Hunan Integrated Management of Contaminated Agricultural Land

Environmental and Social Assessment
Executive Summary

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# TABLE OF CONTENTS

1. INTRODUCTION .................................................................................................................. 3
   1.1 Project Background ........................................................................................................... 3
   1.2 Project Development Objective .................................................................................... 4
   1.3 Project Components ........................................................................................................ 4

2. SUMMARY OF KEY SAFEGUARD ISSUES ............................................................................. 5

3. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE ............................................ 7

4. LEGAL, POLICY AND MANAGEMENT FRAMEWORK ......................................................... 8
   4.1 Policies and EHSGs of the World Bank Group ................................................................. 8
   4.2 Key National Laws and Regulations ............................................................................ 8
   4.3 Relevant National Department Regulations/Rules and Programs ............................... 8
   4.4 Relevant Plans in Hunan Province ................................................................................. 10
   4.5 Relevant National and Local Technical Guidelines and Standards .......................... 10

5. SUMMARY OF SELECTION OF CANDIDATE SITES ............................................................ 11
   5.1 Site Selection Criteria .................................................................................................... 11
   5.2 Safeguard Screening for the Candidate Sites ............................................................... 11

6. SUMMARY OF SOIL REMEDIATION APPROACH ............................................................. 13

7. SUMMARY OF ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK (ESMF) ............................................................................................................................... 13
   7.1 Environmental and Social Safeguard Procedures .......................................................... 13
   7.2 Site-specific Environmental and Social Assessment Procedures .............................. 13

8. ALTERNATIVE ANALYSIS ...................................................................................................... 15

9. SUMMARY OF ENVIRONMENTAL ASSESSMENT OF THE PIONEER COUNTIES ......... 15
   9.1 Description and Baseline ............................................................................................... 15
   9.2 Analysis of Alternatives ................................................................................................ 18
   9.3 Impact Analysis and Mitigation Measures ..................................................................... 18
   9.4 Safety of Dams ............................................................................................................. 21
   9.5 Summary of Social Impact Assessment ....................................................................... 22
   9.6 Land Use and Resettlement Issues .............................................................................. 23
   9.7 Environmental and Social Management Plan ............................................................... 24
      9.7.1 Institutional arrangements ..................................................................................... 24
      9.7.2 Mitigation of environmental and social impacts .................................................. 25
      9.7.3 Environmental and social monitoring Plan ......................................................... 25
      9.7.4 Cost Estimation for both Mitigation Actions and Supervision ................................ 25
      9.7.5 Reporting and Grievance Redress Mechanism ................................................ 25
   9.8 Public consultation and information disclosure .......................................................... 25
   9.9 Information Disclosure .................................................................................................. 27

Figure 1 Geographical Location of Hunan Province ................................................................. 28

Figure 2 Locations of candidate counties and pioneer counties in Hunan Province ........... 29

Annex 1 Specific Activities under Component One ............................................................... 30
Annex 3 Environmental and Social Impacts and Mitigation Measures ............................... 32
Annex 4 Summary of Major Laws, Regulations and Standards ............................................. 34
1. Introduction

1.1 Project background

Hunan produces 6% of the nation’s rice from only 3% of its arable land, making a significant contribution to food security in China. However, the safety of agricultural producing areas in Hunan has been particularly affected by heavy metal contamination of agricultural soil and water, mainly caused by discharge of flue gas, wastewater, and waste residue from mining, smelting and other industries. The quality of agricultural soil is further affected by overuse of agrochemicals and poor farming practices. In addition, severe air pollution (sulfur dioxide emissions from fossil fuel combustion at power plants and other industrial facilities) increases the frequency of acid rain in Hunan, causing soil acidification (reducing soil pH value), which in turn increases the chemical availability of heavy metals to be absorbed by plants. It has been estimated that about 37% of Hunan’s total arable land (2.73 million ha) is contaminated with heavy metals.

The Hunan Provincial Government issued an Implementation Program for Heavy Metal Pollution Control in the Xiang River Basin (2012-2015), a first ever program ratified by the State Council, aiming to address arable land pollution in Hunan. Progress has been made on industrial heavy metal pollution source control and reduction of heavy metal concentration in rice in pilot areas. However, it is recognized that there is an urgent need for improving environmental performance in both industrial and agricultural production operations and promoting an integrated approach - combining environmental management (pollution source control and environmental remediation) and sustainable soil management, in order to fully address agricultural land pollution with heavy metals and other pollutants, contributing to food safety.

Since 2014, a pilot project was launched by the Hunan Government for remediation and adjusting cropping system on the rice-raising area contaminated by heavy metals on a scale of 2.74 million mu. The technical approach employed by this pilot project is proven in effectively reducing the Cd content in the rice while achieving the quality standards in terms of Cd content of the rice, while the physical properties of the soil improved with pH value slightly increased. The lessons learned from this pilot project will be considered in this proposed project.

The central government of China has realized the threat of contaminated agricultural land and the urgency to control the deteriorating trend of soil contamination. On 31 May, 2016, the State Council issued the Soil Contamination Prevention and Control Action Plan. This action plan sets out an ambitious and urgent target for soil contamination control: by year 2020 the trend of soil contamination will be curbed and the safety of soil used for agricultural and construction developments will be basically guaranteed; and by year 2030 the ambient soil quality nation-wide will be gradually restored; by the middle of this century the ambient soil quality will be thoroughly recovered and sustainable development of the ecological environment will be achieved; while the target for soil quality is by year 2020, over 90% of the contaminated farmland will be used in a safe manner; by year 2030, the target is for over 95% of the contaminated farmland. An integrated approach is promoted and
promised by the plan to address the imminent challenge of soil contamination through legislation and standard system development, categorization of agricultural land use, monitoring of pollution sources and strengthening relevant studies and research.

The proposed project is consistent with the national and Hunan’s plan on heavy metal pollution prevention and control and will contribute to sustainable agriculture and food safety in Hunan and China.

1.2 Project development objective

The project development objective is to improve environmental management of agricultural land contaminated with heavy metals and other pollutants for safe agricultural production in selected counties in Hunan.

1.3 Project components

The proposed project is the first operation in China to demonstrate innovatively the integrated approach to control of agricultural land pollution through the following carefully designed components:

Component 1: Sustainable Management of Contaminated Agricultural Land. This component aims to categorize the soil safety risk of agricultural land based on the tested content of heavy metals in the soil and the crops grown on the soil so as to develop and implement corresponding risk management measures for the various categories of risks, properties of soil and the common species of rice in the project area. In addition, to cope with the environmental and safety risks associated with the physical works, irrigation water and sediments, physical measures will be developed and implemented. The map of agricultural risks distributed in the whole province of Hunan will be developed to help guide cropping. The specific activities under the component one are listed in Annex 1.

Component 2: Agricultural Environment Monitoring System. This component is designed to establish an early warning and monitoring system for the agricultural environment for the project area, with the further efforts to develop local legislation and standards, and to provide technical assistance to the industrial enterprises contributing a large share of the pollution load to the project area.

Component 3: Capacity Building. This component aims to strengthen the capacity of the project management through a training plan for government officials and technical staff, training for beneficiary farmers and large cropping partners to raise their awareness of agricultural pollution and technical capacity for sustainable soil management, and studies to develop an environmental protection action plan for soil.

Component 4: Project management. This component is to enhance the daily management of the project by establishing an MIS system, procurement of office equipment and covering the costs associated with the project management.

This proposed project will be initially implemented in the three pioneer counties of Hengyang and Yongxing, and Yongding District of Zhangjiajie City, among the total of 15 candidate counties, which show strong government commitment and public willingness, and where the pollution sources have been clearly identified and
prior attempts were made to reclaim land contaminated by heavy metals. The lessons and experiences derived from the three pioneer counties are then expected to be scaled up in the remaining 13 candidate counties during the follow-up phases of this proposed project.

The location of Hunan Province in China is shown in Figure 1 and the locations of the candidate counties including the three pioneer counties within Hunan Province are shown in Figure 2.

2. **Summary of Key Safeguard Issues**

2.1 **Environmental and Social Impacts.**

The project itself is an environmental remediation and risk reduction effort which aims to support the Chinese government’s efforts to improve its capacity for managing contaminated sites, and demonstrate the identification and cleanup of sites contaminated with heavy metals. Thus the project has significant positive environmental and social benefits.

Most of the environmental and social safeguard issues are directly related to the physical works to be conducted on the farmland, which are limited to small size facilities such as irrigation facilities, rehabilitation and dredging of small farmland reservoirs, farm tracks and small civil works, i.e. waste collection tanks, bio-retention swales, and composting tanks.

These environmental impacts include air-borne dust, nuisance odor and tail gas, construction wastewater and solid waste including the dredged sediments, noise and destruction of artificial vegetative cover. In addition the activities associated with the application of lime and inactivation agents, livestock manure and chemical fertilizers and pesticides are envisaged to cause an impact on soil texture or physical properties, as well as on the health of the people. These impacts, though likely to be site-specific, could be significant to the environment and community health if not well managed. The project is designed to improve environmental management of agricultural land contaminated with heavy metals and other pollutants for safe agricultural production in project counties in Hunan. The Project is proposed as Category A project because heavy metal pollution sources upstream or near the project areas could be very harmful to the environment and community health if not well managed; especially if contaminated rice products are sold on the market, causing serious social and health risks for the public.

During the project preparation stage three counties were selected as pilots for the first year, the remaining counties will be decided during project implementation, and therefore an Environmental and Social Management Framework (ESMF) and three counties’ ESIA (ESMPs) for the first year implementation, PMP and the EA Executive Summary were prepared. ESIA (ESMP) for remaining participating counties will be prepared during project implementation following the ESMF when they are confirmed. A separate Social Assessment was prepared to address the social impacts of the project, and the relevant context was included in the ESIA (ESMP).

