ADB

Environmental Monitoring Report

Project Number: 44037-014
April 2018

PRC: Shaanxi Weinan Luyang Integrated Saline Land Management Project—Semi-Annual Environmental Monitoring Report (July to December 2017)

Prepared by Weinan City Government Project Management Office for Weinan City Government and Asian Development Bank.

Asian Development Bank

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EXECUTIVE SUMMARY

1. This semi-annual report presents the status of compliance with the environment management plan (EMP) during the project implementation from July 1 to December 31, 2017. The key environment issues caused by project construction have been discussed, and corresponding improvement measures and follow up actions have been suggested according to the issues found.

A. Environment management plan implementation

2. The project has been implemented partially in accordance with EMP requirements, and relevant environmental requirement have been included in the bidding document and contract. PMO has distributed both the EMP and design documents to PIO, contractors, and supervisors before the construction commencement.

3. At the project preparation stage, PMO, PIO, design institute, EIA Institute, and WEPB have conducted related public consultation activities in accordance to ADB requirements. The GRM has been established and carried out by PMO. No complaints have been received during this reporting period.

4. Environmental officers of PMO and PIO have been working effectively on the project with the support of WEPB and Loan Implementation Environmental Consultant (LIEC). EMP trainings have been provided to related staffs in PMO, PIO, contractors and supervisors.

5. Xi'an Jingcheng Testing Technology Limited Company has been authorized to conduct the on-site environmental monitoring during the construction stage. The monitoring work was carried out in December 2017 in this reporting period. The monitoring time and frequency has been adjusted by PMO according to the construction progress, which is a little different from original monitoring arrangement in EMP.

6. The water bird monitoring in the year of 2017 was conducted by the Shaanxi Institute of Zoology from March to November. The Luyanghu wetland was divided into 8 survey area, the waterbird amount and species composition was monitored and analyzed.

B. Key issues

7. Some monitoring items for surface water quality did not meet the Class IV standard requirements in *National Environmental Protection Standard (GB3838-2002)*, including COD, BOD5, TN and TP.

8. Uncontrolled dumping of spoil from Tianlu Lake excavation caused the loss of over 1,000 mu (150 ha) salt pans in addition to the agreed 1,650 mu due to the delay of the spoil disposal management plan preparation.

C. Corrective actions

9. On-site environment supervision and management will be enhanced by both PMO and contractors according to the EMP in next reporting period, to avoid the domestic and construction wastewater discharge into the lake.

10. Integrated nutrient management measures around the lakes area for eutrophication prevention should continue to be carried out by PMO, including:

- Monitoring of nitrogen and phosphorous in the lakes according to the EMP monitoring program requirements will be conducted in the next reporting period. The monitoring results will continue to be reported in the semi-annual environment reports.
- Additional monitoring for nutrient indicators and more eutrophication prevention measures in and around the lakes will be carried out by GEF-funded activities before 30 June.
- Improve farming practices to reduce the use of agri-chemicals under the GEF-funded pilots and training in the first half of 2018, to minimize the impact caused by the pesticides and chemical fertilizers in the agricultural non-point source.

11. The spoil generated by Tianlu Lake excavation is piled up at the temporary storage site around the Tianlu Lake. It is proposed by PMO that the spoil will be used for the construction of the ecological soil and water conservation demonstration zone around Tianlu Lake, which project was approved by local government in 2016. This dispose scheme will need to be discussed with ADB for approval. Spoil management plan will be completed accordingly and approved by local related department. The plan should include the soil balance calculation, disposal schedule, and agreement for spoil acceptance by the related department, etc.

12. The spoil disposal will be conducted in accordance with the approved spoil plan. All new earthworks will be subject to the approved spoil plan. PIO capacity for environmental management will be improved.

1. INTRODUCTION

1.1 Report purpose and rationale

13. In accordance with the EMP requirements, the borrower/client is required to prepare semi-annual environment monitoring and progress reports that specify the project EMP implementation, compliance issues, corrective actions, etc. This report is for the construction period from 1 July to 31 December 2017.

1.2 Project objective and components

14. The project objective is to promote the sustainable and inclusive economic growth in Weinan municipality. The outcomes of the project will improve the natural environment and rural livelihoods in Luyanghu area.

15. The project comprises four outputs which are briefly described as below.

- **Output 1: Saline soils rehabilitated.** This output will reduce soil salinity over a total area of 212 km^2 and increase productivity and climate resilience of 186 km^2 of agricultural lands.

- **Output 2: Flood risk management implemented.** This output will improve flood storage capacity of Luyanghu area to reduce flood risks for local people.

- **Output 3: Wetland ecosystem conservation established.** This output has two components: (i) support the development of the Luyanghu National Wetland Park (LNWP); and (ii) the promotion of tourism, livelihoods, and employment opportunities for local communities. The wetlands conservation will reverse degradation ecosystem caused by agricultural encroachment and other pressures associated with the increasing population within the project area.

- **Output 4: Capacity development and project implementation support provided.** This output has two components: (i) institutional strengthening and (ii) project management supporting during project implementation.

1.3 Project implementation progress

16. Summary of project implementation progress as of 1 July – 31 December 2017, is shown as following.

Table 1 Summary of project implementation progress (as of 1 January - 31 July 2017)

No.	Project	Status	Implementation description
Output 1. Saline soils rehabilitated			
1.	Rehabilitation of Central Main (ADB-SS-CD-01-01)	Final acceptance was conducted in March 2017.	Rehabilitation of Central Main, including structures and management office (0-2.848 km)
2	Rehabilitation of East Main and its Branches (ADB-SS-CW-03)	The construction was initiated in late December 2017, and the progress is roughly 5%.	Rehabilitation of East Main and its Branches
3	Rehabilitation of Middle Main and its Branch and Secondary Branch under Middle Main, including structures	The construction was initiated in late November 2017, and the progress is roughly 5%.	Rehabilitation of Middle Main and its Branch and Secondary Branch under Middle Main.

No.	Project	Status	Implementation description
	and on-farm works (ADB-SS-CW-04)		
4	Office equipment (ADB-SS-ME-01-02)	Contract has been awarded by ADB. .	Office equipment for management office and measuring instrument.
Output 2. Flood risk management implemented			
5	Excavation of Tianlu - Tianjiao Lake Connection (ADB-FM-CW-01)	98% of construction has been completed.	Excavation of Tianlu -Tianjiao Lake Connection
6	Excavation of Tianlu Lake (ADB-FM-CW-02-01)	92% of construction has been completed.	Excavation of Tianlu Lake (400mu).
7	Excavation of Tianlu Lake (ADB-FM-CW-02-02)	95% of construction has been completed.	Excavation of Tianlu Lake (350mu).
8	Excavation of Tianlu Lake (ADB-FM-CW-02-03)	98% of construction has been completed.	Excavation of Tianlu Lake (300mu).
9	Excavation of Tianlu Lake (ADB-FM-CW-02-04)	80% of construction has been completed.	Excavation of Tianlu Lake (300mu).
10	Excavation of Tianlu Lake (ADB-FM-CW-02-05)	90% of construction has been completed.	Excavation of Tianlu Lake (300mu).
Output 3. Wetland ecosystem conservation established			
11	NWP master plan (ADB-WE-CS-01)	Engagement of NWP master plan consultant has been completed.	The contract has been signed in early December 2016 with Shaanxi Forestry Survey and Design Institute, for the Master Plan preparation for National wetland park.
Output 4. Capacity development and project implementation supporting			
9	Project management consultant service (ADB-CD-CS-04)	Already kick off	The contract of the project management consultant was signed in April 2015, and consult service has begun.

2. INSTITUTIONAL SETUP

2.1 Institutional responsibilities

17. Weinan Municipal Government is the executing agency (EA). A Project Leading Group (PLG) has been established to helping guide the project. The PMO established by the municipal government holds overall responsibility for supervising the mitigation measures implementation and reporting to ADB. The PMO is also responsible for replying to petitions and/or complaints from the affected people in the project area.

18. Weinan Luyanghu Modern Industrial Development Zone Management Commission is the implementing agency (IA). The IA has established a project implementation office (PIO) to coordinate the project implementation and management. The PIO is responsible for environmental management and mitigation measures implementation, Including: (i) EMP implementation; (ii) supervision of contractors' performance for environmental management (iii) training to contractors on the mitigation measures implementation; (iv) incorporating environmental management, monitoring, and mitigation measures into construction and operation management plans; (v) developing and implementing internal routine environmental monitoring; (vi) reporting to the PMO and related agencies about the EMP implementation progress; and (vii) assisting the PMO in replying to petitions and/or complaints from the affected people.

19. In addition, the PMO, PIO, and contractors have already nominated dedicated, trained, and qualified environment specialists to undertake environmental management activities and ensure effective EMP implementation. The environment specialists are all full-time staff in the environment monitoring and management department of WLMIDZMC, and the environment management tasks for this project are assigned by the WLMIDZMC manager. Project management consultant team engaged by the PMO has assisted the EA/PMO and IA/PIO in preparing quarterly project progress reports and carrying out training programs. Table 2 shows the environmental responsibilities in different phases of the Project. The table is in accordance with Table A2.5 in the EMP.

Table 2 Environmental Responsibility Matrix

Phase	Agencies	Environmental Responsibilities
Preparation	Design institute	Review and select alternatives (technology, design, location, etc.).
	EIA institute	Prepare EIA and EMP for the Project, including public consultations.
	EPB	Review and approve EIA, including the EMP.
	PPTA consultant	Prepare EIA including EMP and public consultations.
	PMO	Coordinate and supervise EIA, EMP and public consultations.
	IA	Review and endorse EIA including the EMP, for posting at ADB website.
Design	Design institute	Update the EMP in cooperation with EIA institute, and incorporate mitigation measures in engineering detail design and contracts.
	PMO, IA	Review and approve environmental measures.
Tendering and Contracting	PMO, IA, procurement agency	Incorporate EMP clauses in bidding documents and contracts.
Construction	IA	Ensure implementation of mitigation measures, and public consultations.
	Contractors	Implement mitigation measures.
	PMO, WEPB	Advise and supervise implementation of mitigation measures.
	EMC contracted by PMO	Conduct internal monitoring and inspection, and public consultations.
	IEM	Conduct independent monitoring (including public consultations),

		and prepare periodic monitoring reports to IA.
	EMS	Conduct compliance monitoring.
Test Operation	IA	Conduct project completion environmental audit, including sampling and lab tests, and prepare project completion environmental audit report.
	WEPB	Review and approve project completion environmental audit report, and order corrective actions if necessary.
	EMC, IEM	Assist IA in conducting environmental audit and preparing progress reports to the PMO.
Operation	IA	Ensure proper operation of Project facilities according to design standards, and implementation of mitigation measures and public consultations.
	IA, EMC	Conduct internal environmental monitoring and inspection, supervise implementation of the EMP, and conduct public consultations.
	IEM	Conduct independent monitoring (including public consultations), and prepare periodic monitoring reports to IA.
	EMS on behalf of WEPB	Conduct regular and unannounced environmental compliance monitoring and inspections.
Grievance Redress Mechanism	Contractors, project managers	Try to resolve a concern arose by affected people during construction directly with them.
	Village committees	If petitions and/or complains are submitted to village committees from affected people, reply to the affected people within 2 weeks.
	Township governments, district offices	If petitions and/or complains are submitted to township governments and/or district offices from affected people, reply to them within 2 weeks.
	IA	If petitions and/or complains are submitted to IA from affected people, reply to them within 30 days.
	PMO	Deal with petitions and/or complains, if such petitions and/or complains are appealed to the PMO.

EIA = environmental impact assessment, EMC = environmental management consultant, EMP = environmental management plan, EPB = environmental protection bureaus, IA = implementing agency, IEM = independent environmental monitor, EMS = environmental monitoring station at city or county level, IA = project implementing agency, PMO = provincial project management office, PPTA = project preparatory technical assistance. Source(s): Domestic EIA, consultations with PMO, WEPB, and IA.

2.2 Environmental requirements within project contractual arrangements

20. In accordance with requirements of the loan agreement and EMP, the following environmental provisions have been clearly listed in the bidding documents and contracts.

21. General Contract Conditions of the bidding documents have clearly defined as: 1) The contractor shall be responsible for the safety of all activities on the site. 2) The contractor shall take all reasonable measures according to applicable environmental protection laws and regulations to protect the environment on and in vicinity of the site and avoid damages or nuisances to personnel or to property of the public and others resulting from pollution, noise or other causes arising as a consequence of the contractor's acts and/or operation.

22. Particular conditions of the contract requires that the contractor shall comply with (i) all environmental laws and regulations of the People's Republic of China; (ii)The Financial Institution's environmental safeguards; (iii) the measures and requirements set forth in the environmental impact assessment (EIA) and the environmental management plan (EMP) attached; and (iv) any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time for monitoring the EIA and EMP implementation; (v) The Contractor shall allocate a budget for compliance with these measures, requirements and actions.

23. Copy of environmental clauses in the construction contract (ADB-SS-CW-01-01) is shown in Appendix 1.

3. COMPLIANCE WITH ENVIRONMENT RELATED PROJECT COVENANTS

24. For the Project, compliance with all environment related project covenants in this report period is described as Table 3.

Table 3 Compliance with environmental related project covenants in this report period

Source	Covenant	Status of compliance
LA2980PA Sched 5 para.3	WMG shall ensure that the preparation, design, construction, commissioning, implementation, operation and decommissioning of the Project and all Project facilities comply with (a) all applicable laws and regulations of the Borrower relating to environment, health and safety; (b) the Environmental Safeguards; and (c) all measures and requirements set forth in the EIA, the EMP, and any corrective or preventative actions (i) set forth in a Safeguard Monitoring Report; or (ii) subsequently agreed between ADB and WMG. SPG and WMG agree that in case of any discrepancy or inconsistency among the Borrower's laws, regulations and procedures relating to environment, health and safety and the SPS, the SPS shall prevail.	Partly complied with. Spoil disposal plan related to the Tianlu Lake excavation is under preparation, and the spoil disposal will be conducted accordingly after ADB's review and approval.
LA2980PA Sched 5 para.4	WMG shall develop and implement an integrated nutrient management plan to address the risks of water pollution in the Project area (including eutrophication in Tianjiao and Tianlu Lakes) from point-and non-point source pollution in the watershed.	Partly complied with. Measures being implemented to monitor and control nutrient inputs into Tianlu Lake includes (a) Periodical monitoring of nitrogen and phosphorous in the lakes according to the EMP requirement, and (b) improved farming practices to reduce the use of agri-chemicals under the GEF-funded pilots and training. And it has been agreed with PMO that nutrient monitoring will continue to be reported in the semi-annual environment monitoring reports.
LA2980PA Sched 5 para.5	WMG shall carry out regular environmental monitoring of the future development activities in the Luyanghu area to ensure that such activities will not negatively impact the environmental benefits achieved by the Project.	Being complied with.
LA2980PA Sched 5 para.6	WMG shall integrate the measures listed in the EMP for the conservation of migratory water birds and their salt pan habitats in Output 3(a) of the Project and shall ensure timely and effective implementation of such measures.	Being complied with.
LA2980PA Sched 5 para.9	WMG shall ensure that the Project does not have any impacts on indigenous people, all within the meaning of the SPS. In the event the Project does have any such impacts, WMG shall take all steps required to ensure that the Project comply with the applicable laws and regulations of the Borrower and with the SPS.	N/A
LA2980PA	Human and Financial Resources Implement Safeguards	Being complied with.

Source	Covenant	Status of compliance
Sched 5 para.10	Requirements. WMG shall make available necessary human and budgetary resources to fully implement, as applicable, the EMP and the RP.	
LA2980PA Sched 5 para.11	WMG shall ensure that all bidding documents and contract for Works contain specific provisions that require contractors to: (a) comply with the measures relevant to the contractors set forth in the EIA, the EMP and the RP and any corrective or preventative actions (i) set forth in a Safeguards Monitoring Report; or (ii) as subsequently agreed between ADB and WMG. (b) make available budget for all such environmental and social measures; (c) provide SPG and WMG with a written notice of any unanticipated environmental, resettlement or indigenous people risks or impacts that arise during construction, implementation or operation of the Project that were not considered in the EIA, the EMP and the RP; (d) adequately record the condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction; (e) reinstatement pathways, other local infrastructure, and agricultural land to at least their pre-project condition as soon as possible but not later than the completion of construction; and (f) comply with all applicable labor laws of the Borrower on the prohibition of child and forced labor; (ii) give equal work regardless of gender, ethnicity or social group; (iii) give priority to women in the employment and training opportunities generated in the Project's construction and operation phases; (iv) disseminate information on sexually transmitted diseases (including HIV/AIDS) and human trafficking to sub-contractors/employees and local communities surrounding the Project construction site; and (v) implement HIV/AIDS and human trafficking awareness activities.	Being partially complied with.
LA2980PA Sched 5 para.12	WMG shall: (a) submit semi-annual Safeguards Monitoring Reports to ADB during the implementation of the Project and disclose relevant information from such reports to affected people promptly upon submission; (b) if any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the EIA, the EMP, and the RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan; (c) engage, prior to commencement of any land acquisition and resettlement activities, qualified and experienced external expert(s) under a selection process and terms of reference acceptable to ADB, to (i) verify resettlement impacts; (ii) monitor and verify timely and full implementation of the RP; (iii) if any unanticipated resettlement /social risks arise during construction, implementation or operation of the Project that were not considered in the RP, promptly inform SPG, WMG and ADB of the occurrence of such risks, with detailed description of the event and proposed corrective action plan; and (iv) evaluate RP's effectiveness in achieving the desired	Being complied with.

Source	Covenant	Status of compliance
	outcome; (d) facilitate the external expert(s) engaged under sub-paragraph (c) in the carrying out of any monitoring and verification activities by such external expert (s); and (e) report any actual or potential breach of compliance with the measures and requirements set forth in the EMP and the RP, promptly after becoming aware of the breach.	
LA2980PA Sched 5 para.15	Grievance Redress Mechanism SPG shall cause WMG and WLMIDZMC to ensure that within 3 months following the effective date, (a) a safeguards grievance redress mechanism, acceptable to ADB, is established in accordance with the Provisions of the EMP and RP, to consider safeguards complaints; and (b) a grievance mechanism is established and a task force is functioning effectively to (i) review and document eligible complaint of Project stakeholders; (ii) proactively address grievances; (iii) provide the complainant of the Project with notice of the chosen mechanisms/action; and (iv) prepare periodic reports to summarize (1) the number of complaints received and resolved; (2) chosen actions; and (3) final outcomes of the grievances and make these reports available to ADB upon request. Eligible complaints include those related to the Project, any of the service providers, any person responsible carrying out the Project, complaint on misuse of funds and other irregularities as well gender-related grievances.	Being complied with. The institution arrangement of GRM has been established during the project preparation stage and now is in implementation by the PMO. The environment protection requirement, the purpose and arrangement of the GRM, and the contact numbers have been informed to the local communities before the construction started. So far no grievance was received yet.

LA=loan agreement, PA=project agreement.

4. MITIGATION MEASURES IMPLEMENTED

25. During this reporting period, according to the EMP requirements, PMO has completed the following tasks: 1) the environmental officers in PMO and PIO implemented the management work according to the EMP requirements; 2) IEM conducted the environmental monitoring and analysis during the construction period; 3) incorporated EMP and EIA clauses in bidding documents and contracts. Summary of potential project environmental impacts and mitigation measures is described in Table 4. The first three columns in Table 4 are in accordance with Table A2.1 in the EMP, and the forth column is a new one for implementation and compliance status assessment according to EMP.

