E4621

EED 能源与环境发展专家 Solution on Environment and Energy Development

Yunnan Highway Asset Management Project

Environmental Code of Practice

Client Agency: Yunnan Province Highway Administration

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August, 2014, Kunming

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Abbreviation:

1、the World Bank (WB)
2、Environmental Assessment（EA）
3、Environmental Impact Assessment（EIA）
4、Environmental Code of Practice（ECOP）

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1 Introduction

1.1 Background

Yunnan province, internal adjacent to Tibet, Sichuan, Guizhou, Guangxi and other provinces (regions), external adjacent to Myanmar, Laos, Vietnam and other countries. The border length is more than four thousand kilometers, accounting for nearly one-fifth of the land border. Yunnan is China's bridgehead for the southwest opening as well as the most convenient land route to go to Southeast Asia, South Asia, which has the unique geographical advantages to communicate with the Pacific and Indian Ocean, connecting East Asia, Southeast Asia and South Asia. According to " *Yunnan province accelerate the opening up important bridgehead Master Plan for the Southwest (2012-2020)*", the provincial trunk highway of Yunnan province is one of the critical infrastructure for carrying out the strategy on China opening up important bridgehead for the southwest. Yunnan conservation management of national and provincial trunk highway is of great importance for playing the advantages of bridgehead and improving the performance of road transport in Yunnan province, and is the important basic protection for the coordinated and stable development of economy and society in Yunnan province.

Yunnan Province is located in inland areas of China and special geographical environment of Yunnan-Guizhou plateau, making road transport has become the province's main mode of transportation as well as the important pillar of economic development, social progress, stability in border areas and national unity. With the implementation of Yunnan highway, water transport of the 12th five-year plan and adjustment plan for national and provincial trunk of Yunnan, and the mileage and the high-level degree of national and provincial trunk increased the road loss and the road damage will continue to intensify, and maintenance management of highway will be increasingly onerous, so that it brought enormous challenges to the management ability and level of national and provincial trunk . Yunnan Province is located in inland areas of China and special geographical environment of Yunnan-Guizhou plateau, making road transport has become the province's main mode of transportation as well as the important pillar of economic development, social progress, stability in border areas and national unity. With the implementation of *Yunnan Highway, Water Transport Of The 12th Five-Year Plan* and *Yunnan Adjustment Plan For National And Provincial Trunk ,* the mileage and the high-level degree of national and provincial trunk highway increased the road loss and the road damage will continue to intensify and maintenance management of highway will be increasingly onerous, so that it brought enormous challenges to the management ability and level of national and provincial trunk highway.

According to statistics, the mileage of national and provincial trunk highway has reached 25,752 km in 2012.At the end of *the 12th five-year plan* , mileage of the provincial trunk highway will reach 38,253 km, and the total highway assets will be more than 1.1 trillion RMB. That how to improve asset management capabilities and level of the trunk highway,

and manage this huge asset well, keep the optimal technology condition in order to provide excellent and efficient service for economic construction and social development is an important task for highway management studying and solving at the present stage.

In order to improve the management level of national and provincial trunk highway, bring in the new concept of the highway asset management, realize modernization ， informationization and scientific of it, *Yunnan Road Asset Management Project* declared by Yunnan highway has been approved by National Development and Reform Commission as well as included in the World Bank loan project planning. Through the implementation of world bank finance projects, they introduced the concept of advanced highway asset management and conservation techniques, build and improve emergency system of highway maintenance, use modern computer and network technology to integrate existing information systems effectively, build management information systems of roads asset, while strengthening management capacity of national and provincial trunk highway , improve asset maintenance management capacity and efficiency of trunk highway, designed to enhance the overall transport performance, protect transportation security, and enhance transport capacity and service levels of the road network in Yunnan province .

Yunnan Highway commissioned the company to undertake the tasks "Environment Code of Practices for Yunnan Highway Asset Management Project". EED Engineering Limited completed the draft and submitted it to Yunnan highway bureau and WB in May 2014. WB sent pre-mission to review and comment the draft " *Environment Implementation Regulation Of Yunnan Highway Asset Management*" in June 2014. This modified report is based on the advice of WB pre-mission and prepare for a formal assessment of the World Bank mission.

1.2 Project Component

Yunnan highway asset management project aims to improve the management level of provincial trunk highway, enhance the level of software and hardware facilities about provincial trunk highway from information systems, software system of highway asset management, road maintenance infrastructure, institutional capacity strengthening and other aspects. The project consists of three contents of construction and more than ten subsystems, relates to the institutional ability construction of Yunnan highway bureau, information system of provincial highway management, infrastructure and equipment of highway maintenance. It is a comprehensive highway asset maintenance management of construction project. Project components as shown in the following table:

Table 1 project components of Yunnan highway asset management

The composition of project	Description
1.Integrated highway asset management and information systems	Build a highway information network (IT category), a cloud computing data center (IT category), seven management systems and services (IT category)
2.Capability construction of highway maintenance and emergency support	Build highway emergency center and management stations at all levels (civil engineering)
1) Prefecture/city-level highway maintenance and emergency support center	16 prefecture/city-level centers
2) county-level highway maintenance and emergency support center	63 county-level centers
3) Maintenance station	225 maintenance stations
4) Market-oriented pilot of highway maintenance	8 pilots
3.Strengthen the capacity of highway asset management institutions	Conduct asset evaluation, capacity building, technology promotion and training

In part of the project, the first and third part is mainly about construction content of "IT Software", design for information systems of highway asset management, the system of highway asset management and strengthening institutional capacity and so on. It does not require physical construction and land acquisition. Engineering environmental conditions have no effect on the construction contents of the "software" section. Physical activities are relevant to building of emergency centers and maintenance stations, and road maintenance pilots that is about application of new pavement materials. Distribution of their locations are shown below:

