. During fieldwork on 17 March 2013, nightsoil was seen spread over the embankment. Other fish feed includes peanut cake (the remains of peanuts after they have been pressed for oil). These activities almost certainly influence lake water quality: aquaculture results in releases of nutrients to the lake waters from fish excreta and waste food, and elsewhere in the PRC, one ton of fish production may produce 141 kg and 14 kg of nitrogen and phosphorous respectively (Cao et al. 2007).[13] There are presently no plans to regulate aquaculture in Gaotang or Shijian Lakes.

8. Physical cultural resources

87. The EIR, based on review of the status of cultural heritage within the project area and consultation with the Huainan Cultural Bureau, did not document any physical cultural resources within the assessment area. Should buried artifacts of archaeological significance be uncovered during construction, construction will be stopped and immediately reported to the Base Cultural Heritage Bureau in accordance with the PRC's Cultural Heritage Protection Law.

9. Greenhouse gas emissions and climate change

88. Following review of the PPTA inception report, ADB recommended that a climate change specialist be added to the PPTA team to review available literature, analyze potential climate risk, and propose potential activities to reduce risk if required. Review of historical and current trends in flooding, and a sensitivity analysis, were conducted to assess the effects of increases in peak rainfall intensity on the drainage capacity of the urban lakes and channels.

89. Climate change is defined as any change in global temperatures and precipitation over time due to natural variability or to human activity. Global warming is the increase in Earth's average surface temperature due to rising levels of greenhouse gases (GHGs) (e.g. carbon

[12] Poverty and social analysis report.

[13] Cao, L. et al. 2007. Environmental impact of aquaculture and countermeasures to aquaculture pollution in China. *Environmental Science and Pollution Research* 14: 452-462

dioxide, methane) and is a sub-set of global climate change. Natural factors causing climate change include oceanic processes, solar radiation received by Earth, plate tectonics, and volcanic eruptions. Examples of human activity affecting the climate are burning fossil fuels, which emits GHGs into the atmosphere, and construction of impervious surfaces using materials such as asphalt and concrete which tend to increase the ambient temperature (heat island effect) as well as increase the volume of storm water runoff. Climate change analysis suggests that the severity of existing weather patterns will intensify, with wet areas getting wetter, and dry and arid areas becoming more so. Much climate change research addresses flood risk. Climate change may invalidate traditional assumptions that historical flood records may predict future conditions.

90. In 2009, a Climate Change Working Leading Group was established within the Anhui Development and Reform Commission to coordinate climate change adaptation and mitigation activities within the province. The province also established the Climate Center of Anhui Province, which twice yearly publishes a report called Climate Change Assessment Report of Anhui Province. The Climate Center participated in preparing the Climate Assessment Report in the region of East China published June 2011, and led the preparation of Anhui's first Climate Change Program of Anhui Province, approved in 2009 by the APG. This program describes provincial objectives for addressing climate change and greenhouse gas (GHG) emissions.

91. The Anhui Provincial Weather Center[14] estimated that total carbon dioxide (CO_2) emission in 2007 was 263.825 million t, mainly from burning of fossil fuel (76%) (Table V.46), and predicted, using the Integrated Policy Assessment Model of China: IPAC, that CO_2 emissions in Anhui Province would increase to 338.04 million t in 2015 and 413.58 million t in 2020, but could be reduced to 303.25 million t in 2015 and 335.35 million t with policy enforcement (to reduce energy consumption and pollutant emissions). According to the provincial climate change program, Anhui should decrease its energy consumption per CNY10,000 of GDP in 2010 by 20% based on the 2005 level, and 15% in 2015 based on the 2010 level. By 2010, the proportion of coal among the primary energy source should decrease to 80%, the utilization of industrial solid waste energy source should reach *c.*85%, and water consumption per CNY10,000 of industrial added value should decrease by 30% compared to that of 2005.[15]

Table V.46: Estimate of Carbon Dioxide Emission in Anhui Province in 2007

Emission Source	CO_2 (million t)	Percentage
Burning of fossil fuel	200.710	76.1%
Industrial production (mainly cement clinker, iron and steel production)	46.430	17.6%
Methane from agriculture (527,000 t)	11.067	4.2%
Methane from landfills and wastewater treatment (268,000 t)	5.618	2.1%
Total CO_2 emission	263.825	100%
Carbon sink by forest	(1.197)	
Net CO_2 emission	262.628	

Source: Liu and Jiang, Anhui Provincial Weather Center

[14] Liu H, K. J. Jiang. Analysis of Anhui Province climate change situation and greenhous gas emission prediction. Anhui Provincial Weather Center.

[15] Source: http://www.linkschina.com/eN/index.php?option=com_content&view=article&id=486:anhui-province-energy-consumption-per-10000-yuan-of-gdp-to-drop-by-15-in-2015-based-on-2010-level&catid=5:climate-change&Itemid=8

92. For the Huai River basin, Cheng and Wang (2008)[16] showed that for the 49 years from 1956 to 2004, drought areas in the Huai River basin increased 2.66% per 10 years. However, days with heavy rain had a slight decreasing trend in the same period. As simulated by 8 climate models for 2050 under ICPP A2 and B2 scenarios, the annual and seasonal temperature/precipitation changes in the Huai River basin might increase mainly in summer for absolute precipitation amount, though % increase might be larger in the winter. Ju et al. (2012)[17] used 8 global climate model scenarios in the 4th ICPP to predict runoff at the Bengbu hydrological station in the Huai River basin for the next 90 years. Their results indicated that (i) compared with average annual flow of the reference period (1961-1990), future average annual flow decreases and dry season runoff is lower than the reference period; and (ii) compared with the monthly flow of the reference period, the maximum flow would occur in July which is consistent with the historical measurement.

93. **Huainan Municipality.** The municipality is vulnerable to climate change from flooding of the Huai River, waterlogging from rainstorms, increase of combined sewer overflows in storms, and drought impacts on agriculture and thermal cooling. Zhang et al. (2008)[18] analyzed Huainan's meteorological data from 1955–2006 which showed (i) an increasing trend in annual average temperature, warming more obvious since the 1990s, and the annual average temperature of 17.2 ^{o}C in 2006 being 1.6 ^{o}C higher than the norm and which was the warmest year since 1955; and (ii) a slight increasing trend in precipitation but with increasing frequency and intensity of drought and flood disasters. From 2001 to 2007, serious drought occurred in 2001 and serious floods occurred in 2003, 2005 and 2007 (Section II-flood data). Based on 8 climate change models for the two UNFCCC scenarios presented[19], average annual temperature is expected to increase by 2.1^{o}C and average annual precipitation is expected to increase by 4%. The Huainan Design Institute modeled likely hydrological impacts on stream flow of these increases, and found that stream flow may decrease due to evapotranspiration. Increases in precipitation would be offset by higher temperatures.

[16] Cheng, X. T and J. Wang. 2008. Impacts of climate change on flood management and drainage improvement project and adaptation options: case study in the Huai River basin. China Institute of Water Resources and Hydropower Research(IWHR), November 2008.

[17] Ju, Q., Z. C. Hao, G. X. Ou, L. Wang and C. J. Zhu. 2012. Impact of global climate change on regional water resources: a case study in the Huai River Basin. In: Climate models, L. Druyan (ed).

[18] Zhang, Z. P. et al. 2008. Huainan climate change and adaption options. Huainan Meteorological Bureau, Anhui.

[19] A2: independently operating, self-reliant nation, economic development is regionally oriented, and population continuously increasing. B2: increasing population, but slower rate than in A2, local solutions, economic development at intermediate levels, slow and fragmented technological change.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

94. This section identifies and assesses the potential for adverse environmental and social impacts that may occur during the project construction and/or operational phases, and the mitigation measures that should be implemented in the phases of detailed design and pre-construction, construction, and operation. The duration of impacts assessed in this EIA covers the construction and operational phases of the project. Construction works have been estimated to take 16 months starting in the second quarter of 2014. The assessment period for the operational phase is three years after commencement of operation, since it will take a few years to realize the benefits of constructed wetlands and channel and lake water improvements.
95.

A. Detailed design and pre-construction phase: measures to be undertaken

96. The following measures will permanently become part of the infrastructure and will be included in the detailed design of facilities by the design institutes.

(i) Technical design of the dredged channel sediment disposal sites must have (a) bottom liner to prevent pore water from polluting the ground water, (b) treatment process for supernatant water to meet *Integrated Wastewater Discharge Standard* (GB 8978-1996), and (c) earth berm or drainage ditch around the perimeter of the disposal site to prevent heavy rainfall or flooding to cause washing away of the disposed sediment.

(ii) Technical design of the flood control capacity of the urban water channels must consider adaptation to climate change, such as future increase in the intensity and frequency of storm events and thus increased flooding and water logging risks.

(iii) Technical design of the storm water pump station must consider (a) adaptation to climate change such that pumping capacity will be adequate to accommodate future increase in the intensity and frequency of storm events, and (b) energy efficiency of the pumps so as to minimize carbon footprint during operation.

(iv) Technical design of the storm water and wastewater pump station must be able to contain the operational noises from pumps, blowers and other noisy equipment with proper acoustic design of these facilities. Technical design of the wastewater pump station must also include odor removal.

(v) Design and construction of the wastewater collection pipelines must be adequate to prevent pipe burst.

(vi) Design of embankments must be adequate to withstand heavy storm water flow but at the same time maximize the adoption of eco-friendly embankment designs.

97. The following measures will be implemented in the pre-construction phase to ensure the project's environment management readiness.

(i) Institutional strengthening, including (a) appointment of one qualified environment specialist within HPMO; (b) hiring of loan implementation environment consultants (LIEC) within loan administration consultant services by HPMO; and (d) contracting of environmental monitoring station by HPMO to conduct environment impact monitoring.

(ii) Updating the EMP. The mitigation measures defined in the project EMP (Attachment A) will be updated based on final technical design. This will be the responsibility of HPMO,

using a local design institute. A waterbird specialist will be contracted by HPMO to review the final designs to ensure that the waterbird management (Section V.B) remains effective.

(iii) Land-take confirmation. The Resettlement Plan will be updated with final inventory. This will be the responsibility of HPMO, using a local design institute.

(iv) Contract documents. All tender documents will include the EMP obligations, including the environmental monitoring program. This will be the responsibility of the local design institute, with support of HPMO and the LIEC.

(v) Environmental protection training. Environmental specialists and/or officials from HEPB will be invited to provide training on implementation and supervision of environmental mitigation measures to contractors. This will be the responsibility of HPMO, with support of the LIEC.

B. Construction phase: potential impacts and their mitigation

1. Impacts on physical resources

98. **Air quality.** Air quality impacts include dust and odor. Dust (which includes both total suspended solids [TSP] and PM_{10} will be emitted during site formation of the pumping stations, excavation and backfilling for wastewater pipeline installation, and earth works during embankment construction. Based on monitoring data from similar projects, the EIR estimates that based on an average wind speed of 2.3 m/s, the TSP level at construction sites may range from 1.5–2.3 times higher than the upwind TSP level, and which could be 1.4–2.5 times higher than the 24 hr average TSP standard of 0.30 mg/m^3 in GB 3095-1996. The impact distance could reach up to 150 m downwind of construction sites. Within the impact zone, 24-hr TSP level could average 0.49 mg/m^3, approximately 1.6 times higher than the standard.

99. Some of the sensitive receptors (Jiannan Village, Xinzhuang No. 3 Village, Xiaodonggang and Sunyingzi) and project sites (Huaibin Village and Xiejiaji dredged sediment disposal sites, and Long Lake and Gaotang Lake pump stations) are already experiencing TSP levels that exceed GB 3095-1996 Class II standards (Table V.19). Mitigation measures such as frequent watering (7-8 times per day) of unpaved areas and haul roads on construction sites, will be needed to suppress fugitive dust emission. The EIR estimates that by doing so the amount of dust will be reduced by 50-70% (based on monitoring data from similar construction projects). A range of additional dust suppression measures will also be employed (see below) and which will further reduce TSP levels. The final net predicted TSP levels after employment of all mitigation measures cannot be estimated at this time: (i) TSP assessment in the PRC does not generally employ ‘fugitive dust models’, and (ii) even if such a model were to be used, there is insufficient data on the exact parameters which would be required, including the detailed construction program, exact locations of construction sites, materials, and traffic movements. Air quality monitoring will be conducted at 21 locations during construction and an exceedence standard has been defined (see Tables A.4–5 of EMP; Attachment 1). These combined measures are anticipated to enable control of TSP to acceptable levels and which are realistic and achievable.

100. Construction methods for the wastewater pipelines will include open-cut and horizontal directional drill (HDD). Where pipe burial is shallow and soil conditions permit, the open-cut method will be adopted. Where pipe burial is deep or crossings of railway lines or water channels are required, HDD will be deployed. The FSR estimates that 27% will be HDD and 73% by open-cut. The HDD method avoids creating an open trench along the pipeline route, thus avoiding piling up soil, dust, and nuisance to pedestrians and traffic. As a linear activity, pipelines will be built in sections, and associated impacts will be temporary; in this way, sensitive receptors will only be exposed to short durations of impact.

101. The following mitigation measures to suppress dust on construction sites will be adopted.

(i) Water unpaved areas, backfill areas and haul roads 7-8 times each day.
(ii) Erect hoarding around dusty activities.
(iii) Cover stockpile areas with tarpaulin and/or employ frequent watering.
(iv) Minimize on-site storage time of construction and demolition wastes by regular disposal.
(v) Do not overload trucks for transporting earth materials, to avoid spillage.
(vi) Equip trucks for transporting earth materials with covers or tarpaulin.
(vii) Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads.
(viii) Immediately clean all muddy or dusty materials on public roads outside site exits.
(ix) Plan the transport routes and times to avoid busy traffic and heavily populated areas.
(x) Upon completion of construction, immediately implement site rehabilitation, including revegetation (including all construction areas and dredged sediment disposal sites).