Table 4 Summary of potential project environmental impacts and mitigation measures

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
A. Pre-Construction (Detailed design phase)			
Establish PMO environmental & social officers		• Officers nominated and roles clearly defined	Being complied with. PMO and PIO appointed one environmental and social officer in May 2014.
		GRM implemented and operating	Being complied with. GRM has been established and is being implemented during construction.
1. Conservation of salt pan habitat and migratory waterbirds	Loss of 110 ha salt pans and potential impacts to migratory waterbirds due to construction of Tianlu Lake	• Reduce loss of salt pans during detailed lake design – exclude areas identified by waterbird survey which support the highest numbers of waterbirds. See the ideal lake design. A compromise will need to be achieved between this and restrictions from topography and land tenure. • Finalize design of Tianlu Lake and calculate exact area of salt pans to be lost. • Design 'soft' transitional zone between western shore of lake and salt pans+reed beds to west; western shoreline of lake to be shallow-water areas with gentle gradient. • Construct new salt pans in the site of abandoned fishponds in west of Project area, before construction of Tianlu Lake. Specialist input to design the salt pans, water balances and salinity will be supported by an ADB grant ($350,000) to maximize the constructed habitat for small to medium sized waders and their food sources. • Prior to construction, delineate vegetation which will not be cleared, and if necessary erect temporary fencing. Ensure that all contractors are aware of these no-clearance zones and do not enter them.	Being complied with. It is advised by PMO that the construction of the 1650 mu new salt pan (Lubotan area) has been completed, the contract for the salt pans operation has been signed with a single contractor, and the operation and management has been initiated since December 2017
2. Review and revision of the EIA including this EMP after detailed engineering designs are completed	Spoil disposal sites	• Finalize the exact locations of the 8 spoil sites. All will be located to the east / north-east of Tianlu Lake to avoid disturbance to remaining saltpans. Prepare a spoil disposal and rehabilitation plan.	Partly complied with. 8 temporary spoil disposal sites situated to the east of Tianlu Lake have been selected at the early stage of the project. The spoil disposal and rehabilitation plan is still under preparation by the PMO. Uncontrolled dumping of spoil that caused the loss of over 1,000 mu

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
			(150 ha) salt pans *in addition* to the agreed 1,650 mu (confirmed by satellite images).
	Update EIA and EMP	• Review and update mitigation measures defined in the EMP and incorporate into the detailed design to minimize adverse environmental impacts	Being complied with. EMP has been reviewed and incorporated into the detailed design.
	Public consultations	• Conduct public consultation and stakeholder consultation as outlined in Table A2.3 of the EMP	Being complied with. The institution arrangement of GRM has been established during the project preparation stage and now is under implementation by the PMO.
	Bidding documents and contractor's qualifications	• Include the relevant sections of the DEIA, EIA and this EMP in the bidding documents, construction contracts and supply contracts. • Ensure that all salt pans, reed beds and other wetland habitats not cleared for lake construction are off-limits to construction personnel and this is stated in work contracts.	Being complied with. The environment safeguard requirements have been stated in both bidding documents and construction contract.
3. Bidding and Construction Preparation	Environmental operation and supervision	• Contractors will prepare an environmental operation, health, safety, and supervision manual for approval by the PIO.	Being complied with. The environmental operation, health, safety, and supervision manual has been prepared by the contractor and approved by PIO. Regular monitoring work has been conducted accordingly.
	Complaint and information office or appointed person	• A complaint and information office, with at least one staff member, will be established before construction begins. • Staff at this office will be trained to handle complaints from residents relating to environmental and cultural impacts.	Being complied with. The environmental officer of PMO is responsible for the GRM implementation.
	Environmental protection training	• Environmental specialists and/or officials from WEPB will provide training on implementation and supervision of environmental mitigation measures to relevant persons, especially construction engineers, managers, and contractors.	Being complied with. The Training for PIO, contractors, and construction supervision was organized in October 2016. Training for new contractor was conducted in January 18, 2018.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
	Engagement of EMC	• Prior to start of construction, a national environmental management consultant will be engaged.	Being complied with. The Loan environmental consultant of AECOM has already assisted PMO in the EMP implementation since April 2015.
	Engagement of IEM	• Prior to start of construction, an independent environmental monitoring contractor (IEM) will be engaged	Being complied with. The environmental monitoring in this reporting period was carried out by Xi'an Jingcheng Testing Technology Limited Company.
B. Construction Phase			
1. Spoil disposal site management and rehabilitation		• Manage temporary spoil disposal sites in accordance with approved plan by the Weinan EPB • Rehabilitate spoil disposal sites in accordance with this plan • Conduct regular internal supervision and periodic external monitoring (licensed soil erosion institute) of the disposal sites • Conduct project completion audit to confirm the spoil disposal sites were rehabilitated in accordance with the plan • Hold contractors liable in case of non-compliance	Not complied with. Large amount of soil from the lake excavation piled up around Tianlu Lake caused loss of more salt pans. Some of the spoil has been used for the nearby airport construction according to the original plan. It is proposed by PMO that the spoil will be used for the construction of the ecological soil and water conservation demonstration zone around Tianlu Lake, which project was approved by local government in 2016. This dispose scheme will need to be discussed with ADB for approval. Detailed spoil disposal and rehabilitation plan, including the soil balance calculations, disposal schedule, agreement for spoil acceptance by the other department as needed, and maps of where spoil will be removed and disposed, etc. will be prepared by PMO and approved by the EPB.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
2. Soil	Soil erosion and sediment run-off due to construction activities	• Implement erosion protection measures such as terraces and silt barriers during excavation works • Stabilize all excavation slopes, embankments, and other erosion-prone working areas during excavation works • All earthwork areas will be stabilized within 30 days after earthworks have ceased at the sites • Divert drainage around areas of excavation during channel rehabilitation and lake excavation works • Undertake excavation in sections, minimizing the area of active excavations at any one time during channel rehabilitation and lake construction activities • Establish temporary detention ponds to control silt runoff • Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage • Strip and stockpile topsoil, cover or seed temporary soil stockpiles • Limit construction during heavy rain and high winds • Properly slope or re-vegetate disturbed surfaces • Locate construction camps and storage areas to minimize the land area required and impact on soil erosion	Partly complied with. Most of the mitigation measures are undertaken accordingly during the construction activities. The earthwork area around the new excavated Tianlu Lake need to be recovered after the construction completion.
	Soil erosion and sediment run-off due to construction activities - Additional measures around NWP	• Where channels drain into the NWP, additional silt barriers will be applied 100 m upstream of interception with the wetlands • During construction phase, wetland water quality will be monitored weekly at the intersection point of each drainage channel • If evidence of sediment runoff entering wetlands is recorded, construction works will be halted and corrective action (improved siltation protection measures) will be implemented	Not yet due.
	Soil contamination	• Store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, using best management practice to avoid soil contamination • Remove construction waste to approved waste disposal sites • Establish emergency preparedness and response plan (Spill Management Plan) in compliance with PRC regulations and the Worldbank Group's EHS Guidelines (General Guidelines, Toll Roads) • Provide spill cleanup measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures	Being complied with. Mitigation measures for soil contamination are being conducted during the construction by contractor. The emergency preparedness and response mechanism has been included into the construction management of both PMO and PIO.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
	Changes in hydrology	• Conduct drainage channel rehabilitation and lake construction works during the dry season (November to February). • Provide adequate opening for flood flow before the rainy season (May to August)	Being complied with.
3. Water hydrology and quality	Changes in hydrology – Additional measures around NWP	• Establish drainage control sluice gates prior to channel rehabilitation and lake construction works • Actively monitor and control water levels within wetlands with sluice gates during the construction phase	Not yet due.
	Surface and groundwater pollution	• Prior to lake construction, wastewater entering the project area along the north-south canal will be permanently diverted to an existing canal east of the project area • Map the existing channel network and ensure that channels for wetland drainage and urban/industrial drainage are kept separate • Follow the national protocol for transferring fuels and oil (Standard JT 3145-88 - Transportation, Loading and Unloading of Dangerous or Harmful Goods) • Collect wastewater from construction works in sedimentation tanks, retention ponds, and filter tanks to remove silts and oil • Equip all areas where construction equipment is being washed with water collection basins and sediment traps • Locate fuel storage, maintenance, and vehicle cleaning areas at least 300m from the nearest water body • Locate storage facilities for fuels, oil, and other hazardous materials in secured areas on impermeable surfaces, and provide bunds and cleanup installations • Locate labor camps at least 500 m from sensitive receivers • Install eco-toilets and septic treatment and disposal systems at construction camps along with proper maintenance protocols • During construction, monitor water quality (including SS, TP, TN, oil, grease) and water balance indicators (total flows into, and discharging from) the drainage channels and Tianlu+Tianjiao Lakes as per this EMP (see Tables A2.2 and A2.3)	Being complied with. Wastewater control measures were taken according to the EMP, and the water quality monitoring has been conducted by the environment monitoring company.
	Surface and groundwater pollution – Additional measures	• Discharge of wastewater into the wetlands is prohibited. Instead, wastewater will be discharged after pre-treatment to the municipal sewer and treated in the Pucheng Wastewater Treatment Plant • Work camp will not be located within wetland areas • Locate fuel storage, maintenance, and vehicle cleaning areas at least 1 km from	Being complied with. The measures were taken, and the surface water monitoring was conducted.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
	around NWP	the NWP boundary • Implement awareness and training program for workers. Prohibit workers from entering non-work areas	
	Dust from construction sites	• Materials storage sites will be at least 400 m from sensitive receptors such as residential areas and wildlife habitats • Extra care will be paid during dry, strong windy days • Spray water on construction sites and material handling routes where fugitive dust is being generated • Upon completion of civil works, all construction sites will be required to be re-vegetated with trees and grasses • Cover materials during truck transportation, in particular, the fine material, to avoid spillage or dust generation	Being complied with. The dust control measures during construction were taken accordingly. Some of the construction site recover should be speed up after the civil works completion.
4. Air Quality	Air emission from asphalt pavement, vehicles and construction equipment	• Locate asphalt plants and mixers at least 200 m downwind from the nearest residential areas and other sensitive receptors • Implement a regular inspection and certification system for vehicle and equipment emission • Store petroleum or other harmful materials in appropriate places and cover to minimize fugitive dust and emission • Ensure that all vehicles onsite meet the PRC emission standards for efficient running and fuel-burning: *GB18352-2005, GB17691-2005, GB 11340-2005, GB3847-2005, and GB18285-2005* • Ensure that equipment and machinery emissions comply with *GB16297-1996.* • Conduct monthly inspections to ensure that vehicles and machinery meet the standards listed above.	Being complied with. Regular inspections were taken to make sure the vehicles and equipment emissions can meet the standards, and harmful materials store in appropriate places. Regular air quality monitoring are in progress.
5. Noise	Noise from equipment and vehicles	• Conduct background checks of manufacturing specifications of all major equipment and machinery to be used on-site to ensure they comply with national standard *GB12523-2011* • Provide routes for large trucks to avoid residential areas • At construction sites within 500 m of the nearest residence, construction activity will be stopped between 22:00 and 06:00 hours, or in accordance with public consultation	Being complied with. All the related measures have been taken, and the noise monitoring has been conducted.
	Community complaints about noise	• Conduct fortnightly interviews with residents near construction sites to identify any community complaints about noise and seek suggestions from community members to reduce noise annoyance • Community suggestions will be used to adjust work hours of noise-generating	Being complied with. The construction noise has been controlled to meet the standard. No community complaints about

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
		machinery	noise have been received during this reporting period.
	Noise impacts on the NWP	• Erect temporary noise barriers around noise sources during construction to comply with Class I (55 dB(A) daytime) of the PRC Ambient Noise Standard (*GB 3096-2008*) • Prohibit use of noise-intensive machinery during the migration season and breeding season • Prohibit construction during night time • Prohibit access to the NWP at night • Erect warning signs to prohibit horn blowing by construction traffic	Being complied with.
6. Solid waste	Domestic waste from construction camps	• Multi-compartment collection bins will be provided to facilitate reuse, recycling and composting of solid waste • Store waste away from water bodies. Waste will be regularly collected by the Weinan Municipal waste collection and hauled to the municipal sanitary landfill • Hold contractors responsible for proper removal and disposal of any significant residual materials, wastes or contaminated soils after construction. Any paving or revegetation shall be done as soon as materials are removed, to stabilize the soil • Prohibit burning of waste	Being complied with. The solid waste was collected regularly and transported to the local landfill plant.
7. Migratory waterbirds and other native flora and fauna	Flora	• In compliance with the PRC's forestry law: (i) document the specific areas of trees and other vegetation which are cleared; (ii) undertake compensatory planting of an equivalent or larger area elsewhere in the project area • For replanting to compensate clearance of existing habitats, only native plant species of local provenance will be used. • Restoration will focus on cleared/bare land, especially erosion-prone slopes, to reduce flooding, soil erosion, and benefit local biodiversity. Areas under rehabilitation will be temporarily fenced.	Being complied with. The construction has been conducted according to the requirement of both PRC's forestry law and EMP for planting protection.
	Fauna	• Construction at Tianlu Lake will be timed to avoid the waterbird migration seasons (March-April and Sep-Oct) as far as possible. • Secure and protect all remaining areas not to be cleared or constructed, including bunds of channels and remnant vegetation • If mammals, birds, amphibians or reptiles are found trapped in construction sites (e.g. new channels, pits), carefully catch these and immediately release them in the reed beds west of the proposed Tianlu Lake. Do not keep them in captivity • If any injured animals are found during construction, immediately report this to WFB and WEPB, who will decide whether the individual should be immediately	Being complied with. Waterbirds and other animals protection measures has been conducted during the Tianlu Lake excavation according to EMP requirement,

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
		euthanized or rehabilitated. Injured animals will only be held in captivity for rehabilitation and will then be released, after confirmation by a qualified vet it is disease-free. • Report all records of biodiversity to the WFB and WEPB • Ensure that Tianlu and Tianjiao Lakes are both included within the NWP master plan and subject to regulations for multiple use and wetland conservation	
	Flora and fauna – Activities to be conducted for Project Output 3 – not part of the EMP but which strengthen the EMP measures	• Gazettement of a new NWP, which will protect 75% of the remaining salt pan habitat for migratory waterbirds. • Potential inclusion of 100 ha of salt pans and ponds, west of the proposed NWP boundary, which were only recently identified. • Finalization of a NWP master plan, including participatory development of regulations to manage the park for biodiversity, local livelihoods and tourism. • Extensive training in waterbird and wetland management. • Construction of a wetland center. This will be located on unused land and will not involve loss of any wetland habitats.	Not yet due.
	Traffic disturbance	• Select transport routes to reduce disturbance to regular traffic • Divert traffic at peak traffic hour	Being complied with
8. Social and Cultural Considerations	Cultural heritage	• Cultural heritage sites will be preserved where identified. In accordance with PRC regulations, no person shall destroy, damage, deface, conceal, or otherwise interfere with a relic. • If a cultural resource is unearthed, work will be stopped immediately and the matter promptly referred to the county, municipal, provincial or state agencies for evaluation and decision on appropriate actions	Not yet due. No cultural resource has been unearthed during construction.
9. Health and safety	Occupational health and safety (OHS)	• Appoint Environmental, Health and Safety Officer to implement and supervise the Environmental, Health, and Safety Management Plan • Develop and implement an Environmental, Health and Safety Management Plan (EHSMP) which shall include the following provisions: (i) Provide clean and sufficient freshwater for construction and camps (ii) Provide adequate latrines and other sanitary arrangements at the site, maintained in a clean and hygienic state (iii) Provide sufficient garbage receptacles on site (iv) Provide personal protection equipment (PPE) in accordance with relevant health and safety regulations (v) Develop an emergency response plan for incidents, including hazardous	Being complied with. The Environmental officer has been appointed by the PMO to conduct the Environmental, Health and Safety (EHS) work simultaneously.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
		material spills and similar events, in compliance with PRC regulations and the WB Group's EHS Guidelines (vi) Provide a fully equipped first-aid base in all camps (vii) Establish a OHS Records Management System (viii) Train staff in OHS and emergency preparedness/response (ix) Implement awareness and prevention program for sexually-transmitted diseases (x) Prior to construction, purchase insurance for casualty accident (workers) and third party insurance (for public) (xi) Implement OHS measures to protect the public e.g. warning signs for safety hazards and barriers to restrict public access (xii) Prohibit smoking on construction sites and in the NWP	
C. Operation phase			
1. Hydrology and water quality	Eutrophication (Nutrient runoff)	• Regulate surface water levels in NWP at pre-construction levels by use of sluice gates and monitoring. • Prohibit discharge of all sewage (untreated/treated) into the Luoxi drainage system • Prior to construction and after detailed Project design, develop an integrated nutrient management plan for the Project area. Aim: to address sources of pollution (point, non-point) in the Project area. The plan will include: (i) Improved monitoring and equipment in the Project area (ii) Improved fertilizer application rates (iii) Use of constructed wetlands at drainage channel discharge points aimed at reducing nutrient levels (iv) Farmer training to improve fertilizer application • Mitigation will be guided by ongoing monitoring of surface and groundwater quality, including TN and TP concentrations in lake and drainage waters – see Table A2.4 of the EMP	Not yet due.
	Salinity Discharge to Luo River	• Monitor salinity discharge from the drainage system into the Luo River as detailed in Table A2.4 of the EMP to confirm the modelling results detailed in this EIA report (2012)	Not yet due.
	Salt pan habitat, migratory waterbirds and	• Document patterns of habitat use by waterbirds after construction of Tianlu Lake: establish seasonal protection zones of any new roosting / foraging sites in/around Tianjiao and Tianlu Lakes. • Ensure that the 550 ha (75%) of remaining salt pans identified for inclusion in the	Not yet due.

Impact Factor/ Stage (1)	Potential Impacts and/or Issues (2)	Mitigation Measures (3)	Implementation status and compliance with EMP
	other biodiversity	NWP are identified within the draft NWP master plan. And, that park regulations are developed which only permit the use of the salt pans for current local livelihoods – salt harvesting – and no commercial development.	
2. Biodiversity	Insufficient environmental management capacity	• Ensure that the environmental training activities to be implemented by the Project are integrated with activities under the EMP, including training in: (i) monitoring of waterbird populations, water levels and salinity concentrations; (ii) capacity building to implement the EMP	Not yet due.
3. Environmental and social management		• Ensure that records of any grievances are well maintained and regularly updated and that the GRM is operational.	Not yet due.

ADB = Asian Development Bank, EIA = environmental impact assessment, EMC = environmental management consultant, EMP = environmental management plan, EPB = Environmental Protection Bureau, GB = *Guo Biao* (National Standards), IEM = independent environmental monitor, m = meter, IA = implementing agency, PMO = provincial project management office, PPTA = project preparatory technical assistance, PRC = People's Republic of China, EIA = initial environmental examination, SARDI = Shaanxi Animal Research Design Institute, TP = total phosphorous content, TN = total nitrogen content, WEPB = Weinan Environmental Protection Bureau, WFB = Weinan Forestry Bureau, WMG = Weinan Municipal Government, WRB = Water Resources Bureau. Sources: Domestic EIA report, and consultations with WEPB.

5. REPORTING AND MONITORING

5.1 Project environmental reporting

26. According to the requirements of the EMP, preparation of the following items should be submitted for the Project: 1) the contractor should submit construction environmental reports every month; 2) the environment monitoring company should submit environment monitoring reports to IA and EPB during the construction every month; 3) IA should submit Environmental Report to the PMO each quarter; 4) PMO should submit environmental report to Weinan City Environmental Protection Bureau every six months; 5) environmental specialists should submit environmental report every six months to IA, PMO, and Weinan EPB; 6) environmental experts should assist the PMO to prepare semi-annual environmental reports and project completion reports (including environmental protection contents), which are submitted to ADB; 7) environment protection inspection and audit reports; and 8) bird experts need to submit waterbird monitoring reports to PMO each year.