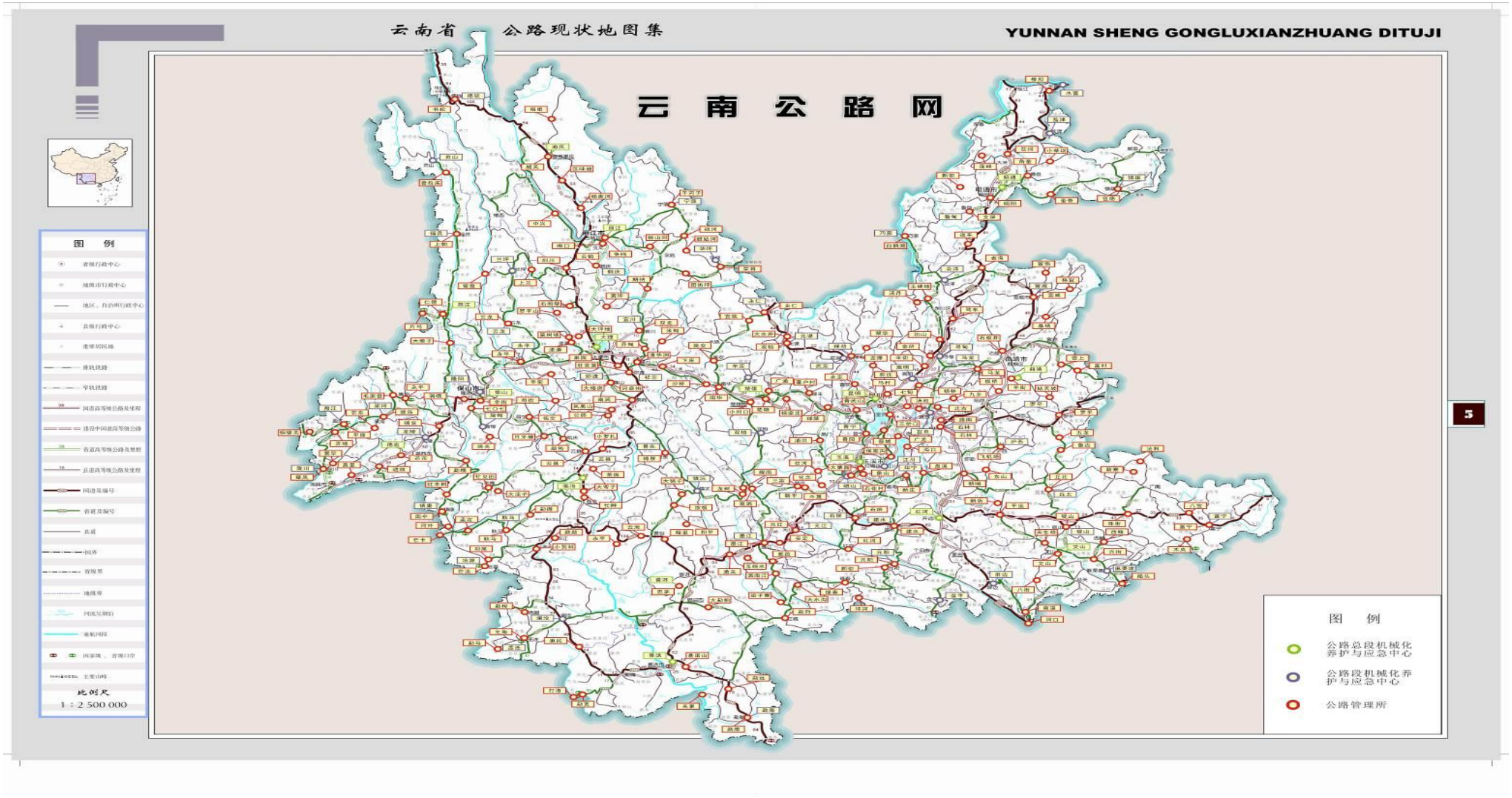


Figure 1 Distribution of the sub-project

1.3 Environment assessment

Environment assessment (EA) of the project shall comply with the relevant policy, regulations and technical guidelines associated with China and WB. Given the nature of the project, the potential environmental impact is smaller, so that World Bank recommend that the EA report of the project should be taken in the form of environmental implementation regulations. Typical construction activities on different forms of investment activities (mechanized conservation and emergency centers of total highway management segment, mechanized conservation and emergency centers of highway management segment, management) is proposed for environmental protection. Environmental Practice should be fully integrated with the design, contractors should be follow. For those large-scale expansion and upgrading of highway maintenance and emergency facilities, before the implementation of the project owner shall comply with the rules of procedure to prepare specific EA and environmental management plans.

Construction scale of highway maintenance and emergency facilities has been identified as a small construction project at project preparation stage. The environmental impact is not significant. According to recommendations of WB above, it is not required to conduct special preparation for EA and environmental management plan for this group of road.

Subprojects involving EA contains 16 state(city)-level centers of mechanized maintenance and emergency of total highway segment,63 county-level centers of mechanized maintenance and emergency of highway segment,225 highway managements and 8 new technologies, and market-oriented maintenance pilot of new materials, the nature of its construction as shown in the table below:

Table 2 Project Components

project content	**The number of subproject points**	**The number of new construction**	**The number of reconstruction**
Prefecture/city-level center of mechanized maintenance and emergency response	16*	9	6
County-level center of mechanized maintenance and emergency response	63	26	37
highway maintenance management station	225	31	194

*Note: Of the 16 prefecture/city level centers, Diqin center has been built.

Detailed list of component information see attachment 1.

The second part of this project, namely road maintenance and emergency supported center section, of which 43.7% are based on the existing highway maintenance center for

renovation and expansion. After years of use, engineering geological conditions do not affect the safety of the maintenance center, and mostly next to the National Road, convenient transportation, especially distribute at the edge of the national road to facilitate the highway emergency rescue. The remaining 56.3% of the new maintenance center and management are also mainly located next to the existing national and provincial highway, the principle of distributed point is also convenient to highway emergency rescue and disaster relief. The engineering geological conditions of new management and maintenance center are stable, after years of observation, can be sure that no engineering geological hazards.

The construction site of conservation and emergency support centers are far from existing urban residential area five kilometers away, and does not produce environmental impact on the existing residential area residents during the stage of construction and operation. In part of the asphalt mixing plant, asphalt inside may produce asphalt breathed polluted environment, for operating time is shorter and more concentrated as well as the main work is in the field, this effect can be ignored.

New and extended projects may involve activities such as: clean-up construction site, access roads, quarry/ soil extraction, soil dumping, construction camp site, operation of emergency center and management. Possible environmental impacts involved include: geological hazards, water and soil erosion, social disturbance, sewage, waste gas, solid waste, noise vibration, ecological protection, landscape, material and cultural resources, safety and health, hazardous waste and so on.

1.4 Objective, Principle and Applicability of the ECOP

1.4.1 Objective of ECOP

The purpose of the ECOP is to definite the responsibilities and obligations of the relevant departments in environmental protection, as a guide of environmental management , guide the contractor to plan and implement measures of retarding the progress of the environmental adverse impacts during the construction; guide the project owners to take stipulated environmental protection measures in the contract after the completion of the project. The ECOP proposed standard practice for potential adverse impacts on the environment in the process of in highway maintenance and construction of emergency facilities, develop a countermeasures which is detailed, technically feasible, financially sustainable and operable, eliminate or offset adverse effects on environment and society as far as possible, and reduced it to an acceptable level. Specific objectives include:

1. **Define obligations of constructors and operators in managing environment.** The units and relevant design institute should check and verify environmental protection targets in details, to put forward practical environmental prevention in the light with environmental features in the project region and project features, and are to ensure that the prevention be incorporated into the project engineering designs and

contracted responsibility of constructors and operators.

2. **Served as the operational directory for environmental management.** The procedures and rules proposed in this ECOP are to ensure the effective implementation of prevention and mitigation measures during construction and operation. This ECOP will be provided to construction supervisors, environmental supervisors and other units concerned whose responsibilities are defined and ways of communication between them are also proposed.
3. The ECOP should be fully integrated with the engineering design of project, and provide guidance for the design.

1.4.2 Principle of ECOP

1. **principles of science, objective and fairness:** ECOP must be scientific, objective and fair, considering the impact on a variety of environmental factors and ecosystems after the implementation of the rules and providing scientific basis for decision making.

2. **Principle of integrity:** ECOP should be related to the policy, planning, plans, and the corresponding project, consider integrity.

3. **Principle of Public Participation:** Encourage and support public participation in ECOP, consider the social various interest and opinions fully.

4. **Principle of consistency:** ECOP should be consistent with the level of construction and degree of detail.

5. **Principle of manipuility:** Principle of manipuility: It should be possible to choose a simple, practical and tested feasible method and the ECOP should be operability.

1.4.3 Applicability of ECOP

In viewing of the type of project activities, locations, sensitivities, scales and potential environmental impact, this project is categorized as **Category B** according to screening and categorization required by the World Bank safeguard policy on environmental assessment (OP 4.01). **Environmental Code of Practice (ECOP)** need to be drew up for ensuring the safety of construction workers and staff of sensitive areas as well as preventing interference with the sensitive area and the surrounding environment. This report is the ECOP of road maintenance and emergency facilities , The ECOP will be applicable to new construction (including mechanized conservation and emergency centers, management, different types of market-oriented pilot project) as well as the renovation and expansion of projects. There is a need to establish environmental management mechanism, prevention and mitigation measures to minimize negative environmental impacts during construction and operation phases.