Although the physical investment of the project is focused on activities on farmland, the potential impact of the off-site pollution sources need to be taken into account in
the assessment so as to avoid the situation where contaminated soil is being remediated while the off-site sources are discharging heavy metals into the soil. Such off-site pollution sources may include:

- Industries discharging wastewater that does not meet the effluent quality standards into rivers from which the farmers take water for irrigation purposes; emitting flue gas containing heavy metals that may be deposited on farmland; discharging industrial solid waste that is not stored and disposed of in compliance with relevant standards.
- Tailings dams that release heavy metals through filtration into the farmland, or in case of a collapse that causes accidental discharge of heavy metals and a safety risk for communities; and
- Legacy issues related to the abandoned industrial residues due to closure of industrial enterprises, which may discharge heavy metals into farmland through rainwater leaching.

One of the criteria for selection of the project site is that these off-site pollution sources should be identified and effectively handled, otherwise such sites should be rejected from the candidate counties.

The social impacts are primarily positive. The stakeholders’ awareness of safe agricultural products will be promoted through the propaganda program and the techniques of safe production will be promulgated among the farmers; a consensus on approaches to remediating contaminated agricultural land will be achieved, and the irrigation facilities will be improved to help sustain the development of agriculture; the management of the quality of agricultural products will be enhanced and supported by the environmental and agricultural monitoring program, and the capacity of withstanding risk and increasing the competitiveness of agricultural products of the farmers will be increased through the establishment of farmers’ cooperatives.

In addition, the project will help increase the price and additional value of agricultural products and improve the efficiency of land use, while decreasing the cost of agricultural production. The project also will lead to the return of migrant workers and the creation of numerous employment opportunities for women, which can contribute to lifting families out of poverty.

The project may have some limited negative social impacts which may cause short-term income reductions due to the changes to cropping systems. This might be the case of long-term crops prior to the first harvest of such a kind of crops or fruit trees and affect the aesthetics of the project area due to the dust, noise and solid waste during the construction phase. However these negative impacts are temporary and can be effectively mitigated or compensated. In addition, as the sub-projects will be selected in areas without industrial discharge of heavy metals, there would be an impact on workers if the enterprises are closed down to eliminate the point source of heavy metals. The resettlement plan for the workers has been developed in line with the OP 4.12 of the Bank to mitigate the social impacts. The due diligence review for such industries was included in the ESMF and EISAs (ESMPs) for the potential environmental and social impacts and mitigation measures.

2.2 Environmental and Social Instruments.
The project plans to conduct soil remediation exercise for up to 15 selected counties sites in total during the implementation stage. To address the potential environmental and social impacts envisaged for the soil remediation exercise, an Environmental and Social Management Framework (ESMF) has been prepared to guide the safeguards preparation and implementation for the whole project. The ESMF specifies procedures for the selection of counties and sites, the environmental and social safeguards documents preparation as per requirement of World Bank safeguards policies, the World Bank Group’s EHSGs and national laws/regulations. Given the complexity of the project a Social Assessment and Resettlement Action Framework also have been prepared and incorporated into the ESMF. Site-specific Environmental and Social Impact Assessment (ESIA) and Integrated Pest Management Plan (IPMP), as well as a resettlement action plan for each county under the proposed project will be prepared during the project implementation stage following the ESMF requirements.

Three pioneer counties have been identified and prepared for implementation once the project is approved. ESIA has been prepared, which covers site investigation/monitoring, risk assessment, alternative analysis for selection of sites, remediation plan, monitoring and capacity building, and public consultation and information disclosure.

2.3 Capacity for Preparation and Implementation of Safeguard Instruments.

The project provincial implementing agency will be the Foreign Economic and Technical Cooperation Center of Hunan Agricultural Commission (FETCC). FETCC has been designated as the provincial lead implementing agency for this project and it will engage an expert panel comprising environmental and social experts to help screen and select the candidate counties and specific sites within each county to participate in the project.

3. Public Consultation and Information Disclosure

The key stakeholders related to the contaminated farmland will include farmers and agricultural cooperative association, government organizations and concerned NGOs as well as experts. Public consultation and information disclosure is an important part of the soil remediation process. Requirements for consultation with project affected people are incorporated into the ESMF based on the World Bank safeguards policy requirements. For each sub-project, at least two rounds of public consultation will be conducted with participation of project affected people: (i) the first round at TORs stage or at the preliminary site investigation stage during which the local public shall be informed of the general information of the project (land remediation) and consulted about their concerns; (ii) the second round when the site-specific draft ESIA is available in which the key findings of environmental assessment and mitigation measures are provided to the public for comments and feedback. The draft and final site ESIA documents will be locally disclosed in the project areas.

The first round of consultation and information disclosure for the ToR of this ESMF was conducted in Sept. 2015 and representatives from the 15 candidate counties and the relevant experts took part in; and the second round of consultation and information disclosure for the draft ESMF was in July through Aug. 2016 with
the representatives and experts of the 15 counties. The discussions during the public meetings were focused on the disposal of the rice high in Cd content, monitoring plans, approaches to prevent the secondary pollution, disposal of sediment from irrigation ditches, possibility of shifting the cropping system and associated compensation standard. These concerns and suggestions have been recorded in the ESMF and considered in the development of the mitigation measures. The draft ESMF is available on website at: http://www.hnagri.gov.cn/web/hnagrizw/xxgk/tzgg/content_221817.html since Nov. 7, 2016.

During the implementation of the project, public consultation will be carried out in each project county each year when the results of the yearly analysis of the agricultural products become available, and the information regarding the project information and the analysis results will be disclosed to farmers and farmers’ associations. A grievance redress mechanism will be set up at each county PMO in line with the procedure acceptable to the Bank.

4. Legal, Policy and Management Framework

4.1 Policies and EHSGs of the World Bank Group

- OP/BP4.01: Environmental Assessment;
- OP/BP4.12: Involuntary Resettlement;
- OP/BP4.10: Indigenous People;
- OP/BP 4.09: Pest Management;
- OP/BP 4.37: Safety of Dams;
- World Bank Group Health, Safety and Environment General Guidelines;
- OP/BP 4.11: Physical Cultural Resources, though is not triggered, the Chance Find procedure is required to include in the site-specific ESIA;
- General EHS Guideline, and EHS Guideline-Plantation Crop Production.

4.2 Key National Laws and Regulations

1) Environmental Protection Law of the People’s Republic of China (2014)


5) For summary of the key laws please see the attached Annex 4.

4.3 Relevant National Department Regulations/ Rules and Programs

• Regulations of the Ministry of Land and Resources on Public Hearing on Land and Resources
• Decision of the State Council on Deepening the Reform and Rigidly Enforcing Land Administration (SC [2004] No.28)
• Notice of the State Council on Issues Concerning the Strengthening of Land Control and Adjustment (SC [2006] No.31)
• Notice on Adjusting Fees for Using Additional Construction Land (CZ [2006] No.48)
• Notice of the Ministry of Land and Resources on Doing a Better Job in LA Management (MLR [2010] No.238)
• Labor Law (July 5, 1994)
• Labor Contract Law (June 29, 2007)
• Regulations on Protection of Women Workers (July 21, 1988)

The Chinese Government issued the following regulations or official documents regarding cleanup of contaminated sites in relation to this proposed project, summary of the regulations and official documents are provided in Annex 4:
• In June 2008, MEP issued an official document entitled “Recommendations on Strengthening Soil Contamination Prevention and Remediation.”
• In 2011, the State Council issued “Opinions on Strengthening Key Tasks on Environmental Protection”.
• In April 2014, the MEP and Land Resource Ministry jointly issued the Soil Contamination Situation Investigation Communique for the Whole Country.
• In January 2013, the State Council further issued “Work Arrangement on Soil Protection and Comprehensive Treatment in Near Future”.
• Based on the Integrated Prevention and Control of Heavy Metal Pollution 12th Five Year Plan issued by the Ministry of Environmental Protection in early 2011.
• Based on the Soil Contamination Prevention and Control Action Plan, issued by the State Council, 31 May, 2016.

MEP is also now making great efforts to include a “Soil Pollution Prevention and Control Law” in the legislation plan of the National Congress. The initial draft of the law has been prepared and comments are being widely collected. The Law, when it is finalized, will be submitted directly to the National People’s Congress for approval without the need of going through the Legislative Affairs Office of the State Council, which means that its review and approval process will be much shortened, it is expected the law will take effect in 2017 or 2018.
4.4 Relevant Plans in Hunan Province

- Implementation Plan for Heavy Metal Pollution Control in Xiang River Basin, 2012-2015;
- The Twelfth-Fiver Plan for Integrated Control of Heavy Metal Pollution in Hunan Province;

4.5 Relevant National and Local Technical Guidelines and Standards

- Technical Guidelines for Investigation of Site Environment (HJ 25.1-2014);
- Technical Specification for Monitoring of Site Environment (HJ 25.2-2014);
- Technical Guidelines for Risk Assessment of Contaminated Sites (HJ 25.3-2014)
- Technical Guidelines for Soil Restoration of Contaminated Sites (HJ 25.4-2014)
- Guidelines for Evaluation of Site Environment (DB11/T 656-2009);
- Ambient Soil Quality Standard (GB 15618-1995)
- Food Safety Standard-Pollutants Limits in Food (GB 2762-2012)
- Agricultural Irrigation Water Quality Standard (GB5084-2005)
- Standard for Assessment of Environmental Quality in Edible Agricultural Products Production Place (HJ/T 332-2006)
- Ecological Indicators for As, Cd, Pb, Cr and Hg in fertilizers (GB/T 23349-2009)

The most important standards are those for the soil quality and food quality which are the focus of the assessment. In order to learn the differences between Chinese standards and international Standards on food quality and soil quality, comparison were made by the EA team to ensure that stringent standards be applied and can be achieved at reasonable cost.