102. Odor will be emitted during dredging, transport and disposal of channel sediment since the sediment is likely to be anoxic with high organic content, generating H_2S, a chemical that smells like rotten egg. The EIR predicts that the odor impact zone may be ~50 m downwind of the source. Households along and downwind of the sections of the urban water channels under construction are regarded as sensitive receptors to this odor. Odor generated during dredging is difficult to mitigate. Because of the linear nature of the construction works along the urban water channels, as one section is completed, construction activities move on. Impacts will be short-term and are expected to be relatively minor. Impacts will be monitored during construction. As part of the project's ongoing public consultation process, residents will be informed of the potential for odors prior to construction, and will be encouraged to report any discomfort. The siting of the dredged sediment disposal locations in this project has taken into consideration potential odor impacts and these disposal locations are distant from sensitive receptors. Dredged sediment will be immediately transported to the disposal site, in vehicles equipped with sealed containers – there will be no storage at construction sites.

103. **Noise and vibration.** Noise and vibrations will be emitted by powered mechanical equipment (PME) used for embankment and pump station construction, pipeline laying and water channel dredging. The defined construction noise standards for this project are 70 dB(A) for day time and 55 dB(A) for night time (Emission Standard of Environmental Noise for Boundary of Construction Site; see Table A.5 of EMP, Attachment 1). Based on the types of PME used for such activities and their sound power levels, the EIR predicted that the impact distance would be ~50 m in the day and up to 120 m at night. At least seven sensitive receptors (City No.

2 Hospital, Xie No. 2 Mine Hospital, Huajian Primary and Secondary School, Huainan Teachers College, Huainan Bureau of Mine, Huainan No. 7 Secondary School, Shangri-La Community) and four project sites (pump station locations at Shijian, Caozuizi, Long, and Dajiangou Lakes) already experience noise levels that exceed the World Bank Group's EHS guideline (day 51.7–57.3 dB(A); night 45.3–46.7 dB(A); Table V.22). Three sensitive receptors may be most affected by construction noise due to their proximity to construction sites: Huainan Teachers College (located 5 m from Old Longwang Channel) and Xie No. 2 Mine Hospital and Jiannan Village (located 50 m from Xiejiaji and Bagongshan Channels respectively).

104. Given the existing noise levels at these seven sites, the day time construction noise limit defined for this project [70dB(A)] will almost certainly be exceeded in at least three sites (Huainan Teacher's College, Xie No. 2 Mine Hospital, Jiannan Village) during some embankment construction and/or dredging, although the exact extent of potential exceedence cannot be estimated as exact construction parameters (specific type of equipment and construction time) are unknown. Project construction will not impact night noise levels because no construction work will be conducted at night (see below).

105. The following mitigation measures will be employed to suppress noise and vibrations at construction sites.

(i) There will be no construction during night time, between 2200 and 0600 hours.
(ii) Quiet equipment (models with low sound levels) will be selected and exhaust muffling devices will be installed on combustion engines.
(iii) Construction equipment will be maintained in good condition.
(i) Temporary noise barriers will be erected near sensitive receptors and on relevant occasions, such as school examination periods.
(ii) Prior to construction near sensitive receptors, the PMO will consult the affected communities and (a) ensure they are aware of the construction and so that activities with the greatest potential to generate noise and vibration are planned during periods of the day that will result in least disturbance, (b) with the communities, delineate construction hazard zones and identify structures which may be especially susceptible to vibration impacts, and (c) distribute ear protection against construction noise.
(iii) Particular attention will given to communities and residential and commercial structures at and near the Huainan Teacher's College, Xie No. 2 Mine Hospital, and Jiannan Village, to avoid impacts to people (from noise) and structures (from vibration).
(iv) Transport routes for project vehicles, including cars, trucks, and heavy machinery, will as far as possible avoid community areas and sensitive receptors.

106. Embankment and pipeline construction as well as water channel dredging are linear activities: as one section is completed, construction activities move on. Construction noise and vibration impacts will be temporary and of short-term duration. Noise levels will be monitored during construction (Table A.4 of EMP; Attachment 1). These combined measures are anticipated to be sufficient to control noise and vibration levels to acceptable levels for the health and safety of residents and structures, and which are realistic and achievable.

107. **Water quality.** At least three project construction activities may impact water quality within and near the project channels and lakes: (i) worker wastewater and muddy runoff at construction sites, (ii) release of sediments and pollutants during channel dredging, and (iii) discharge of supernatant water from dredged sediments, at the three proposed dredge disposal sites.

108. For worker-related impacts, uncontrolled wastewater and muddy runoff from construction sites could pollute nearby water bodies and clog up drains. The EIR estimated that up to 950 workers will be working on different project sites during peak construction periods, generating 76 m^3/d of wastewater having COD levels of 320–360 mg/L and BOD_5 level of 200 mg/L. To prevent water pollution from construction sites, the following measures will be implemented.

(i) Portable toilets and small package WWTPs will be provided for workers and canteens.
(ii) If there are nearby public sewers, interim storage tanks and pipelines will be installed to convey wastewater to those sewers.
(iii) Sedimentation tanks will be installed on-site to treat process water (e.g. concrete batching for bridge construction) and muddy runoff with high concentrations of suspended solids. If necessary, flocculants such as Polyacrylamide (PAM) will be used to facilitate sedimentation.

109. Dredging of the urban channels and in Long Lake will be conducted by using long arm dredgers positioned on the levees, with the bucket at the end of a 2-segment long arm extending into the channels to remove unconsolidated sediment and the underlying soil. The dredge radius is 15 m and each lowering would remove ~0.4 m^3 of sediment. For dredging impacts, wet dredging using long arm dredgers will stir up the channel sediment and any pollutants. Sampling of sediment quality in the project urban water channels showed low levels of heavy metals and pesticides but high levels of nutrients (TP, TN) (Table V.32). Potential downstream impacts will be largely limited to be the temporary increase in suspended solids (SS) and nutrients, with negligible release of heavy metals and chemicals. The dispersion of these substances will depend on the river flow and dredging rate. The EIR estimated that the impact zone with elevated SS levels should be confined to within 50 m downstream of the dredger. The release of nutrients into the water column is considered unlikely to result in algal blooms, because of the high turbidity. Re-mobilization and dispersion of small amounts of heavy metals during dredging is possible, but social and/or ecological impacts are expected to be minimal because (i) the channels are not used for drinking or irrigation purposes and (ii) aquatic species richness is already low due to high pollution levels and currently dominated by pollution-tolerant species (Section V.F.6; Tables V.35–37).

110. To minimize downstream circulation of dredged sediments, the following measures will be implemented.

(i) Water quality monitoring will be undertaken during dredging (Attachment A). This will comprise one location upstream of the dredging site (the ‘control’ site) and one location downstream of the dredging site (‘impact’ sites). Monthly comparisons will be made on SS concentrations between the control and impact sites. If SS levels at impact sites are more than 130% of the control site, mitigation measures such as reducing dredging rates or changing the dredging method (such as using a sealed grab instead of open

grab) will be implemented.

(ii) Sediment 'curtains' (traps) for installation in the channels were considered, but the project channels are too shallow for this to be effective.

111. The total volume of dredged channel sediment is estimated to be 153,148 m^3. This will be transported in sealed containers to three new disposal sites, all of which are currently on unused land (Figure I.3). Sampling (Table V.32) shows that sediment from the six water channels meets PRC's Environmental Quality Standard for Soils (GB 15618-1995) Class 2 standards on heavy metals and pesticides, meaning that the disposal sites, once full, will be suitable for planting uses (e.g. farmland). For the dredged sediments, management will require the disposal of two materials: the dredged sediment, within disposal pits, and, the supernatant water[20] from this sediment. For the supernatant water, which may contain high levels of nutrients, seepage into nearby waterbodies could impact surface and/or ground water quality if the water is not treated. Sampling of groundwater at the three proposed disposal sites all showed Category V water quality due to high levels of nitrate and fecal coliform bacteria (Table V.29). To minimize these impacts, the following measures will be implemented.

(i) The dredged sediment slurry will be allowed to settle, assisted with flocculants such as PAM if needed. Disposal will be in pits lined with geo-membrane or high density polyethylene (HDPE) liners, to prevent pore water from leaching into groundwater.

(ii) The supernatant water will be monitored for compliance with the Integrated Wastewater Discharge Standard (GB 8978-1996) for suspended solids (SS) and then discharged to nearby water channels. If the supernatant water does not meet the discharge standard for SS, settling time will be extended and/or increased dosage of flocculents will be applied until the SS discharge standard is met. SS is the indicator parameter rather than nitrogen or phosphorous (the main issues of concern) because: (i) it is less costly to analyze; (ii) settling of the SS removes excess nutrients through adsorption to particles.

(iii) To avoid the risk of dredged sediments from being washed out from these pits during flooding or heavy rainfall, the perimeter of the pits will be surrounded by earth bunds or storm water drainage ditches.

(iv) Once the disposal pits are full, and if they meet the Environmental Quality Standard for Soils (GB 15618-1995): Class 2 standard, they may be used for agriculture.

112. **Hydrology of Gaotang Lake.** A hydrological analysis was conducted by the design institute to assess whether the proposed embankment at Gaotang Lake could cause changes in lake hydrology. It was found that: (i) at the 22.5 m design elevation, the embankment would reduce the flood detention capacity of the lake, but only by 0.51%; (ii) using the 1991 maximum flood level as a reference, in times of major floods the embankment would further raise the flood height, but only by 0.03 m. It was concluded that these changes would not impact the flood control capacity of the existing dykes and levees surrounding the lake. To build upon these findings, monitoring the hydrological effects of the embankment will be conducted as part of non-structural measures to be conducted in project component 3-2 (Attachment A).

[20] The dredged material will contain water, and when deposited at the disposal sites this water will subsequently form a layer as the material settles.

113. **Solid waste.** Solid waste generated during construction will include construction and demolition (C&D) waste dominated by excavated spoil during earth works for pipeline and embankment construction, dredged sediment and channel soil from the water channels (the sediments and soil are assessed and managed separately; Section I.A project component 2), and refuse generated by construction workers on construction sites. If not properly disposed, such wastes will create community health and sanitation problems. The EIR estimated that the 950 construction workers during peak construction periods would generate approximately 475 kg of solid wastes each day. To minimize adverse impacts from the refuse generated by the workers and C&D waste, refuse will be stored in closed containers and regularly transported off-site for disposal at existing landfill sites. C&D wastes will be cleared and removed regularly.

114. Dredged channel soil (907,995 m^3; Table IV.5) will be disposed at five locations adjacent to the water channels, to minimize transport distance. These five sites (total 443,404 m^2) comprise 197,731 m^2 (45%) dry land, 84,986 m^2 (19%) ponds, 76,100 m^2 (17%) paddy plots, 65,631 m^2 (15%) wasteland, 12,231 m^2 (3%) vegetable plots, and 6,725 m^2 (2%) reed fields. All sites have low ecological value. The channel soil is not contaminated and disposal will not pollute the underlying soil. Sites will be surrounded by perimeter bunds and/or drainage ditches to prevent the deposited materials from being washed away during rainfall events. Once a site is filled up, it will be re-vegetated to prevent soil erosion. Garbage dredged up from the water channels, estimated to be ~58 t, will be removed and disposed at landfill. Installation of 170 km of wastewater pipeline will generate a large quantity (~1,666,000 m^3) of earth cut. Of this, 1,626,000 m^3 will be re-used as back fill material, with only 40,000 m^3 needing disposal. Embankment construction will generate ~370,290 m^3 earth cut but will need ~736,367 m^3 earth fill.

115. **Soil**. To minimize soil erosion during construction, the following measures will be implemented by contractors.

(i) Construction works will be planned so that heavy earthworks will be conducted as much as possible in the dry season and minimized in the wet season.

(ii) For construction of the Gaotang Lake embankment and Shijian Lake revetments, which are located immediately adjacent to wetland habitats and surface water: (i) construct berms or drainage ditches around the perimeter of the construction site to capture soil runoff and direct rainwater away; (ii) plan and implement construction in staged sections, with one section completed and stabilized before beginning the next.

(iii) Soil required for construction of the Gaotang Lake embankment will be sourced from a single site immediately south of the southern end of the embankment, where a proposed marina will be constructed. Another option for soil supply, the creation of temporary spoil pits along the entire length of the embankment, was rejected due to the higher risk of soil erosion into the lake.

(iv) All sediment, channel soil and spoil disposal sites, embankments, and revetments, will be rehabilitated once they are completed (or full in the case of the disposal sites). Any landscaping will only use native plant species.

2. Impacts on biological resources, ecology and biodiversity

116. Records for 9 globally threatened species on the IUCN Red List are present for the project area: one mammal (*Arctonyx collaris*), five birds (Siberian Crane, Oriental White Stork, Hooded Crane, Great Bustard, Swan Goose), two freshwater turtles (*Chinemys reevesii*, *Pelodiscus sinensis*), and one frog (*Pelophylax nigromaculatus*). The five birds and both turtles are also listed on the PRC's list of protected species (Class I or II), and many additional species are listed on the Anhui Province Protection List (Sections IV.4.2.5-4.2.8). The key species of concern for this project are waterbird communities (ducks, geese, swans, cranes, storks, spoonbills, shorebirds).