1.5 Relevant Laws & Regulations and Safeguard Policies

The relevant laws and regulations of the People's Republic of China are shown in table 3:

Table 3 The laws and regulations of People's Republic of China

Serial number	Relevant Laws & Regulations and Safeguard Policies	Implementation time or document number
1.	《Environmental Protection Law of People's Republic of China》	December 26,1989
2.	《Environmental Impact Assessment Law of People's Republic of China》	September 1,2003
3.	《Air Pollution Prevention and Control Law of People's Republic of China》	September 1, 2000
4.	《Water Pollution Prevention and Control Law of People's Republic of China》	February 28, 2008
5.	《Noise Pollution Prevention and Control Law of People's Republic of China》	October 29, 1996
6.	《Soil and Water Conservation Law of People's Republic of China》	March 1, 2011
7.	《Land Management Law of People's Republic of China》	August 29, 1998
8.	《Forestry Law of People's Republic of China》	Revised in 1998
9.	《Law of the Peoples Republic of China on Protection of Cultural Relics》	December 29, 2007
10.	《Wildlife Protection Law of People's Republic of China》	November 8, 1988
11.	《Wild Plants Protection Regulation of People's Republic of China 》	January 1, 1997
12.	《Regulation on Environmental Protection Management of Construction Projects of Peoples Republic of China》	November 29, 1998
13.	《List for classified management of the Construction Project Environmental Impact assessment》	October 1, 2008
14.	《"Three Simultaneity "Supervision Inspection and Environmental Acceptance Management Procedures of the Construction Projects of the Ministry of Environmental Protection (trial)》	December 17, 2009
15.	《Environmental Acceptance Management Measures of Completed Construction projects》	February 1, 2002
16.	《Regulation on Environmental Protection Management of Transportation Construction Project》	Decree No. 5,2003
17.	《Design specification of Highway Environmental Protection》	JTG B04-2010
18.	《Soil and Water Conservation Provision of Highway Construction Projects》	MWR and Water Conservation of MOT [2001] No. 12
19.	《Pollution Prevention Technical Policy of Ground Traffic Noise》	Environmental

		development [2010] No. 7
20.	《Notice on Environment Supervision of Traffic Engineering》	Traffic Environmental development [2004] No. 314
21.	《Design Specifications of Highway Drainage》	JTJ018-97
22.	《Technical Standard of Highway Engineering》	JTGB01-2003
23.	Standards for Control Soil and Water on Development and Construction Projects	GB50434-2008
24.	List for Classified Management of the Construction Project Environmental Impact Assessment of Yunnan Province (2013)	Environmental Development of Yunnan Province [2013] No. 151
25.	《Environmental Protection Regulations of Yunnan Province》	Revision in 2004
26.	《Nature Reserve Management Regulations of Yunnan Province 》	Execute Since March 1, 1998
27.	Yunnan People's Order No. 105《Regulations on Environmental Protection of Construction Project in Yunnan Province》	
28.	EPB of Yunnan Province September 11, 2001《Surface Water Environmental Function Zoning of Yunnan Province,》（review）	Revision in 2012

Relevant World Bank safeguard policies are shown in Table 4:

Table 4 World Bank Safeguard Policies

Serial number	Name	Trigger or not?
1.	Environmental Assessment（OP/BP 4.01）	Applicable
2.	Natural Habitats（OP/BP 4.04）	Not Applicable
3.	Physical Cultural Resources（OP/BP 4.11）	Not Applicable
4.	Involuntary Resettlement （OP/BP 4.12）	Applicable
5.	Forest（OP/BP 4.36）	Not Applicable
6.	Pest Management （OP/BP 4.09）	Not Applicable
7.	Dam Safety（OP/BP 4.37）	Not Applicable
8.	Indigenous Peoples（OP/BP 4.10）	Applicable
9.	International Waters （OP/BP 7.50）	Not Applicable
10.	Disputed Area（OP/BP 7.60）	Not Applicable

1.6 Other Similar Projects Experience

The project will draw lessons from the concept of international advanced highway asset management, practice highway as an asset management across the country in the first time, integrate with the international advanced level, and become the demonstration project of domestic highway asset management. Therefore, it lack similar projects to learn

from in the country.

Yunnan Highway Bureau are implementing provincial pavement rehabilitation project simultaneously, which obtain a loan from ADB. The site of project involves 15 states (city)in Yunnan Province such as Kunming, Lijiang, Dali and other cities, the main constructive contents include: large and medium projects on maintenance of highway pavement maintenance, highway maintenance pilot project based on the performance, construction of highway asset management system and so on. The project will help the Yunnan highway network, improve service levels of road transport and road maintenance capabilities. The total investment of the project is about 1.458 billion yuan, plans to use $ 80 million loan from ADB, the remaining funds collect from the local government financing. The ADB loan is mainly used for building projects, procurement of equipment and materials, institutional capacity building, and other aspect. From the Angle of environment, the project of ADB is mainly for the maintenance of highway itself, and the project of World Bank is mainly for construction of state (city), county highway mechanized conservation and emergency centers, management of highway, market-oriented maintenance test section of technology and new materials, thus Impact on the environment have certain differences. This project is also categorized as “Category B”, according to ADB's Safeguard Policy Statement (2009) ,prepare initial environmental examination (IEE) and Environmental Assessment Review Framework (EARF)

2 Environmental Baselines in Yunnan Province

2.1 Regional Location

Yunnan Province is located in north latitude of 21°8'32" ~ 29°15' 8"and east longitude of 97°31'39"~ 106°11'47". The maximum horizontal distance of Yunnan Province is 864.9 kilometers, the north-south longitudinal distance of 990 kilometers, the largest total area of 39.4 square kilometers, accounting for 4.1% of the total land area in China and the eighth in the nation. It neighbors guizhou and the guangxi zhuang autonomous region east, connecting to sichuan province north, leaning on the Tibet autonomous region northwest. It is adjacent to Burmese on the west and to Laos and Vietnam on the South, with complex and diverse natural geographical environment.

The total boundary lines of Yunnan province is about 4060 kilometers with neighboring countries, with eight prefecture-level cities totally, 25 county-level cities, 20 country-level ports, more than 20 country roads. Yunnan borders with Myanmar, Laos, Vietnam directly and is not far from Thailand, Cambodia, Bangladesh, India and so on. Mekong, known as the Oriental Danube, flows through Burma, Thailand, old, Cambodia, Vietnam and other countries, exiting from Yunnan Province, passing which the South the Silk Road reached Burma, India, central Asia, the Arab region and the western countries from Sichuan Province 2000 years ago. The "Ma Yuan old road" got to Vietnam and the South China sea from the southern Yunnan a century ago, which played an important role in foreign communication in ancient China.

The location of Yunnan Province in China(lab led by yellow) is shown as the figure 2.

Figure 2 the location of Yunnan Province in China

2.2 Topography

Yunnan is a plateau mountainous province, attached to the south part of Qinghai-Tibet plateau. The topography of Yunnan is divided into two parts of east and west area, parted by Mudanjiang valley and the wide valley, south of yeanling mountains. There are Eastern

Yunnan plateau and Middle Yunnan Plateau on the east, named as Yunnan plateau, which is a part of the Yunnan-Guizhou plateau, with an average elevation of 2000 meters, which terrain is undulating and gentle low mountains and rounded hills. It is longitudinal valley of hengduan mountains region on the west, with mountains and deep valleys. The characteristics of Yunnan landscape as follows: firstly, the plateau shows the waves; secondly, it is alternant between the mountains and valleys; thirdly, it is progressive decreased in three big steps from northwest to southeast; fourthly, the down faulted basins distributed all over the province; fifthly, mountains and lakes distributes crisscross vertically and horizontally.

2.3 Climate

Yunnan province is located in the southeast of the Qinghai-Tibet plateau, near the bay of Bengal and South China sea, belonging to the typical low latitude plateau climate, covering various climate types from Hainan island to Heilongjiang province in China. Xishuangbanna is located in the southernmost tip of Yunnan, belonging to the northern edge of the tropical climate types, warm, humid climate, with abundant rainfall, sufficient heat.