27. During the reporting period, the project construction was in progress. Summary of the report completion in current situation is shown in the table below.

Table 5 Project reporting plan

Agency	Report	To	Frequency	Compliance during this reporting period		
				# reports due	# reports received	Actions taken
Contractor	Internal progress report	PMO, IAs	Monthly	1	1	Being complied with. The internal progress report was prepared by PIO and submitted to PMO every month.
EMS/EMC	Environmental monitoring report (air, noise, water, soil)	EPB, PMO	Semi-annual	6	6	Being complied with. The environmental monitoring in this reporting period was carried out by Xi'an Jingcheng Testing Technology Limited Company.
Waterbird Specialist	Waterbird monitoring report	PMO	annual	6	6	Being complied with.
PMO	Summary environmental monitoring report	ADB	Semi-annual	8	8	Being complied with.
LIEC	Summary environmental monitoring report	PMO, ADB	Project-specific	7	7	Being complied with.
Licensed institute	Environmental	EPB	Once; within 3	Not yet	Not yet	Not applicable

	acceptance monitoring and audit report		months of completion of physical works	due	due	

ADB=Asian Development Bank, IA=Implementing Agency, EMC=Environment Monitoring Station, EPB=Environmental Protection Bureau, LIEC=Loan Implementation Environmental Consultant, PMO=Project Management Office, EMC=Environment Monitoring Corporation.

5.2 Summary of project environmental monitoring

28. In accordance with the EMP, there are three types of environmental monitoring need to be conducted by the project.

1) **Project readiness monitoring.** To be conducted by the PMO and Loan Implementation Environmental Consultant (LIEC).

2) **Project impact monitoring.** Probably to be conducted by three groups: (a) The local Environmental Monitoring Station under the local Environment Protection Bureau - for air, water, noise, soil. (b) Any other specialists contracted for the Project – for additional, project-specific issues e.g. flora, fauna. (c) The contractors – who will conduct frequent environmental monitoring at construction sites and to report monitoring results in the framework of their regular progress reports to the PMO and the IAs.

3) **Independent evaluation.** To be conducted by the LIEC or an external monitoring agency contracted by the Project. To verify EMP compliance during project implementation.

29. The construction of contract package ADB-FM-CW-02-01~05, ADB-SS-CW-03 and ADB-SS-CW-04 was in progress in this reporting period, and the environmental monitoring work in this reporting period was carried out from 19th December 2017 to 25th December 2017.

5.3 Project environmental protection preparation

30. Project environmental protection preparation works are shown in Table 6 as following.

Table 6 Project readiness evaluation indicators

Indicator	Criteria	Assessment
EMP update	• EMP was updated after technical detail design & approved by ADB	No The construction content was in accordance with the design in PPTA stage at present. EMP will be updated if there is any design changes during construction stage.
Compliance with	• The borrower complies with loan covenants related to project	Partly comply with.

Indicator	Criteria	Assessment
loan covenants	design and environmental management planning	The project construction has not been completed. Most of the loan covenants are being complied with.
Public involvement effectiveness	• Meaningful consultation completed	Yes
	• GRM established with entry points	Yes
Environmental Supervision in place	• LIEC is in place	Yes
	• PMO environment and social officers appointed by PMO	Yes
	• Environment monitoring station contracted by PMO	Yes
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances	Yes
	• Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP	Yes
	• Environmental requirements of EMP included in contract documents for construction contracts	Yes
EMP financial support	• The required funds have been set aside for EMP implementation	Yes

5.4 Project impact monitoring

31. According to ADB requirement, project impact monitoring should be conducted during both the construction and operation stage. The proposed environmental monitoring contents in the EMP (Table A2.3) are shown in Table 7.

Table 7: Environmental Monitoring Content

Project	Parameters	Address	Time and frequency	IA	Supervise Agency	Construction cost estimation （$/yr, ‘000s）	Operation cost estimation （$/yr, ‘000s）
1.Contractor performance against environmental management plan	inspection and examination	all fields	every week	PMO， IA， EMC	WEPB	10	-
2.water quality	see environmental management schedule A2.2	•100m upstream of the outfall of Luo River • 100m downstream of the outfall of Luo River • Four wetlands • 6 main drainage channel	• Every month during construction • every three months in construction	IEM,EMS	EMC, IA, PMO,WEPB	100	30
	sediment	• depends on observation	• every week in construction	IEM，EMS	EMC,IA,PMO,WEPB	5	-
3.hydrology	surface water level	• four wetlands	• every month in construction • every three months after construction	IEM，EMS	EMC,IA,PMO,WEPB	10	5
	groundwater level	• four wetlands	• every month in construction • every three months after construction	IEM，EMS	EMC,IA,PMO,WEPB	10	5
4.soil(spoil)	see environmental management schedule A2.2	• excavation spoil	• One sample per 100,000 m^3 excavated (about 100 samples in total) • if pollution overflow occurs, add more sampling sites	IEM，EMS	EMC,IA,PMO,WEPB	10	-

Project	Parameters	Address	Time and frequency	IA	Supervise Agency	Construction cost estimation （$/yr, '000s）	Operation cost estimation （$/yr, '000s）
5.noise	see environmental management schedule A2.2	• 10 monitoring sites related to construction	•every month during construction; twice per day (daytime and night)	IEM，EMS	EMC,IA,PMO, WEPB	50	-
6.air	see environmental management schedule A2.2	• 5 monitoring sites related to construction	• every month in construction	IEM，EMS	EMC,IA,PMO, WEPB	25	-
7.water bird	NA	• Select monitoring sites according to water birds monitoring activities in 2012.	• At least 5 times during the five-year project construction period (2013-2017)	SARDI	EMC,IA,PMO, WEPB	10	10
8、EOHS	Inspection and estimation according to the environmental management schedule A2.1	• all flied	•random inspection • at least one year for each construction campus	IEM，EMS	EMC,IA,PMO, WEPB	20	-
					Total	250	50

EMC= environmental management consultant；EMP= environmental management plan；EMS= environmental monitoring station at city or county level；EPB= environmental protection bureaus；IEM= independent environmental monitor；IA= implementing agency；PMO= provincial project management office；SARDI = Shaanxi Animal Research Design Institute, WEPB= Weinan Environmental Protection Department；EOHS= Environmental Occupational Safety & Health

5.5 Construction phase

32. Xi'an Jingcheng Testing Technology Limited conducted surface water sampling and monitoring on 23th December 2017; the sampling and analysis of soil in the excavation site were conducted on 23th December 2017; air sampling and analysis was carried out from 19th December to 25th December 2017; and the noise monitoring was conducted on 23th December 2017.

33. The distribution of the monitoring points is shown in Figure 1. And the monitoring sections and contents are listed in Table 8 – Table 13 separately.

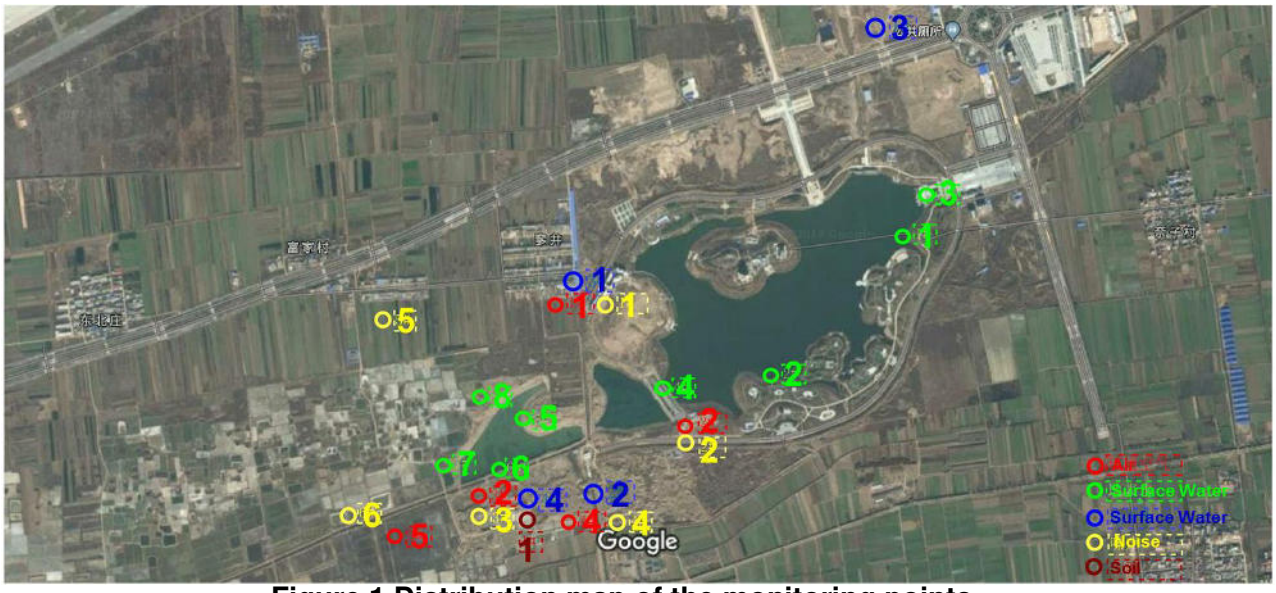


Figure 1 Distribution map of the monitoring points

Table 8 Monitoring sections of surface water - Wetland of both Tianjiao Lake and Tianlu Lake

No.	Point Name	Monitoring Content
1#	Located in the east of the island	DO, COD, BOD_5, TDS, TN, TP, Coliform
2#	Located in the south of the island	
3#	Located in the Guyun wharf of Lutan	
4#	Located near the Tianhong Bridge	
5#	East bank of Tianlu Lake	
6#	South bank of Tianlu Lake	
7#	West bank of Tianlu Lake	
8#	North bank of Tianlu Lake	

Table 9 Monitoring sites of surface water-Central Main

No.	Point Name	Monitoring Content
1#	Near the culvert of Central Main	DO, COD, BOD_5 , TDS, TN, TP Coliform
2#	Central Main in the east of Jingjia Village pumping station	

3#	Joint of East Main and Tianyang Avenue	
4#	700m west from the intersection of Central Main and West Main	

Table 10 Monitoring sites of soil environment

No.	Sampling Point	Monitoring Content
1#	Excavation site	Cr, As, Pb

Table 11 Monitoring sites of noise

No.	Point Name	Monitoring Content
1#	500 m northwest from Tianhong Bridge	Daytime Nighttime
2#	Southern end of Tianhong Bridge	
3#	500 m west from the intersection of Middle Main and Lake Road	
4#	Intersection of East Main and West Main	
5#	3 km west from the culvert of Central Main	
6#	3 km west from the intersection of Central Main and West Main	

Table 12 Monitoring sites of ambient air

No.	Point Name	Monitoring Content
1#	500 m northwest from Tianhong Bridge	TSP, SO_2, NO_2, PM10
2#	Southern end of Tianhong Bridge	
3#	500 m west from the intersection of Middle Main and Lake Road	
4#	Intersection of East Main and West Main	
5#	2 km west from the intersection of Central Main and West Main	

34. The related detection methods, executive standard and baseline of environmental quality are shown in Table 13 and Table 14.

Table 13 Environmental quality detection methods

Item	Detection Methods	Detection Limit
Surface water		
DO	Water quality - Determination of dissolved oxygen - Electrochemical probe method （HJ 506 - 2009）	/
COD	Dichromate Method （HJ828-2017）	4mg/L
BOD_5	dilution and seeding method （HJ505-2009）	0.5 mg/L
fecal coliform	GB/T 5750 - 2006	/
total salt content	Water quality - Determination of total salt - Gravimetric method	5mg/L

	（HJ/T 51-1999）	
TN	Water quality-Determination of total nitrogen-Alkaline potassium persulfate digestion UV spectrophotometric method （HJ 636—2012）	0.05 mg/L
TP	Alkaline potassium persulfate digestion-UV spectrophotometric method （GB11893-1989）	0.01mg/L
Air		
SO_2	Ambient air—Determination of sulfur dioxide—Formaldehyde absorbing-pararosaniline spectrophotometry (HJ 482—2009)	0.007mg/m^3 Hourly average
		0.004mg/m^3 Daily average
NO_2	Ambient air--Determination of nitrogen dioxide--Saltzman method (GB/T 15435-1995)	0.005mg/m^3 Hourly average
		0.003mg/m^3 Daily average
PM10	Determination of atmospheric articles PM10 and PM2.5 in ambient air by gravimetric method （HJ 618-2011)	0.01mg/m^3
TSP	gravimetric method (GB/T15432-1995)	0.001mg/m^3
Noise		
Environment Noise	Environmental quality standard for noise (GB 3096-2008)	--
Solid		
As	Soil and Sediment-Determination of mercury, arsenic, selenium, bismuth and antimony-Microwave acid dissolution/Hydride generation-atomic fluorescence spectrometric method (HJ680-2013)	0.01 mg/kg
Pb	Determination of lead, cadmium_Graphite furnace atomic absorption spectrophotometricry (GB/T17141-1997)	0.2 mg/kg
Cr	potassium permanganate oxidation-diphenylcarbohydrazide spectrophotometric (GB7466-87)	1.0 mg/kg

Table 14 Project Environmental Monitoring Parameters, Standard Limits and Baseline

Media		**Executive Standard**	**Selected Monitoring Parameters**	**PRC Standard**	**Baseline[1]**
Surface Water mg/L	• Luo River	Environment Quality Standard for Surface Water （GB3838-2002）Class III	DO	5	8.8 – 10.2
			COD	20	32 - 45
			BOD_5	4	10.6 – 16.3
			TN	1.0	3.83 – 6.16
			TP	0.2	0.15 – 0.19
			Fecal Col	10,000	7,933 - 16,000
			Salinity (TDS)	-	1,100
	• Tianjiao Lake • Tianlu Lake • Wetlands	Environment Quality Standard for Surface Water (GB3838-2002）Class IV	DO	3	ND
			COD	30	27 - 37
			BOD_5	6	ND
			TN	1.5	1.6 – 3.3
			TP	0.1	0.03 – 0.1

[1]Baseline data from monitoring events were undertaken in 2011 and 2012 as reported in the PPTA EIA Report (2012)

			Fecal Col	20,000	ND
			Salinity (TDS)	-	251 – 7,669
Water balance*			Monthly flow volumes	None	Pre-construction
Groundwater		Quality standard for ground water （GB/T 14848-93） Class IV	Monitoring only required in a pollution event occurs		NA
Soil Spoil from excavation pH>7.5[2] mg/kg		Environmental quality standard for soils（GB15618—1995） Class II	Arsenic	30	4.11 – 6.37
			Lead	300	17.9 – 31.5
			Chromium	200	47.7 – 67.9
			DDT	0.50	ND
			TPH	100	ND
Air mg/m³		Ambient air quality standards （GB3095-2012）Class II	TSP	0.30	0.141 – 0.3
			PM10	0.15	0.06 – 0.15
			NO_2	0.12	0.019 – 0.08
			SO_2	0.15	0.036 – 0.15
Noise dB(A)		Environmental quality standard for noise（GB 3096-2008） Class II	Day	60	50
			Night time	50	45

BOD = biochemical oxygen demand, COD = chemical oxygen demand, dB(A) = A-weighted decibel, m = meter, pH = measure of acidity and alkalinity, PM10 = particulate matter smaller than 10 micrometers, TN = total nitrogen, TP = total phosphor, TSP = total suspended particulates, TSS = total suspended solids, Source(s): Domestic EIA, and consultations with PMO, WEPB, and IA. *Flow volume will be measured at key water entry points (channels) into the wetlands + Tianlu + Tianjia Lakes and, at key discharge outlets from the wetlands and both lakes

35. The monitoring results are shown as following. And the detailed monitoring report is shown in Appendix 2.

1. Air, noise, soil, and water quality

a) Results

[2] Note, all soils tested within Project Area where pH>7.5

Table 15 Air, noise, soil and water quality monitoring results

Project	Monitoring subject	Site	Frequency	Data Analysis					
				Item	Monitoring Results	National Standard	Baseline Value	Excessive indicators	Note
1. Contractor performance according to the environmental management plan requirement	Inspection and examination	All fields	every week						The contractor has conducted daily qualitative environmental inspection according to the environmental requirement in the contract.
2.Surface and ground water quality	According to Table A2.2 in EMP	• 100m upstream of the outfall of Luo River • 100m downstream of the outfall of Luo River	• every month in construction • every three months after construction						The items were not monitored in this report period.
		• 4 points in Tianjiao Lake		DO (mg/L)	7.01-7.33	3		NO	
				COD(mg/L)	59.0-79.0	30	27 -37	YES	
				BOD_5 (mg/L)	12.9-19.5	6		YES	
				TN (mg/L)	1.73-5.03	1.5	1.6 – 3.3	YES	
				TP (mg/L)	0.07-0.15	0.1	0.03 - 0.1	YES	
				fecal coliform (MPN/100 mL)	5-8	2×10^4 /L		NA	
				salinity (TDS) (mg/L)	1.20×10^4 – 1.28×10^4		251 - 7669	NA	
		• 4 points in Tianlu Lake		DO (mg/L)	5.45-5.62	3		YES	
				COD(mg/L)	34-44	30		YES	

Project	Monitoring subject	Site	Frequency	Data Analysis					
				Item	Monitoring Results	National Standard	Baseline Value	Excessive indicators	Note
				BOD_5 (mg/L)	9.0-12.7	6		YES	
				TN (mg/L)	6.33-7.21	1.5		YES	
				TP (mg/L)	0.07-0.24	0.1		YES	
				fecal coliform (MPN/100 mL)	2-5	2×10^4 /L		NA	
				salinity (TDS) (mg/L)	8.00×10^3 – 8.20×10^3		251 - 7669	NA	
		• 4 sites in main channel		DO (mg/L)	5.34-6.76	3		NO	
				COD(mg/L)	25-39	30		YES	
				BOD_5 (mg/L)	5.2-9.1	6		YES	
				TN (mg/L)	2.11-13.7	1.5		YES	
				TP (mg/L)	0.1-1.22	0.1		YES	
				fecal coliform (MPN/100 mL)	8-22	2×10^4 /L		NA	
				salinity (TDS)	3.85×10^3 – 8.76×10^3			NA	
	sediment	• Visual inspection	• every week in construction						Not monitored in this report period
3. Water hydrology, including flow volumes into and out of the NWP and Tianlu+Tianjiao Lakes	surface water level	• 4 locations in wetlands	• every month in construction • every three months after construction						Not yet due.
	groundwater level	4 locations in wetlands	• every month in construction • every three						Not yet due.