117. For the waterbird communities, the key site of concern is Gaotang Lake, which probably supports the largest numbers of resident and migratory waterbirds in the project area. Potential construction impacts are disturbance to feeding or roosting waterbirds during construction of the 14.47 km embankment, the spoil site where material for the embankment will be sourced, and the constructed wetlands. These sites are restricted to the north-western region of the lake. The risk for impacts is anticipated to be low, because: (i) the embankment will be situated 400-1,000 m inland from the water's edge, creating a buffer between waterbird feeding sites and construction noise and visual disturbance; (ii) the spoil site and locations for the constructed wetlands are mainly farmland and adjacent to roads and residences i.e. they are modified habitats already subject to human disturbance. The following mitigation measures will be adopted at Gaotang Lake to avoid impacts to waterbirds.

(i) Embankment and wetland construction activities will be stopped during the winter migration season from December to February. At all other times of year, construction will be restricted to between 0900 and 1600 h, to avoid dawn and dusk hours, when bird activity is usually the highest.

(ii) Muddy water runoff and discharge of construction and workers wastewater into Gaotang Lake is strictly forbidden, to protect the water quality of waterbird feeding ground.

(iii) Construction workers are forbidden to capture any wild birds and animals in the area.

(iv) In the event that waterbird roosting sites are observed close to the sites of the embankment or constructed wetlands, these will be documented and the need for any additional management measures assessed.

(v) A comprehensive bird and water quality monitoring program (Attachment A) will be carried out through the embankment and wetland construction period.

118. For all other species, the project is expected to have low or negligible impacts. Project sites largely support degraded and modified channel or lake habitats with low conservation values (Sections IV.5-10). At Gaotang and Shijian Lakes, the two project sites which support the highest ecological values in the project area, project embankment and revetment activities will be located inland from the lake margins (Gaotang Lake) or will only be implemented for eroded lake banks with few habitats (Shijian Lake), reducing the possibility that fish, turtle or frog feeding or breeding sites will be affected. No project activities involve works within the actual waterbodies of any of the project lakes.

3. Impacts on physical cultural resources

119. No physical cultural resources were documented during fieldwork. Should buried artifacts of archaeological significance be uncovered, construction will be stopped and immediately reported to the Huainan Cultural Heritage Bureau in accordance with the PRC's Cultural Heritage Protection Law.

4. Impacts on socio-economic conditions

120. **Land acquisition and resettlement.** The project will acquire ~1,900 mu (126 ha) of land in total, including 1,500.66 mu (100 ha) collective-owned land and 386.345 mu (26 ha) state-owned land. A total of 3,700 mu (247 ha) land will be occupied temporarily. The project will demolish 14,257 m^2 (1.4 ha) residential housing and 780 m^2 (0.08 ha) small business shops. A total of 1,985 persons will be affected by the project, including 498 households with 1,963 persons and 10 small business shops with 22 staff. There will be no economic displacement in this project.

121. **Employment.** The project will generate ~5,000 full-time positions (2,360 skilled and 2,640 unskilled) during construction (4 years) providing estimated total gross income of CNY286 million, and 119 full-time positions during the operations phase providing an estimated total gross annual income of CNY4.9 million. The HPMO has set employment targets for women which have been included in the social action plan and gender action plan and will be monitored. District government and the Huainan Labor Bureau will assist the contractors in realizing these targets. Implementing agencies will ensure that all PRC labor laws and core labor standards are respected. Requirements for HIV, AIDS, and sexually transmitted infection awareness training will be included in contractor bidding documents and monitored during implementation.

122. **Gender.** The project has been designed as effective gender mainstreaming. Women focus group discussions found that environmental improvements are anticipated to have a significant positive gender impact, including reduced time burdens and costs for healthcare, for preparing for flooding and clean-up after, and for overall improvement of surroundings.[21]

5. Impacts on health and safety

123. **Occupational health and safety.** Due to its nature the construction industry is a hazardous industry with the potential for accidents. The civil works contractors will implement adequate precautions to protect the health and safety of construction workers. Contractors will manage occupational health and safety risks by applying the following measures.

(i) Construction site sanitation:

a) Effectively clean and disinfect project sites. During site formation, spray with phenolated

[21] The gender action plan ensures (i) women's employment in the project; (ii) participation and gender-sensitive training in environmental awareness and public health programs, and outreach for public participation in the tariff reform program; and (iii) appropriate gender targets, indicators, and sex-disaggregated data for project monitoring and evaluation.

water for disinfection. Disinfect toilets and refuse piles and timely remove solid waste.

b) Ensure that no stagnant water collects on construction sites (e.g. in drains or open containers) to reduce the incidence of mosquitos or other disease vectors.

c) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year.

d) Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection.

e) Provide awareness training to all construction workers to minimize disease risk (e.g. washing hands after using the toilet).

(ii) Occupational safety:

a) Provide safety wear (hats, shoes, goggles, ear plugs, respiratory masks) to all construction workers and ensure they are used in all necessary construction activities.

(iii) Food safety: Inspect and supervise food hygiene in cafeteria or canteen on site regularly. Cafeteria workers must have valid health permits. If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.

(iv) Disease prevention and safety awareness:

a) Provide all construction workers with physical examination before starting employment and implement semi-annual health checks. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the 2nd year onwards, conduct physical examination on 20% of the workers every year.

b) Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents.

c) Specify (by the IA and contractors) the person responsible for health and epidemic prevention responsible for the education and propaganda on food and toilet hygiene and disease prevention to raise the awareness of workers.

124. **Community health and safety.** Traffic congestion may worsen as construction traffic increases during rush hours, causing temporary inconvenience to traffic, residents, commercial operations, and institutions. Construction sites will be partly located close to residential and commercial areas, presenting a threat to public health and safety. The project may also contribute to road accidents through the use of heavy machinery on existing roads, temporarily blocking pavements for pedestrians etc. The following project mitigation measures will be adopted by all project agencies and contractors.

(i) Traffic management: A traffic control and operation plan will be prepared by the contractor together with the local traffic management authority prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on public safety through clear signs, controls and planning in advance.

(ii) Information disclosure: Residents and businesses will be informed in advance through media of the road improvement activities, and the dates and duration of disruption.

(iii) Construction sites: Public signs will be placed at construction sites, warning people of potential dangers such as moving vehicles, hazardous materials, open cut trenches and excavations, and raising awareness on safety issues. Heavy machinery will not be used

after day light (to reduce night time construction noise) and all such equipment will be returned to its overnight storage area/position before night. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate.

(iv) Prolonged construction time along urban channels, especially next to residences. For the construction of discrete sections of urban channels (embankment and dredging), identify with the contractors specific and realistic time limits for construction, to ensure that construction impacts are not prolonged.

125. **Utilities provision interruption.** Construction may require relocation of municipal utilities such as power, water, communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents daily life. Mitigation of impacts on utilities provision will be through a number of activities defined in the EMP, to be incorporated in the bid documents and construction contracts:

(i) Contractors will assess construction locations in advance for potential disruption to services and identify risks before starting construction.

(ii) If temporary disruption is unavoidable the contractor will, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to all affected people.

C. Operational phase: potential impacts and their mitigation

126. The main potential impact during project operation is from operation of the pump stations. The wastewater pump stations will generate odor, and both wastewater and storm water pump stations will generate noise from the mechanical pumps. Station staff will generate wastewater and refuse. The pump stations will also produce waste collected at the intake screens.

127. **Air quality.** Operation of the three wastewater pump stations (Figure IV.3, Table IV.1) will emit odor. Odor dispersion estimation in the EIR indicated that the concentrations of odorous chemicals NH_3 and H_2S emitted would meet PRC's GB 14554-93: Emission Standards for Odor Pollutants, Class 2 standards (1.5 mg/m^3 for NH_3 and 0.06 mg/m^3 for H_2S) at the boundaries of the pump stations. Odor absorbents such as activated carbon or biochemical system will be installed for odor removal. In addition, a minimum distance of 50 m will be established as a buffer distance from the pump station to the nearest sensitive receptor.

128. **Noise.** Operational noise impact could come from the wastewater and stormwater pump stations. The sound pressure level of the pump models to be used would be 65 dB(A) according to the EIR. To mitigate potential noise impacts, the pump stations will use low noise equipment, submerged pumps and building walls with adequate thickness and acoustic measures such as barriers or sound absorbing materials if needed. The station operators will maintain such equipment to keep them in good working condition. With these mitigation measures in place, noise levels from equipment could be reduced to 70-95 dB(A). Noise levels at the boundaries of these facilities were predicted to be 54.4 dB(A) during day time and 46.3 dB(A) at night, which

comply with Grade II noise requirements of 60 dB(A) during day time and 50 dB(A) at night under GB 12348-2008: Noise Standards at the Boundary of Industries and Enterprises.

129. **Water quality.** The main water quality impact would come from the discharge of staff-generated wastewater. The EIR estimated that the quantity generated by the workers for all 10 pump stations (seven stormwater and three wastewater stations) would amount to 6 m^3/d or 2,190 t/a. This quantity is small and will be treated by septic tanks installed on site.

130. **Solid waste.** Small quantities of solid waste generated at the pump stations will be collected for disposal at the Huainan MSW Sanitary Landfill. The EIR estimated that the total general refuse from workers at all 10 pump stations would be approximately 18.25 t/a and the total waste collected at the ten intake screens (one per station) would be approximately 150 t/a.

D. Climate change and greenhouse gas emissions

131. The project will strengthen Huainan Municipality's adaptation to flood risk by achieving increased drainage capacity of urban water channels, reducing the number of combined wastewater-stormwater channels (easing flow volume loads during floods), strengthening channels and some lake shores by embankment and revetment, and improving the capacity to move floodwater from urban areas to the Huai River (by upgrading the pump stations). Wastewater pipelines and manholes will be properly installed during construction to minimize infiltration from groundwater and stormwater. Culverts in channel embankments will be cleaned and repaired so as not to impede the flow of water. These details will be developed by the design Institute for technical specifications of the bidding documents. The project is also implementing non-structural approaches for flood control and warning (sub-component 2-4; Section I.B).

132. Sensitivity analysis in the FSR showed that a 15% increase in peak rainfall would cause increases in channel flow rate of 4.45% and in channel water level of 2.2%, in the project urban water channels. The PRC's Embankment Projects Design Specification (GB 50286-98) requires an additional height between the top of embankment and the maximum design water level to protect against wind and wave action and inaccuracies in design and construction workmanship. For the urban channels in this project, this additional height is sufficient to accommodate increases in water level within the channels due to 15% increase in the design rainfall.

133. Planned urban development for Huainan is both south (away from the Huai River) and east towards Gaotang Lake (along the south side of the River). In new areas the requirement is for separate sewer and storm water systems and buildings are multi-story with commerce on ground level and residences above. These requirements will partly mitigate flooding impacts to properties, although they will not protect surface or subsurface infrastructure and resources.

134. For the streams and lakes in Huainan municipality, increased temperatures will lead to increased water temperatures. Subsequent declines in water quality due to eutrophication are likely. Fisheries production may decrease, as higher temperatures affect reproductive capability and survival rates of eggs and fry. Other likely impacts include decreased biodiversity. These ecological impacts will impact the local economy and quality of water available for domestic use.

135. Greenhouse gas (GHG) emissions from this project will be generated during construction (vehicles, machinery, workers) and operation (electricity use at the ten wastewater and storm water pump stations, emissions of station vehicles, and emergency generators during power black-outs). Electricity will be supplied through the municipal grid. ADB's SPS for environment (SPS, 2009) requires that estimates of GHG emissions be made for projects which may emit $\geq$100,000 t carbon dioxide equivalent (CO_2e) per year. A course estimate of some key project GHG emissions was derived using the following assumptions: construction – three-year full schedule (project is five years but peak construction intensity will be less) employing 950 full-time workers, construction vehicles, and generation of construction waste; operation – electricity use of 10 pump stations and emissions of 10 commercial vehicles, for the first 10 years of operation (Table VI.1). This is not a detailed project GHG inventory and almost certainly under-estimates total project GHG emissions; nonetheless, after 13 years of construction and operation, the total estimated emissions (Table IV.1) are only one-third of the level defined by ADB as significant, and are small compared with the annual emission of high-risk projects listed by the *ADB Environment Safeguards Good Practices* handbook (ADB 2012, pp.59–62).

Table IV.1: Course estimate of GHG emissions for the project

Constuction	**CO_2 equivalent (t CO_2e)**[1]
Workers (950)- consume 1 kg meat/day for 3 years	5,350
Articulated truck (100 t) – total 100,000 km	2,000
Light commercial truck (10 t) – total 100,000 km	13
Construction & demolition waste (10,000 t)	2,000
Operation (first 10 years)	
Pump electricity use (assume 250,000 kWh/pump/year) x 10 pumps[2]	26,500
Pump station vehicles (10 light vehicles x 10,000 km/year)	282
Total	36,144

[1]Estimates made using online GHG calculator (www.carbonneutral.com.au). [2]Annual pump electricity consumption based on a study of 19 pumps at a wastewater treatment plant – see: www.multitrode.com/assets/assets/pump-station-efficiency-reduces-greenhouse-gas-emissions.pdf.

E. Cumulative, indirect, and induced impacts

136. **Cumulative impacts.** Cumulative impacts are defined as the combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that would not be expected in case of a stand-alone project.

137. Short-term cumulative impacts comprise the combined effects of the project construction activities and together with any nearby construction projects, which collectively will increase the pressures of traffic on the existing road network, civil works, air-borne dust, waste generation and community disturbance. These will be mitigated to acceptable levels by: (i) coordination between project components and with other projects, including construction schedules and shared access roads and borrow/disposal sites; (ii) planning of vehicle transport routes and schedules by contractors with road management authorities and communities; (iii) construction mitigation measures to minimize dust, noise and waste impacts; (iv) education of construction

workers to minimize social disturbance and cultural conflict; (vi) access for local traffic; and (vii) maintenance of the access roads and timely restoration/strengthening upon completion.