Winter and summer, both affected by the dry-cold and hot-humid monsoon, dry and rainy season are formed. The dry season lasts from November to April of the next year, the rainy season does from May to October of the next year. Annual precipitation is roughly between 1000 ~ 1500 mm, of which more than 80% is concentrated in the rainy season. Relatively, the climate characteristics of spring and autumn is not obvious. Most of Province is warm in winter and cool in summer, with the seasons similar to spring.

2.4 Surface Waters

2.4.1 Hydrographic net

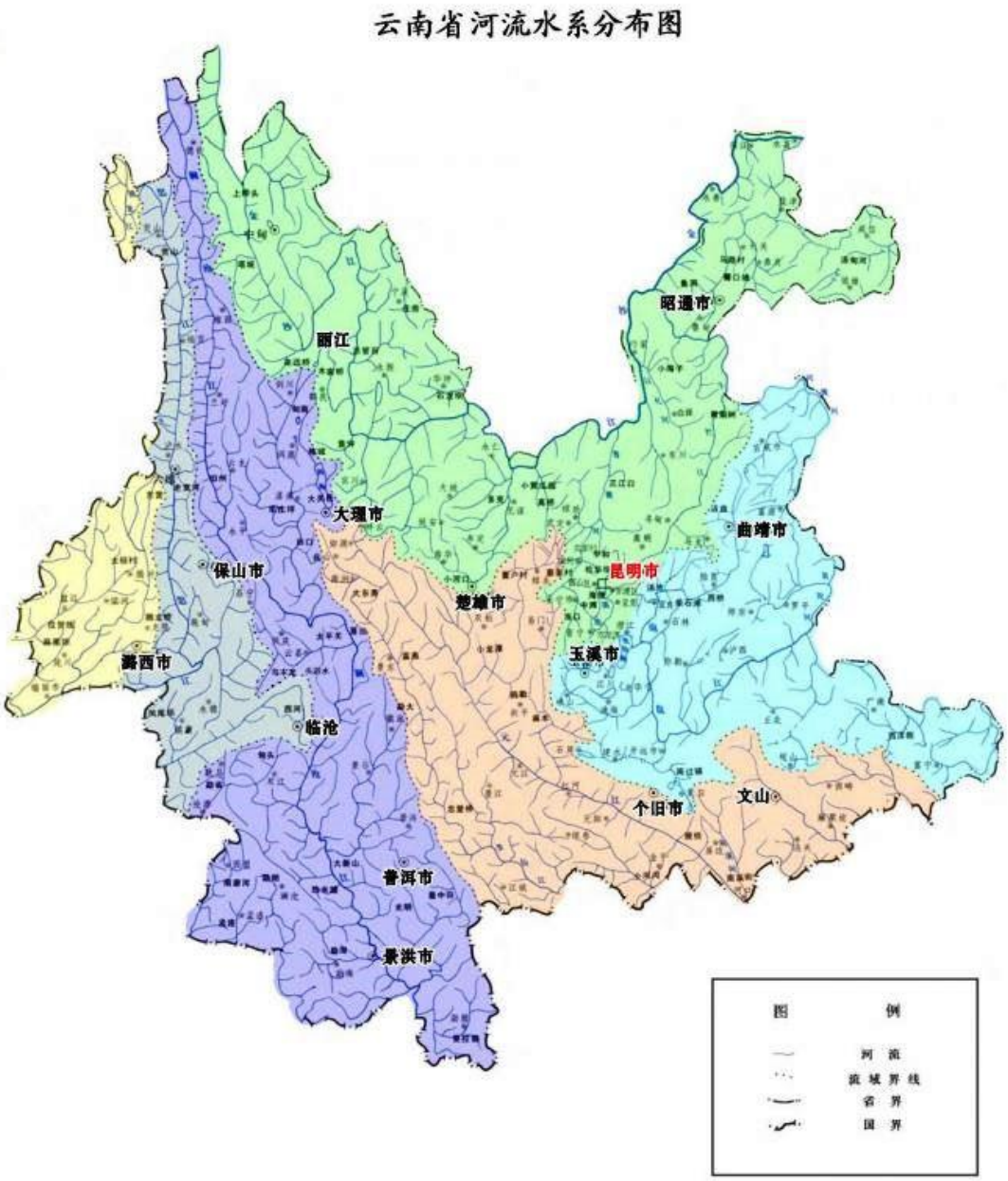


Figure3 Distribution of water system in Yunnan Province

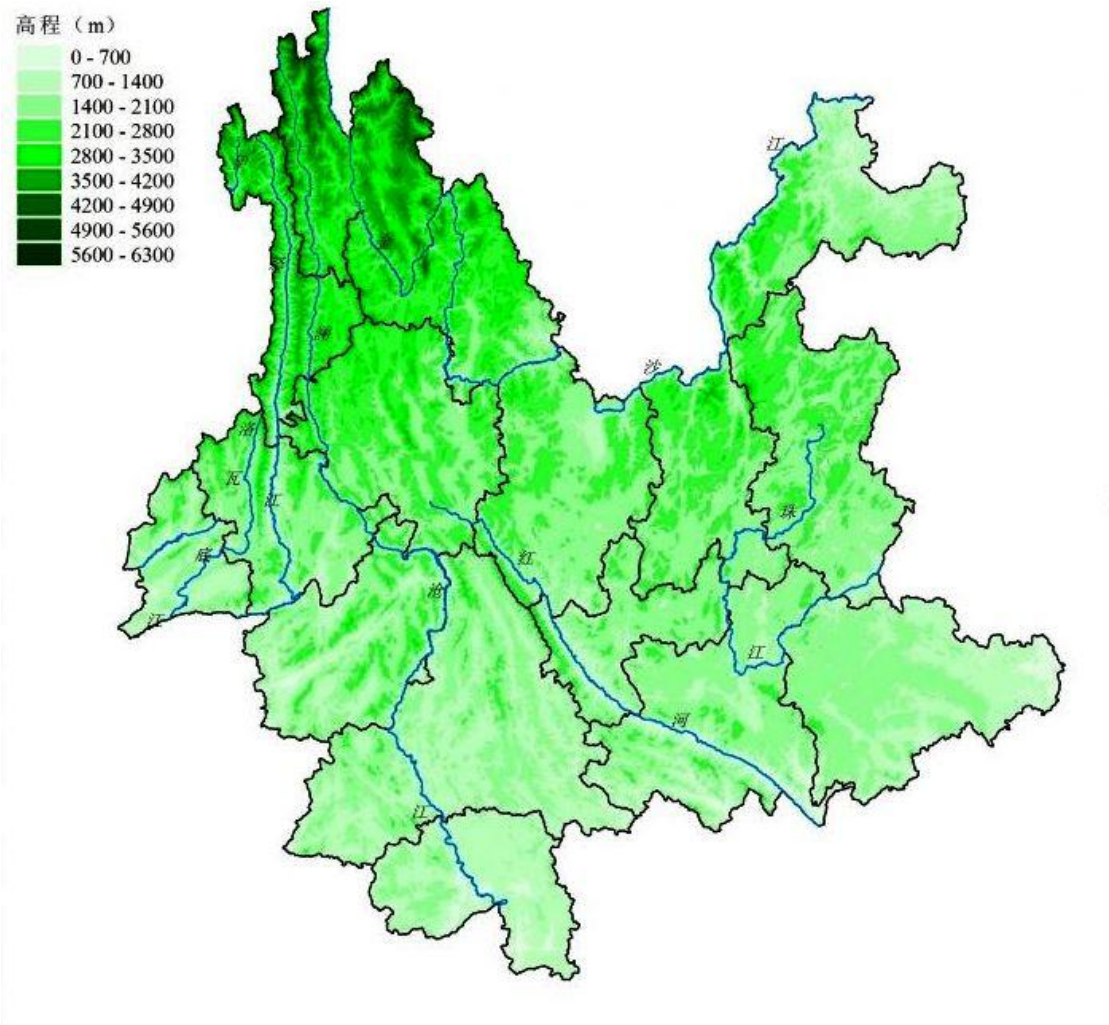


Figure4 Map of elevation of the six-water system in Yunnan Province

The hydrographic net of Yunnan is complex for meandrous for numerous criss-cross rivers. There are more than 600 rivers through the territory of Yunnan Province, among which more than 180 are great rivers as the upstream of the river emptying into the sea. The water-collecting area of the rivers cover the entire Province as the tributaries of the six major hydrographic nets, including Yuanjiang - Red river, the Lancang - Mekong river, Nujiang-Salween river, Dulongjiang river, Dayingjiang, Ruili river - the Irrawaddy, which respectively flows into three sea and bays: the East China sea, the South China sea and the Andaman sea, the North bay, Motama bay, the bay of Bengal; Two oceans that the rivers flows into includes the Pacific and Indian Oceans. So there are not any more complicated hydrographic net in other province. Another characteristic of rivers in Yunnan province is lies in that it flows from north to south, different from the most domestic rivers flowing from west to east. Map of elevation of the major rivers and the six-hydrographic in Yunnan Province is shown as blow.