Project	Monitoring subject	Site	Frequency	Data Analysis					
				Item	Monitoring Results	National Standard	Baseline Value	Excessive indicators	Note
			months after construction						
4. Soil (Spoil)	According to Table A2,2 in EMP	Excavated spoil	• One sample per 100,000 m^3 excavated (approximately 100 samples in total) • if pollution overflow occurs, add more sampling sites	As (mg/kg)	3.18-10.9	30	4.11-6.37	NO	
				Pb (mg/kg)	14.6-37.1	300	17.9-31.5	NO	
				Cr (mg/kg)	25.2-78.6	200	47.7-67.9	NO	
				DDT (mg/kg)	not monitoring	0.5	not detected	NA	
				TPH (mg/kg)	not monitoring	100	not detected	NA	
5. Noise	According to Table A2,2 in EMP	10 monitoring locations associated with major construction works	• every month in construction, twice per day (daytime and night)	L_{Aeq} (dB) Daytime	46.6-48.7	60	50	NO	
				LAeq (dB) Nightime	39.2-40.5	50	45	NO	
6. Air	According to Table A2,2 in EMP	5 monitoring locations associated with major construction works	• every month in construction	TSP (mg/m^3)	0.197-0.384	0.3	0.141-0.3	YES	The statistics is for daily average monitoring
				PM10(mg/m^3)	0.101-0.193	0.15	0.06-0.15	YES	
				NO2(mg/m^3)	0.030-0.054	0.12	0.019-0.08	NO	
				SO2(mg/m^3)	0.019-0.035	0.15	0.036-0.15	NO	
7. Water bird	NA	Monitoring sites will follow those of the 2012 watrebird survey	• At least 5 times during the five-year project construction period (2013-2017)						The water bird monitoring was conducted from March to November in 2017, and the number and

Project	Monitoring subject	Site	Frequency	Data Analysis					
				Item	Monitoring Results	National Standard	Baseline Value	Excessive indicators	Note
									distribution of the water bird was analyzed in the monitoring report.
8.Environmental Health and occupational disease	According to Table A2,1 in EMP	• all monitoring sites	• Random inspection • at least one year for each construction campus						Only routine Environmental Health and safety inspection was included in the contractor's supervision.

b) Assessment

Surface Water

36. The executive standard of the surface water monitoring parameters for this project are shown in Table 14.

37. The monitoring reports showed that, in Tianjiao Lake Wetland, Dissolved Oxygen (DO) values in all of the 4 monitoring points can meet the Class IV Standard requirement in the Environmental Quality Standards for Surface Water (GB3838-2002). TP value of No. 1, No.2, and No.4 monitoring section can meet Class IV Standard requirement of GB 3838-2002, however No.3 monitoring section can only meet Class V standard of GB 3838-2002. Only the TN value of No. 4 monitoring section can meet the Class IV standard requirement of GB 3838-2002, TN in other monitoring sections all exceeded the Class V standard. All of the monitored COD and BOD5 values in Tianjiao Lake exceed the Class V standard.

38. The water quality monitoring for the new excavated Tianlu Lake was also conducted during this reporting period. According to the monitoring results, the DO value in all of the 4 monitoring sections in Tianlu Lake can meet the Class IV standard of GB 3838-2002. TP values of No. 5, No. 6 and No. 8 monitoring sections can meet the Class IV standard, but the No. 7 sections exceed the Class V standard. Both the COD and BOD5 values of No.5 and No.6 sections can only meet the Class V standard of GB 3838-2002, and the values of No.7 and No.8 sections slightly exceed the Class V standard. The TN values of all the monitoring sections of Tianlu Lake exceed the Class V standard.

39. The values of the salinity (TDS) monitored in both Tianjiao Lake and Tianlu Lake were higher than the background values in PPTA stage.

40. As to the water quality monitoring in main channel, DO can meet the Class IV requirement of GB3838-2002. TP values in the No.1 section can meet the Class IV standard of GB3838-2002, but in the No.2, No.3 and No.4 sections exceed the Class V standard. The COD values in No. 3 and No.4 sections can meet the Class IV standard, in No.1 and No.2 sections exceed the Class IV standard but can meet the Class V standard. BOD5 values in No.3 section can meet the Class IV standard, in No.1, No.2 and No.4 sections exceed the Class IV standard but can meet the Class V standard. TN values of all the monitoring sections exceed the Class V standard.

41. The unit of monitored data of fecal coliform is inconsistent with the National Environmental Protection Standard (GB3838-2002), so it can't be compared with the standard requirement. It is suggested that both the monitoring analysis methods and the unit of monitored data should be referred to the National Environmental Protection Standard (GB3838-2002).

42. The main reasons of the exceeded water quality standard were caused by:

1) The monitored data of COD, BOD5, TN, and TP was high in the previous monitoring period. It is difficult to lower the pollution concentration only by the limited water self-purification ability of the lakes without any wastewater treatment or water quality improvement measures.
2) The surface water sampling was conducted in dry season, so the TDS values are higher than the baseline value.

Soil

43. The standard requirement of the soil monitoring parameters for this project is shown in Table 14.

44. The results of soil monitoring showed that the As, Pb and Cr pollution in the monitoring sites can meet the secondary standard requirement in Soil Environmental Quality Standard (GB15618-1995).

Noise

45. The standard requirement of the noise monitoring parameters for this project is shown in Table 14.

46. The monitored data of equivalent sound level (Leq [dB(A)]) at the boundary of construction area can meet the standard requirement of second-class noise environment functional area (residential, commercial and industrial mixed zone) in National Acoustic Environmental Quality Standard (GB3096-2008).

Air

47. The standard requirement of the air monitoring parameters for this project is shown in Table 14.

48. Seven days continuous air quality monitoring was carried out from 19th-25th December 2017. The monitoring results of both SO2 and NO2 during the sampling period can meet the Class II standard of "Ambient Air Quality Standard" (GB3095-2012). For the PM10 and TSP value, it can meet the Class II standard requirement of GB3095-2012 except for the period during 22th-24th December 2017 due to the windy weather impact.

49. The monitoring result showed that the main environmental issue is that the values of surface water quality can't comply with the Class IV standard in GB 3838-2002 required in EMP. A series of measures will continue to be conducted for water pollution control in the lakes, e.g. domestic wastewater collection, guidance for local farmers about the reasonable use of chemical fertilizer, runoff pollution control during the rainy season. Nutrient monitoring will continue to be carried out in the following construction stage by PMO.

50. According to the monitoring results, the air quality at construction site was improved, only the monitored PM10 and TSP exceeded the standard requirement during the windy season. The mitigation measures for air pollution control need to be conducted in the following construction period, especially need to be strengthened during the dry season.

51. The regular on-site inspection for the environment management by the PMO environment officer and contractors, as well as the EMP training to both the contractors and construction supervisors should be enhanced.

2. Water bird monitoring

52. The water bird monitoring was carried out on 18th-20th March, 2nd - 4th and 22nd-24th April, 1st-3rd and 25th-27th May, 25th-27th June, 4th -6th and 28th -30th July, 11th -13th and 22th – 24th August, 2th – 4th and 17th -19th September, 7th -9th and 23th – 25th October, and 11th -13th November. The monitoring time is mainly 6:40 – 11:00 in the morning and 16:30 – 19:00 in the afternoon.

53. The Luyanghu wetland has been divided into 8 survey area, and the partitioning index method has been adopted for the water bird monitoring. The detailed monitoring result and analysis is specified in the annual survey report of water bird.

5.6 Operational phase

54. Not yet due.

6. PUBLIC CONSULTATION AND GRIEVANCE REDRESS MECHANISM

55. Public consultation conducted includes EIA public opinion survey, socioeconomic and AP surveys, public consultation meeting, questionnaire survey and site visits organized by the PMO, PIO, Design Institute, EIA institute and WEPB in accordance with public consultation program shown in Table 16 (exactly the same as Table A2.4 of EMP) during the project preparation period.

Table16 Public Consultation Program

Organizer	Approach / Frequency	Subjects	Participants
1. Project Preparation			
PMO, IA, Design Institute, EIA institute, WEPB	• EIA public opinion surveys • Socioeconomic and AP surveys • Public consultation meeting and questionnaire • Site visits: multiple times	Priority, design, environmental benefits and impacts, social benefits and impacts, mitigation measures, attitudes toward project, and suggestions	PMO, IA, Design institute, EIA institute, WEPB, other provincial, municipal, county government stakeholders, community representatives
2. Construction			
PMO, IA, EMC, IEM	• Public consultation and site visits: at least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Residents within construction area
	• Public information session: at least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Representatives of residents and social sectors
3. Test Operation			
PMO, IA, EMC, IEM	• Questionnaire survey: at least once during test operation • Site visits: multiple, depending on results of project completion environmental audit	Comments and suggestion on operational impacts, public suggestion on corrective actions	Local residents and social sectors, WEPB
4. Operation			
PMO, IA	• Site visits: once every 6 months by IEM and PMO	Irrigation system operational performance, informal interviews with local residents	Farm manager, local residents adjacent to farms
	• Expert workshop or press conference: as needed based on public consultation and workshop	Expert comments and suggestion on corrective measures	Experts from residents, social sectors and media

56. In accordance with the EMP, any grievances which arise due to project activities will be managed through a grievance redress mechanism (GRM), as follows.

(i) Stage 1: If a concern arises during construction, the affected person will try to resolve the issue with the contractor and project manager. If successful, no follow-up will be required.

(ii) Stage 2: If not successful, the affected people can submit an oral or written petition/complaint to the village committee. For an oral complaint, the village committee

must make a written record. The village committee must respond to the affected person within 2 weeks. The IEM will assist the committee in replying to the affected person.

(iii) Stage 3: If the affected person is not satisfied with the reply in Stage 2, he/she can appeal to the township government and the township government must give a clear reply within 2 weeks. The IEM will assist the township government in replying to the affected person.

(iv) Stage 4: If the affected person is still not satisfied with the reply of township government, he/she can appeal to the IA. The IA will record the complaint and report to the ADB project officer through the LPMO and PMO. The IA, through the EMU established in the IA, must prepare a clear reply in consultation with the EPB, EMC, and IEM, and give it back to the affected person within 30 days.

(v) Stage 5: If the affected person is still not satisfied with the reply of the IA, he/she can appeal to the PMO after receiving the reply of Stage 4. The PMO must report to ADB as soon as the complaint is recorded by submitting relevant documents, and prepare a clear reply in consultation with ADB, EMU, EMC, and IEM. The PMO must give the reply to the affected person within 30 days. The ADB project team will assess the situation, contact the affected people and Government project counterparts, and provide advices to the government. Stages (ii)-(v) will be further refined during the detailed design stage.

(vi) Stages 1–5: At any time, the affected person may contact ADB directly, specifically the East Asia Department, including the ADB Resident Mission in the PRC. If this approach is unsuccessful, people 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, the complaints will approach by the Accountability Mechanism.

57. In the project construction phase, the information of project overview, construction content, construction site management, EHS management, contact person and complaint hotline of the project, etc. were disclosed on the construction bulletin board at the construction site entrance. There is little residential area close to the construction site, and no complaint on the environment impact has been received since the construction commencement.

58. So far, except for asking about the project information by the local residents, the village committee, local governments, PIO and PMO have not received any petitions and/or complaints since the GRM started performing in July 2014. The public consultation will be organized by PMO and PIO regularly in the remaining implementation period. If there are any petitions and/or complaints, the related agencies will make records in accordance with Table 17 below.

Table17 Summary Record of Petitions and/or Complaints

No.	Types of petitions and/or complaints(oral or written)	scope of grievances	Name or number of affected persons	date grievance was lodged with				date grievance was resolved by				date of follow up				remark
				Village committee	Town Gov.	PIO	PMO	Village committee	Town Gov.	PIO	PMO	Town Gov.	PIO	PMO	ADB	

7. INSTITUTIONAL TRAINING AND STRENGTHENING

59. In accordance with the EMP requirement, the PMO and PIO have appointed a full-time environmental officer respectively. An environmental management consultant has also been hired to assist PMO in the EMP implementation work.

60. The planned training program is shown in Table 18 (exactly the same as Table A2.6 of EMP).

Table 18 Institutional Strengthening and Training

Activities	Target Agencies/ Attendees	Contents	Timing	Actions taken
Strengthening				
Institutional Strengthening	PMO, IA, WEPB, WEPB	● Defining institutional arrangements for environmental management, monitoring, and supervision	During project preparation	Complied with
		● Defining positions and responsibilities		Complied with
	EMC	● Recruiting and contracting EMC for internal environmental management consultancy and monitoring	Prior to project implementation	Complied with
	IEM	● Recruiting and contracting IEM to conduct independent environmental monitoring for the Project	Prior to project implementation	Complied with
Environmental Management Clauses and Protocols	IA, procurement agency, EMC	● Developing environmental management clauses and incorporating them into construction and operational contracts	During project preparation	Complied with
		● Developing/refining environmental monitoring protocols		Complied with
		● Developing environmental emergency response procedures		Complied with
Training				
Environmental Laws, Regulations and Policies	PMO, IA, contractors	● Environmental laws and regulations	Prior to project implementation	Being complied with
		● Environmental policies and plan		Being complied with
		● Basic environmental management		Being complied with
		● Environmental emergency response		Being complied with
EMP Implementation	PMO, IA, contractors	● Responsibility and duties for project construction, management and environmental protection	Prior to and during project implementation	Being complied with
		● Tasks of environmental protection in the project construction		Being complied with
		● Key environmental protection contents in project construction		Being complied

				with
		• EMP improvement and corrective actions		Being complied with
Environmental Monitoring, Inspection and Reporting	IA, contractors	• Monitoring and inspection methods, data collection and processing, interpretation of data, reporting system	Prior to and during project implementation	Being complied with
		• Environmental reporting requirements		Being complied with

Notes: EMC = environmental management consultant, EMP = environmental management plan, EPB = environmental protection bureau, IA = implementing agency, IEM = independent environmental monitor, PMO = provincial project management office, WEPB = Weinan provincial Environmental Protection Department.
Source(s): Domestic EIA, and consultations with PMO, WEPB, WEPB, and IA.

61. Three environment management trainings were conducted by the LIEC on 16 July 2015, 2 June 2016 and 18 January 2018 respectively. The participants included the PMO environment officer, construction consultants from PIO, contractors and construction supervising units. Totally 50 participants attended the trainings. The training contents include:

1) ADB project procedure and ADB safeguard policy.
2) Brief introduction of the EMP
3) Objective, procedures, and responsibility of different agencies for the EMP implementation during construction stage.
4) Detailed introduction of the potential environment impact and mitigation measures for each subcomponent of this project.
5) Work contents, procedure, and requirement of the environment management during the construction stage.
6) Environment management, monitoring report, and records requirement during construction stage for both PMO and the contractors, including the suggested outlines of the report.
7) Brief introduction for the potential environment impact, management and monitoring during the operation stage.

During the first two trainings, all the participants agreed to conduct the environment management according to the EMP and no other questions. During the third training, the contractors discussed the water pollution control of the lakes with the LIEC. It is very important to protect the water environment of the lakes during both the construction and operation stage, because it is stagnant water with low self-purification capacity. It will be extremely difficult to do the pollution treatment if there were water pollution accident in the lakes area.

62. The training material has been delivered to the PMO environment officer for internal circulation and training, to ensure all project participants from relevant units can be benefit from the information sharing. Environment management training will be held in the following reporting period according to the project implementation progress.

8. BUDGET

63. In accordance with the EMP, costs of the environmental measures/monitoring and management is USD 1.3 million (see Table 19 for more details, the table is exactly the same with Table A2.8 of EMP). The main environmental protection expenditure for the project in this reporting period is the cost for environmental monitoring at the construction site. The actual expenditure in 2017 is shown in the real cost column of Year 4. The real cost is less than the environmental management plan budget, because the project progress is behind the schedule and the EMP work is delayed.

Table 19 Cost Estimates for EMP and Real Cost (USD '000)

	Year 1		Year 2		Year 3		Year 4		Year 5		**Total**	
	Cost Estimates	Real Cost	Cost Estimates	Real Cost	Cost Estimates	Real Cost	Cost Estimates	Real Cost	Cost Estimates	Real Cost	Cost Estimates	Real Cost
Sediment, dust, noise, solid waste control equipment	290			47							290	
Wetland flora and fauna protection measures during construction	50										50	
OHS	50			31							50	
Nutrient Management Plan	100										100	
Monitoring - construction phase (annual)*	10		250	110	250	100	250	100			760	
Monitoring - operation phase (annual)**									50		50	
Total of the project	500	80	250	188	250	100	250	100	50		1300	

Note: * Monitoring – construction phase includes air, water, soil, noise, and years 1 to 4 of waterbird survey (Table A2.2 in EMP). Monitoring – operation phase includes water and Year 5 of waterbird survey (Table A2.2 in EMP).

9. SUMMARY

9.1 Summary of issues identified and corrective actions

64. According to the environment monitoring results at the construction site and EMP implementation status, the main environmental issues found and proposed improvement measures are listed in Table 20 below.

Table 20 Improvement measures for environment issues

Main issues	Improvement measures	Follow up actions
Some monitoring items for surface water did not meet the Class IV requirement of Environmental Quality Standards for Surface Water (GB3838-2002).	• On-site environment supervision and environment management during construction stage should be strengthened. • Nutrient monitoring will continue to be conducted and reported. • Water pollution control measures will be adopted to avoid wastewater flow into the lakes. • Periodical environment management training will continue to be carried out to contractors by PMO and LEIC.	On-site environment management should be enhanced by PMO and contractors to avoid the domestic and construction wastewater discharge into the water body directly. The following mitigation measures in EMP should be conducted strictly: • Construction camp shall not be placed in wetland area • Fuel depots, maintenance, and vehicle washing site cannot be placed within 1km outside of the border area of National Wetland. • Training to construction workers on EMP implementation. • Integrated nutrient management and monitoring in and around the lakes • Water pollution control measures undertaken around the lakes area for eutrophication prevention.
Uncontrolled dumping of spoil from Tianlu Lake construction caused the loss of over 1,000 mu (150 ha) salt pans in addition to the agreed 1,650 mu due to the delay of the spoil disposal management plan preparation.	• The spoil disposal and rehabilitation plan preparation should be completed as early as possible. • PIO capacity for environmental management should be enhanced.	• It is proposed by PMO that the spoil will be used for the construction of the ecological soil and water conservation demonstration zone around Tianlu Lake • Spoil plan should be completed and approved by local related department such as Weinan EPB • The spoil disposal will be conducted in accordance with the approved spoil plan • All new earthworks will be subject to an approved spoil plan. • PIO capacity for environmental management will be improved.