138. Long term cumulative impacts may be greatest at Gaotang Lake, where the 14.47 km embankment will add to the hard infrastructure that is progressively being constructed around the margins of this lake, combined with increasing residential and commercial development, as well as aquaculture production within the lake. The need for a provincial management plan for this lake, supported by the municipalities that co-manage it, is recognized by the EA. A non-structural project component to facilitate the preparation of such a plan has been included in the project.

139. **Indirect and induced impacts.** Indirect impacts are adverse and/or beneficial environmental impacts which cannot be immediately traced to a project activity but can be causally linked. Induced impacts are adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project which may occur later or at a different location.

140. The project may cause the following. (i) At least one indirect impact may occur, the loss or alteration of soil and water conditions required for wetland flora and/or fauna, due to altered hydrology resulting from embankment and revetment at the project lakes. Such changes are expected to be localized, and offset by the mitigation measures to be implemented during construction and operation, including management actions for waterbirds and threatened flora. (ii) At least one induced impact, increased pressure on WWTPs to accommodate the increased efficiency of wastewater supply to WWTPs achieved by the project. This risk has been considered in the Huainan Municipality Urban Master Plan (2010-2020) and the planned upgrade in treatment capacity of exiting WWTPs, as well as construction of a new WWTP (separate to this project), will be included as a project assurance in the loan agreement.

F. Associated facilities

141. The two existing WWTPs that will treat the wastewater to be collected by the pipelines built under this project are partly associated facilities, although their viability and existence do not depend exclusively on the project (the wastewater to be collected by this project will account for ~37% of their combined treatment capacity). The expansion of these WWTPs and potential impacts was assessed through examination of existing plans and discussions with key agencies, and which confirmed that no significant impacts will occur (Section II-wastewater treatment).

VII. ANALYSIS OF ALTERNATIVES

142. Four types of alternatives were assessed: (i) 'no project' scenario, (ii) use of different wastewater pipe materials, (iii) use of different dredging methods and devises, and (iv) alternative methods of embankment and revetment.

143. Under the 'no project' scenario, the annual input of 43 million m^3 untreated wastewater into the Huai River and its waterbodies will continue, bank erosion at the project lakes will continue, flood risks to life and property will remain unchanged and/or will increase under climate change, and water quality in the lakes and channels will continue to decline. Overall, these impacts will negatively affect the municipal economy and health and socio-economic status of its residents.

144. For the wastewater pipe materials, different materials were compared on the basis of durability, availability, and cost (VII.1). On the basis of cost, site conditions, and ease of construction, the following materials were selected for this project: pre-stressed reinforced concrete pipes, steel strip reinforced polyethylene spiral corrugated pipes, glass reinforced plastic mortar pipes, and high-density polyethylene (HDPE) pipes.

Table VII.1: Comparison of wastewater pipe materials. Source: FSR

Type / Material	Advantage	Disadvantage
Ordinary reinforced concrete pipe	• Abundant construction experience • Low cost • Adequate supply	• Poor construction condition; Poor sealing performance; Poor strength and short service life; Long construction period; Can be significantly affected by weather and other natural environmental factors
Pre-stressed reinforced concrete pipe	• Abundant construction experience; Low cost; Good sealing performance; High strength and long service life; Adequate supply; Simple construction and quality assurance; Not significantly affected by natural environment	• Still subject to some leakage • Subject to corrosion that might shorten service life
Modern materials: Steel strip reinforced polyethylene spiral corrugated pipe; Glass reinforced plastic mortar pipe; HDPE pipe	• Good sealing performance; Low leakage rate if same material is used for the inspection well; Light weight, can be laid and connected conveniently; Simple construction; Short construction period • Good resistance against corrosion	• High cost • High requirement for construction quality (e.g. screening of backfill material)

145. For the dredging, nine types of dredging devices were compared on the basis of cost, availability, and suitability for local site conditions (VII.2). The long arm excavator with two arm segments was selected.

Table VII.2: Comparison of dredging devices. Source: FSR

Dredging Device	Advantages and disadvantages	Suitability for this Project
Trailing suction hopper dredger	• The smallest size in the PRC at present; dredging capacity (hopper size) of 500 m^3, with draft in full load of >3 m - difficult to operate in shallow water • It is one whole ship and thus difficult to transport • During dredging, hopper overflow returns muddy water to the channel causing pollution • The advantage is high dredging rate thus shortening the dredging duration	Not suitable
Ladder bucket dredger	• Can excavate hard soil • Large bucket size with considerable soil scattering and overflow of muddy water back to the channel causing water pollution • Reduced efficiency when dredging for thin layers of bottom sediment	Not very suitable
Pneumatic pump dredger	• High efficiency in dredging and transmission of dredged sediment • Discharge (of dredged sediment) distance for single dredger is short and therefore not cost effective for dredging in shallow depth • Pump can clog up easily, difficult to clean, not suitable for sediment with much impurities	Not very suitable
Cutter suction dredger	• Good adaptability to different soil qualities with long discharge distance • Flexible in the selection of production rate and discharge distance • High efficiency and low energy consumption and cost • Dredged sediment will not be scattered during transportation • Cutter head would stir up surrounding bottom sediment causing pollution to some extent	Quite suitable
Suction dredger	• Suitable for sediment with high moisture content • Difficult for compactly packed and clayey sediment • Need high pressure water jet device to loosen the sediment, thus would stir up and re-suspend surrounding sediment causing pollution • This type is outdated and no longer commonly used	Not very suitable
Wheel bucket dredger	• Able to excavate high density and compactly packed sediment • Size of bucket is big with considerable soil scattering and overflow of muddy water back to the channel causing water pollution • Reduced efficiency when dredging for thin layers of bottom sediment • Easily clogged and difficult to clean, not suitable for sediment with much impurities	Not very suitable
Water slurry unit	• Suitable for waterways and lakes with shallow water depth and slow flow • Abundant equipment and manpower needed for large dredging quantities • Short discharge distance	Not suitable
Land based machinery	• Suitable for waterways and lakes with shallow water depth and slow flow • Abundant equipment and manpower needed for large dredging quantities • Needs motor vehicles for transporting dredged sediment - may cause secondary pollution and nuisance to road traffic	Not suitable
Long arm excavator	• Suitable for relatively wide rivers with large dredging radius • Long arm, big bucket, deep excavation and good performance • Maintenance cost often high due to complex structure of arm segments and bucket • Needs motor vehicles for transporting dredged sediment - may cause secondary pollution and nuisance to road traffic	Quite suitable

146. For the embankment and revetment, eight designs were compared, based on local site conditions, cost, and ease of installation (Table IV.7). Narrow, steeply sloping channel sections will require vertical embankments while wider channel sections will require a composite of vertical and sloped embankments. Hard revetments will be used in submerged areas and narrow channel sections to prevent erosion of the embankment, and soft or vegetated revetment will be used for areas above the typical water level. Materials for ecological bag slope protection in the upper part of the composite revetment were selected on the basis of a comparison of the permeability, stability, safety, ease of construction, and vegetation growth of the alternative materials. Materials such as coconut shred, natural palm fibers and turf will be used for the vegetation blanket.

VIII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

147. **Legislative framework.** Public participation in project planning and implementation is an important safeguard requirement and can reflect public perceptions of environmental quality in a project's area of influence. The Environmental Protection Law of PRC and Regulations on the Administration of Construction Project Environmental Protection (Order of the State Council, No. 253) require that "Environmental Impact Report formulated by construction unit shall be in accordance with relevant laws to solicit the opinions of units concerned and inhabitants of project construction site". In January 2011, the MEP circulated the draft Technical Guidelines for Environmental Impact Assessment: Public Participation for public commenting, which specifies the requirements of information disclosure and stakeholder opinion survey. ADB's SPS (2009) also requires meaningful participation, consultation and information disclosure.

148. **Information disclosure and public consultation.** Information disclosure and public consultation were conducted for preparation of the EIR and this EIA, comprising: internet disclosure, informal communication with residents, local authorities and relevant institutions and authorities, a questionnaire survey, and a general public meeting attended by affected people. Information disclosure was undertaken by the Coal Industry Hefei Design and Research Academy (the agency responsible for preparation of the EIR) on 5 November 2012 (upon commencement of the domestic EIR), and 25 February 2013 (to disclose preliminary findings and mitigation measures). Both events were published on the HMG website. Public consultation comprised a questionnaire survey conducted in November 2012 and a public discussion forum held on 27 February 2013.

149. **Results of public consultation.** A questionnaire survey was distributed in November 2012: 130 were questionnaires were distributed and 127 (97.7%) responses were received. Of these, 75% were from males and 24% from females. Age of interviewees was: ≤40 years old (34%), 40-60 years (58%) >60 (8%). Thirty-seven percent of interviewees had only attended middle school, 20% had attended high school, and 25% had attended university. The following responses were received.

(i) 'What are the environmental problems in Huainan that concern you the most?' 53% and 42% stated that air pollution and ecological restoration respectively were their main concerns, followed by water (35%) and noise 32% pollution [some interviewees chose more than one answer].

(ii) 'What environmental problem do you think needs resolving immediately?' 57% and 37% indicated water pollution and ecological deterioration respectively were their main concerns, followed by air (29%) and noise (23%) pollution [some interviewees chose more than one answer].

(iii) 'What do you think will be the major environmental pollution issues during construction?' 47% and 44% stated noise and solid waste respectively were their main concern, followed by water (36%) and air (31%) [some interviewees chose more than one answer].

(iv) 'Will you be affected by the project construction?' 87% stated they would be affected but that the impacts should be acceptable and 13% stated they would not be affected.

150. A public discussion forum was held on 27 February 2013 (after the preliminary findings of the draft EIR were placed on the HMG website on 25 February) chaired by HPMO and supported by the domestic EIA institute and PPTA national environmental specialist. Participants included government representatives, community representatives and local residents. The major concerns raised by participants were: dredging, transport and disposal of channel sediment, the time and duration of using noisy construction equipment, and nuisance to the residents caused by wastewater pipeline construction. The domestic EIA institute explained the mitigation measures to be adopted during the construction stage, and the participants deemed these to be acceptable. Approximately 90% of the participants expressed the need for HPMO to establish a complaint center for resolving complaints and grievances.

151. **Continuing public participation for project construction.** Public consultation will continue during the detailed design, construction and operation phases. The HPMO and IAs will organize public consultations, with the support of the Loan Implementation Environmental Consultant (LIEC) to be hired by HPMO under the loan implementation consulting services. Contractors will be required to communicate and consult with the communities in the project area of influence, especially those near channel dredging, pipeline laying and embankment and pump station works areas. Public notice boards will be set at each work site to provide information on the purpose of the project activity, the duration of disturbance, the responsible entities on-site (contractors, IA), and the project Grievance Redress Mechanism (GRM). Contact information of all GRM entry points and HPMO will be disclosed on the construction site information boards. Consultation will focus on any public complaints and concerns for public health and well-being e.g. noise, dust, dust, traffic disturbance, and concerns about the environment and resettlement.

152. Future consultation and participation will also include (i) involvement of affected people during inspection and monitoring of EMP implementation during construction and operation phases; (ii) participatory evaluation on the environmental and social-economic benefits and impacts; and (iii) consultation with the public after project completion. The EMP includes plans for future public participation (Attachment A).

153. The following measures for information disclosure will also be conducted: (i) copies of the domestic EIR (Chinese-language) will be publicly available from the HPMO on request; (ii) this draft EIA (English-language) will be placed on the ADB public website (www.adb.org) for 120 days prior to ADB Board consideration; and, (iv) during project implementation, the semi-annual environment monitoring reports will be disclosed on ADB's public website.

IX. GRIEVANCE REDRESS MECHANISM

154. To settle unforeseen issues effectively, an effective and transparent channel for lodging complaints and grievances has been established. The grievance redress mechanism (GRM) is detailed in the EMP (Attachment A). The EMP, including the GRM, will be refined during the detailed design phase of the project when more design details become available. The updated documents will be approved by the HMG and ADB.

X. CONCLUSIONS AND RECOMMENDATIONS

Adverse impacts and mitigation measures

155. Channel dredging and construction of pipeline networks, embankments and revetments will cause impacts to air quality, noise, water quality, ecology, solid waste and occupational health and safety. Project operational impacts include odor from the wastewater pump stations, noise from the wastewater and storm water pump stations, and wastewater and solid waste from the workers operating the pump stations. Mitigation measures for the pre-construction, construction and operational phases have been designed to address these impacts, are tailored to site conditions, and are described in the project EMP (Attachment A). The EMP includes an environmental monitoring program, which includes water quality in all sites and waterbird monitoring at Gaotang Lake, and instructions in the event that any buried physical cultural resources are discovered during construction.

156. The project will permanently utilize ~1,900 mu (126 ha) of land, mainly comprising farmland and land allocated for construction. A resettlement and compensation plan has been developed and meets the PRC and ADB applicable policies and requirements.

Risks and assurances

157. The key environmental safeguard risk is the relatively low capacity of HPMO and the IAs (HMSC, HMAMB, HMLMB) to effectively implement the EMP. This EIA has assessed impact severity on the assumption that the prescribed mitigation measures will be fully and effectively implemented. This risk will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project implementation consultants, (iii) adhering to the project mitigation and monitoring arrangements, (iv) ADB conducting regular project reviews; and (v) project assurances covenanted in the loan and project agreement with ADB.

158. The following project environmental assurances are included in the loan covenant to offset environmental risks.

Standard assurances

(i) During construction, the IAs will provide monthly environmental monitoring reports to HMG PMO, who will prepare and submit to ADB semi-annual environmental reports in a format acceptable to ADB until the completion of all construction activities.