2.4.2 Lakes

There are numerous plateau lakes in Yunnan Province, which is the Province with most

lakes, among which there are 37 lakes with area more the 1 km^2. The total area of lakes is 1066 km^2, water-collecting area of 9000km^2 with total water storage of 30 billion m^3. There are the Diane Lake, Fuxian Lake, Yangzonghai Lake, Qili Lake and Xingyun Lake on east of Yunnan; In weat there are Erhai Lake, Chenghai Lake, Lugu Lake, Jianhu Lake, Zibihu Lake, Napa Lake and Bita Lake and so on, Yilong Lake, Changqiao Lake and Datun Lake in the south.

The lakes with capacity more than 2 billion m^3 includes Fuxian Lake, Erhai Lake, Chenghai Lake and Gulu Lake; the ones with 20m of mean water depth covers Fuxian Lake, Gulu Lake, Chenghai Lake and Yangzonghai Lake; the ones with area more than 200km^2 includes Dian Lake, Erhai Lake and Fuxian Lake. Dian Lake is the one with most extensive lake surface, the sixth over the country. Fuxian Lake is the first one in terms of capacity and mean water depth, as well the second deep lake over the country.

Most lakes in Yunnan are located among the lofty mountains and high ranges, surrounded by beautiful scenery, which is the imoportant part of the glorious natural landscape.

2.5 Water resource

2.5.1 Precipitation

Yunnan Province is near to tropical oceans, located in the southeast of the Qinghai-tibet plateau, under the common effect of warm moist air flows in the southwest and southeast. For the terrain and climate, It has enough water vapor is and precipitation. The annual mean precipitation is 1278.8 mm, converted into water volume of 490 billionm^3.

Precipitation of Yunnan varies obviously as alternating seasons, with uneven distribution of precipitation of different seasons, which results in dry climate in winter, spring and the beginning of summer, flood in summer and autumn. The most of the rainfall is concentrated in the flood season (from may to October), generally accounting for more than 85%.Various precipitation concentration degree happens different places

1. Surface water

Surface runoff Province is mainly produced by precipitation in Yunnan province, which is supplied by the early spring snowmelt in west minority region. the mean surface water resource of entire province is about 221 billionm^3, accounting for about 1/13 of the whole nation, the province mean runoff for many years is deep of 576.7mm/km^2. the mean runoff modulus is 577000m^3/a·km^2, about twice of the national yield.

2. Runoff into and out of border

Runoff into the border of China refers to the runoff of rivers that flows into the territory of China from neighboring countries, not including the one flows into the common boundary

rivers from one side of neighboring country. The runoff into the border of China is from Burma and Lao, mean capacity for many years of 2.463 billion m^3, among which the capacity flows into Lancang River is 1.226 billion m3, into Nujiang River is 0.157 billion m^3 and into Yluowadi River is 1.08 billion m^3. The mean capacity of runoff into neighbouring countries such as Vietnam, Burma and Lao through territory Yunan Province is about 220.4 billion $m^{3.}$ Among the major 4 international rivers, Lancang river occupies the most capacity of runoff out of border, about 73.81 billion m^3, the second is Nujiang River of 71 billion m^3, successively Red River of 44.03 billion m^3 and the least is Yiluowadi River of 31.6 billion m^3.

Runoff into and out of province

The runoff into Yunnan Province from other provinces mainly comes from Tibet, Sichuan, Guizhou, Guangxi. Mean capacity of runoff for many years is 162.5 billionm^3. The capacity of runoff flows into the Yangtze river basin locally, Zhujiang, Lancang River, Nujiang and Yiluowadijiang respectively are 162.5, 96.11, 2.574, 21.22, 38.64, and 3.77 billion m^3. The mean capacity of runoff flows to other province from Yunnan for many years is 163 billion m^3, among which the capacity of the runoff flows from Yangtze river, Pearl river and Red riverrespectively are 137.6, 25.02 billion m^3, and 372 million m^3.

3. Underground water

Annual mean capacity of groundwater in Yunnan province is 77.15 billion m^3, which takes up about 9.54% of the total groundwater throughout the country. Mean modulus of underground water for many years is 200000 m^3/a. Regional distribution of groundwater resources in Yunnan Province is uneven, whose change trend is in accord with the regional distribution of surface water which shows more distribution in the west than east, more in the south than north. Vertical distribution of the groundwater and surface water both are almost the same, namely in term of similar climate and underlying conditions, generally water yield of groundwater in high altitude region is more than the one in low altitudes.

2.6 Flora and Fauna

2.6.1 Wild plant

Yunnan Province is known as kingdom of flora, with the characteristic as bellows:

Firstly, Yunnan has the most abundant flora all over the country. According to incomplete statistics, there are 12 vegetation types, covering 34 vegetation sub-types, composed of 169 flora including 209 association, which covers most vegetation types including tropical, subtropical, temperate, cold temperate and frigid zone vegetation. There are higher 426 families of plants, containing 426 genera, nearly 17000 species, respectively taking up 88.4%, 68.7% and 88.4% of the one all over the country. There are many different species

of lower plants as well. So there are all species of wild plants found over the globe in Yunnan Province, among which there are 64 families including 158 species are enrolled into the "The national key protected wild plants list".

Secondly, botany in Yunnan originate from antiquity, especially most of progeny of paleobotany such as paleofern, some original gymnosperm and angiosperm.

Thirdly, There are many endemic species. For instance, Yunnan spermatophyte contains 108 endemic genus accounting for 52.9% over the country, covering more than 1000 species, accounting for 10%. Especially the traverse Mountainous Region on the west of Yunnan, dry-hot vellay region, karst area on the southeast of Yunnan and tropical mountainous facing to southeast monsoon, where the endemic genus and species concentrate.

Fourthly, the composition is complex geographicially in Yunnan Province, which connect with each other widely.Yunnan flora stretches across Holarctic plant area and paleotropic plant area, whose border crosses slantwise over the province from east to west, passing the line of Guangnan, Yanshan, Gejiu, Jianshui, Xinping, Jingdong, Fengqing, Changning, Yongping and Liuku successively. The vegetation of Yunnan is divided into 5 flora as follows: (1) Subflora of South and Southwest Yunann, (2) Subflora of Southeast Yunnan, (3) Subflora of the central plateau of Yunnan Province, (4) Subflora of traverse mountains of West and North Yunnan, (5) Subflora of Northeast Yunnan.

2.6.2 Wild animal

Yunnan has complex and varied geography and climate, which provide advantageous conditions for all kinds of animal survival and reproduction, with great advantage in animal resources, known as "animal kingdom". Main features shown as follows:

Firstly, there are a great variety of species in Yunnan Province for the various habitats, with the most animal species over the country. At the beginning of 21st century, there were 309 species of beasts, 849 species of birds, 121 species of batrachians and 163 species of reptilia, among which the species of vertebrate takes up 39%～64% over the country.