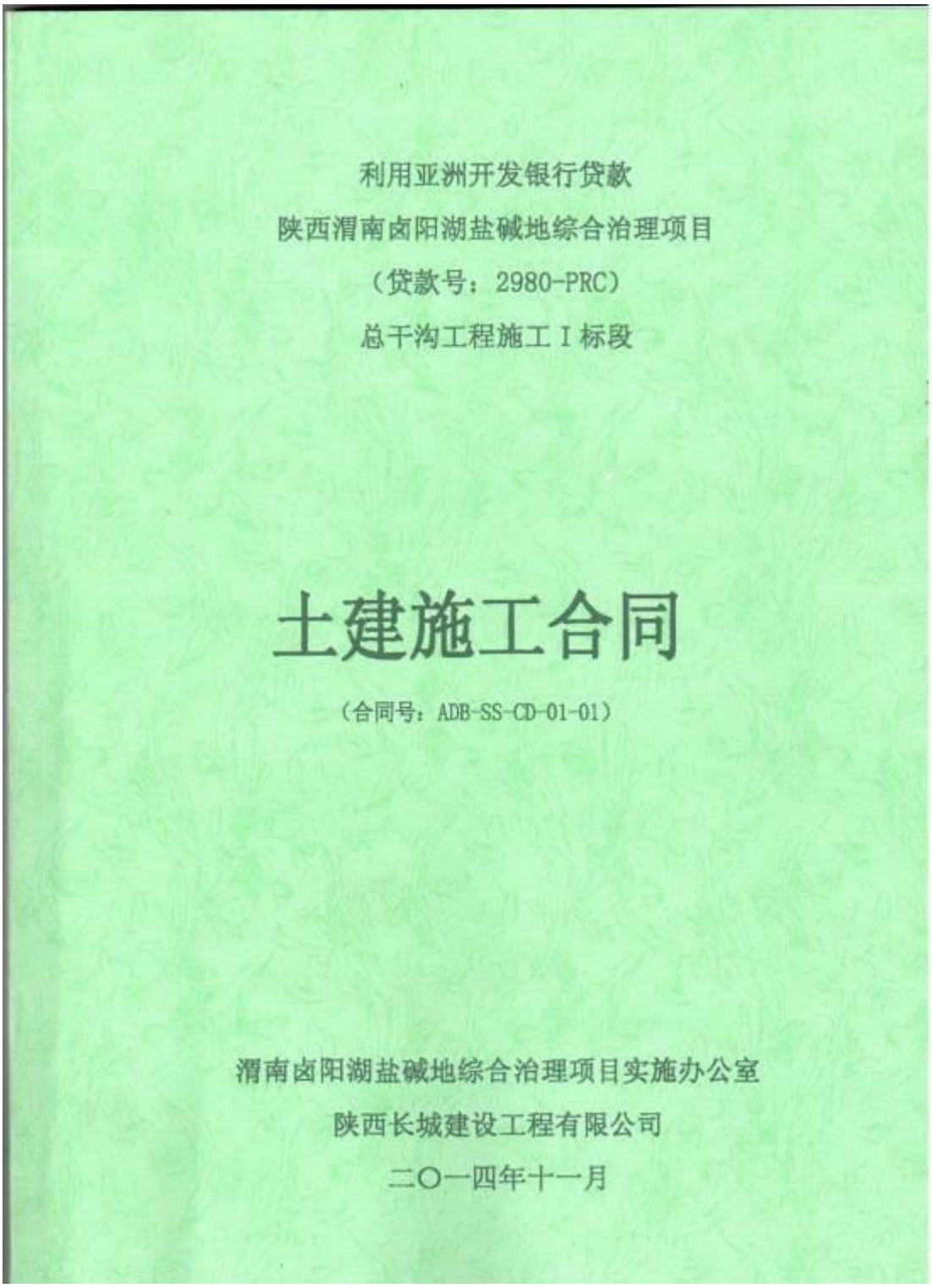
9.2 Overall progress implementing the project EMP

65. At the pre-construction stage, the EMP and design documents have been distributed to contractors and supervisors. Related EMP requirements and environment mitigation measures have been included in the contract. Most of the construction and environment management works are conducted in accordance with the EMP.

66. Xi'an Jingcheng Testing Technology Limited Company is engaged to carry out the environmental monitoring according to the monitoring plan in the EMP. PMO has submitted semi-annual environmental monitoring report timely to ADB with the support of the LIEC. The environmental issues found have been analyzed and discussed with the PMO, the follow-up actions based on the mitigation measures will be carried out.

APPENDICES

A. Environmental clauses in contracts of contractors



利用亚洲开发银行贷款

陕西渭南卤阳湖盐碱地综合治理项目

（贷款号：2980-PRC）

总干沟工程施工Ⅰ标段

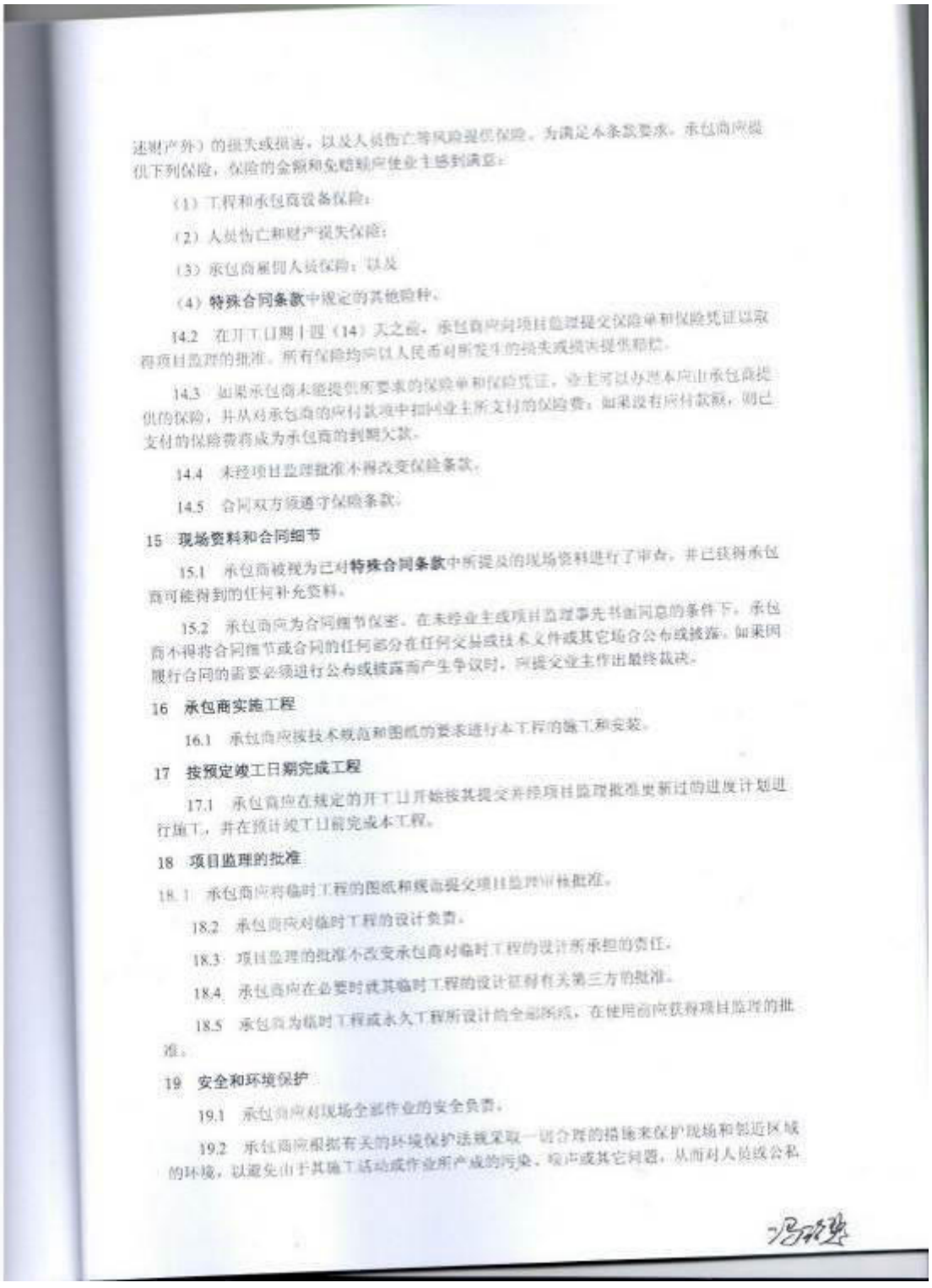
土建施工合同

（合同号：ADB-SS-CD-01-01）

渭南卤阳湖盐碱地综合治理项目实施办公室

陕西长城建设工程有限公司

二〇一四年十一月



述财产外）的损失或损害，以及人员伤亡等风险提供保险。为满足本条款要求，承包商应提供下列保险，保险的金额和免赔额应使业主感到满意：

（1）工程和承包商设备保险；

（2）人员伤亡和财产损失保险；

（3）承包商雇佣人员保险；以及

（4）**特殊合同条款**中规定的其他险种。

14.2 在开工日期后四（14）天之前，承包商应向项目监理提交保险单和保险凭证以取得项目监理的批准。所有保险均应以人民币对所发生的损失或损害提供赔偿。

14.3 如果承包商未能提供所要求的保险单和保险凭证，业主可以办理本应由承包商提供的保险，并从对承包商的应付款项中扣回业主所支付的保险费；如果没有应付款额，则已支付的保险费将成为承包商的到期欠款。

14.4 未经项目监理批准不得改变保险条款。

14.5 合同双方须遵守保险条款。

15 现场资料和合同细节

15.1 承包商被视为已对**特殊合同条款**中所提及的现场资料进行了审查，并已获得承包商可能得到的任何补充资料。

15.2 承包商应为合同细节保密。在未经业主或项目监理事先书面同意的条件下，承包商不得将合同细节或合同的任何部分在任何交易或技术文件或其它场合公布或披露。如果因履行合同的需要必须进行公布或披露而产生争议时，应提交业主作出最终裁决。

16 承包商实施工程

16.1 承包商应按技术规范和图纸的要求进行本工程的施工和安装。

17 按预定竣工日期完成工程

17.1 承包商应在规定的开工日开始按其提交并经项目监理批准更新过的进度计划进行施工，并在预计竣工日前完成本工程。

18 项目监理的批准

18.1 承包商应将临时工程的图纸和规范提交项目监理审核批准。

18.2 承包商应对临时工程的设计负责。

18.3 项目监理的批准不改变承包商对临时工程的设计所承担的责任。

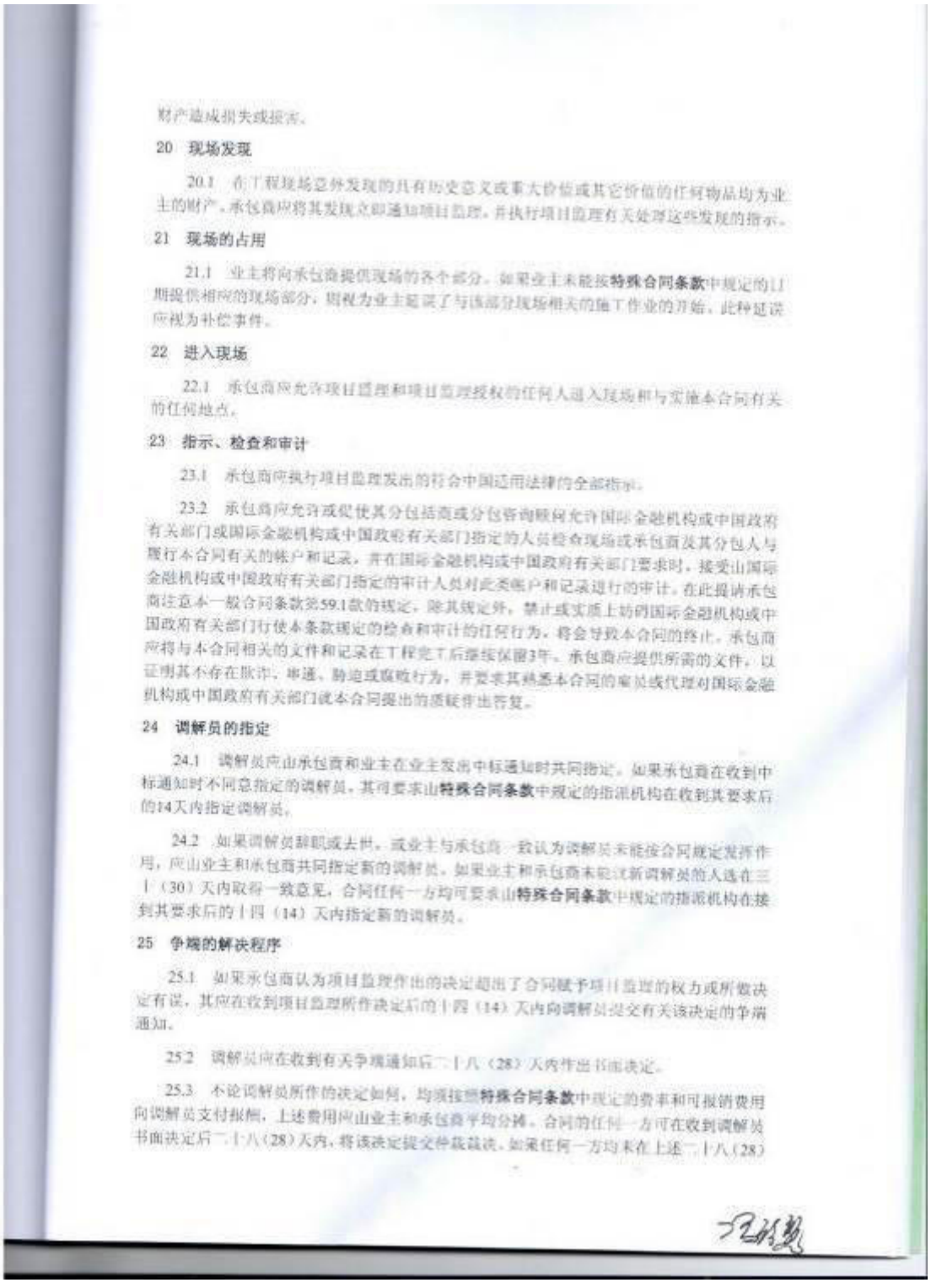
18.4 承包商应在必要时就其临时工程的设计征得有关第三方的批准。

18.5 承包商为临时工程或永久工程所设计的全部系统，在使用前应获得项目监理的批准。

19 安全和环境保护

19.1 承包商应对现场全部作业的安全负责。

19.2 承包商应根据有关的环境保护法规采取一切合理的措施来保护现场和邻近区域的环境，以避免由于其施工活动或作业所产生的污染、噪声或其它问题，从而对人员或公私



财产造成损失或损害。

20 现场发现

20.1 在工程现场意外发现的具有历史意义或重大价值或其它价值的任何物品均为业主的财产。承包商应将其发现立即通知项目监理，并执行项目监理有关处理这些发现的指示。

21 现场的占用

21.1 业主将向承包商提供现场的各个部分。如果业主未能按**特殊合同条款**中规定的日期提供相应的现场部分，则视为业主延误了与该部分现场相关的施工作业的开始，此种延误应视为补偿事件。

22 进入现场

22.1 承包商应允许项目监理和项目监理授权的任何人进入现场和与实施本合同有关的任何地点。

23 指示、检查和审计

23.1 承包商应执行项目监理发出的符合中国适用法律的全部指示。

23.2 承包商应允许或促使其分包商或分包咨询顾问允许国际金融机构或中国政府有关部门或国际金融机构或中国政府有关部门指定的人员检查现场或承包商及其分包人与履行本合同有关的账户和记录，并在国际金融机构或中国政府有关部门要求时，接受由国际金融机构或中国政府有关部门指定的审计人员对此类账户和记录进行的审计。在此提请承包商注意本一般合同条款第59.1款的规定，除其规定外，禁止或实质上妨碍国际金融机构或中国政府有关部门行使本条款规定的检查和审计的任何行为，将会导致本合同的终止。承包商应将与本合同相关的文件和记录在工程完工后继续保留3年。承包商应提供所需的文件，以证明其不存在欺诈、串通、胁迫或腐败行为，并要求其履约本合同的雇员或代理对国际金融机构或中国政府有关部门就本合同提出的问题作出答复。

24 调解员的指定

24.1 调解员应由承包商和业主在业主发出中标通知时共同指定。如果承包商在收到中标通知时不同意指定的调解员，其可要求由**特殊合同条款**中规定的指派机构在收到其要求后的14天内指定调解员。

24.2 如果调解员辞职或去世，或业主与承包商一致认为调解员未能按合同规定发挥作用，应由业主和承包商共同指定新的调解员。如果业主和承包商未能达成新调解员的人选在三十（30）天内取得一致意见，合同任何一方均可要求由**特殊合同条款**中规定的指派机构在接到其要求后的十四（14）天内指定新的调解员。

25 争端的解决程序

25.1 如果承包商认为项目监理作出的决定超出了合同赋予项目监理的权力或所做决定有误，其应在收到项目监理所作决定后的十四（14）天内向调解员提交有关该决定的争端通知。

25.2 调解员应在收到有关争端通知后二十八（28）天内作出书面决定。

25.3 不论调解员所作的决定如何，均须按**特殊合同条款**中规定的费率和可报销费用向调解员支付报酬，上述费用应由业主和承包商平均分摊。合同的任何一方可在收到调解员书面决定后二十八（28）天内，将该决定提交仲裁裁决。如果任何一方均未在上述二十八（28）

B. Environmental Monitoring reports

BJT-GL-067A

C/1

京诚检测 Best Justicial Testing

报告编号：XAH170641C

正本

162721340317
有效期至2022年01月22日

监 测 报 告

项目名称 渭南卤阳湖盐碱地综合治理项目

委托单位 渭南卤阳湖亚行项目管理办公室

报告日期 2017 年 12 月 31 日

西安京诚检测技术有限公司
（加盖报告专用章）

报告编号：XAH170641C

一、项目信息：

项目名称	渭南卤阳湖盐碱地综合治理项目		
委托单位	渭南卤阳湖亚行项目管理办公室		
单位地址	渭南市		
监测地址	渭南市		
监测日期	2017-12-19~2017-12-25	监测类别	现状监测

二、监测结果：

（一）环境空气监测结果：

监测日期	监测点位	监测项目			
		二氧化硫 24h 平均值 μg/m³	二氧化氮 24h 平均值 μg/m³	PM_{10} 24h 平均值 μg/m³	TSP 24h 平均值 μg/m³
2017-12-19	1#天虹桥西北 500 米处	21	34	106	224
	2#天虹桥南端	28	39	112	235
	3#中干沟与环湖路交接点向西 500 米处	23	31	105	219
	4#东干沟与西干沟交接点处	26	33	101	197
	5#总干沟与西干沟交汇处向西 2 公里处	19	37	108	223
2017-12-20	1#天虹桥西北 500 米处	27	38	126	256
	2#天虹桥南端	32	31	119	238
	3#中干沟与环湖路交接点向西 500 米处	25	30	115	231
	4#东干沟与西干沟交接点处	23	35	124	254
	5#总干沟与西干沟交汇处向西 2 公里处	29	33	107	229
2017-12-21	1#天虹桥西北 500 米处	30	43	134	276
	2#天虹桥南端	34	47	130	268
	3#中干沟与环湖路交接点向西 500 米处	28	40	125	261
	4#东干沟与西干沟交接点处	32	45	121	248
	5#总干沟与西干沟交汇处向西 2 公里处	25	42	129	263

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报告编号：XAH170641C

（一）环境空气监测结果：

监测日期	监测点位	监测项目			
		二氧化硫 24h 平均值 μg/m³	二氧化氮 24h 平均值 μg/m³	PM_{10} 24h 平均值 μg/m³	TSP 24h 平均值 μg/m³
2017-12-22	1#天虹桥西北 500 米处	35	50	187	342
	2#天虹桥南端	31	54	173	326
	3#中干沟与环湖路交接点向西 500 米处	34	45	194	357
	4#东干沟与西干沟交接点处	28	42	168	335
	5#总干沟与西干沟交汇处向西 2 公里处	30	46	176	341
2017-12-23	1#天虹桥西北 500 米处	29	46	198	375
	2#天虹桥南端	33	42	185	368
	3#中干沟与环湖路交接点向西 500 米处	26	38	179	376
	4#东干沟与西干沟交接点处	31	34	193	384
	5#总干沟与西干沟交汇处向西 2 公里处	34	40	182	358
2017-12-24	1#天虹桥西北 500 米处	20	30	165	329
	2#天虹桥南端	23	34	170	354
	3#中干沟与环湖路交接点向西 500 米处	28	30	159	324
	4#东干沟与西干沟交接点处	26	36	168	342
	5#总干沟与西干沟交汇处向西 2 公里处	24	38	163	332
2017-12-25	1#天虹桥西北 500 米处	26	43	148	296
	2#天虹桥南端	29	45	140	291
	3#中干沟与环湖路交接点向西 500 米处	23	39	139	276
	4#东干沟与西干沟交接点处	21	42	136	281
	5#总干沟与西干沟交汇处向西 2 公里处	25	40	145	293