- **Ambient Soil Quality Standard**: Comparison of Chinese standards, the Ambient Soil Quality Standard (GB 15618-1995) versus the corresponding standards in Netherlands, EU and Japan indicates that the limit for Cd in the Chinese standard is much more stringent than those of Netherlands, EU and Japan, where the Chinese standard in 0.3 mg/kg for acid soil while 0.8 mg/kg in Netherlands standard and 1-mg/kg in EU standard, and 0.4 mg/kg of Japanese standard. The Chinese standard is adopted for this project. For the details of the Ambient Soil Quality Standard, please see the attached Annex 4.

- **Food Safety Standard**: comparison of Chinese standard, the Food Safety Standard-Pollutants Limits in Food (GB 2762-2012) versus corresponding standards of (CODEX STAN 193-1995)2013 of Codex Alimentarius Commission and the (EU) No 488/2014 of EU indicate that the limit for Cd content in rice of the Chinese standard is the same as that in the (EU) No 488/2014 of EU as low as 0.2 mg/kg, much more stringent than the limit of 0.4 mg/kg provided in the (CODEX STAN 193-1995)2013. Thus the Chinese standard for food safety is applied.
5. **Summary of Selection of Candidate Sites**

5.1 **Site Selection Criteria**

A site selection exercise was carried out during project preparation. The purpose of the selection was to identify a list of candidate sites suitable for the project. The site selection criteria is two tiered at the levels of county and site. The potential 15 counties selection was based on such criteria as:

- Being a major production place of agricultural products;
- Being located within the key area for heavy metal pollution control in the province;
- Being clear about the soil quality and the pollution status of agricultural products;
- Being clear about pollution sources which can be controlled;
- Representative farmland sites for management of heavy metal pollution and application of sustainable soil management practices, which should have potential for scaling up;
- Having prior experience in heavy metal pollution control and the existing industrial sources having been closed down or controlled effectively.

Based upon the above criteria, totally 15 candidate counties were selected for implementation under the project. These counties are Jihou, Yongshun, Baojing, Huayuan of Xiangxi Prefecture, Yongding, Cili of Zhangjiajie City, Zhongfang of Huaihua City, Anhua County of Yiyang City, Hengyang and Hengnan of Hengyang City, Yizhang, linwu and Yongxing of Chenzhou City, and Lengshuitan District and Qiyang County of Yongzhou City.

The provincial PMO will screen and select the sites within each candidate county based on the principles such as the sites having enough area to be scale-efficient, the pollution information is accurate with the major pollution sources cut off or can be controlled, the site can represent the actual local situation and can be duplicated to other parts of the province. Each candidate county would select 4 to 6 sites for implementation based on the principles.

5.2 **Safeguard screening for the candidate sites**

Once the Provincial PMO has selected one county and the sites within the county for implementation as the next step of the project, the expert panel of the Provincial PMO will use the screening matrix already agreed with the Bank to screen the Operating Policies one by one, so as to determine what safeguard documents will be required to prepare.

In addition, in order to enhance the management of social risks and impacts associated with the project, specific and requirements for further actions during project implementation have been highlighted below to help guide the assessment and handling of social issues. All the social instruments shall be prepared by the project owner through support of qualified and experienced social experts. The social instruments should be submitted to the Bank for prior review when each new subproject proposal is submitted for review:

- Resettlement Policy Framework: Although the project activities will be mostly implemented within project villages, project civil works may include small irrigation canals and ditches on farm land. As a common practice in China, the
use of land for village level public facilities like irrigation canals will be resolved within the related village with no need for acquiring land. That is, land is usually provided by villagers through consultation and land readjustment or rebalancing within the village. The project might experience very limited changes to the current design in relation to land use. A Resettlement policy Framework has been prepared to provide guidance on dealing with the issues of land acquisition and resettlement in case land acquisition and involuntary resettlement emerge during the implementation stage of the project. In doing so, it is to ensure the OP 4.12 Involuntary Resettlement is properly complied with.

- Resettlement Action Plan: a full RAP needs to prepare for the sub-project when more than 200 people will be affected by land acquisition and resettlement; otherwise a brief RAP needs to be prepared for sub-projects where less than 200 people will be affected by land acquisition and resettlement while such impact is minor. The minor impact is that the people will not lose all or part of their house which lead to loss of less than 10% of productive materials.

- Social Assessment: Social screening will be done for every subproject before the subproject proposal is submitted for consideration. A social assessment report needs to be prepared for sub-projects that will cause significant social impacts. Such social impacts could be presence of indigenous people, land acquisition and resettlement, loss of income or access to assets or livelihoods.

- Ethnic Minority Plan Framework (EMPF): an EMPF is prepared as part of the ESMF to guide the project in handling issues related to ethnic minority people (i.e. IP by the Bank term definition). The EMPF is prepared for the sub-projects although ethnic minorities or groups of ethnic minorities are not found within the first three project cities or county, and it is very unlikely to have presence of IP by the Bank IP term requirements in the project sites. The impact on ethnic minorities is still uncertain as the remaining project sites have yet not been determined; Once the presence of IP is confirmed in the future project sites, an ethnic minority development plan will be prepared by following the EMPF requirements.

- Gender dimension needs to be considered throughout the project cycle, so as to promote the equal development and fair treatment for both men and women. The vulnerable groups, particularly women, should be given high attention in project consultation, farmer’s organization, training and subsidy provision.

- Employees Resettlement Plan Framework (ERDF): through the initial identification of social risks, there might be risks of employee retrenchment as a result of the cutting-off pollution sources causing the relocation or closing down of enterprises. Thus the employees resettlement plan framework needs to be prepared for the events of closing down or relocation of enterprises, so as to provide protection for the affected employees. This framework is developed based on the applicable national legal system for labor laws and regulations, labor contracts, social security and employment promotion. The fund for implementation of this framework will be provided by the enterprises, while the local government will provide the free training to the workers and assistance on job seeking. Chinese labor laws and regulations and World Bank safeguards policies should be followed to ensure appropriate compensation and livelihood restoration for affected people. Those laying off less than 20 employees, the employee resettlement plan can be covered in the environment assessment and ESMP under Op 4.01, otherwise a separate ERP should be prepared and
submitted to local labor authorities, FECO and World Bank for prior review. The employee resettlement plan will be monitored and evaluated during the project implementation period.

6. Summary of Soil Remediation Approach

Remediation of agricultural soil contaminated with heavy metals is a complex and difficult task. A comprehensive remediation and treatment technical package including pollution source control, remediation approach and technology, engineering measures, remediation management and decision making systems are proposed for the project based on the best practice available internationally. The specific measures will be selected and adopted from the technical package based on risk assessment of soil contamination and alternative analysis for each site for remediation. Addressing agricultural land contamination also requires sustainable soil management practices for restoration and maintenance of soil quality. This means a combination of the technical options for soil remediation and soil quality management will be used in this project.

7. Summary of Environmental and Social Management Framework (ESMF)

7.1 Environmental and Social Safeguard Procedures

For the contaminated sites to be confirmed during project implementation the following steps of environmental and social impact screening, mitigation and management measures development and implementation will be followed:

- Step 1 - Identification and selection of sub-project according to the selection criteria;
- Step 2 - Identification and selection of contaminated sites according to the selection criteria;
- Step 3 - Screening for potential environmental and social impacts;
- Step 4 - Development of site-specific TORs for Environmental Assessment (EA) and Social Assessment (SA), Resettlement Action Plan (RAP) and/or Ethnic Minority Development Plan (EMDP); when applicable, EA and SA should be integrated as ESA;
- Step 5 - Review of the safeguards screening in view of all World Bank safeguard policies and EA, RAP or SA/EMDP TORs by World Bank;
- Step 6 - Preparation of environmental and social safeguards documents;
- Step 7 - Review and clearance of the safeguard documents by government and the Bank;
- Step 8 - Implementation, supervision, environmental monitoring and reporting.

7.2 Site-specific Environmental and Social Assessment Procedures

The objectives of the site-specific environmental and social assessment are to:

a) Identify the scope of site contamination through information collection, site investigation and sampling/testing;

b) Assess risks of the contaminated site and propose remedial technology;

c) Conduct alternative analysis for site remediation technologies and develop a site remediation plan;

d) Assess the potential impacts and develop an environmental and social management plan.
The ESIA will include:

a) Site investigation. During site investigation, the site area, cropping pattern and system, irrigation water source of the site are confirmed; the social baseline on poverty level, level of women’s participation, household income structure, cropping cost, and business mode is confirmed; the potential risk receptors are investigated and the public (affected people) consulted, the information on the existing pollution source investigated. Site investigation in general follows multi-phase approach which is an international best practice and also adopted recently in China for contaminated site management. Phases can be divided in different ways, but in general follow the same logical order:

(i) phase I preliminary assessment. During phase I site investigation, environmental pollution of the site is analyzed preliminarily and preliminary conceptual site model is established through data collection and analysis, field reconnaissance, public consultation and information disclosure, etc.

(ii) phase II field sampling. Phase II site investigation is to screen whether there are risks on the site or not through preliminary sampling, including sampling, lab analysis and preliminary risk screening. If a risk is confirmed, detailed sampling shall be conducted.