(ii) HMG will construct, operate, maintain, and monitor the project facilities in strict conformity with all laws and regulations on environmental protection, health, labor, and occupational safety and ADB's Environment Policy; and all environmental mitigation and monitoring measures detailed in the EIA and EMP for the Project shall be undertaken under the guidance of the relevant EPB or other environmental monitoring centers.

(iii) During the pre-construction phase, the HMG PMO, IAs and Huainan EPB shall review the final engineering designs and adjust environmental mitigation and monitoring measures in the project Environmental Management Plan (EMP) accordingly in consultation with ADB.

(iv) HMG PMO will implement the following measures in the pre-construction phase to ensure the project's environment management readiness: (i) appointment of one qualified environment specialist within HMG PMO, (ii) hiring of loan implementation environment consultants (LIEC) within loan administration consultant services by HPMO; and (iii) contracting of environmental monitoring station by HMG PMO to conduct environment impact monitoring.

(v) HMG PMO will ensure that all contract and tender documents include the EMP obligations, including the environmental monitoring program.

(vi) Before and during project construction, HMG PMO will organize and conduct training on implementation and supervision of the project EMP to the IAs and contractors.

(vii) HMG will ensure that a project Grievance Redress Mechanism for environmental and social matters is established by the HMG PMO and HMG EPB with clear procedures to receive, resolve, and document any grievances.

Project-specific assurances

(viii) Final engineering designs will be reviewed by a waterbird specialist to avoid impacts to the globally and/or nationally threatened waterbird which occur in some project sites.

(ix) Embankment and wetland construction activities at Gaotang Lake will be suspended during the waterbird winter migration season from December to February. In all other times of year, construction will be restricted to between 0900 h and 1600 h (to avoid dawn and dusk hours, when bird activities are usually highest).

(x) The five proposed disposal sites for excess soil generated from construction will be identified in the detailed design stage and their selection will consider potential environmental and social impacts.

(xi) HMG shall ensure that the Huainan Capital Water Company will complete the expansion of the No. 1 WWTP and Bagongshan WWTP, in accordance with the 'Agreement on the Expansion of Urban Wastewater Treatment Plant' signed between HMG and Huainan Capital Water Company (2012).

159. The long-term success of the project will not only depend on effective implementation, but a coordinated approach with other government projects to reduce water pollution and flood risk in Huainan Municipality. For example, the constructed wetlands to be created in this project will result in the removal pollutants from five urban lakes, but despite this achievement, the quality of water exiting these lakes is expected to remain worse than Category V, due to the very high levels of TN, NH_3-N and TP entering the lakes. Efforts by the government to address upstream sources of water pollution will be critical to improving water quality in these lakes.

Overall conclusion

160. Based on information gathered and assessments by the Coal Industry Hefei Design and Research Academy and PPTA team, it is concluded that the net environmental impacts during project construction and operation, assuming full and effective implementation of the mitigation measures in the project EMP, are in compliance with PRC regulations and the ADB Safeguard Policy Statement (2009).

ATTACHMENT A. ENVIRONMENT MANAGEMENT PLAN

ENVIRONMENTAL MANAGEMENT PLAN FOR THE ANHUI HUAINAN URBAN WATER SYSTEMS INTEGRATED REHABILITATION PROJECT

People's Republic of China

Prepared by the Huainan Municipal Government with the assistance of the Asian Development Bank

Table of Contents

A. Introduction

1. This Environmental Management Plan (EMP) is developed for the Anhui Huainan Urban Water Systems Integrated Rehabilitation Project (the project). It identifies the potential project environmental impacts and defines mitigation measures and monitoring requirements for the design, construction, and operational stages of the project. It also defines the institutional arrangements and mechanisms, the roles and responsibilities of different institutions, procedures and budgets for implementation of the EMP. The EMP seeks to ensure continuously improving environmental protection activities during preconstruction, construction, and operation in order to prevent, reduce, or mitigate adverse impacts and risks. The EMP draws on the findings of the project EIA, the domestic EIR, the PPTA reports, and discussions and agreements with relevant government agencies and the Asian Development Bank (ADB).

2. This EMP is based on proposed project designs as of April 2013. Detailed engineering designs are yet to be finalized and may require subsequent impact assessment and/or revisions to this EMP. The Huainan Municipal Government (HMG) will provide the detailed designs to ADB for joint review and to decide if the EMP requires revision. The finalized EMP will be disclosed on the ADB public website (www.adb.org) and included in the Project Administration Manual (PAM). The final EMP will also be included as a separate annex in all bidding and contract documents. The contractors will be informed of their obligations to implement the EMP, and to provide for EMP implementation costs in their bids for project works.

3. The EMP includes an environmental monitoring program. The monitoring results will be used to evaluate (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of the environmental protection measures and compliance with relevant laws and regulations, (iii) trends of impacts, and (iv) overall effectiveness of the project EMP.

B. Institutional arrangements and responsibilities for EMP implementation

4. The HMG is the Executing Agency (EA) for the project. The EA has established a Huainan Project Management Office (HPMO), who will be responsible, on behalf of the EA, for the day-to-day management of the project and the implementation of the EMP.

5. Huainan Project Leading Group (HPLG). The HPLG has been established for the project. It is chaired by the vice-mayor of Huainan Municipality and comprises senior officials from relevant government agencies, to facilitate inter-agency coordination, and to resolve any institutional problems affecting project implementation at municipal level.

6. Implementing Agencies (IAs). The IAs will assume the debt servicing responsibility as the end-users of the ADB loan. They will implement project components, administer and monitor contractors and suppliers, and be responsible for construction supervision and quality control. Four IAs have been established by the HMG for the project:

(i) Huainan Municipal Sewage Company (HMSC).—The IA and also the O&M Unit for

component 1 (improved wastewater collection).

(ii) Huainan Municipal Administration Management Bureau (HMAMB).— The IA and also the O&M Unit for component 2 (structural measures on improvement of urban water environment and flood management: 2-1-improved urban water channels; 2-2- improved flood control facilities).

(iii) Huainan Municipal Landscaping Management Bureau (HMLMB).—The IA and also the O&M Unit for component 3-1 (structural measures on improved urban lake environment).

(iv) Huainan Project Management Office (HPMO).—The IA for the project non-structural measures (sub-components 2-3, 2-4, 3-2 and 4, comprising procurement of consulting services and equipment for water channels, lakes and flood management, and training to build capacity in project and environmental management).

7. The HPMO, in coordination with the Loan Implementation Environmental Consultant (LIEC; see below), will do the following.

(i) Prepare and provide the following specification clauses for incorporation in the bidding procedures: (i) environmental management requirements to be budgeted by the bidders in their proposals; (ii) environmental clauses for contractual terms and conditions; and (iii) the EMP.

(ii) Translate the EMP into Chinese-language and ensure that it remains consistent with this original version in English-language.

(iii) Ensure the EMP is implemented by the contractors, and that all contractors and project agencies comply with the EMP.

(iv) Implement the Grievance Redress Mechanism (Section G).

(v) Prepare and submit semi-annual environmental monitoring reports to ADB.

(vi) Appoint one qualified environment specialist on its staff to implement the EMP, including supervision of the IAs and contractors, collection, storage and analysis of the monitoring data, and preparation of the semi-annual environmental monitoring reports.

8. The Huainan Environmental Monitoring Station (HEMS) (under the Huainan Environmental Protection Bureau) will be contracted by the HPMO to implement the environmental monitoring program described in this EMP for the construction stage, and by the respective IAs (who are also the O&M Units) for the operational stage. HEMS is a qualified entity to conduct environmental monitoring in Huainan.

9. Loan Implementation Environmental Consultant (LIEC). A LIEC will be hired under the loan implementation consultancy services to assist the HPMO Environmental Specialist with the following.

i. Before project implementation.

- Conduct a final review and - if necessary - revision of the EMP, to ensure that any environmental impacts that may result from the finalized engineering designs are identified and addressed in the EMP. Any revisions in mitigation measures may also require updating of the EMP budget.
- Submit the revised EMP to HMG and ADB for review and approval.
- Support the HPMO and IAs to ensure that tender and bidding documents, and civil works contracts, contain provisions requiring contractors to comply with the mitigation measures

in the EMP and that relevant sections of the project EMP (or updated EMP, if prepared) are incorporated in the bidding and contract documents.

- Establish the GRM.
- Develop procedures to collect, enter, store, and analyze the progress on implementation of the EMP, specifically: (a) any complaints and issues received and how these were addressed (GRM); (b) data collected by the HEMS for the EMP environmental monitoring program, and the interpretation of this data (e.g. is project construction within the limits of air quality, noise levels etc. specified in the EMP?); (c) compliance of the contractors with the EMP; (d) a reporting schedule for the preparation and submission of the semi-annual environmental monitoring reports to ADB.
- Provide training to HPMO, IAs and contractors on the specific requirements of the EMP.
- EMP independent evaluation
- Assess the project components' environmental readiness prior to implementation based on the readiness indicators defined in Table A.3.

ii. During project implementation.

- Conduct regular EMP compliance assessments, undertake site visits as required, identify any environment-related implementation issues, propose necessary corrective actions, and prepare these in a corrective action plan.
- Assist HPMO to prepare semi-annual environmental monitoring progress reports for submission to ADB.
- Provide periodic 'refresher' training sessions to HPMO, IAs and contractors on the EMP, to ensure that on-site personnel continue to comply with the EMP.
- Assist the HPMO and IAs in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, and the GRM.

10. Construction contractors. The construction contractors will be responsible for implementing the EMP mitigation measures during construction, under the supervision of the IAs (primary) and HPMO (secondary). The contractors will need to understand their requirements under the EMP. In their bids, contractors will be required to respond to the specific environmental management requirements in the EMP. Each contractor will be required to assign a specific member of their work team who will be directly responsible for the team's environmental, health and safety management. The contractors will work directly with the HPMO Environmental Specialist and LIEC to ensure that prior to any works, the EMP is jointly reviewed and any site-specific measures are identified and agreed.

11. Overall environmental responsibilities are outlined in Table A.1.

Table A.1: Environmental responsibility

Phase	Responsible Agency	Environmental Responsibility
Project preparation	Design Institutes on behalf of HPMO	Prepare project FSRs, EIR and EMP, RPs, conduct public consultation
	HEPB	Review and approve the project EIR and EMP
	PPTA consultant	Provide technical assistance, review EIR, prepare EIA report
	ADB	Review and approve the EIA and EMP, including disclosure

Phase	Responsible Agency	Environmental Responsibility
Engineering detail design	Design Institutes on behalf of HPMO	Incorporate mitigation measures defined in the EMP into engineering detail designs; Update the EMP in cooperation with the LIEC
	HPMO, LIEC	Review updated EMP, confirm that mitigation measures have been included in engineering detail design
	ADB	Approve updated EMP, including disclosure
Tender & contracting	HPMO, IAs and contractors	Incorporate EMP clauses in tender documents and contracts
	ADB, LIEC	Review bidding documents; confirm project's readiness
Construction	HMSC (Component 1), HMAMB (Component 2), HMLMB (Component 3)	Supervise contractors and ensure compliance with the EMP for their respective components; coordinate construction supervision and quality control; act as local entry point for the project grievance redress mechanism (GRM).
	HPMO	Appoint one environment specialist on its staff; supervise the effective implementation of the EMP; coordinate periodic environmental impact monitoring according to the approved monitoring plan; coordinate the project level GRM; prepare semi-annual environment progress reports and submit them to ADB; conduct public consultation and inspect implementation of mitigation measures.
	Contractors	Assign EMP implementation responsibilities; ensure health and safety; implement mitigation measures; conduct frequent noise and dust monitoring around construction sites.
	HEMS (contracted by HPMO)	Undertake internal environmental monitoring; submit quarterly monitoring results to HPMO, HMSC, HMAMB, HMLMB, HEPB.
	LIEC	Advise on the mitigation measures; provide comprehensive technical support to HPMO, HMSC, HMAMB, HMLMB for environmental management; conduct training; conduct annual EMP compliance review; support HPMO in preparing quarterly project progress reports and semi-annual environment monitoring reports
	HEPB	Conduct periodic inspections of all construction projects relative to compliance with PRC regulations and standards.
Operation	O&M Units (who are also the IAs): HMSC (Component 1), HMAMB (Component 2), HMLMB (Component 3)	Ensure proper operation of component facilities according to design standards, and implement mitigation measures and public consultations
	HPMO, LIEC	Conduct EMP compliance review, instruct HMSC, HMAMB, HMLMB on environmental management requirements; coordinate internal environmental monitoring; prepare quarterly project progress reports and semi-annual environment monitoring reports
	HEMS (contracted by the IAs who are also the O&M Units)	Undertake internal environmental monitoring for the first year of operation; submit quarterly monitoring results to HPMO, HMSC, HMAMB, HMLMB, HEPB.
	HEPB	Undertake periodic and random environmental monitoring and inspect environmental compliance
	ADB	Review and approve environmental progress report, disclose on ADB project website

Notes: **ADB** = Asian Development Bank; **HEMS** = Huainan Environment Monitoring Station; **HEPB** = Huainan Environmental Protection Bureau; **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office; **LIEC** = Loan Implementation Environment Consultant.

C. Summary of potential impacts and mitigation measures

12. Potential environmental issues and impacts during the pre-construction, construction and operation phases, and corresponding mitigation measures, are summarized in Table A.2. These include two types of mitigation measures:

(i) Measures that will permanently become part of the infrastructure such as noise reduction materials and odor removal equipment for the solid waste transfer station. These will need to be included in the design of the facility by the design institutes, otherwise they will not be built. The costs of building and maintaining these systems have already been included in the infrastructure construction and operating costs and therefore will not be double-counted as part of the EMP costs.