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（二）地表水监测结果：

报告编号：XAH170641C

监测日期	监测点位	采样时间	监测项目						
			溶解氧 mg/L	全盐量 mg/L	化学需氧量（COD） mg/L	五日生化需氧量（BOD_5） mg/L	总氮 mg/L	总磷 mg/L	粪大肠菌群 MPN/100mL
2017-12-23	1#湖心岛正东方	09:23	7.13	1.20×10^4	74	18.9	5.03	0.07	8
	2#湖心岛正南方	09:49	7.01	1.28×10^4	68	15.8	4.12	0.10	8
	3#卤滩古韵码头	09:34	7.33	1.16×10^4	79	19.5	2.30	0.15	5
	4#天虹桥附近	09:58	7.15	1.22×10^4	59	12.9	1.73	0.07	5
	5#天卤湖东岸	10:05	5.45	8.20×10^3	34	9.0	7.07	0.07	5
	6#天卤湖南岸	10:13	5.62	8.00×10^3	38	9.6	6.33	0.12	5
	7#天卤湖西岸	10:21	5.55	8.11×10^3	41	11.3	6.90	0.24	2
	8#天卤湖北岸	10:30	5.51	8.15×10^3	44	12.7	7.21	0.15	5
	9#总干沟涵洞附近	12:02	5.34	8.76×10^3	32	8.9	8.74	0.10	22
	10#井家村抽水站东边总干沟	10:50	6.43	5.93×10^3	39	9.1	13.1	0.53	17
	11#东干沟与天阳大道连接处	11:15	6.76	3.85×10^3	25	5.2	13.7	1.22	17
	12#总干沟与西干沟交汇处向西 700 米处	11:35	6.05	6.30×10^3	25	7.0	2.11	0.30	8

注：ND 表示未检出，ND 后数字为相应项目的检出限。

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报告编号：XAH170641C

（三）噪声监测结果：

监测日期	监测点位	监测时间	监测项目
			噪声 dB(A)
2017-12-23	1#天虹桥西北 500 米处	昼间（09:11）	46.3
		夜间（22:03）	40.2
	2#天虹桥南端	昼间（09:19）	45.7
		夜间（22:14）	40.8
	3#中干沟与环湖路交接点向西 500 米处	昼间（10:12）	44.5
		夜间（23:16）	39.5
	4#东干沟与西干沟交接点处	昼间（09:34）	46.8
		夜间（22:35）	41.2
	5#总干沟涵洞向西 3 公里处	昼间（09:58）	44.5
		夜间（23:02）	39.8
	6#总干沟与西干沟交汇处向西 3 公里处	昼间（09:43）	45.5
		夜间（23:30）	40.6

（四）土壤监测结果：

监测日期	监测点位		监测项目		
			铬 mg/kg	总砷 mg/kg	铅 mg/kg
2017-12-23	1#工地开挖点	表（0~20cm）	25.2	3.18	14.6
		中（20~60cm）	55.3	6.34	26.0
		深（60~100cm）	78.6	10.9	37.1

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报告编号：XAH170641C

三、监测技术规范、依据、使用仪器及检测人员：

样品类别	分析项目	分析方法	方法依据	仪器设备及编号	检出限	检测人员
环境空气	二氧化硫	甲醛吸收-副玫瑰苯胺分光光度法	HJ 482-2009	分光光度计 YQ-002	1h 平均值：7μg/m³ 24h 平均值：4μg/m³	尚征征
	二氧化氮	盐酸萘乙二胺分光光度法	HJ 479-2009	分光光度计 YQ-002	1h 平均值：5μg/m³ 24h 平均值：3μg/m³	尚征征
	PM_{10}	重量法	HJ 618-2011	分析天平 YQ-001	10μg/m³	鲁师师
	TSP	重量法	GB/T 15432-1995	分析天平 YQ-001	1μg/m³	鲁师师
地表水	溶解氧	电化学探头法	HJ 506-2009	便携式溶解氧测定仪 YQ-034	——	尚征征
	全盐量	重量法	HJ/T 51-1999	分析天平 YQ-001	5mg/L	王宁宁
	化学需氧量（COD）	重铬酸盐法	HJ 828-2017	——	4mg/L	鲁师师
	五日生化需氧量（BOD_5）	稀释与接种法	HJ 505-2009	BOD 生化培养箱 YQ-014	0.5mg/L	鲁师师
	总氮	碱性过硫酸钾消解紫外分光光度法	HJ 636-2012	紫外可见分光光度计 YQ-010	0.05mg/L	王宁宁
	总磷	钼酸铵分光光度法	GB/T 11893-1989	分光光度计 YQ-002	0.01mg/L	王宁宁
	粪大肠菌群*	——	GB/T 5750-2006	——	——	陕西工程勘察院
噪声	噪声	声环境质量标准	GB 3096-2008	多功能声级计 YQ-043	——	尚征征
土壤	铬	原子吸收分光光度法	HJ 491-2009	火焰原子吸收分光光度计 YQ-003	5.0mg/kg	米小龙
	总砷	原子荧光法	GB/T 22105.2-2008	非色散原子荧光光度计 YQ-007	0.01mg/kg	雷瑾
	铅	原子吸收分光光度法	GB/T 17140-1997	火焰原子吸收分光光度计 YQ-003	0.2mg/kg	米小龙

注：*号项目不在本公司资质认定范围内，分包检测；
承担分包机构：陕西工程勘察研究院水土监测中心 资质认定编号：1627010603050。

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报告编号：XAH170641C

四、附表（不在资质认定范围内）：

（一）环境空气监测期间参数统计表：

监测日期	气温（℃）	气压（kPa）	风速（m/s）	风向
2017-12-19	-1.0	97.4	1.8	SW
2017-12-20	0.4	97.5	1.1	SW
2017-12-21	-0.1	97.3	0.9	SW
2017-12-22	0.5	97.3	1.3	SE
2017-12-23	0.8	97.2	1.3	SW
2017-12-24	-1.1	97.4	1.3	SW
2017-12-25	-0.5	97.2	1.1	NW

（二）地表水监测期间参数统计表：

监测日期	监测点位	河宽（m）	河深（m）	流量（m^3/s）	流速（m/s）
2017-12-23	1#湖心岛正东方	——	——	——	——
	2#湖心岛正南方	——	——	——	——
	3#卤滩古韵码头	——	——	——	——
	4#天虹桥附近	——	——	——	——
	5#天卤湖东岸	——	——	——	——
	6#天卤湖南岸	——	——	——	——
	7#天卤湖西岸	——	——	——	——
	8#天卤湖北岸	——	——	——	——
	9#总干沟涵洞附近	2.0	0.2	0.010	0.05
	10#井家村抽水站东边总干沟	6.0	0.6	0.088	0.05
	11#东干沟与天阳大道连接处	8.0	0.6	0.141	0.06
	12#总干沟与西干沟交汇处向西700米处	4.0	0.5	0.049	0.05

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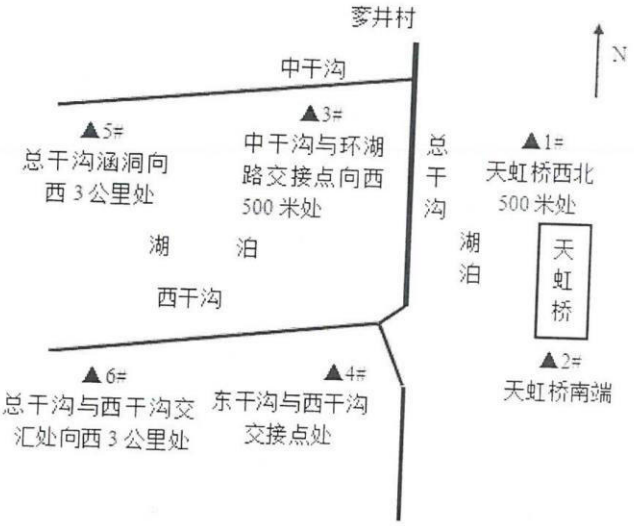
报告编号：XAH170641C

五、附图：

噪声监测点位图：



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C. Water Bird Monitoring Report

卤阳湖水鸟调查报告

（2017 年 3-11 月）

项目负责人： 高学斌

研 究 组： 鸟类多样性研究组

研究中心： 生物多样性与生态监测研究中心

承担单位： 陕西省动物研究所

2017 年 11 月 30 日

1

1 调查时间

2017 年 3-11 月，按照已经确定的监测方案，对渭南卤阳湖湿地的鸟类进行了调查。具体调查时间为 3 月 18-20 日、4 月 2-4 日和 22-24 日、5 月 1-3 日和 25-27 日及 6 月 25-27 日、7 月 4-6 日和 28-30 日、8 月 11-13 日和 22-24 日、9 月 2-4 日和 17-19 日、10 月 7-9 日和 23-25 日及 11 月 11-13 日；野外观察时间主要为每天上午 6:40-11:00 和下午 16:30-19:00，但随着季节的变化，有时提前（上午）或推迟（下午）1 小时。

2 调查与统计方法

采用分区直数法对项目区进行全面调查，采用双筒望远镜和单筒望远镜相结合的方式对各个调查区域的水鸟的种类和数量进行全面的统计，同时对生境变化和鸟类的分布特点也进行记录。

3 调查范围的划分与生境状况

本次调查范围及其调查小区划分方法基本与 2016 年的一致，共划分了 8 个调查小区，包括了东区的天骄湖（E_1）、内府滩湿地（E_2、E_{3A} 和 E_{3B}）及其新修建盐池区域（E_4），西区的铁路东侧晒碱池（W_1）和卤泊滩湿地（W_2 和 W_3）。但自 9 月第二次调查，在卤泊滩湿地增加了一个调查区（W_4），位置位于 W_2 之东（劳改场东西马路的对面）。目的是进一步掌握随着卤阳湖湿地的开发建设对水鸟及其栖息地所带来的影响，同时也使管理者对项目区的水鸟状况有一个直观的了解。

天骄湖（E_1）主要为水域，其周边尤其西侧仍在开发建设中，旅游季节有游客在湖区游玩；内府滩湿地的 E_2 和 E_{3A} 已经开发为湖泊，E_{3B} 基本仍未碱池，只是 11 月第二次调查时，该区东南部有 20 余亩正在栽种松树苗；E_4 虽然也新开发了碱池，但一直未投入使用，已经荒废；西区的生境情况基本与 2016 年相同，而且，W_2 和 W_3 的北部一直在修建公路，同时在 W_2 的东侧新修建了碱池，尽管自 8 月下旬已开始注水，但自 9 月这些碱池所蓄的水才得到了部分保留，且碱水来自于该区的排水渠。

4 水鸟的分布特点

（1）鸻鹬类的大多数物种主要分布于 E_{3B}、W_2、W_3 和 E_2 区域。10 月第二次

调查鸻鹬类的数量大幅度下降，主要分布于 W_1 和 E_2 区域。

（2）其他水鸟如雁鸭类、小鹬鹭等主要分布于 E_2 的水塘和 E_1 天骄湖的水域。

5 水鸟的组成与数量

5.1 物种组成与丰富度

从附表 10 可知，2016 年 3-11 月卤阳湖共分布水鸟 7 目 12 科 55 种。其中，鸻鹬类 30 种，其他水鸟 25 种。从居留型来看，留鸟 4 种，夏候鸟 15 种，旅鸟 36 种。其中，鸻鹬类为夏候鸟 9 种，旅鸟 21 种；其他水鸟为留鸟 4 种，夏候鸟 6 种，旅鸟 15 种。

从图 1 可知，4 月至 5 月上旬、9 月下旬和 10 月下旬至 11 月上旬水鸟的物种丰富度最高；鸻鹬类在 4 月下旬至 5 月和 9 月的物种丰富度相对最高；其他水鸟在 4 月上旬和 10 月下旬至 11 月初的物种丰富度相对丰富。从图 2 可知，鸻鹬类主要分布于除 E_1、E_4 和 E_{3A} 以外的其他各区域。从图 3 可以得出，其他水鸟在 E_1 和 E_2 的物种丰富度较高。

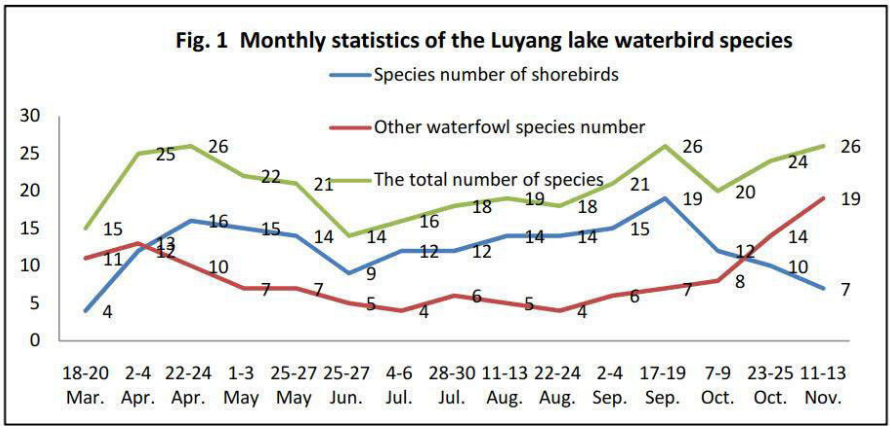

图 1　水鸟物种数月变化

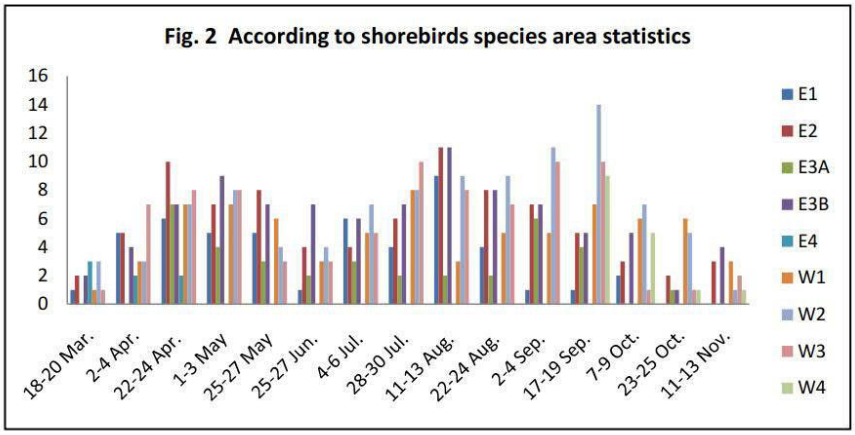

图 2 每个调查期各区的鸻鹬类物种数

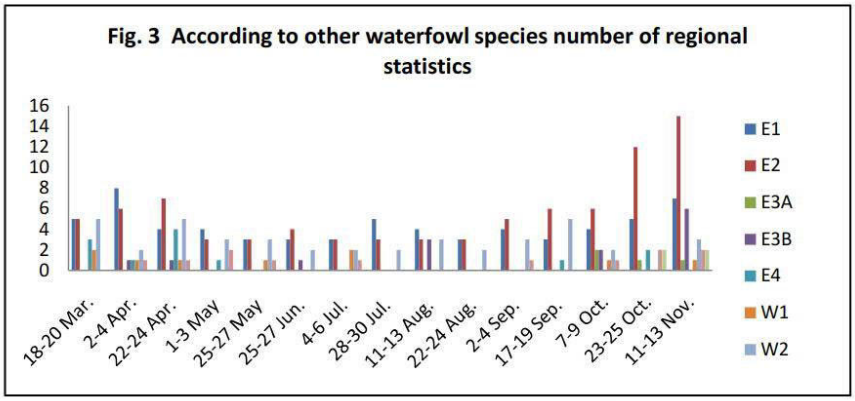

图 3 每个调查期各区的其他水鸟物种数

5.2 数量统计

从图 4 可知，鸻鹬类的多度在 8 月上旬最高，其次为 5 月上旬。而其他水鸟在 11 月上旬的多度最高（图 5）。

4

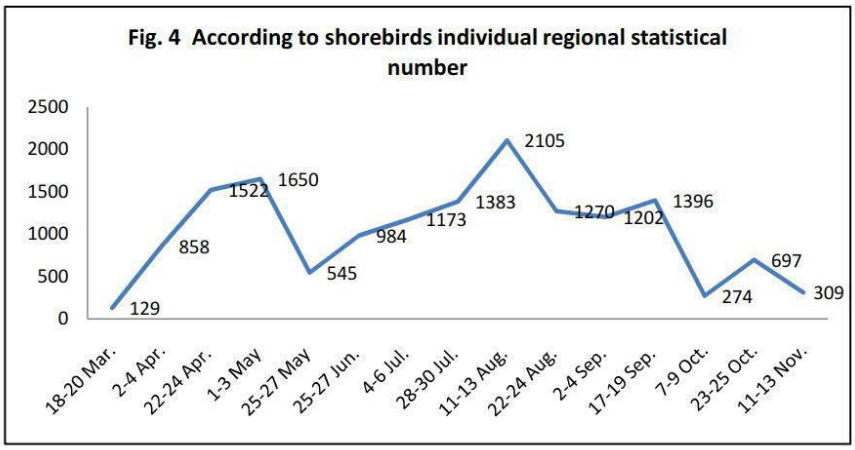

图 4 3-11 月鸻鹬类的数量变化

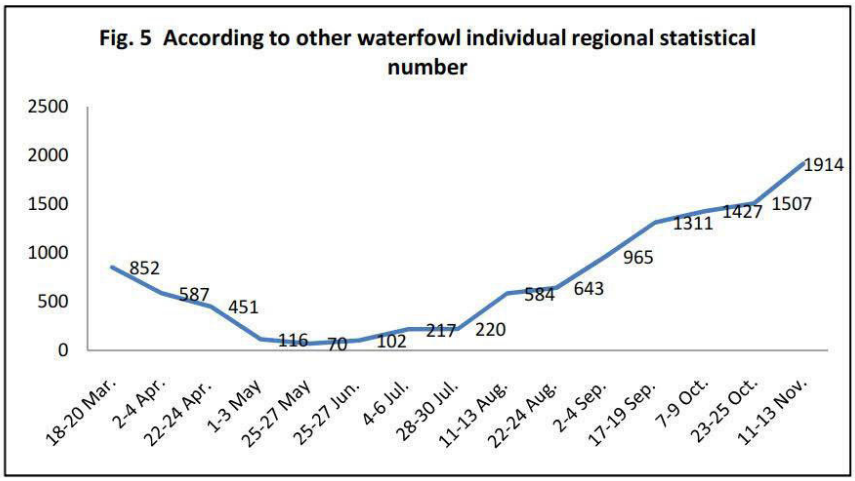

图 5 3-11 月其他水鸟的数量变化

从分区调查结果来看，在各个调查期，鸻鹬类数量较多区域基本为 E_2、E_{3B}、W_2 和 W_3（图 6），其他水鸟的数量 E_1 和 E_2 的数量最多，其次 W_2 的数量较高。（图 7）。