(iii) phase III site investigation and additional sampling is needed. Phase III site investigation is to investigate site characteristic parameters and Due Diligence for industrial sources through data query, field measurement and lab analysis, etc.

b) Risk Assessment. The content of Cd, Hg, Cr, Pb, and As in the rice are the indicators for the risk assessment for farmland contamination. Five categories of risk are established based on the indicators in rice and corresponding remediation targets and remediation technology recommended. Three models for the risk assessment for soil contamination source, farmland contamination source and farmland management respectively are established to screen out the major risks, for which the mitigation measures are developed;

c) Site Remediation Technology Program. The contaminated site remediation technology program should be prepared based on the site investigation and risk assessment. Firstly, refine the conceptual site model, determine the overall remediation goals and develop appropriate remediation strategy; secondly, determine the feasible site remediation technology through remediation technology screening and technical feasibility evaluation. Finally, establish the potentially feasible remediation technical program through the rational combination of all feasible technologies; then compare the solutions by taking economic, technical, environmental and social indexes into account so as to determine the best remediation technology program.

d) Environmental and Social Management Plan. The ESMP is an instrument that will detail (a) the feasible and cost-effective measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental and social impacts, or to reduce them to acceptable levels; (b) the actions needed to implement these measures. The ESMP is an integral part of the ESIA. The ESMP for the contaminated site remediation sub-project will include the environmental and social impacts of the site cleanup activity, mitigation measures, environmental supervision plan, resettlement action plan,
Executive Summary

Hunan Integrated Management of Contaminated Agricultural Land

ethnic minority plan, or employee resettlement plan if applicable, remediation validation plan, institutional arrangement and responsibilities, capacity building activities, and implementation schedule and cost estimate.

e) Public consultation and information disclosure. The safeguard documents, i.e. ESIA, Resettlement Action Plan and Social Assessment, Employees Relocation Policy Framework, and Ethnic Minority Development Plan where applicable, are subject to public consultation and disclosure in an accessible place, in a timely manner, in a form and language understandable to the project-affected people. Particular attention will be given to ensure project affected persons get adequate time and ready access to draft documents before consultation takes place. The ESMF has also included a Resettlement Policy Framework and an Ethnic Minority plan Framework to guide preparation of the RAP and EMDP and employee resettlement as needed. The ESMF,SA, RPF and EMDP have been disclosed to the public in Chinese and in English.

f) g) Due Diligence review for the enterprises closed down or relocated: the following information should be obtained or investigated: the legacy issues on the disposal of the facilities and structures, the industrial wastewater and solid waste, site contamination, examination and acceptance of environmental facilities, pollution discharge of the enterprises after relocation, the basic information on the workers affected, e.g. the age, education background, skill, training, livelihood and type of contract, any recent land acquisition (usually occurred in the past two years at the proposal of subproject).

8. Alternative Analysis

The two alternatives on With and Without Project have been compared. Through the comparison the pros and cons of the project are clearly identified and justified. Although the With Project would cause environmental impacts such as dust, noise and wastewater, such impacts are temporary and site-specific and can be readily mitigated. The With Project will gain tremendous positive social and environmental benefits in reducing health risk and improving living conditions for people. Such positive benefits are long-term and the benefits largely outweigh the negative impact under the With Project. The With Project is quite urgent and preferred.

In addition, a matrix for alternative analysis for the selection of the project sites has been developed based on the criteria above to help the borrower determine the sites feasible for implementation of the project.

9. Summary of Environmental Assessment of the Pioneer Counties

9.1 Description and Baseline

Three counties have been selected as the pioneer sub-projects, they are Hengyang and Yongxing, and Yongding District of Zhangjiajie City. The information on the industrial and agricultural activities and routine environmental quality data were collected to evaluate the overall soil contamination in the three pioneer counties. The description of the three pioneer counties are as follows:
Yongding District is located in the deep Wuling Mountain. The soil pH values of the 1059 samples measured have an average pH value of 6.0, which means that they show a weak acidity. The irrigation water of the project areas is from reservoirs upstream, the irrigation water quality meets the national standards, and seven small dams in Yongding District triggered the dam safety policy. The monitoring results of the soil in the farmland showed the Cd contents in project areas exceed the Class 2 standard of the Soil Environmental Quality Standard, while the other heavy metals Pb, As, Cr, and Hg meet with the Class 2 standard of the Ambient Soil Quality Standard. The monitoring results of the bottom mud (sediments) in the irrigation channels of the project areas showed the Cd contents in some channels exceed the Class 2 standard of the Soil Environmental Quality Standard, while the other heavy metals Pb, As, Cr, and Hg comply with the Class 2 standard. The source for heavy metals that contaminated the agricultural land is mainly the solid waste and wastewater once discharged by the mining enterprises. The application of fertilizers that contain Cd during the past three decades is considered another reason for contamination of farmland. In addition, the natural background of heavy metal content is relatively high given that Yongding is rich in minerals. Recently Yongding is promoting the development of tourism, as a result the industrial enterprise involving in heavy metal and mining have been closed down. The legacy issues on the abandoned industrial wastes are being addressed.

In 2012 and 2015 a total of 1549 sampling points were established across the county of Hengyang. The Soil pH value of 80 percent of the farmland areas is less than 7, the irrigation water of the project areas is from Zhengshui River, the irrigation water quality meets the national standards of Surface Water Environmental Quality Standards, The monitoring results of the soil in the farmland showed the Cd, As and Hg contents in project areas exceed the Class 2 standard of the Ambient Soil Quality Standard, the monitoring results of the bottom mud (sediments) in the irrigation channels of the project areas showed the Cd and Hg contents in some channels exceed the Class 2 standard of the Soil Environmental Quality Standard, The analysis results indicate that the soil contamination risk is generally low; however measures need to be taken to curb the trend of soil contamination. The rice sampling exercise made in 2013 and 2016 respectively confirmed this trend that there is a risk of heavy metal contamination in some samples at certain degree with Cd being the primary concern. The main source for heavy metal pollution is the historic discharge from mining and smelting enterprises which have already been closed down. The application of the sediments dredged from the Zheng River which once received the direct discharge of untreated industrial wastewater is considered another reason. In addition, the application of the fertilizer containing Cd during the past decades may cause the accumulation of the Cd in the soil.

In 2012 a total of 781 sampling points were established across Yongxing County. The main soil PH value is acidic to low acidic. The heavy metal activity in soils is relatively high. The irrigation water of the project areas is from reservoirs upstream, the irrigation water quality meets with the national standards, and six small dams in Yongxing triggered the dam safety policy. The analysis results show that the risk of soil contamination in the farmland is moderate with Cd and As being the primary and secondary concern respectively. The monitoring results of the bottom mud (sediments) in the irrigation channels of the project areas showed the Cd and Hg content in some channels exceed the Class 2 standard of...
the Ambient Soil Quality Standard. The rice quality testing result confirmed that the rice is contaminated by Cd. As a famous silver production county, there are numerous smelting enterprises. The historical discharge of untreated industrial waste and flue gas is considered the fundamental source for heavy metal in the soil. The legacy pollution is being treated actively by the government of Yongxing.

The sites for soil remediation have been screened and selected under the three pioneer counties based on the procedure and criteria provided in the ESMF. To further learn the actual situation of soil contamination in the selected sites, additional sampling program for surface water, soil, agricultural products (mainly rice) has been developed and conducted for each of the sites selected. The findings of the sampling program are given as follows:

- The total area of the sites is 15,108.9 mu in the six selected townships under Yongding District of Zhangjiakou City eligible for the loan from the project. The irrigation water is from either the surface water reservoir or mountain spring. The water quality sampling results show that the water quality in the reservoirs or mountain springs is good and meets the quality standard for agricultural irrigation.
- The total area of the sites is 15661.05 mu in the four selected townships under Yongxing County. The water source for irrigation is the surface water reservoir or streams. The analysis results show that the water quality is good and meets the standard but the Zhengjiachong reservoir which is highly polluted by Cd discharged from adjacent smelter. Thus the Zhengjiachong Reservoir is not used as the water source for irrigation in the site of Songbai Township.
- The total area of the sites is 17,671.35 mu in the three selected townships under Hengyang County. The water source for irrigation is the Zhengshui River. The analysis results show that the water quality is good and meets the standards for agricultural irrigation.
- The sampling and analysis of the soil quality in the sites have been conducted by a certified laboratory in early 2016 to assess the risk of the soil. The analysis results indicate that the heavy metal of primary concern is Cd while the risk categories of the soil quality ranging from low to medium in the sites under Hengyang, from medium to very high in site under Yongxing, and from medium to very high in the site under Yongding. Additional sampling was made for the sediment in the ditches that convey water to the site for irrigation. The analysis results show that the sediment quality does not exceed the threshold developed under the GEF project, but in Taiping Village the Cd content exceeds the threshold by 0.2 times. Thus it is expected that the heavy metals contained in the sediments are unlikely to be the major source for the site contamination.
- The rice samples were collected and analyzed in line with national standard procedures. The analysis results indicate that the categories of risk for the rice ranges from moderate to very high for Yongding, from moderate to very high for Yongxing, and remains moderate for Hengyang.

The conclusion from the baseline investigation is that the sites selected under the three pioneer counties are no longer affected by the off-site pollution sources, and the risk of the rice and soil ranges from moderate to very high.
9.2 Analysis of Alternatives

The criteria for comparison and selection of the candidate regions, towns and villages for inclusion into the sub-projects in the three pioneer counties have been followed and the local conditions/situations of the area of farmland, rice yield, content of heavy metals in the soil, risk of contamination for farmland, Cd content in rice, contamination source and pathway, the current status of soil contamination management, willingness of local government and public, etc. have been surveyed and specific data/information obtained.