(ii) Temporary measures during the construction stage (e.g. dust suppression by watering, use of quiet / low noise powered mechanical equipment, flocculants used to facilitate sedimentation of suspended solids in construction site runoff, etc). These will need to be included in the tender documents, otherwise they will not be budgeted by the contractor and will not be implemented.

13. The mitigation measures defined in the EMP will be (i) checked and where necessary re-designed by the design institutes; (ii) incorporated into tender documents (where appropriate), construction contracts, and operational management plans; and (iii) implemented by contractors and IAs under supervision of HPMO. The effectiveness of these measures will be evaluated based on the results of the environmental impact monitoring conducted by HEMS, and through EMP compliance verification conducted by the HPMO and LIEC.

Table A.2: Summary of Potential Impacts and Mitigation Measures

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
Detailed Design Stage						
Design of wastewater collection system	Air quality	Odor from wastewater pump stations	Wastewater pump station design to include odor removal equipment/ facility	Design Institute	HPMO; **HMSC**	Included in design contract
	Noise	Pump noise from wastewater pump stations	Design of the wastewater pump stations must be able to contain operational noise from the pumps and other electro-mechanical equipment.	Design Institute	HPMO; **HMSC**	Included in design contract
	Water quality and public health	Pipe burst	Design of pipe materials and connections must be adequate to prevent pipe burst.	Design Institute	HPMO; **HMSC**	Included in design contract
	Climate change	GHG emissions	Take into account energy efficiency, energy conservation and low GHG emissions in all building and systems designs and equipment selection for the wastewater pump stations.	Design Institute	HPMO; **HMSC**	Included in design contract
Design of storm water pump stations	Noise	Pump noise from storm water pump stations	Design of the storm water pump stations must be able to contain operational noise from the pumps and other electro-mechanical equipment.	Design Institute	HPMO; **HMAMB**	Included in design contract
	Climate change	GHG emissions	Take into account energy efficiency, energy conservation and low GHG emissions in all building and systems designs and equipment selection for the storm water pump stations.	Design Institute	HPMO; **HMAMB**	Included in design contract
Design of the dredged sediment disposal sites	Water quality	Leaching of pore water into ground water	Technical design of dredged sediment disposal sites includes impermeable bottom liner to contain pore water from seeping into ground water.	Design Institute	HPMO; **HMAMB**	Included in design contract
		Site drainage for heavy rain storm	Design of the dredged sediment disposal sites includes perimeter drainage for diverting overland runoff during rain storm.	Design Institute	HPMO; **HMAMB**	Included in design contract
		Discharge of supernatant water	Design of the dredged sediment disposal sites includes treatment of supernatant water.	Design Institute	HPMO; **HMAMB**	Included in design contract
Dredging method	Water quality	Overflow from the grab or bucket	Design of the dredging method and selection of the dredging equipment must minimize overflow from the dredging equipment.	Design Institute	HPMO; **HMAMB**	Included in design contract
Pre-construction Stage						
Institutional strengthening	-	Lack of environmental management capacities within	Appoint qualified environment specialist on staff within the HPMO Contract loan implementation environment consultant (LIEC) within loan	**HPMO**, HMLMB, LIEC	ADB	HMG

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
		HPMO, HMSC, HMAMB and HMLMB	administration consultant services; Conduct environment management training.			
	-	Lack of environmental monitoring capability and qualification	Contract Huainan Environmental Monitoring Station and waterbird specialist to conduct project impact monitoring during construction.	HPMO	ADB	HPMO
			Contract Huainan Environmental Monitoring Station to conduct project impact monitoring during the operational stage.	HMSC, HMAMB, HMLMB	HPMO	HMSC, HMAMB, HMLMB
EMP Update	-	-	Review mitigation measures defined in this EMP, update as required to reflect detailed design, disclose updated EMP on project website.	HPMO, LIEC	ADB	HPMO, Loan implementation TA
Tender documents	Air quality	Dust (TSP) impact to sensitive receptors	Put into tender documents dust suppression measures: Water unpaved areas, backfill areas and haul roads 7-8 times each day; Erect hoarding around dusty activities; Strengthen the management of stockpile areas with frequent watering or covering with tarpaulin; Minimize the storage time of construction and demolition wastes on site by regularly removing them off site; Do not overload trucks for transporting earth materials to avoid spilling dusty materials onto public roads. Equip trucks for transporting earth materials with covers or tarpaulin to cover up the earthy materials during transport; Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads; Immediately cleanup all muddy or dusty materials on public roads outside the exits of the works areas; Sensibly plan the transport routes and time to avoid busy traffic and heavily populated areas when transporting earthy materials; Immediately plan vegetation in all temporary land take areas upon completion of construction to prevent dust and soil erosion.	Design Institute	HPMO; LIEC	Included in tendering agency contract

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
		Odor impact to sensitive receptors	Put into tender documents that the transport of dredged sediment from the dredging site to the disposal site must be in sealed containers.	Design Institute	HPMO; LIEC	Included in tendering agency contract
	Noise	PME noise impact to sensitive receptors	Put into tender documents the following noise mitigation measures: Use quiet equipment; Adopt good O&M of machinery; Use temporary hoardings or noise barriers to shield off noise sources; Minimize night time road construction between 2200 and 0600 hours. If night time construction is needed, consult and notify local communities beforehand; Maintain continual communication with the schools in Dongsun sub-district to avoid noisy construction activities near the schools during examination periods.	Design Institute	HPMO; LIEC	Included in tendering agency contract
	Water quality	Construction site wastewater impact on water bodies	Put into tender documents the following measures to treat wastewater and runoff from construction sites: Provide portable toilets or small package WWTPs for workers and canteens Install sedimentation tanks on-site to treat process water and muddy runoff	Design Institute	HPMO; LIEC	Included in tendering agency contract
	Ecology	Construction impact on waterbirds and wildlife at Gaotang Lake	Put into tender documents the following ecological mitigation measures for Gaotang Lake: No embankment and wetland construction works shall be carried out from 1 December to 28 February at Gaotang Lake for protection of winter migrating waterbirds; During all other times of the year, embankment and wetland construction at Gaotang Lake shall be restricted to between 0900 and 1600 hours, to avoid disturbing the dawn and dusk feeding time for birds; Construction workers are prohibited from capturing any wildlife at Gaotang Lake or anywhere in the project area.	Design Institute	HPMO; LIEC	Included in tendering agency contract
	Solid waste	Disposal or storage of excavated spoil	Specify in tender documents the spoil disposal or storage sites and that only these sites could be used.	Design Institute	HPMO; LIEC	Included in tendering agency contract

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
	Health & safety	Occupational health & safety of workers	Specify in tender documents the provision of personal safety and protective equipment such as safety hats and shoes, eye goggles, respiratory masks, etc. to all construction workers.	Design Institute	HPMO; LIEC	Included in tendering agency contract
Construction traffic	Traffic	Construction vehicles causing traffic congestion	Plan transport routes for construction vehicles and specify in tender documents to forbid vehicles from using other roads and during peak traffic hours.	Design Institute, Local traffic police	HPMO; LIEC	Included in tendering agency contract
						Estimated cost for Design and Pre-construction stage: Included in detailed design and contract tender fees
Construction Stage						
Construction site good practice	Air quality	Dust (TSP) during construction	Frequent watering of unpaved areas, backfill areas and haul roads; Erect hoarding around dusty activities; Strengthen the management of stockpile areas with frequent watering or covering with tarpaulin; Minimize the storage time of construction and demolition wastes on site by regularly removing them off site; Do not overload trucks for transporting earth materials to avoid spilling dusty materials onto public roads; Equip trucks for transporting earth materials with covers or tarpaulin to cover up the earthy materials during transport; Install wheel washing equipment or conduct wheel washing manually at each exit of the works area to prevent trucks from carrying muddy or dusty substance onto public roads; Immediately cleanup all muddy or dusty materials on public roads outside the exits of the works areas; Sensibly plan the transport routes and time to avoid busy traffic and heavily populated areas when transporting earthy materials; Immediately plan vegetation in all temporary land take areas upon completion of construction to prevent dust and soil erosion.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
	Noise and vibration	Noise from PME and vehicles	Sensibly schedule construction activities, avoid noisy equipment working concurrently; Select advanced quiet equipment and construction method, and tightly control the use of self-provided generators; Control speed of bulldozer, excavator, crusher and other transport vehicles travelling on site, adopt noise reduction measures on equipment, strengthen equipment repair and maintenance to keep them in good working condition; Limit the speed of vehicles travelling on site (less than 8 km/hr), forbid the use of horns unless absolutely necessary, minimize the use of whistles; Maintain continual communication with nearby schools to avoid noisy activities near the schools during examination periods. Prior to construction near sensitive receptors the PMO and contractor will consult the affected communities: (a) ensure they are aware of the construction; (b) plan construction at times of least disturbance, (c) delineate construction hazard zones and identify structures which may be especially susceptible to vibration impacts, (d) distribute ear protection against construction noise; Give particular attention to communities and residential and commercial structures at and near the Huainan Teacher's College, Xie No. 2 Mine Hospital, and Jiannan Village (sites with high existing day-time noise levels) Prohibit night-time construction. If exceptional and unforeseen circumstances require night-time work, discuss with communities first and employ all noise suppression measures used in the day time.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000
	Water quality	(i) Construction site wastewater discharge (ii) Treatment of supernatant water from dredged sediments	Domestic and cafeteria wastewater will go through biochemical treatment and grease trap prior to discharge; Timely cleanup scattered materials on site, stockpiles must adopt measures to prevent being washed into water bodies by rain water; Reuse equipment and wheel wash WW for dust suppression; Erect berms or sandbags during embankment works at Gaotang Lake if	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			necessary to contain muddy runoff polluting lake; Supernatant water at the 3 disposal sites for dredged sediments will be tested against the discharge standard (see Table A.5). If standards are not met, the settling time will be extended and/or increased dosage of flocculents will be used (increasing the adsorption of nutrients to particles).			
	Solid waste	Construction site refuse and spoil disposal	Transport construction waste in enclosed containers; Establish enclosed waste collection points on site, with separation of domestic waste and construction waste; Set up centralized domestic waste collection point and transport offsite for disposal regularly by sanitation department; Dispose spoil at the 5 designated disposal sites (Table IV.6 of EIA). Backfilled area if not being used must be planted with vegetation to prevent soil erosion.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000
	Ecology and Soil	Destruction of vegetation, Soil Erosion	Construct berms or drainage ditches around the perimeter to direct rainwater runoff away from the construction site during the rainy season; Pay close attention to the growth of vegetation cover on backfilled area to prevent soil erosion; Immediately restore, level and plant landscape on temporary occupied land upon completion of construction works.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000
	Physical cultural resources	Destruction of cultural relics in stream bed and soil	Contractor must comply with PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Regulations* if such relics are discovered, stop work immediately and notify the relevant authorities, adopt protection measures and notify the Security Bureau to protect the site.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	None
	Overall disturbance to communities	Excessive disturbance to communities due to prolonged construction times and/or close proximity to channels	Contractors to identify and adhere to strict schedule for completion of each channel section – avoid prolonged construction, disturbance Identify and record specific channel sections with residences very close to channels. In these sections: (i) ensure all fume-emitting machinery and pumps are covered to avoid fumes entering homes, (ii) restrict size of excavation machinery and techniques to avoid physical damage to adjacent homes	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	Covered in above costs

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
Health and Safety	Occupational health and safety	Construction site sanitation	Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse piles and timely remove solid waste; Minimise the risk of fly- or mosquito-borne diseases by maintaining well-drained and hygenic project sites; Remove standing water bodies and cover drums and other containers to avoid formation of stagnant water; Ensure personnel are aware of potential disease risks; Enforce on-site hygiene regulations to prevent litter; Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000
		Occupational safety	Provide safety hats and shoes to all construction workers and enforce their use by the workers; Provide ear plugs to workers working near noisy PME; Clearly demarcate all open-cut pipeline trenches and erect barriers on either side of them to prevent injury to workers / the public	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000
		Food safety	Inspect and supervise food hygiene in cafeteria on site regularly. Cafeteria workers must have valid health permits. Once food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	None
		Disease prevention and safety awareness	Construction workers must have physical examination before start working on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the 2nd year onwards, conduct physical examination on 20% of the workers every year. Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	$30,000

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			Specify the persons responsible for health and epidemic prevention, education on food hygiene, and disease prevention, to raise the awareness of workers.			
	Community health and safety	Temporary traffic management	A traffic control and operation plan will be prepared together with the local traffic management authority prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.	**Contractor**, local traffic police	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	HMG (traffic police department)
		Information disclosure	Residents and businesses will be informed in advance through media of the construction activities, given the dates and duration of expected disruption.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	None
		Access to construction sites	Clear signs will be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc and raising awareness on safety issues. All sites will be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate.	Contractor	HPMO, **HMSC, HMAMB, HMLMB**, LIEC	None
		Utility services interruptions	Assess construction locations in advance for potential disruption to services and identify risks before starting construction. If temporary disruption is unavoidable, develop a plan to minimize disruption with relevant authorities e.g. power company, water supply company, communication company, and communicate dates and duration in advance to all affected people.	**Contractor**, local service providers	HPMO, HMSC, HMAMB, HMLMB, LIEC	None
Grievance redress mechanism	Social & environmental	Handling and resolving complaints on contractors	Establish a GRM, appoint a GRM coordinator within HPMO. Brief and provide training to GRM access points (HPMO, contractors). Disclose GRM to affected people before construction begins at the main entrance to each construction site. Maintain and update a Complaint Register to document all complaints.	Contractor, **HPMO**, HMSC, HMAMB, HMLMB, LIEC	HEPB	HPMO budget, Loan implementation TA
						Estimated cost for the Construction Stage: $240,000
Operational Stage						

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
Wastewater collection	Air quality	Odor from wastewater pump stations	Regular maintenance of odor removal equipment/facility.	HMSC	HPMO	O&M Unit's operation budget
	Noise	Noise from wastewater pump stations	Keep the equipment in good working condition and with regular maintenance.	HMSC	HPMO	O&M Unit's operation budget
Flood management	Noise	Noise from storm water pump stations	Keep the equipment in good working condition and with regular maintenance.	HMAMB	HPMO	O&M Unit's operation budget
Urban water channels	Solid waste	Dumping of garbage on channel banks	Provide sufficient garbage bins near channel banks; Educate residents on garbage disposal; Regularly inspect and remove garbage from channel banks.	HMAMB	HPMO	O&M Unit's operation budget
	Soil erosion	Dredged sediment and earth cut material disposal sites	Expedite planting of vegetation on these sites and regularly monitor vegetation growth.	HMAMB	HPMO	O&M Unit's operation budget
Estimated cost for the Operational Stage: the cost will be included in the O&M budget						

Key: **ADB** = Asian Development Bank; **CESFMT** = Community Environmental Supervision and Flood Management Team; **HEMS** = Huainan Environment Monitoring Station; **HEPB** = Huainan Environmental Protection Bureau; **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office; **LIEC** = Loan Implementation Environment Consultant.; **O&M** = operation & maintenance; PME = powered mechanical equipment; TSP = total suspended particles. **Implementing and Supervising Entities**: those in **Bold** have primary responsibility

D. Monitoring and reporting

14. Three types of project monitoring will be conducted under the EMP. [22]

(i) Project readiness monitoring. To be conducted by the LIEC.