Secondly, there are numerous endemic species in Yunnan Province. The distribution range of most animal are excluded except Yunnan Province or most are there such as Elephas maximus, Yunnan snub-nosed monkey, binturong and so on.There are 1257 species of bids record in China, 114 species found in Yunnan Province such as little cormorant and pavo muticu.

Thirdly, The kind of rare and threatened plants are abundance in Yunnan Province. There are 58 families and 228 species enlisted in the protected specie in China, among which 29 species of beasts, 24 species of birds, 5 species of reptilia and 2 species of fish is enlisted

as class I protected species and 26 species of beasts, 128 species of birds, 4 species of reptilia andbatrachian, and 3 species of fish and insect as class II, totally 168 species.

2.7 Forest

Yunnan forest consists of 4 vegetation type including coniferous forest, broad-leaved forest, bamboo forest, shrub and other, 17 vegetation subtypes, 105 forest type. There are various forest and huge volum of timber, as one of the three major forest. the distribution characteristics is shown as follows: horizontal distribution. Yunnan stretches from south to north across eight latitudes, covering the tropical and subtropical forests; forming variety of climatic conditions for the north-south oriented mountain and rivers cutting the geographic surface, resulting in some tropical forests extending to the north along the valley, subtrapical forest extending to the south along the ridge, combined with some regions with special climate (such as foehn effect of the valley), forming interlaced and inlayed forest distribution over the province. Given in a range of certain altitude, zonal forest type is still relatively stable with latitude. Secondly, the most striking feature of Yunnan province is the vertical distribution. Climate, soil and vegetation of Yunnan forest shows obvious difference with increasing altitude. Within the scope of a certain height, the climate conditions are relatively stable, the formation of a certain type of forest, so that constitutes a series of vertical mountain forest.

The province's forest area occupies 15.015 million ha, the total stocking volume of 1.548 billion m^3, respectively accounting for 1/10 and 1/8 of the total ones over the country, nearly 50% fo forest coverage rate.

2.8 Sensitive area

2.8.1 Nature reserve

Distribution of natural reserve areas in Yunnan Province as belows:

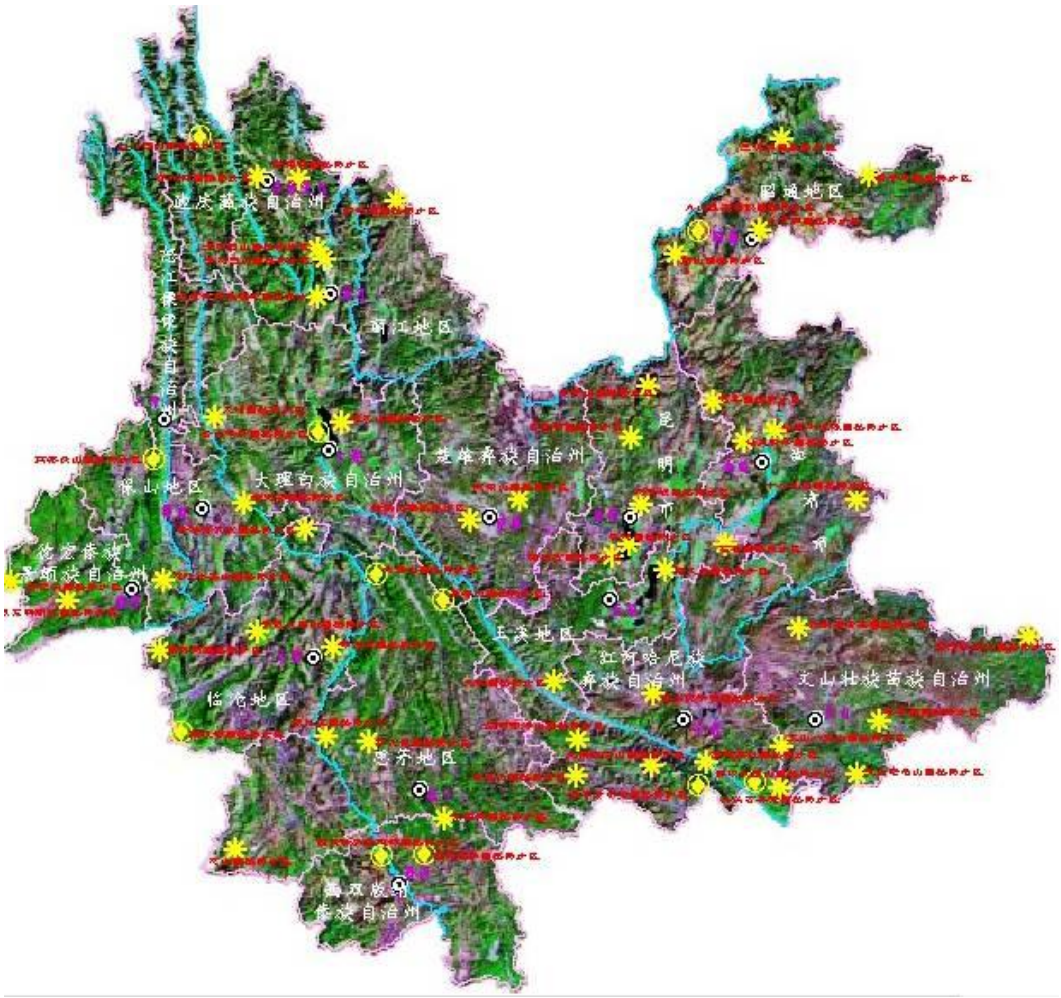


Figure5 Distribution of natural reserve areas in Yunnan Province

2.8.2 Scenic Areas

1. World heritage

Chengjiang biota is located near Maotian Mountain, Chengjiang river, Yunnan Province of China, a very complete paleontological fossil early Cambrian, which vividly recapitulates magnificent landscape of marine life and originally biological characteristics 530 million years ago, providing valuable evidence for the theory study of the origin, evolution and ecology of early life on the earth. Chengjiang fossil was discovered in 1984, where fossils found cover 16 categories, more than 200 species of fossils by 2012. It was officially enrolled world heritage sites by the 36th world heritage committee meeting, On July 1, 2012.

The Stone Forster - world geological park in The Stone Forest of Yunnan province is located in The stone Forest Yi autonomous county in Kunming, Yunnan province, with an altitude between 1500-1900m, subtropical low latitude plateau hilly monsoon climate, annual average temperature around 16 ˚C, about 78km away from Kunming. The climate of the Stone Forest world geological park keeps the status like spring in different seasons,

without freeze in winter, without heat in summer, which is the unique karst landform scenic area located in the subtropical plateau over the world, known as the "world wonders" and "the Stone Forest museum". The Stone Forst is earliest certificated as national key scenic area, national geological parks in China, and the world geological park, which is known as one of China's four famous tourist attraction, equally famou as Beijing palace museum, the terracotta warriors in Xi'an, Guilin landscape. The Stone Forest in Yunnan province is famous for numerous stone like forest. The sightseeing developed includes the Stone Forest scenic spot, pine rock, waterfall scenic area, Changhu lake scenic area.

The Old Town of Lijiang: Authorize: December 1997. The heritage categories: cultural heritage. Selection criteria Heritage: enroiied into "The world heritage list" according to selection criteria of cultural heritage C (II) (IV). The.ancient building of the Old Town of Lijiang occupies unique characteristics nature, pragmatism , empressement and inclusion, which contains the unique human creation spirit and the progressive significanc in the building itself formed in the specific historical conditions. The Old Town of Lijiang is a significant minority traditional settlements, which provides valuable information for research of human urban construction history research and the human development history research, as precious cultural heritage and the treasure of China and the world, in line with the world heritage list.