- Under Yongxing County, Bianjiang and Huangni Towns have been selected which meet all of the criteria among the total 15 candidate towns. And the five villages of Jinli, Tangmen, Wuni, Tielu and Songbai under the selected towns are considered in full compliance with the criteria and recommended to be included in the sub-project from the total 10 candidate villages within the Bianjiang and Huangni Towns;
- Under Yongding, the towns of Fengxianggang, Houping, Luotaping, Wentang, Xixiping, Yanghuping have been selected which meet all of the criteria among the total 27 candidate towns. And the 12 villages of Taiping, Wentang, Wuxi, Bajiahe, Guangyanzui, Qingyutan, Fengxianggang, Darongxi, Dingjiarong, Zhuangjiayu, Wujiazui, and Yangchi under the selected towns are considered in full compliance with the criteria and recommended to be included in the sub-project;
- Under Hengyang, the towns of Taiyuan, Hongshi and Xidu have been selected which meet all of the criteria among the total 24 candidate towns. And the 15 villages of Jiushi, Taijiu, Changqing, Hengxing, Hongshi, Yutian, Gaolu, Qingjiang, Daoshan, Shimen, Qingmu, Meihua, Douling, Xianzhong and Shuangqiao under the selected towns are considered in full compliance with the criteria and recommended to be included in the sub-project.

9.3 Impact Analysis and Mitigation Measures

The sub-projects will support rehabilitation of small agricultural facilities, i.e. linking ditches. Like other similar projects, the environmental impacts may include wastewater, dust, noise, solid waste and soil erosion during the construction phase. Given the small size of the works the magnitude of the impacts would be very limited and temporary. Thus these impacts are site specific and can be readily mitigated. Two sets of ECOPs are developed to mitigate the potential impacts, one for small civil works and the other for irrigation facilities. The sediments to be dredged in the irrigation ditches would be a concern if they contain heavy metals. Analysis of the content of heavy metals in the sediments will be carried out by chartered laboratories to learn the toxicity of the sediments. If the health metals in the sediments meet the Class II of the Ambient Soil Quality Standard (GB 15618-1995) that is designed to ensure the soil quality to meet the requirements for safeguarding the human health and agricultural production, the sediments will be used on site; if the heavy metals exceed the Class II but below the Class III that is designed to safeguard the normal growth of trees, agricultural crops (excludes vegetables), the sediments will be applied in woodland; and if the heavy metals exceed the Class III, the minimum requirements for beneficiary use of soil, the sediments will be dried and transported to local sanitary landfills for landfill where the landfill facilities are designed and constructed to the sanitary standards.
Investigations on the pollution sources upstream of the selected sites were conducted based on field investigation, public consultation and information collection. Following are the findings of the investigation:

- **Yongding District:** it is confirmed that there are neither operating industrial enterprises discharging heavy metals near or upstream of the selected sites nor tailings dams upstream of the sites. However there are still legacy industrial wastes upstream of the sites which may release heavy metals through rainwater leaching into stream and soil.

- **Hengyang County:** it is confirmed that there are neither operating industrial enterprises discharging heavy metals near or upstream of the selected sites nor legacy industrial wastes upstream of the sites; and there are no tailings dams upstream.

- **Yongxing County:** the site visit and consultation indicate that there is only one industrial source discharging heavy metals near the sites. This industrial enterprise has been identified and the inventory of pollutants and pathways has been confirmed. The provincial government has issued the circular to close down the industrial enterprise and the local government made commitments to completing the close-down and site cleaning by the end of 2016. According to the relocation plan, this enterprise will be relocated into the industrial park and the workers will continue to be employed by the enterprise after relocation. Thus there will be no need for preparation of an employee relocation plan. In addition, there are neither legacy industrial waste issues nor tailing dams near the sites.

Thus the following mitigation measures are developed to tackle the industrial pollution issues.

- **Hengyang:** 1) conduct regular monitoring of the water quality in Zhengshui River; 2) rehabilitate the irrigation ditches; 3) enhance law enforcement on the industrial enterprise and the mining activities upstream of the sites to prevent these operations from being reactivated.

- **Yongxing:** 1) local government authorities need to enhance cooperation to close down the industrial operations by the end of 2016 and supervise the whole process of the site cleaning to remove the heavy metal pollution sources; the industrial waste piled in the enterprises should be disposed of by certified companies so as to ensure that new heavy metal pollution would not be generated; 2) prior to the dismantling of the industrial facilities the owner should report to the local government authorities for appropriate measures and the whole process of dismantling should be supervised by government authorities; 3) the hazardous waste deposited in the facilities should be cleaned and disposed of by certified companies before dismantling; 4) the construction waste, i.e. bricks and steel bars, should be reused or recycled and the remaining waste should be disposed in a solid construction waste facility; 5) the Zhengjiachong reservoir should not be used to provide water for irrigation in this project and the pathway of effluent from Zhengjiachong reservoir should avoid the project area. The ditches conveying water discharged from Zhengjiachong should be closely supervised by local government authorities to ensure no overflow or runoff from the ditches into the project area. 6) construct new irrigation pumping stations to introduce the water from the Xi River into the project farmland. 7) suggest to launch the remediation plan for the Zhengjiachong Reservoir to ensure the water
quality in the reservoir can meet the Water Quality for Agricultural Irrigation (GB 5084-2005) to eradicate the risk of Cd pollution. 8) set up a front settling tank for residence time of more than 2 hours at the end of the link ditches. The settling tanks should be managed by the county PMO and dredged each year. The dredged sediment will be transported and disposed by certified companies.

- **Yongding:** 1) enhance law enforcement on the industrial enterprise and the mining activities upstream of the sites to prevent these operations from being reactivated. 2) set up a front settling tank at the end of the link ditches to remove silt containing heavy metals. 3) the settling tanks should be dredged regularly and disposed by certified companies. 4) the legacy mining wastes should be collected and transported to the certified disposal facility and the timing should be scheduled to avoid rainy days and nighttime.

During the operation of the subprojects, the potential environmental impacts are mainly associated with the application of lime, fertilizers and pesticides, etc. and these impacts may cause risk for human health or soil quality. Following is the summary of the analysis of the impacts in operation phase:

- **Impact by application of lime:** the water to be used for irrigation in the project is slightly acidic, thus application of lime at a proper rate would be helpful to adjusting the pH value of the water. The application rate has been carefully calculated based on the pH value of soil and the soil texture, so as to avoid increasing the hardness of the soil. The composition of lime is prepared to ensure the percentage of CaO is at 70%, so as to avoid scorching to crops and people. During the application of lime, the fine powder of lime would cause air-borne dust which will affect the health of the operating staff. Thus protective gear should be provided to the staff before the application of lime. In addition, application of lime would increase the operating cost for farmers, the cost compensation plan will be developed and covered by the project budget.

- **Impact of applying inactivation agent:** the inactivation agents to be applied are those permitted by the agricultural departments, thus additional loads of heavy metals will not be brought to the soil through the application of inactivation agents. However application of the inactivation agents at excessive amount may affect the physical property of the soil. Thus the rate should be carefully calculated based on the instructions of the manufacturer and close monitoring on the soil properties, and the quality and yield of agricultural products should be maintained. The cost compensation plan will be developed and covered by the project budget to compensate for the increased cost due to application of the soil inactivation agents.

- **Impact of application of organic fertilizers:** the raw materials for composting may be diversified in the project area, including crop residues, livestock manure, waste food and river sediments, etc.. These raw materials may contain a high content of heavy metals, which may add a new load of heavy metals to the soil through application of the compost products. It is required that the content of heavy metals contained in the organic fertilizers be less than the limits provided in the Organic Fertilizer (NY 525-2012). In addition, the county PMO should closely supervise the use of livestock manure in the composting. Livestock manure containing excessive heavy metals should be prohibited from composting.

- **Impact of application of chemical fertilizers:** application of chemical fertilizer may provide a pathway for heavy metals (mainly Cd) to enter the soil.
Particularly the application of phosphatic fertilizer may contribute a larger share of heavy metal load than other fertilizers. The chemical fertilizers low in Cd should be preferred for application.

- Impact of application of pesticides: the impact of pesticide is widely known. The integrated pest management approach will be extensively promoted across the project area. In the case of application of pesticides, staff designated by the local agricultural department will provide training and guidance on the selection, preparation and application of the pesticide. An Integrated Pest Management Plan has been prepared for this project which will be helpful to protect the health and safety of people and crops. The 1a and 1b category of the WHO pesticide categorization should be prohibited from use in the project. The pesticides, if any, should be procured from licenced manufacturers.