(ii) Project impact monitoring. To be conducted by: (a) the Huainan Environmental Monitoring Station (HEMS) under the Huainan EPB (for air, water, noise); (b) a waterbird specialist (for waterbird monitoring at Gaotang Lake); and (c) the contractors, who will be required to conduct frequent noise and air quality monitoring around construction sites and to report monitoring results in the framework of their weekly progress reports to HPMO and the three IAs (HMSC, HMAMB, HMLMB).

(iii) Independent evaluation. To be conducted by the LIEC. To verify EMP compliance during project implementation.

15. ADB will oversee project compliance on the basis of the semi-annual environmental monitoring reports provided by the HMG and site visits (generally 1-2 times/year). Monitoring and reporting arrangements defined for this project are described below.

16. **Project readiness monitoring.** Before construction, the LIEC will assess the project's readiness in terms of environmental management based on a set of indicators (Table A.3) and report it to ADB and HPMO. This assessment will demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table A.3: Project Readiness Assessment Indicators

Indicator	Criteria	Assessment	
EMP update	• EMP was updated after technical detail design & approved by ADB	Yes	No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes	No
Public involvement effectiveness	• Meaningful consultation completed	Yes	No
	• GRM established with entry points	Yes	No
Environmental Supervision in place	• LIEC is in place	Yes	No
	• Environment specialists appointed by HPMO, HMSC, HMAMB and HMLMB	Yes	No
	• Environment monitoring station contracted by HPMO	Yes	No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances	Yes	No
	• Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP	Yes	No
	• Environmental requirements of EMP included in contract documents	Yes	No

[22] In addition to project-specific monitoring, Huainan EPB will conduct independent ambient and/or enforcement monitoring as per national requirements. This is separate to, and not funded by, the project.

Indicator	Criteria	Assessment
	for construction contracts	
EMP financial support	• The required funds have been set aside for EMP implementation	Yes No

17. **Projetc impact monitoring.** Table A.4 shows the internal environmental monitoring program designed for this project, defining the scope, location, parameter, duration and frequency, and responsible agencies, for monitoring during the construction and operational stages. Internal environmental monitoring will include monitoring of air quality, noise, water quality and ecology. For air, noise, and water, the monitoring during construction and operation will be conducted by HEMS contracted by HPMO, except for waterbirds, for which a qualified ecologist will be contracted by HPMO to undertake monitoring.

18. For monitoring of dredging impacts on channel water quality, a control station versus impact station approach will be adopted. The monitoring station upstream of the dredging section will function as the control station as it is not to be impacted by dredging activities. The monitoring station downstream of the dredging section will function as the impact station. Any increase in the level of water quality parameter (such as suspended solids; SS) at the impact station compared to the control station is indicative of potential impact due to dredging. If the level of the water quality parameter (mainly SS) at the impact station is >130% of the control station, mitigation measures such as changing the dredging method or reducing the dredging rate will need to be adopted.

19. The internal environmental monitoring results will be compared with relevant PRC performance standards (Table A.5). Non-compliance with these standards will be highlighted in the monitoring reports. Monitoring results will be (i) submitted by HEMS to HPMO and the three IAs on a monthly basis, and (ii) then reported by HPMO to ADB in semi-annual environmental monitoring reports (prepared with the support of the LIEC – Table A.6).

Table A.4: Internal Environmental Monitoring Program

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
Construction Stage						
Dust and noise	TSP, L_{Aeq}	At boundaries of all construction sites	2 times/day, three times/ week during construction period	Contractor	HPMO, **HMSC, HMAMB, HMLMB**	Included in Contractor budget
Air quality	TSP	21 locations: 1. Jiannan Village 2. City No. 2 Hospital 3. Xinzhuang Third Village 4. Xie No. 2 Quarry Hospital 5. Xiaodonggang 6. Huajian Primary and Secondary School 7. Sunyingzi 8. Huainan Bureau of Mine	1 day (24-hr continuous sampling) per month when there is construction occurring within 200 m of the monitoring location	HEMS (contracted through HPMO)	HPMO; **HMSC, HMAMB**	$50,000

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
		9. Huainan No. 7 Secondary School 10.Shangri-La Community 11.Juren Village 12.Hudayingzi 13.Xinfu Village Dairy Product Company 14.Shangyao Medical Clinic 15.Jiushang Road dredged sediment disposal site 16.Xiejiaji Landfill dredged sediment disposal site 17.Huaibin Village dredged sediment disposal site 18.Shijian Lake pump station 19.Long Lake pump station 20.Dajiangou pump station 21.Gaotang Lake #2 pump station				
Noise	L_{Aeq}	21 locations (same as for air quality)	2 times per day (day time and night time); 1 day per month when there is construction occurring within 200 m of the monitoring location	HEMS (contracted through HPMO)	HPMO; **HMSC, HMAMB**	$50,000
Water quality	SS, DO, TPH	Bagongshan Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact station) Xiejiaji Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact station) Donghua Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact station) Old Longwang Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact station) Longwang Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact	2 times/ day: 1 day per month during construction period with dredging activities.	HEMS (contracted through HPMO)	HPMO; **HMAMB**	$50,000

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
		station) Longwang Flood Diversion Channel dredging: 2 locations at each dredging section: (1) 50 m upstream of the dredging section (control station), (2) 100 m downstream of the dredging section (impact station) Embankment works on Gaotang Lake bank: 28 locations: 14 transects, each 100 m long, will be established perpendicular to the shoreline, 1 km apart, along the 14.47 embankment. Each transect will have 2 monitoring locations: one at 25 m from the shoreline (impact station) and one at 100 m from the shoreline (control station).				
	SS, NH_3-N, PO_4	3 locations, one each at each of the dredged sediment disposal site supernatant water discharge point: 1. Jiushang Road site 2. Xiejiaji Landfill site 3. Huaibin Village site	1 time per day; 1 day per month during construction period	HEMS (contracted through HPMO)	HPMO; **HMAMB**	$20,000
Ecology	Waterbird counts and distribution	Western shoreline of Gaotang Lake: sites for the 14.47 km embankment and the constructed wetlands	1 time per day in early morning hours; 2 consecutive days per month during Gaotang Lake embankment construction period	Ornithologists (contracted through HPMO)	HPMO; **HMAMB**	$70,000
Social	Community	3-person Community Environmental Supervision and Flood Management Team (CESFMT) to monitor environmental conditions of construction and raise public awareness of litter / clogging of channels	Ad hoc	CESFMT (contracted through HPMO)	HPMO	Included in Sub-component 2.3
Operational Stage						
Air quality	NH_3, H_2S	3 locations: One each at downwind site boundary of each of the 3 wastewater pump stations	1 time per day when the pumps are operational; 2 days per month for 12 consecutive months	HEMS (contracted through HMSC)	**HPMO**, HEPB	Included in O&M budget
Noise	L_{Aeq}	40 monitoring points at 10 locations: 4 sides of site boundary of each of the 3 wastewater pump stations and 7 storm water pump stations	Two times per day (day time and night time); 2 days per month for 12 consecutive months. Monitoring can cease when 100% compliance is achieved 3 consecutive times at the same site	HEMS (contracted through HMSC and HMAMB)	**HPMO**, HEPB	Included in O&M budget

Item	Parameter	Monitoring Location	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity	Estimated Cost
Constructed Wetland	COD，NH_3-N，TN，TP	2 monitoring points (1 at water inflow and 1 at water outflow) at each of the following constructed wetlands: GW1 and GW3 SW1 and SW2 and SW5 CW1 LW1 DW1	1 day per month for 36 consecutive months	HEMS (contracted through HMLMB)	**HPMO**; HEPB	Included in O&M budget
	Waterbird counts	At each of the following constructed wetland locations: GW1 and GW3	2 consecutive days per month for 36 consecutive months	Ornithologist (contracted by HMLMB)	**HPMO**; HEPB	Included in O&M budget
Total estimated cost:						**$240,000**

Notes: **CESFMT** = Community Environmental Supervision and Management Team; **HEMS** = Huainan Environment Monitoring Station; **HEPB** = Huainan Environmental Protection Bureau; **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office. **Implementing and Supervising Entities**: those in **Bold** have primary responsibility

Table A.5: Monitoring Indicators and Applicable PRC Standards[23]

Phase	Indicator	Standard
Construction	TSP	Class II Ambient Air Quality Standard (GB 3095-1996)
	Noise limits of PME at boundary of construction site	Emission Standard of Environmental Noise for Boundary of Construction Site (GB 12523-2011)
	Water quality during dredging and embankment construction (SS, DO, TPH)	Use control station and impact station approach. If the level at the impact station is >130% of the control station, mitigation measures such as reducing the dredging rate or changing the dredging equipment will be implemented.
	Water quality of supernatant discharge at dredged sediment disposal site (SS, NH_3-N, PO_4)	Integrated Wastewater Discharge Standard (GB 8978-1996)
Operation	Odor (NH_3, H_2S)	Emission Standards for Odor Pollutants (GB 14554-93)
	Noise	Emission Standard for Industrial Enterprises Noise at Boundary (GB 12348-2008)

Note: DO = dissolved oxygen, PME = powered mechanical equipment, SS = suspended solids, TPH = total petroleum hydrocarbon, TSP = total suspended particles.

20. **Independent evaluation.** Independent evaluation on EMP implementation will be undertaken by the LIEC. HPMO will report the LIEC's independent evaluation to ADB on the

[23] The project applies PRC standards. A comparison of PRC standards with internationally accepted standards (as defined in the World Bank's Environment Health and Safety Guidelines) was conducted for the EIA. The comparison confirmed that PRC standards are either internationally accepted, or have comparable standard limits with most of the international standards.

project's adherence to the EMP, information on project implementation, environmental performance of the contractors, and environmental compliance through quarterly project progress reports and semi-annual environmental monitoring reports (Table A.6). The LIEC will support HPMO in developing the semi-annual environmental monitoring reports. The reports should confirm the project's compliance with the EMP and local legislation (including the PRC's EIA requirements), the results of independent evaluation (both contractor compliance with the EMP and the results of environmental monitoring by the HEMS), identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. Operation and performance of the project GRM, environmental institutional strengthening and training, and compliance with all covenants under the project will be included in the report.

21. **Monitoring by ADB.** Besides reviewing the semi-annual environment monitoring reports from HPMO and the verification reports from the LIEC, ADB missions will inspect the project progress and implementation on site at least once a year. For environmental issues, inspections will focus mainly on (i) monitoring data; (ii) the implementation status of project performance indicators specified in the loan documents for the environment, environmental compliance, implementation of the EMP, and environmental institutional strengthening and training; (iii) the environmental performance of contractors, LIEC, and HPMO; and (iv) operation and performance of the project GRM. The performance of the contractors in respect of environmental compliance will be recorded and will be considered in the next bid evaluations.

22. **Environmental acceptance monitoring and reporting.** Following the PRC Regulation on Project Completion Environmental Audit (MEP, 2001), within three months after the completion of each project component, an environmental acceptance monitoring and audit report for the component shall be prepared by a licensed environmental monitoring institute. The report will be reviewed and approved by HEPB, and then reported to ADB (Table A.6). The environmental acceptance reports of the component completions will indicate the timing, extent, effectiveness of completed mitigation and of maintenance, and the needs for additional mitigation measures and monitoring during operations.