Three parallel rivers refers that three rivers Jinsha river, Lancang river and Nujiang, originated in the Qinghai-tibet plateau, flows through Yunnan province from north to south in the parallel, running more than 170 kilometers, crossing the mountains and rivers, forming the strange natural geographical landscape of "river and stream without intersection". The natural landscape of three parallel rivers composes of Nu river, Lancang river, Jinsha river and the mountains of, covering area of 1.7 million hectares, including 9 natural reserve areas and 10 sightseeing area located in Lijiang of Yunnan province, Diqing Tibetan autonomous prefecture and Nujiang Llisu autonomous prefecture.

2. 12 spots of National scenic

3. 54 spots of The provincial scenic

The list of profile of forest park in Yunnan Province (see annex 1)

List of National scenic and provincial scenic(see annex 4)

3 ECOP Implementation Arrangement

3.1 Institution setting and main responsibility

According to the relevant policies of the World Bank loans and the actual work needs, for the implementation of the procedure of the ECOP, the project will set up a special organization, responsible for project environmental management and supervision work. The internal management institutional framework is proposed to be established by the persons from the Yunnan Road Asset Management Project Management Office (PMO), City/District/Counties PMOs of Yunnan, the External Design Institute, the EIA institute, the External Monitoring Institute of Environmental Management (see **Annex 2:** "TOR of hiring external monitoring institute of environmental management"), and the Environmental Supervision Institute to be responsible for the implementation of environmental management and environmental engineering supervision work. The main responsibilities of institutional settings and various agencies please see the chart below:

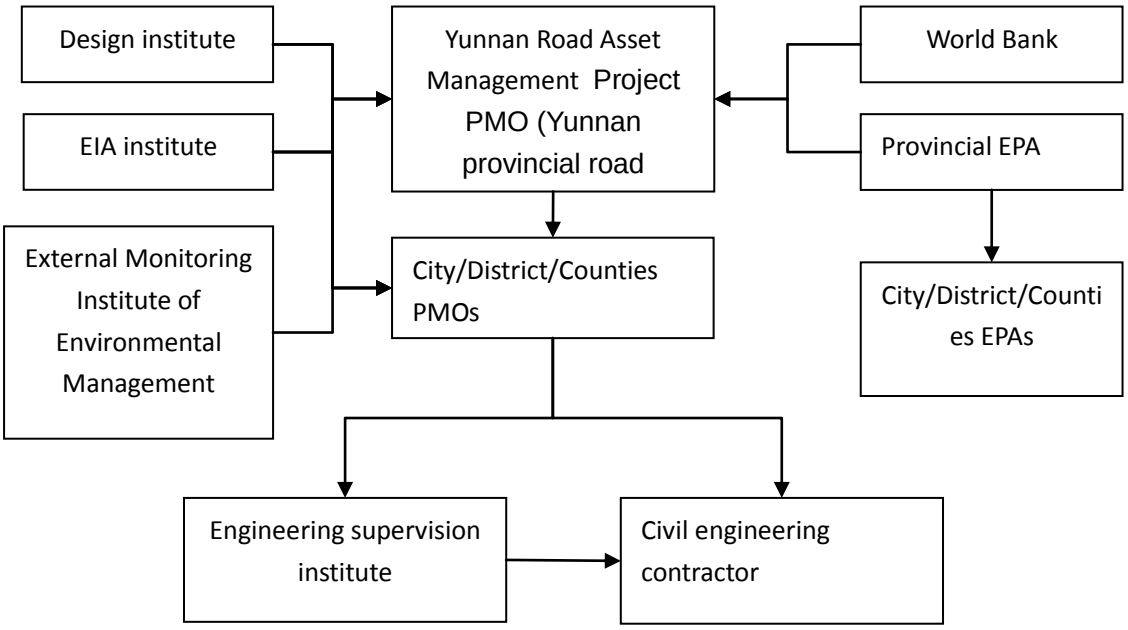


Figure6 ECOP Management System

Table 5 Agencies of the environmental management system and main responsibilities

Name of Agencies	Tasks of Agencies	The main responsibilities
Yunnan Road Asset Management Project Management Office (PMO)	Be responsible for overall project coordination and management	responsible for the planning, design and meet the requirements of the environmental protection of the projects in China and the World Bank. coordination, supervision and overall tracking report, and solve major environmental problems. responsible for hiring EIA Institute, and managing external environmental monitoring Institute.
District/City PMOs	Be responsible for sub-project implementation and management	responsible for a series of environmental management work during the project design and preparation phase. implementation of environmental funding. responsible for liaison and coordination with Yunnan Road Asset Management PMO, and the implementation of environmental management issues. designated environmental managers to implement their own procedures OF ECOP and tracking, and timely coordination and supervision with the contractor to take environmental management actions, accept and deal with environmental complaints.
Counties PMOs	Be responsible for sub-project coordination	responsible for coordinating the land acquisition, demolition work of various subprojects.
District /City/County Environmental Protection Bureau	Govt. agencies responsible for environmental administration and approval of EIAs	the environmental administration agency and be responsible for approval of EIAs
Implementation bodies (Contractor)	Implementation bodies, responsible for carrying out mitigation measures proposed in ECOP	Before construction, verify the site environment against respective EIA Report, ECOP implementation, protect environmental quality
Environmental Supervision Institute	according to the law, conduct on-site supervision and inspection regarding the emissions of pollutants pollution and ecological destruction events, and participate in the	Conduct weekly site environmental inspection and keep inspection checklist for filing during the construction phase; When break of regulation or nonconformity are inspected, issue notice sheet for correction actions to be taken by contractor and then supervise ,

	treatment during construction process	
EIA Institute	To conduct independent EIAs to the sub projects, provide technical support to the design issues related to environmental protection, prepare ECOP	Preparation of EIAs; Preparation of ECOP
External Design Institute	To prepare feasibility studies, preliminary designs, construction drawings, bid documents for the project	ensure minimal environmental impact engineering technology program. Combine the environmental measures proposed in the feasibility study, preliminary design and the project's environmental impact assessment into the design of programs and budgets, and integrated into the technical specifications of the tender.
External Monitoring Institute of Environmental Management	Assist Yunnan Road Asset Management PMO to prepare external environment monitoring reports and oversee the implementation of environmental protection during the project implementation	submit an interim monitoring report to the World Bank and the environmental management implementing institutes. submit an annual monitoring report to the World Bank and the owners. six months after the completion of all environmental management, submit a comprehensive environmental management assessment report.

3.2 Environmental Management Staffs and Their Duties

In the environmental management system of this project,, some is within the organization, and some are consulting services, while others are outside the project organization. To deliver obligations more appropriately, it is proposed that the relevant agencies designate their staff responsible for environmental management as shown in Table 6.

Table 6Staffing for Environmental management

Agencies for environmental management	**Environmental staff**	**Staff duties**	**Quality requirement**
Yunnan Road Asset Management PMO	1 staff in charge	① Oversee and coordinate works of its counterpart staff in County/District PMOs, ② Reporting the implementation EMP to WB, and arrange for actions responding to WB's	Knowledge of professional environmental management

		requirements on EMP. ③ Consolidating environmental management report and submit the report to WB, coordinating with relevant agencies to address environmental issues. ④ Pay environmental site visit at least once a year and prepare site inspection checklist for filing.	are required
	Independent external monitoring agency for environmental management	①Provide technical assistance and training; ②Assist in the implementation of the ecological environment recovery plan which was destroyed during the construction; ③ Accordance with the requirements of ECOP, conduct survey of monitoring the implementation of environmental management; ④ Assess the living conditions of affected populations to determine whether the recovery is adequate; ⑤ Prepare and provide external monitoring and evaluation reports to the Project Management Office and the World Bank.	
District/City PMOs	Project Director	Responsible for coordinating the implementation of subprojects in related matters with Yunnan Road Asset Management PMO to do environmental work.	
County/City PMOs	Project Director	① Pay environmental site visit at least once a year and prepare site inspection checklist for filing(Annex 6); ②Organize trainings on environmental management, ③ Course the implementation of mitigation measures proposed in ECOP ④ Record, collate and report environmental complaints, if any, and address public complaint issues;	
EA Consultant (holder of Class A certificate for processing EIA on construction projects)	Project Director	① Conduct site visits to each project and its environmental evaluation; ② Responsible for the preparation of the content of ECOP.	
contractors	1 staff in charge of environmental management	① Implement mitigation measures proposed in ECOP during construction; ② Promptly report to staff in charge of environmental management of County/District	