- Impact of agricultural solid waste: the agricultural solid waste include waste agricultural plastic mulch and packing materials. Such solid waste should be collected otherwise the soil texture would be affected. Thus the farmers’ awareness of the agricultural solid waste management should be enhanced as a part of the environmental awareness outreach campaign;

- Impact of adjustment of cropping pattern: Although the adjustment of cropping patterns will help produce safe crops and create job opportunities, there are some expected risks if the subsidies are lower than expected by farmers, lower market demand for the adjusted crops, and non-income for farmers for a certain period if they plant oranges to replace the existing crops. The compensation plan and training plan will be developed to offset these risks;

- Removal of crop residues: when the Cd content in the crop residues exceeds 1.5 mg/kg, the residues should be removed from farmland. Disposal of the crop residues will pose environmental impacts, and removal of the crop residues would increase the cost. The mitigation measures include the promotion of PPP mode to remove the crop residues, and the removed residues will be used for producing ropes, bags, pulp, etc. to minimize the amount requiring disposal. The residues remaining after beneficiary use should be disposed of in a landfill. When the crop residues are used for covering fruit gardens, the fruits should be monitored for heavy metals;

- Phyto-remediation: the plants enriching heavy metals would cause impacts during collection, transportation and disposal. Application of the phyto-remediation method would cause the lie fallow or prohibition of crops, thus reducing the income of farmers. The plants enriching heavy metals will be collected and transported to the local sanitary landfill via enclosed vehicles. The compensation plan should be developed for farmers in the case of lie fallow or prohibition of cropping;

- Impact of rice high in heavy metals: the residues of industrial use of rice high in heavy metals will cause risk of contamination of heavy metals, but such risk is minor. The residues will be transported to the sanitary landfill for landfiling, and the compensation will be provided to the farmers in the case that the market price for the rice high in heavy metals is lower than the government rate. In addition, the Plan for control of rice high in heavy metals will be developed.

### 9.4 Safety of Dams

Through site surveys, a total of 13 reservoirs were identified to trigger the OP 4.37 Safety of Dams in the pioneer counties. Among them there are 7 in Yongding District of Zhangjiagie City and 6 in Yongxing County of Chenzhou City. The height of the
dams ranges from 33 m to 12 m, and the volume of the reservoirs ranges from 6.74 million m$^3$ to 0.18 million m$^3$. All of these 13 reservoirs have been enhanced recently.

These reservoirs have been evaluated through the Dam Safety Evaluation Report for the project prepared by an independent dam safety expert. The report confirms the operational safety of the dams and suggests some actions to enhance the maintenance and operation of the reservoirs, e.g. construction of seepage measuring facilities in downstream dam to monitor dam seepage; strengthening daily monitoring and normal maintenance, and providing official review and acceptance report for the dam strengthening works. To strengthen the dam safety management and ensure the sustainable safe operation of the dams, an action plan to reflect the recommendations will be prepared and submitted to the Bank for review before project Appraisal.

9.5 Summary of Social Impact Assessment

In general the project is socially positive as it will 1) improve the soil quality and increase the yield and quality of crops; 2) improve infrastructure such as irrigation facilities and the ecological environment; 3) stimulate socio-economic growth; 4) raise the knowledge and skills of farmers as well as reduce adverse impacts on the health of local residents, help disseminate advanced agronomic technologies and enhance the awareness of heavy metal pollution. In addition, given the very small size of the civil works, only very small numbers of workers will be required for the construction of the works. It is expected to be around 5 to 10 workers in one construction site, thus on-site workers’ camps are not necessary. However, the project may cause some negative social impacts in terms of short term income loss due to adjusting cropping systems and land use adjustment. Other impacts may come from the likely unemployment of workers due to the closing down of industries discharging heavy metals to the project area. But such impacts of job loss or employee retrenchment will be also very limited. This is because usually the enterprise in highly contaminated areas is small with a small number of employees. If such an enterprise is to relocate, it often moves to an industrial park nearby and all the employees move to the new location with no redundancy. The negative impacts can be effectively mitigated by proper compensation and other assistance. Of the first three counties identified, only one enterprise in Yongxing is expected to relocate in an existing industrial park with no need for employee redundancy or land acquisition.

Involuntary Resettlement: the first three subprojects will not involve resettlement of people or land acquisition. But some project areas may lead to changing to new crops, such as fruit trees or others which may cause non-land economic displacement. This will not be on a big scale, but still may affect a small number of farmers in terms of income loss for a short period of time before the new crops can be harvested. In this case they will receive subsidy from the project to cover any loss of income. In some seriously contaminated areas in the project farmers will not be able to access their contracted land for cropping, in this case they will receive subsidies according to the project tailored subsidy measures which is based upon existing pilot policy applied in Hunan and consultation with farmers and officials in the project areas.. In case there is any land acquisition or resettlement, a resettlement policy framework has been prepared.
Indigenous People: although there are some ethnic minorities of Tujia and Bai and 13 Miao people by the Chinese ethnic criteria in Yongding district of the western part of Hunan, yet they are well integrated with the majority Han people, speak mandarin Chinese and will not be disadvantaged in the project. These minorities do not fit the definition of the Bank IP term. Thus the Bank OP/BP4.10: Indigenous People is not triggered for the first three pilot counties. Yet the impact on ethnic minorities is still uncertain as the rest of the subproject sites have not been determined. To take a cautious approach this policy is deemed triggered. An Ethnic Minority Plan Framework (EMPF) has been prepared. Once the presence of IP is confirmed in the future project sites an ethnic minority development plan will be prepared following the EMPF requirements.

The corresponding mitigation measures have been developed and consulted with the affected people as mentioned above. Other measures are also incorporated into the ESIA of the sub-projects which include the following:

- The local traditions and customs should be respected;
- The policy and standards for compensation and subsidies for those affected by reduced yields and income should be applied during project implementation through public consultation with the agricultural departments, environmental protection agencies, affected villages and farmers.
- A plan for training and subsidies should be developed;
- Detailed technical specifications should be developed;
- Institutional capacity for supervision and implementation of the project should be enhanced;
- Environmental awareness of farmers should be enhanced by launching comprehensive awareness outreach plans.

In addition, this project has prepared a compensation mechanism for farmer’s non-land economic displacement, such as cases of short term reduced income due to the adjustment of cropping system, and A RAP will be prepared to tackle issues related to any land acquisition that occurs.

As a concern, the management of rice containing high content of Cd become a focus of the soil remediation approach. If the content of Cd in the rice is less than 0.5 mg/kg, the rice will be purchased by enterprises where the rice will be used as a raw material for industrial purpose or for producing fodder; if the Cd content is more than 0.5 mg/kg, the rice should be limited to be used solely for industrial purpose, such as for producing aginomoto, alcohol or starch, with the residues to be landfilled in the sanitary landfill facility; if the content of heavy metals is very high, exceeding the standard for food, the rice will be transported to local sanitary landfill facility for landfill.

To prevent the heavy metals from returning to the soil through crop residues which may remain in the soil after harvesting, if the Cd content is more than 1.5 mg/kg, the crop residue should be removed from the farmland. Incentives should be paid to farmers or the harvesting companies to change the traditional harvesting mode which uses combine harvesters to chop the crop residue into small chips.

9.6 Land Use and Resettlement Issues

Civil works under the project are mainly limited to the rehabilitation of existing irrigation ditches, small canals and construction of irrigation water pumping
stations within project villages. Similarly the land occupation of other civil works such as irrigation water pumping stations is quite limited. Typically one machine would occupy only 4 m² of collectively owned land within a project village, while one irrigation water pumping station would occupy 3 m² of collectively owned land. Thus there is no need to change the land ownership as this kind of land use in China is traditionally provided by villagers through land readjustment within the same village as village public facilities in China. In addition, the first three determined subprojects will not involve relocation of any people. But they may be non-land economic impacts on a short term when the farm land is used to grow new crops or no more crops. Project subsidy will be provided to subsidize increased costs for new crop seedlings, labor or early stages with lower yield in highly contaminated project areas when new non-grain crops are required to grow on such land.

9.7 Environmental and social management plan

9.7.1 Institutional arrangements

According to remediation demands the institutional arrangement will be established with management, supervision, consultation, and implementation entities which cooperate with each other, and the corresponding responsibilities of these entities are defined as well.

(I) Provincial Joint Coordinating Committee: providing overall and general guidance on the relevant policies, implementation and coordination as well as tricky issues; supervising the implementation of the project; review and clear project proposals, seek counterpart funding and coordinate inter-institutional cooperation for the project.

(2) Provincial PMO: will be responsible for overall management of the project to ensure the successful implementation of ESIA. It is explicitly responsible for:

- Examining and coordinating the local EPB;
- Arranging site visits for World Bank missions;
- Summarizing reports and submission to the World Bank;
- Reporting to the World Bank regularly.

(3) County PMO: will be responsible for implementation of the ESIA, by:

- Supervising the measures to be included in the contract;
- Supervising the mitigation measures to be performed by contractors;
- Preparing implementation reports for ESIA;
- Reporting to the Provincial PMO on the progress of the ESIA.

(4) Environmental Protection Bureau (EPB): Responsible for the whole-process environmental supervision including:

- Examination and approval of site investigations, risk assessment, technical schemes and acceptance inspection reports for remediation of the sites;
- Disclose the information on the cleanup of sub-projects for the sites, and handle public comments and complaints.

(5) Township MIUs with support of villages: will be responsible for implementation of the mitigation measures.

(6) Environmental and Social Monitoring Institutes: will be responsible for carrying out environmental and social monitoring plans;

(7) Environmental and Social consultants: will be responsible for providing technical support to the Provincial PMO on the screening and selection of the
sub-projects as well as other technical services.\(^{(8)}\) The Land Resource Bureau will be responsible for review and approval of land acquisition if needed for civil works associated with the project;

### 9.7.2 Mitigation of environmental and social impacts

The potential impacts have been identified and analyzed. These impacts have been addressed and corresponding mitigation measures have been developed as shown in the environmental and social instruments (see Annex 3).

#### 9.7.3 Environmental and social monitoring Plan

A comprehensive monitoring plan is prepared to cover all of the primary concerns, i.e. water quality, soil, agricultural products, organic fertilizer, pesticide, land acquisition and resettlement, ethnic minorities if any, etc. the national relevant protocols for sampling and analysis have been considered in the preparation of the monitoring plan, and the applicable standards to evaluate the analysis results have been confirmed.