Table A.6: Reporting Plan

Reports		From	To	Frequency
Construction Phase				
Internal progress reports by contractors	Internal project progress report by construction contractors, including monitoring results	Contractors	HPMO, HMSC, HMAMB, HMLMB	Monthly
Internal environmental monitoring	Environmental monitoring report	HEMS, Ornithologist,	HEPB, HPMO	Monthly
	Environment progress and monitoring reports	HPMO	ADB	Semi-annual
Acceptance report	Environmental acceptance monitoring and audit report	Licensed institute	HEPB	Once; within 3 months of completion of physical works
Operational Phase				
Internal environmental monitoring	Environmental monitoring report (first year of operation)	HEMS	HEPB, HPMO	Quarterly
	Environment progress and monitoring report	HPMO	ADB	Semi-annual

Notes: **ADB** = Asian Development Bank; **HEMS** = Huainan Environment Monitoring Station; **HEPB** = Huainan Environmental Protection

Reports	From	To	Frequency
Bureau; **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office			

23. In addition to the EMP monitoring program, project component 3-2 will include a hydrological monitoring program at Gaotang Lake to assess whether the 14.47 km embankment at the lake causes any changes in the lake hydrology. Monitoring parameters will be identified and may include the installation of water level gauges along the lake shoreline near the embankment.

E. Institutional Capacity Building and Training

24. The capacity of HPMO, HMSC, HMAMB, HMLMB and contractors' staff responsible for EMP implementation and supervision will be strengthened. All parties involved in implementing and supervising the EMP must have an understanding of the goals, methods, and practices of project environmental management. The project will address the lack of capacities and expertise in environmental management through (i) institutional capacity building, and (ii) training.

25. Institutional strengthening. The capacities of the HPMO, HMSC, HMAMB and HMLMB to coordinate environmental management will be strengthened through a set of measures:

(i) The appointment of a qualified environment specialist within the HPMO staff to be in charge of EMP coordination, including GRM.
(ii) The appointment of LIEC under the loan implementation consultancy to guide HPMO, HMSC, HMAMB and HMLMB in implementing the EMP and ensure compliance with ADB's Safeguard Policy Statement (SPS 2009).

26. Training. HPMO, HMSC, HMAMB and HMLMB, contractors and O&M units will receive training in EMP implementation, supervision, and reporting, and on the Grievance Redress Mechanism (Table A.7). Training will be facilitated by the LIEC with support of other experts under the loan implementation consultant services.

Table A.7: Training Program

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
EMP adjustment and implementation	HPMO, HMSC, HMAMB, HMLMB, contractors	Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	2	15	100	$6,000
Grievance Redress Mechanism	HPMO, HMSC, HMAMB, HMLMB, contractors, HEPB	Roles and responsibilities, Procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	1	10	100	$2,000
Environmental protection	HPMO, HMSC, HMAMB, HMLMB,	Pollution control on construction sites (air, noise, wastewater,	Once (during project	2	10	100	$2,000

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
	contractors	solid waste)	implementation)				
Environmental monitoring	HPMO, HMSC, HMAMB, HMLMB, contractors	Monitoring methods, data collection and processing, reporting systems	Once (at beginning of project construction)	1	10	100	$1,000
						Total estimated cost:	**$11,000**

Notes: **ADB** = Asian Development Bank; **HEPB** = Huainan Environmental Protection Bureau; **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office; **O&M** = operation and maintenance.

27. Capacity building. In addition to training for EMP implementation, the project will provide consulting services and training to assist and train the staff of HPMO, HMSC, HMAMB and HMLMB in project management, environmental management, land acquisition and resettlement, procurement, as well as external resettlement and environmental monitoring. The institutional components of the project will also involve training by loan implementation consultants in operation and maintenance of completed facilities. Part of this training will focus on teaching staff how to use a set of indicators to monitor performance of the completed facilities. These indicators will be designed by loan implementation consultants prior to operation start-up.

F. Consultation, Participation and Information Disclosure

28. Consultation during Project Preparation. Section VII of the EIA describes the public participation and consultation implemented during project preparation.

29. Future Public Consultation Plan. Plans for public involvement during construction and operation stages were developed during project preparation. These include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages; (ii) evaluating environmental and economic benefits and social impacts; and (iii) interviewing the public after the project is completed. These plans will include several types of public involvement, including site visits, workshops, investigation of specific issues, interviews, and public hearings (Table A.8). The budget for public consultation is estimated to be $8,500.

Table A.8: Public Consultation Plan

Organizer	Format	No. of Times	Subject	Attendees	Budget
Construction Stage					
HPMO	Public consultation & site visit	4 times: 1 time before construction commences and 1 time each year during construction	Adjusting of mitigation measures, if necessary; construction impact; comments and suggestions	Residents adjacent to components, representatives of social sectors	$4,000
HPMO	Expert workshop / press conference	As needed based on public consultation	Comments / suggestions on mitigation measures, public opinions	Experts of various sectors, media	$1,500
HPMO	Resettlement survey	As required by relevant resettlement plan	Comments on resettlement, improvement of living conditions,	Persons affected by resettlement and	Included in the resettlement

Organizer	Format	No. of Times	Subject	Attendees	Budget
			livelihood, and poverty reduction; comments and suggestions	relocation	plan update survey budget
Operational Stage					
HMSC, HMAMB, HMLMB, O&M Units	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Residents adjacent to component sites, social sectors	$1,500
HMSC, HMAMB, HMLMB, O&M Units	Expert workshop or press conference	As needed based on public consultation	Comments and suggestions on operational impacts, public opinions	Experts of various sectors, media	$1,500
				Total budget:	**$8,500**

Notes: **HMAMB** = Huainan Municipal Administration Management Bureau; **HMLMB** = Huainan Municipal Landscaping Management Bureau; **HMSC** = Huainan Municipal Sewage Company; **HPMO** = Huainan Project Management Office; **O&M** = operation and maintenance.

G. Grievance Redress Mechanism

30. A Grievance Redress Mechanism (GRM) will be established as part of this EMP to receive and manage any public concerns or issues which may arise due to the project. The GRM comprises: (i) a set of clear procedures developed by the HPMO to receive, record, and address any concerns which are lodged; (ii) specific contact individuals at the HPMO and the three IAs, the Huainan Municipal Sewage Company (HMSC), Huainan Municipal Administration Management Bureau (HMAMB) and Huainan Municipal Landscaping Management Bureau (HMLMB); and (iii) the Huainan Environmental Protection Bureau (HEPB).

31. All contractors and work staff will be briefed by the HPMO on the GRM. Contractors and workers will be instructed to be courteous to local residents and, in the event they are approached by the general public with an issue, to immediately halt their work and report the issue to the foreman. The foreman will immediately report the issue to the IA or HPMO for action.

32. Multiple means of using this mechanism, including face-to-face meetings, written complaints, hotline number and telephone conversations, anonymous drop-boxes for written comments, and/or e-mail, will be available. All concerns received will be treated confidentially and professionally. The identity of individuals will not be circulated among project agencies or staff and will only be shared with senior staff, and then only when there is clear justification. In the construction period and the initial operational period covered by loan covenants, the HPMO will report progress to the ADB, and this will include reporting complaints and their resolution.

33. Basic steps for resolving complaints are as follows and illustrated in Figure A.1.

i. Step 1: For environmental problems during the construction stage, the affected persons (AP) can register their complaints directly with the contractors as well as the HPMO, any of the IAs, or HEPB. Contractors are required to set up a complaint hotline and anonymous

drop-box and designate a person in charge of handling complaints, and to advertise the hotline number at the main entrance to each construction site. The contractors will maintain and update a Complaint Register to document all complaints. Unless the comment was received anonymously, the contractors are required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the grievance handling ends here. The contractors are required to report all complaints received, handled, resolved and unresolved to HMSC, HMAMB, HMLMB and HPMO monthly.

ii. Step 2: For environmental problems that could not be resolved at the contractor level, the affected person can take the grievance to the IAs (HMSC, HMAMB, HMLMB, HEPB). On receiving complaints by the IAs or HEPB, the party receiving the complaints must notify the other party and document the complaint in writing in a Complaint Register. The IAs must immediately inform the HPMO Environmental Specialist of a complaint and to agree on a course of action. The IAs and HEPB must reply to each complain in writing within 14 calendar days on the proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, the IAs should document the complaint and resolution process in its Complaint Register, with quarterly reporting to HPMO.

iii. Step 3: If the affected person is not satisfied with the proposed solutions in Step 2, he/she can, upon receiving the reply, take the grievance to the HPMO (which will be received by the HPMO Environment or Social Specialist). Upon receiving the complaint, HPMO must deal with it within 14 calendar days. Once a complaint is documented and put on file, HPMO will immediately notify ADB. After discussing the complaint and potential solutions among ADB, HPMO, the LIEC, the contractor, and the affected person, HPMO must provide clear answers to the complainant within 14 calendar days from when the complaint is documented and put on file.

34. The tracking and documenting of grievance resolutions by HPMO will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the HPMO Environment and/or Social Specialist; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

35. At any time, an affected person may contact ADB (East Asia Department) directly, including the ADB Resident Mission in the PRC.

36. If the above steps are unsuccessful, people who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good

faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[24]

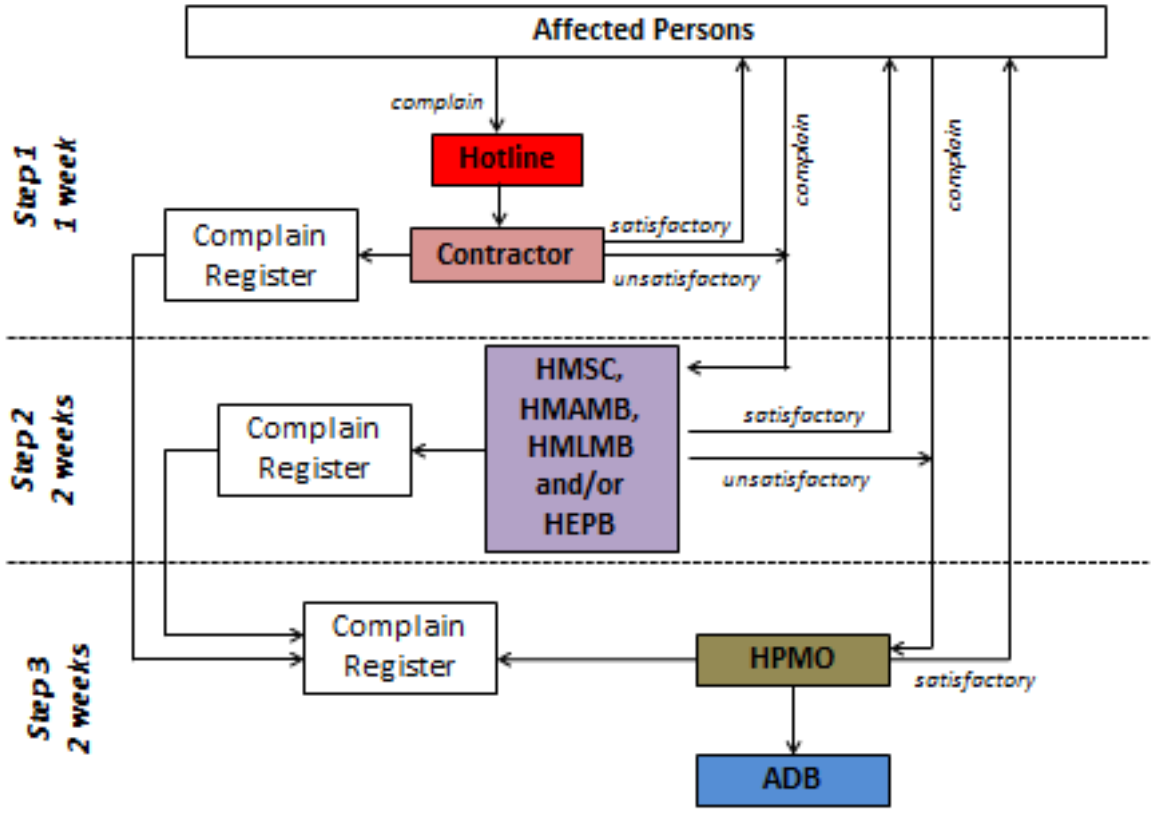


Figure A.1: Proposed Grievance Redress Mechanism

H. Cost Estimates

37. The total cost for EMP implementation comprises four items: (i) mitigation measures (Table A.2), (ii) environmental monitoring (Table A.4), (iii) public consultation (Table A.7), and (iv) training (Table A.8). The total cost is summarized in Table A.9 and is $499,500. Excluded from the budget are (i) infrastructure costs which relate to environment and public health but which are already included in the project direct costs and (ii) remuneration for the HPMO Environment Specialist, consulting packages for the non-structural sub-components, loan implementation consultants, and technical experts on equipment operation and maintenance (covered elsewhere in the project budget).

[24] See: http://compliance.adb.org/

Table A.9: Estimated Budget for Implementation of the Environmental Management Plan

EMP Item	Estimated Cost
Mitigation measures	$240,000
Internal environmental monitoring	$240,000
Training	$11,000
Public consultation	$8,500
Total	**$499,500**

38. HPMO will bear all internal environmental monitoring costs during the construction stage. The three IAs, HMSC, HMAMB and HMLMB (= the O&M Units) will bear all internal monitoring costs during the operational stage. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities. The IAs will bear the costs related to mitigation measures during operation. The IAs and HPMO will bear the costs related to environmental supervision during construction and operation respectively. The project as a whole, through HPMO, will bear the costs for training, the GRM, and the Loan Implementation Environment Consultants under contract to HPMO.

I. Mechanisms for Feedback and Adjustment

39. The EMP is a living document. The need to update and adjust the EMP will be reviewed when there are design changes, changes in construction methods and program, unfavorable environmental monitoring results or inappropriate monitoring locations, and ineffective or inadequate mitigation measures. Based on environmental monitoring and reporting systems in place, HPMO (with the support of the LIEC) shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. HPMO will inform ADB promptly on any changes to the project and needed adjustments to the EMP. The updated EMP will be submitted to ADB for review and approval, and will be disclosed on the ADB and HMG project website.