5

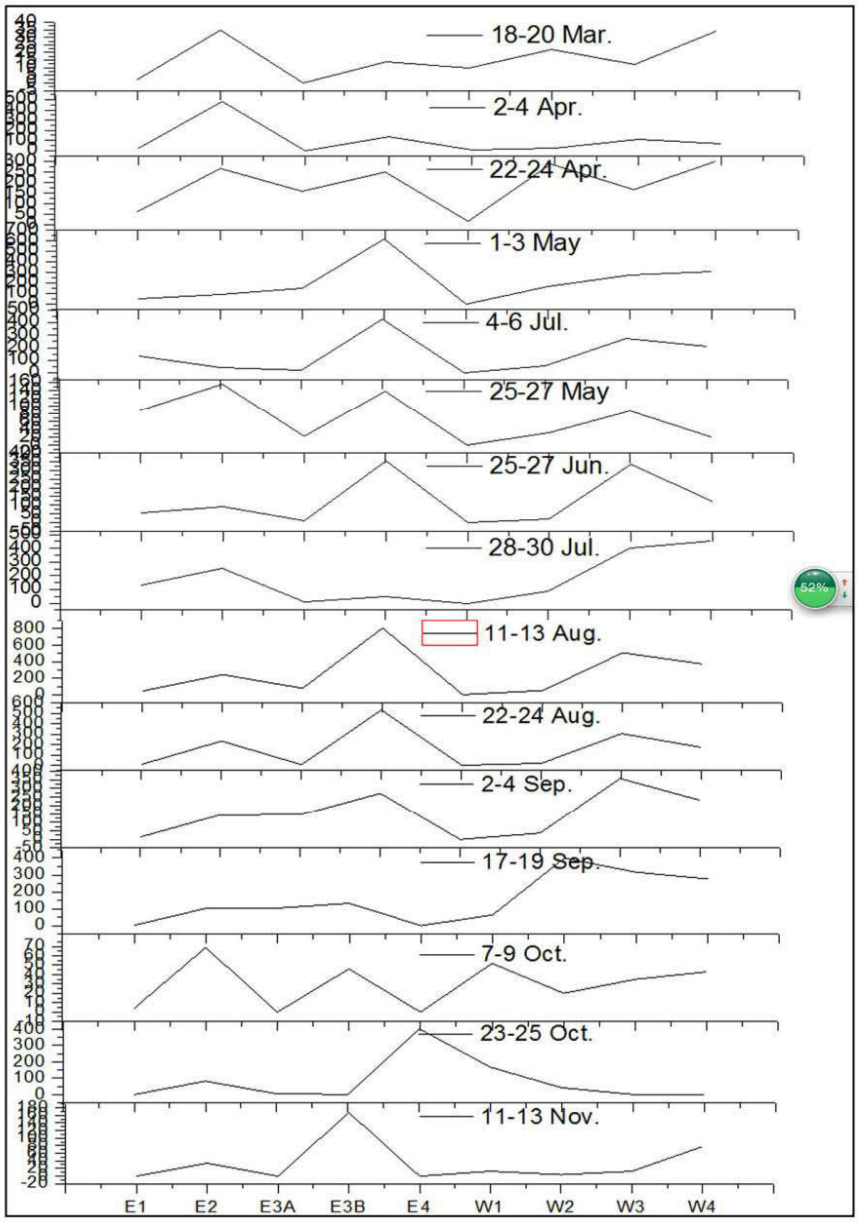

图 6 各调查区鸻鹬类数量月变化

6

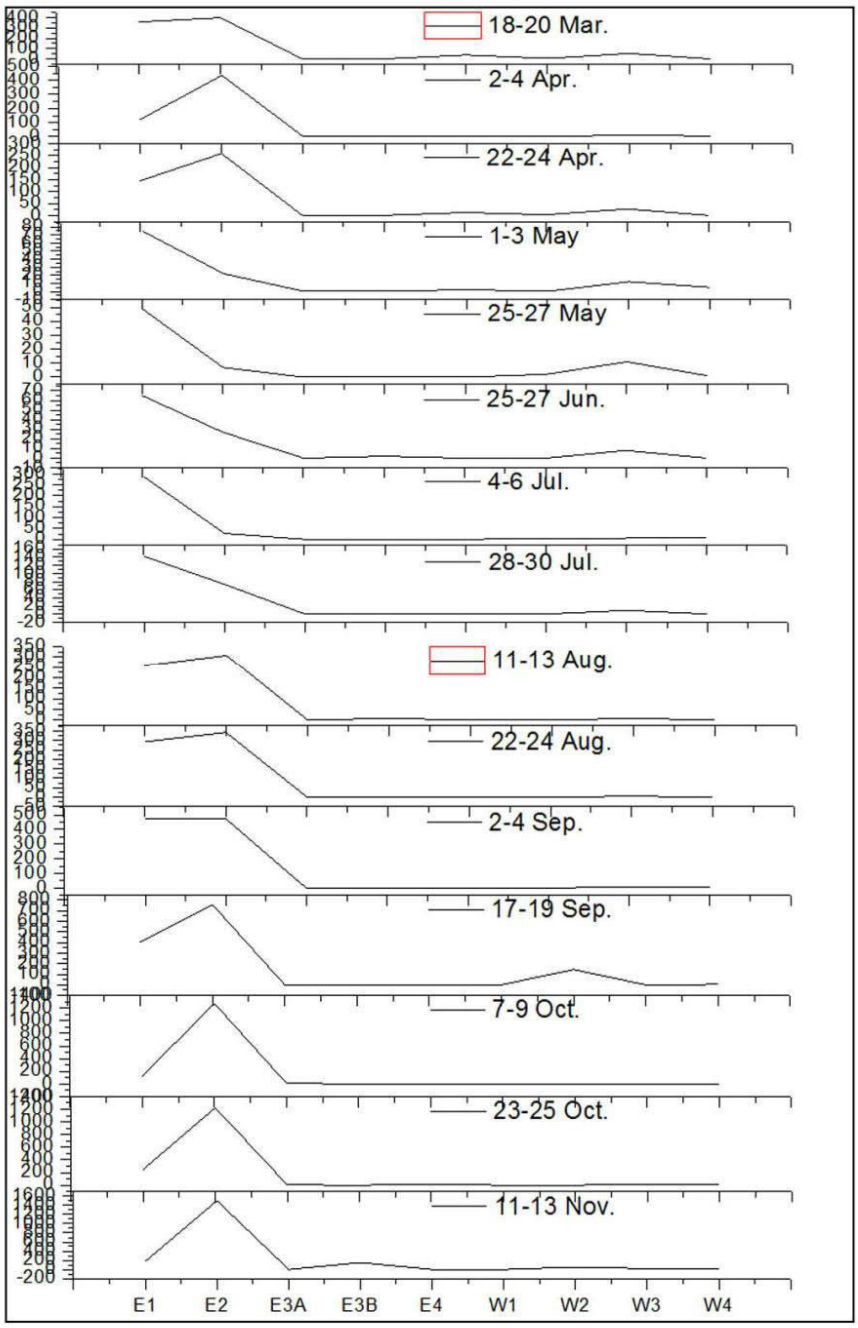

图 7 各调查区其他水鸟数量月变化

5.3 按照种群数量级别对鸻鹬类物种数的统计

7

从 5.1 和 5.2 章节的统计结果，我们已经知道了卤阳湖鸻鹬类的物种组成和数量的变化，那么，在每个调查期内，哪些鸻鹬类物种主要在卤阳湖栖息呢？从表 1 可知，种群数量超过 50 只的物种，3 月 1 种，4 月上旬有 3 种，4 月下旬有 6 种，5 月上旬有 4 种，5 月下旬 2 种，6 月 3 种，7 月上旬 4 种，7 月下旬 4 种，8 月上旬 7 种，8 月下旬 4 种，9 月上旬 5 种，9 月下旬 7 种，10 月上旬 2 种，10 月下旬 2 种，11 月上旬 1 种。从 3-11 月整体来看，在卤阳湖分布的 30 种鸻鹬类物种中，仅有 12 种在各个调查期的种群数量超过了 50 只，即黑翅长脚鹬、环颈鸻、鹤鹬、林鹬、长嘴剑鸻、青脚鹬、白腰草鹬、长趾滨鹬、金眶鸻、灰头麦鸡、普通燕鸻和凤头麦鸡。而同期或者从年度来看，大多数鸻鹬类物种的种群数量均不超过 50 只。

表 1　按照种群数量级别对鸻鹬类物种数的统计

调查期	种群数量级别（只）						
	≥500	400-500	300-400	200-300	100-200	50-100	≤50
18-20 Mar.						环颈鸻	4
2-4 Apr.		黑翅长脚鹬			环颈鸻	鹤鹬	9
22-24 Apr.	林鹬	黑翅长脚鹬			环颈鸻	长嘴剑鸻、青脚鹬、白腰草鹬	10
1-3 May	林鹬		黑翅长脚鹬		环颈鸻	长趾滨鹬	11
25-27 May				黑翅长脚鹬	环颈鸻		12
25-27 Jun.		黑翅长脚鹬	环颈鸻			金眶鸻	6
4-6 Jul.	黑翅长脚鹬		环颈鸻		长嘴剑鸻	长趾滨鹬	9
28-30 Jul.	黑翅长脚鹬、环颈鸻				灰头麦鸡	林鹬	8
11-13 Aug.	黑翅长脚鹬、环颈鸻	灰头麦鸡			鹤鹬	长嘴剑鸻、普通燕鸻、青脚鹬	7
22-24 Aug.			黑翅长脚鹬、普通燕鸻	灰头麦鸡、环颈鸻			10
2-4 Sep.			灰头麦鸡、环颈鸻	黑翅长脚鹬		林鹬、鹤鹬	10
17-19 Sep.		灰头麦鸡		环颈鸻、鹤鹬	黑翅长脚鹬	普通燕鸻、林鹬、青脚鹬	12
7-9 Oct.					青脚鹬	环颈鸻	10
23-25 Oct.		鹤鹬			凤头麦鸡		8
11-13 Nov.				凤头麦鸡			6

5.4 6 种重要水鸟的数量统计

从图 8 可知，黑翅长脚鹬的种群数量在 7 月上旬最高，其次为 7 月下旬和 8 月上旬；环颈鸻的多度 7 月下旬到 8 月上旬最高；长嘴剑鸻在 7 月上旬种群数量最多；鹤鹬在 10 月下旬的种群数量最高；金眶鸻为 6 月最多；灰头麦鸡为 9 月

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中旬和 8 月上旬多度最高。

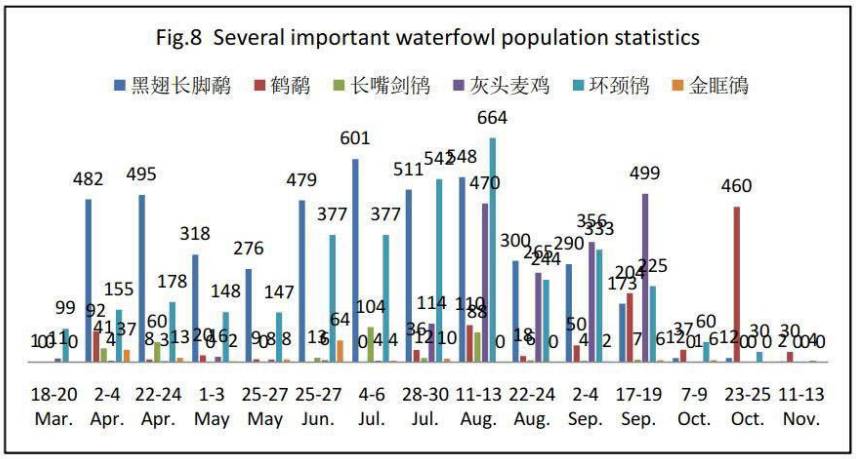

图 8 一些重要鸻鹬类物种的数量月变化

6 生境与鸟类分布变化

2017 年水鸟的生境与分布变化如下：

（1）4 月，E_{3A} 全面开挖；

（2）7 月，天气干旱，气温达到 39-41 度，许多碱池干枯；

（3）8 月，W_4开始注水，但水池泄露，水量极少；

（4)9 月第二次调查，W_4碱池已经有水，并开始对此区域的鸟类进行了统计；黑翅长脚鹬和环颈鸻等鸟类部分已经南迁，种群数量下降。

（5）由于 9 月底至 10 月中旬前后下连阴雨，碱池的水位明显上升以及气温下降至 15 度左右（最高温度），原来在此栖息的鸻鹬类，如环颈鸻、黑翅长脚鹬等已经基本迁离，而雁鸭类数量在逐渐增多。

（6）与 2016 年相比，鸻鹬类中泽鹬、灰尾漂鹬、白腰杓鹬和大杓鹬没有见到，增加了红腹滨鹬、青脚滨鹬、红颈瓣蹼鹬和凤头麦鸡；其他水鸟类减少了 3 种，包括白眉鸭、普通秋沙鸭和蓝翡翠，增加了如普通鸬鹚和花脸鸭等，而且，雁鸭类的数量在逐年明显增加。

附表 1-9 2017 年 3-11 月卤阳湖鸟类调查统计表

附表 10 2017 年卤阳湖鸟类的物种及其数量汇总表

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附表 1-9：2016 年 3-11 月卤阳湖鸟类调查统计表

附表 1　3 月卤阳湖鸟类调查数据统计表

Table 1　statistical table of March

调查小区（area）		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	合计(total)	居留型
调查时间(number of times)		18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	(reside)
物　种(species)											
中文名	Scientific Name										
鹈鹕目	**PODICIPEDIFORMES**										
鹈鹕科	Podicipedidae										
小鹈鹕	*Podiceps ruficollis*	53					2	2		57	R
雁形目	**ANSERIFORMES**										
鸭科	Anatidae										
绿头鸭	*Anas platyrhynchos*		129							129	P
针尾鸭	*Anas acuta*		3							3	P
赤麻鸭	*Tadorna ferruginea*		48					44		92	P
绿翅鸭	*Anas crecca*	2	213			35				250	P
斑嘴鸭	*Anas poecilorhyncha*	5						2		7	S
翘鼻麻鸭	*Tadorna tadorna*		5							5	P
鹳形目	**CICONIIFORMES**										
鹭科	Ardeidae										
大白鹭	*Ardea alba*					1		2		3	P
鹤形目	**GRUIFORMES**										
秧鸡科	Rallidae										
黑水鸡	*Gallicrex chloropus*	32				2	4	3		41	R

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附表 1 3 月卤阳湖鸟类调查数据统计表

Table 1 statistical table of March

调查小区（area）		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	合计(total)	居留型
调查时间(number of times)		18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	18-20 Mar.	(reside)
物 种(species)											
中文名	Scientific Name										
白骨顶	*Fulica atra*	265								265	P
鸻形目	**CHARADRIIFORMES**										
反嘴鹬科	Recurvirostridae										
反嘴鹬	*Recurvirostra avosetta*		17							17	S,P
黑翅长脚鹬	*Himantopus himantopus*					1				1	S
鸻科	Charadriidae										
灰头麦鸡	*Vanellus cinereus*				2	5		4		11	S
环颈鸻	*Charadrius alexandrinus*	2	18		12	4	22	7	34	99	S
鹬科	Scolopacidae										
白腰草鹬	*Tringa ochropus*							1		1	P

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附表 2 4月卤阳湖鸟类调查数据统计表

Table 2 the statistical table of April

调查小区（area）		E_1		E_2		E_{1A}		E_{SR}		E_4		W_1		W_2		W_3		合计		居留型
调查时间 (number of times)		2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	
物 种(species)																				
中文名	Scientific Name																			
鹈鹕目	**PODICIPEDIFORMES**																			
鹈鹕科	Podicipedidae																			
小鹈鹕	*Podiceps ruficollis*	46	98	6	47						2			4	10			56	157	R
凤头鹈鹕	*Podiceps cristatus*	8																8		P
鹳形目	**CICONIIFORMES**																			
鹭科	Ardeidae																			
白鹭	*Egretta garzetta*										1								1	S
大白鹭	*Ardea alba*				6				1	2								2	7	P
苍鹭	*Ardea cinerea*			2														2		R
雁形目	**ANSERIFORMES**																			
鸭科	Anatidae																			
绿翅鸭	*Anas crecca*		6	310	174										3			310	183	W
绿头鸭	*Anas platyrhynchos*	4		21	2													25	2	W
赤麻鸭	*Tadorna ferruginea*			86	26													86	26	S
斑嘴鸭	*Anas poecilorhyncha*	4			2						2				5			4	9	S
翘鼻麻鸭	*Tadorna tadorna*			10											1			10	1	P
红头潜鸭	*Aythya ferina*	2																2		P
鹤形目	**GRUIFORMES**																			
秧鸡科	Rallidae																			
黑水鸡	*Gallicrex chloropus*	36	23		2			7			8	4	4	6	9	6	1	59	47	R
白骨顶	*Fulica atra*	22	18															22	18	P
鸻形目	**CHARADRIIFORMES**																			
反嘴鹬科	Recurvirostridae																			
黑翅长脚鹬	*Himantopus himantopus*	1	33	332	170		120		8				14	104	66	45	84	482	495	S
反嘴鹬	*Recurvirostra avosetta*		2	33	14		2									2		35	18	S
鸻科	Charadriidae																			
灰头麦鸡	*Vanellus cinereus*		1							2						2	2	4	3	S
长嘴剑鸻	*Charadrius placidus*	4			2			32	58			5						41	60	P
环颈鸻	*Charadrius alexandrinus*	9	25	29	33		19	77	57	8	5	18	2	6	14	8	20	155	178	S
金眶鸻	*Charadrius dubius*	6			9			25				4			2	2	2	37	13	S
鹬科	Scolopacidae																			

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附表 2 4月卤阳湖鸟类调查数据统计表

Table 2 the statistical table of April

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计		居留型
调查时间 (number of times)		2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	2-4 Apr.	22-24 Apr.	
物 种(species)																				
中文名	Scientific Name																			
沙锥	*Gallinago sp.*							2										2		P
青脚鹬	*Tringa nebularia*				17				22						18		2		59	P
白腰草鹬	*Tringa ochropus*		2		8		9						2		6	2	34	2	61	P
林鹬	*Tringa glareola*	1			10		1		101				264	2	58		146	3	580	P
矶鹬	*Actitis hypoleucos*				5								1						6	P
鹤鹬	*Tringa erythropus*			92			8											92	8	P
青脚滨鹬	*Calidris temminckii*												2						2	P
长趾滨鹬	*Calidris subminuta*								5				3		2	4	11	4	21	P
红颈瓣蹼鹬	*Phalaropus lobatus*			1														1		P
黑尾塍鹬	*Limosa limosa*						1												1	P
燕鸻科	Glareolidae																			
普通燕鸻	*Glareola maldivarum*				2				2		11								15	S
燕鸥科	Sternidae																			
普通燕鸥	*Sterna hirundo*		2																2	S
佛法僧目	**CORACIIFORMES**																			
翠鸟科	Alcedinidae																			
普通翠鸟	*Alcedo atthis*	1																1		R

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附表 3 5 月卤阳湖鸟类调查数据统计表

Table 3 The statistical table of May

调查小区 (area)		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计 (total)		居留型 (reside)
调查次数(number of times)		1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	
物 种(species)																				
中文名	Scientific Name																			
䴙䴘目	**PODICIPEDIFORMES**																			
䴙䴘科	Podicipedidae																			
小䴙䴘	*Podiceps ruficollis*	49	31	2										5	8			56	39	R
鹳形目	**CICONIIFORMES**																			
鹭科	Ardeidae																			
大白鹭	*Ardea alba*				2														2	W
池鹭	*Ardeola bacchus*															1		1		S
牛背鹭	*Bubulcus ibis*													5				5		S
夜鹭	*Nycticorax nycticorax*														1				1	S
雁形目	**ANSERIFORMES**																			
鸭科	Anatidae																			
绿翅鸭	*Anas crecca*			18														18		W
绿头鸭	*Anas platyrhynchos*				2														2	W,S
斑嘴鸭	*Anas poecilorhyncha*	2			3					2							1	4	4	S
鹤形目	**GRUIFORMES**																			
秧鸡科	Rallidae																			
黑水鸡	*Gallicrex chloropus*	18	6	2									2	2	2	4		26	10	R
白骨顶	*Fulica atra*	6	12															6	12	P,S
鸻形目	**CHARADRIIFORMES**																			
反嘴鹬科	Recurvirostridae																			
黑翅长脚鹬	*Himantopus himantopus*	19	44(16)	54	82	74	15	34	49			22	10	49	62	66	14	318	276(16)	S
反嘴鹬	*Recurvirostra avosetta*		2	20		2							2		6			22	10	S
鸻科	Charadriidae																			
灰头麦鸡	*Vanellus cinereus*	2						4					2	10	3		3	16	8	S
环颈鸻	*Charadrius alexandrinus*	6	22	4	50	39	7	67	35			7	14	20	16	5	3	148	147	S
金眶鸻	*Charadrius dubius*				6							2	2					2	8	S
燕鸻科	Glareolidae																			
普通燕鸻	*Glareola maldivarum*			2														2		S
鹬科	Scolopacidae																			
沙锥	*Gallinago* sp.													1		2		3		P
青脚鹬	*Tringa nebularia*	4		2				12						16		10		44		P
红脚鹬	*Tringa totanus*								2										2	P