#### 9.7.4 Cost Estimation for both Mitigation Actions and Supervision

The total cost of mitigation actions will be included in the winning bidder’s bid. The funding sources will come from the loan and counterpart funds. Budget for site remediation including supervision cost will be included in Annual Work Plans and also the procurement plan of the project. Selection of remediation contractors will be carried out through a competitive bidding process to ensure cost-effectiveness.

#### 9.7.5 Reporting and Grievance Redress Mechanism

The requirements for environmental and social supervision and monitoring, as well as the reporting system has been clearly specified. A mechanism has been established for redressing grievance for affected people and environment. Grievances can be filed both orally and in writing. Starting at village and neighborhood committee level grievances can be elevated to PMOs at county/district, city and provincial levels if they are not satisfied with the resolution at the lower level. The affected people could also file their cases in court if they are not happy with the resolution by the project authority. All grievances and their resolution will be recorded. This mechanism has been disclosed to the local population and will be further disseminated through the Resettlement Information Booklet. The grievance Redress mechanism will be maintained throughout the project life-cycle to deal with any public concerns in environmental and social management.

### 9.8 Public consultation and information disclosure

In accordance with the requirements of China’s EA Law and the World Bank, two rounds of public consultation were conducted by the EIA team. The first round focused on environmental screening to define public concerns, to assist identification of key environmental issues and to draw public response and comments on the mitigation measures initially developed for potential adverse impacts identified before EA TOR finalization. The second round was designed to ensure public awareness of the EA effort and final project definition and mitigation by presenting a draft EA document to the public through information disclosure procedures. Details of the two rounds of public consultation undertaken are presented in Table 9-2.
<table>
<thead>
<tr>
<th>Subproject</th>
<th>Round</th>
<th>Timing</th>
<th>Participants</th>
<th>Form</th>
<th>Organizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hengyang</td>
<td>1</td>
<td>Sept. –Nov. 2015</td>
<td>Local residents, farmers and concerned agencies¹</td>
<td>Interview and public meeting</td>
<td>Hengyang County Agricultural Bureau, and EA team</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Jan. 2016</td>
<td>Affected local residents, concerned agencies</td>
<td>Questionnaires, interview</td>
<td></td>
</tr>
<tr>
<td>Yongxing</td>
<td>1</td>
<td>Sept. 2015</td>
<td>Local residents affected and of interest, concerned agencies</td>
<td>Questionnaires, interview and public meeting</td>
<td>Yongxing County Agricultural Bureau, and EA team</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Jan. 2016</td>
<td>Affected residents, concerned agencies</td>
<td>Questionnaires, interview</td>
<td></td>
</tr>
<tr>
<td>Yongding</td>
<td>1</td>
<td>Sept. –Nov. 2015</td>
<td>Affected residents, sensitive receptors, concerned agencies</td>
<td>Interview and public meeting</td>
<td>Yongding County Agricultural Bureau, and EA team</td>
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During consultations the public expressed several concerns regarding solid waste, quality of irrigation water, occupational health due to spraying of lime, the actual effects of the project, for which due attention has been given in the ESIA. These concerns have been responded to in the public meetings and considered in the EA. Through consultation it was learned that the public strongly support the project as they think it would be a good approach to improving their living conditions. During consultation all of the people thought that the impacts of primary concern will be effectively mitigated to an acceptable level.

Consultations on social impacts and risks have also been broadly conducted. In the preparation stage of the project community consultation meetings and interviews were mainly undertaken in three basic forms of group workshops with PMOs, field surveys at village level and household questionnaire surveys. County and city project agencies include agricultural bureau, water conservancy bureau, EPB, quality supervision bureau, production safety bureau.

¹ The concerned government agencies include agricultural bureau, water conservancy bureau, EPB, quality supervision bureau, production safety bureau.
management offices of the project invited relevant county governor/ mayor, Agricultural Development Office, Environmental Protection Bureau, Civil Affairs and Religious Bureau, Water Conservancy Bureau, Agricultural Bureau, Poverty Alleviation Office, Women’s Federation and other relevant departments involved with the project as well as township leaders in charge and business backbone to participate in the group meetings. The social assessment team held a total of 18 villager meetings in the first three project counties. In addition, a total of 632 household questionnaires were returned with 604 valid questionnaires. Of these there were 199 questionnaires from Hengyang County, 209 questionnaires from Yongxing County and 196 questionnaires from Yongding District.

9.9 Information Disclosure

Information on the project EA and SA, as well as ESIA (EMPs) and ESMF has been disclosed to the public through public consultation. Bulletins have been pasted in the villages to be affected informing the place to access the project information at the first round of consultation and the place to access the draft EA document at the second round of consultation. The ESIA in Chinese has been disclosed since Oct. 2016 and in English since Nov. 2016.
Figure 1 Geographical Location of Hunan Province

(the area in red is Hunan Province)
Figure 2 Locations of candidate counties and pioneer counties in Hunan Province
Annex 1 Specific Activities under Component One

<table>
<thead>
<tr>
<th>Series</th>
<th>Activities</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot farmland risk management</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Intensified monitoring and risk evaluation</td>
<td>Based on the monitoring plan, monitoring for the selected project area should be intensified (one monitoring point for each 30-50mu in hilly area, for each 50-100 mu in flat area; the heavy metal content in soil and corresponding crops will be monitored; the heavy metal in sediment and irrigation water will be monitored. Based on the monitored data, the contamination risk will be evaluated so as to develop specific measures for risk control.</td>
</tr>
<tr>
<td>1.2</td>
<td>Integrated risk management measures</td>
<td>Based on the analysis results on the rice, internal and external course for pollution, and cropping management, to develop the specific risk control and management measures. For details please see 2.1 to 2.4 below.</td>
</tr>
<tr>
<td>1.2.1</td>
<td>Physical works</td>
<td>The physical works in the 15 counties include 2 irrigation stations, 346.01 km of irrigation ditches, 115 sedimentation tanks, 8.2 km ecological retention walls, and 67.33 km paths.</td>
</tr>
<tr>
<td>1.2.2</td>
<td>Agronomic measures</td>
<td>Combination of measures for rich species control, improvement of irrigation, adjustment of pH, application of organic fertilizers, application of inactivation agents, adjustment of cropping pattern, removal of residues.</td>
</tr>
<tr>
<td>1.2.3</td>
<td>Integrated pest management</td>
<td>Promote cleaner agricultural production by encouraging the application of organic fertilizers, reducing the use of chemical fertilizers, enhancing the scientific application of pesticides; promote integrated pest management and use pesticides with minimal residue and modern plant protection equipment.</td>
</tr>
<tr>
<td>1.2.4</td>
<td>Other measures</td>
<td>Carry out the study on the safe rice production based on the inventory of low-accumulating Cd rice species recommended for Hunan Province so as to screen and select the proper rice species for Hunan; determine the Cd accumulating index for the rice species recommended; If the BCF indicator is above the VI risk which means the higher risk of Cd accumulation, the rice species should be rejected from the project area.</td>
</tr>
<tr>
<td>(1)</td>
<td>Selection of rice species</td>
<td>The rice with heavy metal exceeding the standard will be purchased by special enterprises as raw</td>
</tr>
<tr>
<td>Series</td>
<td>Activities</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>1</td>
<td>exceeding the standard</td>
<td>material for industrial use or fodder; subsidies will be provided to such enterprises at the rate of RMB 200/ton.</td>
</tr>
<tr>
<td>(3)</td>
<td>Certification of agricultural production areas</td>
<td>Provide subsidies to entities which have obtained the certificate for pollution-free, green and organic food, at the rate of RMB 5,000, 10,000 and 20,000 respectively.</td>
</tr>
<tr>
<td>(4)</td>
<td>Advertisement of agricultural products</td>
<td>Encourage the establishment and promotion of local brands for agricultural products, so as to increase the economic value of the products.</td>
</tr>
<tr>
<td>1.3</td>
<td>Project supervision</td>
<td>Engage certified supervision institutes to organize the staff at the township and village levels to supervise the implementation of agronomic measures, at the cost rate of RMB 20/mu/quarter.</td>
</tr>
<tr>
<td>2</td>
<td>Enhance the monitoring and management of agricultural environment</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Establish the data base and early warning system for agricultural environment</td>
<td>Include one set of software of early warning, 15 sets of sampling and analysis vehicles, 30 sets of computers, 2 sets of GPS devices and elevation devices; support the construction of heavy metal laboratories in Hengyang County.</td>
</tr>
<tr>
<td>2.2</td>
<td>Agricultural land management tools and mapping of agricultural risks</td>
<td>Set up a model based on the indicators of component 1 so as to support the management of agricultural risks; determine the risk categories of contamination in crops and farmland; develop the risk map of agricultural production for the whole province.</td>
</tr>
<tr>
<td>2.3</td>
<td>Develop and enact the local policies and standards</td>
<td>Develop or enact local codes of technical standards for agricultural land pollution control and reclamation.</td>
</tr>
<tr>
<td>2.4</td>
<td>Study the system for sustainable financing and ecological compensation</td>
<td>Study the system for financing and ecological compensation for the long-term agricultural land contamination control and remediation.</td>
</tr>
<tr>
<td>3</td>
<td>Capacity building</td>
<td>Enhance the management and technical capacity of government staff, organize study or training tours overseas or domestically; provide training for environmental monitoring staff and farmers, and provide technical assistance to enterprises discharging heavy metals; outreach program for experience and concepts.</td>
</tr>
<tr>
<td>4</td>
<td>Project management and evaluation</td>
<td>Provide training to project management staff on procurement, safeguard and financial aspects; purchase office equipment and stationery and cover recurrent costs; build a MIS system and project launch and completion workshops; collect the data on agricultural land to assess and monitor the project results.</td>
</tr>
</tbody>
</table>
### Annex 3 Environmental and social impacts and mitigation measures