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附表 3 5 月卤阳湖鸟类调查数据统计表

Table 3 The statistical table of May

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计（total）		居留型 (reside)
调查次数(number of times)		1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	1-3 May	25-27 May	
物 种(species)																				
中文名	Scientific Name																			
白腰草鹬	*Tringa ochropus*			2								1				9		12		S
林鹬	*Tringa glareola*	15		4	8	35		402	38			127	2	174		203		960	48	P
鹤鹬	*Tringa erythropus*				4		1	18	4							2		20	9	P
矶鹬	*Actitis hypoleucos*				2							1		2				3	2	P
长趾滨鹬	*Calidris subminuta*							75	8			4		6		13		98	8	P
弯嘴滨鹬	*Calidris ferruginea*								2										2	P
黑尾塍鹬	*Limosa limosa*							1										1		P
燕鸥科	Sternidae																			
普通燕鸥	*Sterna hirundo*		12		2			1										1	14	S
白额燕鸥	*Sterna albifrons*		2																2	S
鸥科	**Laridae**																			
红嘴鸥	*Larus ridibundus*		7		2														9	P

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附表 4 6 月卤阳湖鸟类调查数据统计表

Table 4 The statistical table of June

调查小区（area）		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	合计 (total)	居留型 (reside)
调查次数(number of times)		25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	
物 种(species)											
中文名	Scientific Name										
鸊鹈目	**PODICIPEDIFORMES**										
鸊鹈科	Podicipedidae										
小鸊鹈	*Podiceps ruficollis*	50	8					6		64	R
雁形目	**ANSERIFORMES**										
鸭科	Anatidae										
斑嘴鸭	*Anas poecilorhyncha*		16		2					18	S
绿翅鸭	*Anas crecca*		1							1	P
鹤形目	**GRUIFORMES**										
秧鸡科	Rallidae										
黑水鸡	*Gallicrex chloropus*	13	2					2		17	R
白骨顶	*Fulica atra*	2								2	S
鸻形目	**CHARADRIIFORMES**										
反嘴鹬科	Recurvirostridae										
黑翅长脚鹬	*Himantopus himantopus*	53(22)	47	3	88		13	168	107	479(22)	S
反嘴鹬	*Recurvirostra avosetta*		12(1)							12(1)	S
鸻科	Charadriidae										
灰头麦鸡	*Vanellus cinereus*				2		2	2		6	S
环颈鸻	*Charadrius alexandrinus*		31	7	169		6	153	11	377	S

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附表 4 6月卤阳湖鸟类调查数据统计表

Table 4 The statistical table of June

调查小区（area）		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	合计 (total)	居留型 (reside)
调查次数(number of times)		25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	25-27Jun.	
物 种(species)											
中文名	Scientific Name										
金眶鸻	*Charadrius dubius*				64					64	S
长嘴剑鸻	*Charadrius placidus*				13					13	P
燕鸻科	Glareolidae										
普通燕鸻	*Glareola maldivarum*				18			10		28	S
燕鸥科	Sternidae										
白额燕鸥	*Sterna albifrons*				1					1	S
灰翅浮鸥	*Chlidonias hybrida*		3						1	4	S

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附表 5 7月卤阳湖鸟类调查数据统计表

Table 5 The statistical table of July

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计（total）		居留型 (reside)
调查次数(number of times)		4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	21-23 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	
物 种(species)																				
中文名	Scientific Name																			
鹈鹕目	**PODICIPEDIFORMES**																			
鹈鹕科	Podicipedidae																			
小䴙䴘	*Podiceps ruficollis*	85	41	10	56							2		4	5			101	102	R
鹳形目	**CICONIIFORMES**																			
鹭科	Ardeidae																			
白鹭	*Egretta garzetta*		1																1	S
牛背鹭	*Bubulcus ibis*		2																2	S
雁形目	**ANSERIFORMES**																			
鸭科	Anatidae																			
斑嘴鸭	*Anas poecilorhyncha*			16	13													16	13	S
绿头鸭	*Anas platyrhynchos*			2														2		S
鹤形目	**GRUIFORMES**																			
秧鸡科	Rallidae														4					
黑水鸡	*Gallicrex chloropus*	86	51		4							2		2		8		98	55	R
白骨顶	*Fulica atra*	16(1)	47																47	S
鸻形目	**CHARADRIIFORMES**																			
反嘴鹬科	Recurvirostridae																			
黑翅长脚鹬	*Himantopus himantopus*	69(20)	60	33	109	12	4	115	22			18	26	192	143	162(5)	147	601（25）	511	S
反嘴鹬	*Recurvirostra avosetta*			1		2							3					3	3	S
鸻科	Charadriidae																			
灰头麦鸡	*Vanellus cinereus*	1										2	2			1	112	4	114	S
长嘴剑鸻	*Charadrius placidus*	5		2	2			68	2			20		4	6	5	2	104	12	P
环颈鸻	*Charadrius alexandrinus*	51	58	9	121	7		190	14			18	39	59	191	39	119	377	542	S
金眶鸻	*Charadrius dubius*												2	4	4		4	4	10	S
燕鸻科	Glareolidae																			
普通燕鸻	*Glareola maldivarum*				2		5	33	6									33	13	S
鹬科	Scolopacidae																			
青脚鹬	*Tringa nebularia*		2		7								4	3	6		8	3	27	P
林鹬	*Tringa glareola*		11		15			11	3			1	6	11	35	2	22	25	92	P
鹤鹬	*Tringa erythropus*								2						9		25		36	P
长趾滨鹬	*Calidris subminuta*							8	1				2	1	9		7	9	19	P
尖尾滨鹬	*Calidris acuminata*																4		4	P
燕鸥科	Sternidae																			
普通燕鸥	*Sterna hirundo*	8																8		S

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附表 5 7月卤阳湖鸟类调查数据统计表

Table 5 The statistical table of July

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计（total）		居留型 (reside)
调查次数(number of times)		4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	21-23 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	4-6 Jul.	28-30 Jul.	
物 种(species)																				
中文名	Scientific Name																			
灰翅浮鸥	*Chlidonias hybrida*	2																2		S

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附表 6 8月卤阳湖鸟类调查数据统计表

Table 6 The statistical table of August

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		合计 (total)		居留型 (reside)
调查次数(number of times)		11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	11-13 Aug.	22-24 Aug.	
物 种(species)																				
中文名	Scientific Name																			
䴙䴘目	**PODICIPEDIFORMES**																			
䴙䴘科	Podicipedidae																			
小䴙䴘	*Podiceps ruficollis*	91	125	243	238			4						4	2			342	365	R
雁形目	**ANSERIFORMES**																			
鸭科	Anatidae																			
斑嘴鸭	*Anas poecilorhyncha*			29	42													29	42	S
白眼潜鸭	*Aythya nyroca*	3																3		P
鹤形目	**GRUIFORMES**																			
秧鸡科	Rallidae																			
黑水鸡	*Gallicrex chloropus*	55	58					3						3				61	58	R
白骨顶	*Fulica atra*	110	111	35	64			2						2	3			149	178	p ,S
鸻形目	**CHARADRIIFORMES**																			
反嘴鹬科	Recurvirostridae																			
黑翅长脚鹬	*Himantopus himantopus*	3	4	74	56	3	3	193	16			29	7	146	123	100	91	548	300	S
反嘴鹬	*Recurvirostra avosetta*	2		3	10													5	10	P,S
鸻科	Charadriidae																			
灰头麦鸡	*Vanellus cinereus*	25		7		75		117	238			3	3	85	18	158	6	470	265	S
长嘴剑鸻	*Charadrius placidus*	1		3				72	1				5	12				88	6	P
环颈鸻	*Charadrius alexandrinus*	2	1	57	62		2	295	35			18		189	89	103	55	664	244	S
金鸻	*Pluvialis fulva*															2		2		p
燕鸻科	Glareolidae																			
普通燕鸻	*Glareola maldivarum*		1	37	85			47	230					2	52			86	368	S
鹬科	Scolopacidae																			
青脚鹬	*Tringa nebularia*							26						26	2		2	52	4	P
白腰草鹬	*Tringa ochropus*	1		12	6			6						6	7	2	6	27	19	P
林鹬	*Tringa glareola*	5		13	2			8	8						9	5	9	31	28	P
鹤鹬	*Tringa erythropus*	5	1	31	9			37	2				2	37	1		3	110	18	P
矶鹬	*Actitis hypoleucos*			1									1			1		2	1	P
长趾滨鹬	*Calidris subminuta*	1		5				5						5	2	1		17	2	P
红颈滨鹬	*Calidris ruficollis*				3														3	P
尖尾滨鹬	*Calidris acuminata*							3	2									3	2	P

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附表 7 9 月卤阳湖鸟类调查数据统计表
Table 7 The statistical table of Sep.

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		W_4		合计（total）		居留型（reside）
调查次数(number of times)		2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	
物 种(species)																						
中文名	Scientific Name																					
鸊鹈目	**PODICIPEDIFORMES**																					
鸊鹈科	Podicipedidae																					
小鸊鹈	*Podiceps ruficollis*	221	167	292	243									2	5					515	415	R
鹈形目	**CICONIIFORMES**																					
鹭科	Ardeidae																					
白鹭	*Egretta garzetta*			12																12		S
苍鹭	*Ardea cinerea*				1																1	R
雁形目	**ANSERIFORMES**																					
鸭科	Anatidae																					
绿翅鸭	*Anas crecca*														23						23	P
斑嘴鸭	*Anas poecilorhyncha*	3		70	201										112					73	313	S,W
白眼潜鸭	*Aythya nyroca*				4																4	P
鹤形目	**GRUIFORMES**																					
秧鸡科	Rallidae																					
黑水鸡	*Gallicrex chloropus*	76	93		20									5	2	4			4	85	119	R
白骨顶	*Fulica atra*	178	145	97	289									3	2					278	436	p ,S
鸻形目	**CHARADRIIFORMES**																					
反嘴鹬科	Recurvirostridae																					
黑翅长脚鹬	*Himantopus himantopus*	14		37	27	6		25	3			20	8	83	44	105	60		31	290	173	S
鸻科	Charadriidae																					
灰头麦鸡	*Vanellus cinereus*			2	37	113	13	169	105				9	47	127	25	151		57	356	499	S
长嘴剑鸻	*Charadrius placidus*													4	7					4	7	P
环颈鸻	*Charadrius alexandrinus*			91	2	13	52	28	19			5	10	135	57	61	58		27	333	225	S
金眶鸻	*Charadrius dubius*													2	6					2	6	S
金鸻	*Pluvialis fulva*													3	2					3	2	P
铁嘴沙鸻	*Charadrius leschenaultii*																1				1	P
燕鸻科	Glareolidae																					
普通燕鸻	*Glareola maldivarum*					8		22											83	30	83	S
鹬科	Scolopacidae																					
沙锥	*Gallinago* sp.														2		2				4	P
青脚鹬	*Tringa nebularia*			3	7				2			2	4	26	24	5	22		7	36	66	P

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附表 7 9月卤阳湖鸟类调查数据统计表

Table 7 The statistical table of Sep.

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		W_4		合计（total）		居留型 (reside)
调查次数(number of times)		2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	2-4 Sep.	17-19 Sep.	
物 种(species)																						
中文名	Scientific Name																					
红脚鹬	*Tringa totanus*														2						2	P
白腰草鹬	*Tringa ochropus*		2	2		2	2		3					4	12	6	2		5	14	26	P
林鹬	*Tringa glareola*			5		3		17				8	15	16	22	23	17		27	72	81	P
鹤鹬	*Tringa erythropus*				30		37	9				2	17	36	87	3			33	50	204	P
流苏鹬	*Philomachus pugnax*												1								1	P
矶鹬	*Actitis hypoleucos*							2						2	2	1				5	2	P
长趾滨鹬	*Calidris subminuta*														5	1			6	1	11	P
弯嘴滨鹬	*Calidris ferruginea*																2				2	P
红颈滨鹬	*Calidris ruficollis*																1				1	P
红腹滨鹬	*Calidris canutus*															2				2		P
燕鸥科	Sternidae																					
普通燕鸥	*Sterna hirundo*			4																4		S
佛法僧目	**CORACIIFORMES**																					
翠鸟科	Alcedinidae																					
普通翠鸟	*Alcedo atthis*			2																2		R

注：W_4为卤泊滩新增加区域。

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表 8 10 月卤阳湖鸟类调查数据统计表
Table 8 The statistical table of Oct.

调查小区（area）		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		W_4		合计（total）		居留型 (reside)
调查次数(number of times)		7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	
物 种(species)																						
中文名	Scientific Name																					
鹈鹕目	**PODICIPEDIFORMES**																					
鹈鹕科	Podicipedidae																					
小䴙䴘	*Podiceps ruficollis*	49	48	251	47	4	2							2			5		1	306	103	R
鹈形目	*PELECANIFORMES*																					
鸬鹚科	Phalacrocoracidae																					
普通鸬鹚	*Phalacrocorax carbo*		1																		1	P
鹳形目	**CICONIIFORMES**																					
鹭科	Ardeidae																					
大白鹭	*Ardea alba*							2			6					4	4			6	10	P
苍鹭	*Ardea cinerea*					5														5		R
雁形目	**ANSERIFORMES**																					
鸭科	Anatidae																					
瘤鼻麻鸭	*Tadorna tadorna*				1																1	P
斑嘴鸭	*Anas poecilorhyncha*			62	139			3			2								16	65	157	S
绿翅鸭	*Anas crecca*	5		350	712															355	712	P
绿头鸭	*Anas platyrhynchos*			138	130															138	130	P
赤膀鸭	*Anas strepera*				30																30	P
针尾鸭	*Anas acuta*				8																8	P
琵嘴鸭	*Anas clypeata*				5																5	P
白眼潜鸭	*Aythya nyroca*		26		76																102	P
红头潜鸭	*Aythya ferina*				15																15	P
鸳鸯	*Aix galericulata*				4																4	P
鹤形目	**GRUIFORMES**																					
秧鸡科	Rallidae																					
黑水鸡	*Gallicrex chloropus*	35	33	53								4		2						94	33	R
白骨顶	*Fulica atra*	40	141	418	59															458	200	p ,S
鸻形目	**CHARADRIIFORMES**																					
反嘴鹬科	Recurvirostridae																					
黑翅长脚鹬	*Himantopus himantopus*												12	6				6		12	12	S
反嘴鹬	*Recurvirostra avosetta*			1	4															1	4	S
鸻科	Charadriidae																					
灰头麦鸡	*Vanellus cinereus*													1						1		S
凤头麦鸡	*Vanellus vanellus*														101		42				143	p

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表 8 10 月卤阳湖鸟类调查数据统计表
Table 8 The statistical table of Oct.

调查小区 (area)		E_1		E_2		E_{3A}		E_{3B}		E_4		W_1		W_2		W_3		W_4		合计 (total)		居留型 (reside)
调查次数(number of times)		7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	7-9 Oct.	23-25 Oct.	
物 种(species)																						
中文名	Scientific Name																					
环颈鸻	*Charadrius alexandrinus*	2						17				2		4	30	35				60	30	S
金眶鸻	*Charadrius dubius*							6												6		S
鹬科	Scolopacidae																					
青脚鹬	*Tringa nebularia*			67								4	2	3				30		104	2	P
红脚鹬	*Tringa totanus*											12								12		P
白腰草鹬	*Tringa ochropus*											2	9	2	2			1		5	11	P
林鹬	*Tringa glareola*	2		1				17				5	4	3				2		30	4	P
鹤鹬	*Tringa erythropus*				78				1			27	371	1	14			4	1	37	460	P
矶鹬	*Actitis hypoleucos*							5												5		P
流苏鹬	*Philomachus pugnax*												5								5	P
沙锥	*Gallinago* sp.							1												1		P
红颈滨鹬	*Calidris ruficollis*						5								21						26	P

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附表 9 11 月卤阳湖鸟类调查数据统计表
Table 9 The statistical table of Nov.

调查小区 (area)		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	W_4	合计 (total)	居留型 (reside)
调查次数(number of times)		11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	
物 种(species)												
中文名	Scientific Name											
鸊鹈目	**PODICIPEDIFORMES**											
鸊鹈科	Podicipedidae											
小䴙䴘	*Podiceps ruficollis*	20	71	2			1	30		3	127	R
凤头䴙䴘	*Podiceps cristatus*	2	3								5	P
鹈形目	**PELECANIFORMES**											
鸬鹚科	Phalacrocoracidae											
普通鸬鹚	*Phalacrocorax carbo*	1	23								24	P
鹳形目	**CICONIIFORMES**											
鹭科	Ardeidae											
大白鹭	*Ardea alba*		2								2	W
苍鹭	*Ardea cinerea*		1								1	R
雁形目	**ANSERIFORMES**											
鸭科	Anatidae											
绿翅鸭	*Anas crecca*	9	1216		103				1		1329	P
绿头鸭	*Anas platyrhynchos*		80		9						89	S
赤膀鸭	*Anas strepera*		35								35	P
赤颈鸭	*Anas penelope*		4								4	P
针尾鸭	*Anas acuta*		2								2	P
斑嘴鸭	*Anas poecilorhyncha*				28			12			40	S
琵嘴鸭	*Anas clypeata*		5								5	P
花脸鸭	*Anas formosa*		12								12	P
赤麻鸭	*Tadorna ferruginea*				2						2	P
翘鼻麻鸭	*Tadorna tadorna*		16		7						23	P
白眼潜鸭	*Aythya nyroca*	40									40	P
红头潜鸭	*Aythya ferina*		10								10	P
鹤形目	**GRUIFORMES**											
秧鸡科	Rallidae											
黑水鸡	*Gallicrex chloropus*	21			2				18		41	R
白骨顶	*Fulica atra*	86	20					13		4	123	P
鸻形目	**CHARADRIIFORMES**											
反嘴鹬科	Recurvirostridae											
黑翅长脚鹬	*Himantopus himantopus*						2				2	S
鸻科	Charadriidae											

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附表 9 11 月卤阳湖鸟类调查数据统计表
Table 9 The statistical table of Nov.

调查小区 (area)		E_1	E_2	E_{3A}	E_{3B}	E_4	W_1	W_2	W_3	W_4	合计 (total)	居留型 (reside)
调查次数(number of times)		11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	11-13 Nov.	
物 种(species)												
中文名	Scientific Name											
风头麦鸡	*Vanellus vanellus*				144					78	222	P
环颈鸻	*Charadrius alexandrinus*						4				4	S
金鸻	*Pluvialis fulva*								2		2	p
鹬科	Scolopacidae											
青脚鹬	*Tringa nebularia*		7		7						14	P
白腰草鹬	*Tringa ochropus*		1		12		7	4	11		35	P
鹤鹬	*Tringa erythropus*		26		4						30	P

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D. Photographs of construction site