<table>
<thead>
<tr>
<th>Environmental elements</th>
<th>Mitigation Measures</th>
<th>Implemented by</th>
<th>Supervised by</th>
</tr>
</thead>
</table>
| noise                  | - No-horn sign shall be set up in sensitive spots and measures shall be adopted to reduce noise, such as using low-noise equipment, control noise source, transmission and traffic noise.  
                         - Schedule construction activities to avoid noon and night;  
                         - Cushion devises should be provided to the equipment making high noise;  
                         - All equipment should be maintained regularly to reduce the noise;                                                                                                                                 | County PMO                            | Hunan Provincial EPB and County EPB |
| Air                    | - The earth excavated should be used for grade filling in other contracts of the project;  
                         - Such activities as excavation and filling should be banned in windy and raining days;  
                         - The powder materials such as sand, cement and lime, should be carefully stockpiled and covered, water spray will be applied where necessary;  
                         - The construction works should be divided into several sections to reduce dust. Water spray should be applied on the site;  
                         - Mixing stations should be enclosed;  
                         - Equipment and vehicles should be maintained in good condition;  
                         - Construction vehicles should be inspected and maintained regularly.                                                                                                                                 | County PMO                            | Hunan Provincial EPB and County EPB |
| Water                  | - Rehabilitation or construction of irrigation ditches should be scheduled to avoid the irrigation season, and temporary by-pass ditches should be provided as necessary;  
                         - Settling tanks should be set up at construction sites to treat the construction wastewater for reuse on site;  
                         - Temporary lavatories should be provided within the construction site and the waste should be cleaned regularly;  
                         - Construction management should be enhanced to avoid the leakage of fuel from mixing stations.                                                                                                                                 | County PMO                            | Hunan Provincial EPB and County EPB |
### Environmental Elements

<table>
<thead>
<tr>
<th>Environmental Elements</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid waste</strong></td>
<td>Equipment; the drainage system should be established in the spoil stockpile area; Contractors should carry out the mitigation measures for construction wastewater and domestic wastewater; The works contractor should be trained on environmental protection.</td>
</tr>
<tr>
<td><strong>Physical cultural resources</strong></td>
<td>Domestic solid waste on construction site should be collected and transported off site to local landfill facility for landfill; The heavy metal content in the sediments should be sampled and analyzed, and corresponding measures taken to dispose of the sediment properly;</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>The local traditions and customs should be respected, especially in ethnic minority communities; The ethnic and other vulnerable people should be protected by providing adequate opportunities, compensation and assistance as applicable. The policy and standard for compensation for those affected by land loss, reduced yield and income loss should be applied, through the public consultation with the agricultural departments, environmental protection agency, affected villages and farmers. The plan for training and subsidies should be implemented; Detailed technical specifications should be developed; Institutional capacity for supervision and implementation of the project should be enhanced; Environmental awareness of farmers should be enhanced by launching comprehensive awareness outreach plans.</td>
</tr>
</tbody>
</table>

### Implementation and Supervision

<table>
<thead>
<tr>
<th></th>
<th>Implemented by</th>
<th>Supervised by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid waste</td>
<td>County PMO</td>
<td>Hunan Provincial EPB and County EPB</td>
</tr>
<tr>
<td>Physical cultural resources</td>
<td>County PMO</td>
<td>Provincial PMO</td>
</tr>
<tr>
<td>Social</td>
<td>County PMO</td>
<td>Provincial PMO</td>
</tr>
</tbody>
</table>
Annex 4 Summary of Major Laws, Regulations and Standards

1) Environmental Protection Law of the People's Republic of China (2014): Article 32 “China will intensify protection for the air, water, soil and so on, establish and improve the system for investigation, monitoring, evaluation and restoration”. Article 42 “the enterprises and other manufacturers discharging pollutants shall take proper actions to prevent and control pollution and hazards to the environment caused by the waste gas, waste water, waste residues, medical waste, dust, foul gas, radioactive substances as well as noise, vibration, optical radiation, electromagnetic radiation and so on generated during production, construction and other activities. The enterprises discharging pollutants shall establish an environmental protection responsibility system, and define the responsibilities of the person in charge of the enterprise and the personnel related”.

2) Environmental Impact Assessment Law of the People's Republic of China (2002): Article 16 “China adopts classified management for environmental impact assessment of construction projects based on the extent of impact on the environment. Article 25 “Where the environmental impact assessment documents of a construction project has not been examined by the competent authority defined in applicable laws or fails to pass the examination, the authority in charge of examination and approval of the project shall not approve and make it eligible for construction, and the construction unit may not commence”.

3) Land Administration Law of the PRC (2004): Article 27 “The State shall establish a land survey system. People's governments at or above the county level in company with relevant departments at the same level shall carry out land investigation. Land owners or users should cooperate with the investigation and provide relevant information”. Article 47 “For land acquisition, compensation should be given according to the land original use”. Article 48 “After the land compensation and resettlement plan is finalized, the local government shall hear the opinions of rural collective economic organizations and farmers through announcement”.

4) Agricultural Products Quality Safety Law of the PRC (2006): Article 17 “the activities for producing, collecting and fishing agricultural products or establishment of agricultural products production centers shall be prohibited from the areas where the hazardous and toxic substances exceed the applicable standards”. Article 18 “wastewater, solid waste, waste gas or other hazardous and toxic substances shall be prohibited from discharging into the areas for production of agricultural products

The regulation and official documents issued including:
- In June 2008, MEP issued an official document entitled “Recommendations on Strengthening Soil Contamination Prevention and Remediation.”
- In 2011, the State Council issued “Opinions on Strengthening Key Tasks on Environmental Protection”, which requires that environmental assessment and
environmentally sound management should be carried out for contaminated sites before they can be redeveloped.

- In April 2014, the MEP and Land Resource Ministry jointly issued the Soil Contamination Situation Investigation Communique for the Whole Country, which indicate that the overall percentage of sample points exceeding the screening threshold in the country is estimated at 16.1%, involving 19.4% of arable land. More than 80% of the surveyed pollution points result from inorganic toxins, with the top three heavy metal contaminants identified as cadmium (Cd), nickel (Ni) and arsenic (As).

- In January 2013, the State Council further issued “Work Arrangement on Soil Protection and Comprehensive Treatment in Near Future”.

- Based on the Integrated Prevention and Control of Heavy Metal Pollution 12th Five Year Plan issued by the Ministry of Environmental Protection in early 2011, the first national plan for addressing heavy metal pollution. The key guiding principle of the Plan is to prevent new pollution and remediate contaminated water and land by focusing on top control of pollution sources - cleaner production, and end treatment of soil contamination, a concept of whole-process pollution prevention and control.

- Based on the Soil Contamination Prevention and Control Action Plan, issued by the State Council, 31 May, 2016. This action plan sets out an ambitious and urgent target for soil contamination control: by year 2020 the trend of soil contamination will be curbed and the safety of soil used for agricultural and construction developments will be basically guaranteed; and by year 2030 the ambient soil quality nation-wide will be gradually restored; by the middle of this century, the ambient soil quality will be thoroughly recovered and the sustainable development of ecological environment will be achieved; while the target for soil quality is by year 2020, over 90% of the contaminated farmland will be used in a safe manner; by year 203, the target is over 95% for the contaminated farmland. An integrated approach is promoted and promised by the plan to address the imminent challenge of soil contamination through legislation and standard system development, categorization of agricultural land use, monitoring of pollution sources and strengthening relevant studies and research.

**Ambient Soil Quality Standard (GB 15618-1995)**

The quality of the ambient soil is classified into three categories as follows:

- Category One: the natural soil, for areas zoned for natural reserves, concentrated drinking water sources, tea gardens, ranches and other protected areas;
- Category Two: the soil for the general agricultural land, vegetable land, tea garden, fruit garden, ranches, which could not damage or pollute the plants and environment;
- Category Three: the soil for the woods land, and agricultural land near mineral resources or with high contamination background (excluding vegetable farm).

The Standard is classified into three Classes according to the above three categories of soil:

- Class I: the soil quality limit for sustaining the natural eco-system and the natural soil in the protected areas;
• Class II: the soil quality limit for safeguarding the agricultural production and human health;
• Class III: the soil quality limit for safeguarding the production of forestry and agricultural, and growth of plants.

### Table 1 Soil Quality Standard mg/kg

<table>
<thead>
<tr>
<th>Item</th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH of soil</td>
<td>Natural background</td>
<td>&lt;6.5</td>
<td>6.5~7.5</td>
</tr>
<tr>
<td>Cd ≤</td>
<td>0.20</td>
<td>0.30</td>
<td>0.60</td>
</tr>
<tr>
<td>Hg ≤</td>
<td>0.15</td>
<td>0.30</td>
<td>0.50</td>
</tr>
<tr>
<td>As Paddy ≤</td>
<td>15</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Dry land ≤</td>
<td>15</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Cu farmland ≤</td>
<td>35</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Fruit garden ≤</td>
<td>—</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Pb ≤</td>
<td>35</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Cr paddy ≤</td>
<td>90</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Dry land ≤</td>
<td>90</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Zn ≤</td>
<td>100</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Ni ≤</td>
<td>40</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>HCH ≤</td>
<td>0.05</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>DDT ≤</td>
<td>0.05</td>
<td>0.50</td>
<td></td>
</tr>
</tbody>
</table>