		PMO when environmental emergency occurs ③ accept the environmental protection supervision and inspection by Engineering Supervision, World Bank, and environmental protection departments at all levels; ④ establish a feedback mechanism, three working days after receiving a rectification notice, to complete the rectification (those requires administrative agencies to coordinate should be in 10 working days to complete the rectification); ⑤ checklist is completed together with engineering supervision at the construction site before construction, and report to the organization at the project site; ⑥ construction implementation institute report to the project Management division weekly.	
Environmental Supervision (ES)	Environmental Supervision is taken by the Construction supervision	① conduct weekly environmental inspection, keep site inspection checklist for filing; ② When break of regulation or nonconformity are inspected, issue notice sheet for correction actions to be taken by contractor and then supervise.	

3.3 Environmental Management Tasks in Different Stages

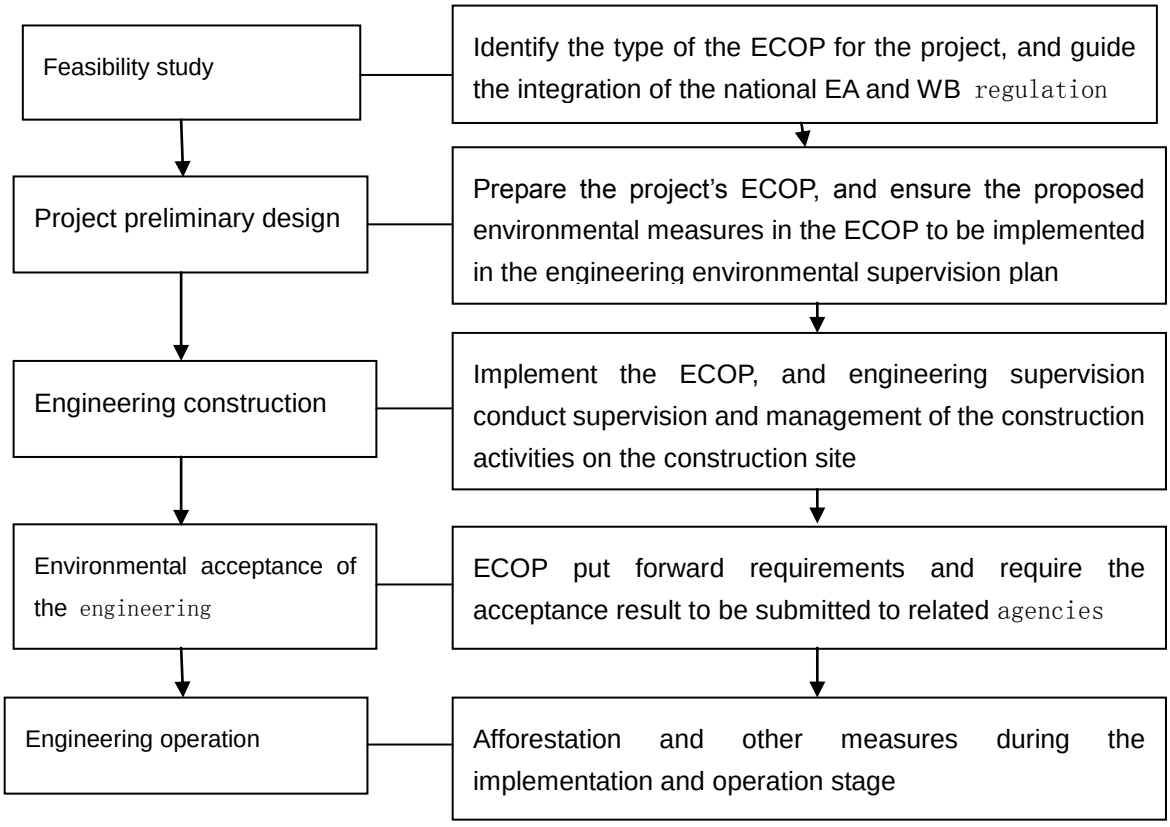


Figure 7 ECOP tasks vary from different stages

ECOP tasks vary from different stages and are shown in Figure 2-3 The most important task of ECOP is to ensure that all the environmental protection prevention and mitigation measures are effective carried out, including 1) incorporation environmental prevention and mitigation measures into the project design and contracts; 2) ES's supervision of contractors' implementation of environmental prevention and mitigation measures and ES's inspection of the effectiveness of environmental prevention and mitigation measures taken by contractors; 3) checking mechanism, reporting mechanism, archiving mechanism of ECOP. the work of timeliness is reflected by checking the daily work.

3.4 Construction Preparation and Environmental Supervision

The ECOP (environmental management plan may be prepared in the future) will be included in the tender documents and the civil construction contract, and the Contractor shall give full consideration to these measures in the tender offer. After entering the construction site, the contractor need to conduct site survey, to verify and identify whether the situation is to adapt to the ECOP (or environmental management plan), and if new environment sensitive issues are found, the Contractor shall submit the appropriate environmental prevention and mitigation measures. After obtaining the approval of the environmental supervision and PMO, construction could be started.

During construction, the main task of environmental supervisors are to check of the measures taken by contractors are conformity with the ECOP requirement (Regarding these measures, contractors and environmental supervision could refer to subsequent chapters and Annex 5: Summary of project environmental supervision and management).

ES should conduct site inspection at least once a week; prepare its checklist and keep the checklist in files (Annex 6).

The ES should issue notice sheet (see in Annex 7) for correction actions to be taken by contractor and then supervise when breach of regulation or nonconformity are inspected. ES should report to PMO staff in charge of environment and WB task team once a half year.

Before the end of construction, environmental supervision should carry out environmental inspection, and fill in checklist environmental inspection before (see Annex 8) and archive, and then submit it to the PMO.

3.5 Environmental Supervision Plan

The supervision of the project will incorporate environmental supervision duties. According to the dual requirements of the project quality and environmental quality, total quality management of the project will be conducted.

3.5.1 Environmental Supervision Range

The range of the ES are mainly focus on construction area such as the primary site, spoil ground, concrete mixing plants and other, which will bring environmental pollution to the surrounding area by the production.

3.5.2 Environmental Supervision Content

1. Review the environmental protection measures of the engineering design, construction design of are already implementing environmental protection measures proposed in this ECOP;
2. Assist the environmental training of the construction workers and management staff organized by the contractor;
3. Audit the terms relating to environmental protection in the engineering contract;
4. Conduct acceptance review in accordance with the standards of environmental protection measures for the water, sound, air and environmental, environmental impact quality during the construction process, and as well as the environmental protection engineering supervision;
5. Systematically record the situation of the environmental impact of construction, the effect of environmental protection measures, environmental protection;
6. Reflect construction problems that appear unexpectedly regarding environmental protection measures during construction to the engineering supervision group timely, and put forward recommendations;
7. Be responsible for project environmental supervision work plan and summary.

3.5.3 Environmental Supervision Framework

Establish and improve environmental supervision security system. Require full-time environmental engineering supervision personnel, in accordance with dual requirements of the project quality and environmental quality for the project, the quality will be totally managed. The work of project environmental protection and environmental supervision will accept , supervision of Provincial Highway Project Office, states and counties (districts) Project Office, Environmental Specialist, and the EPA.

Develop related environmental management practices and implementation details. According to the characteristics of the project, develop the project environmental management practices, details of environmental protection work on and other implementation environmental protection system.

Establish and improve the environmental supervision system: ① work recording system, that is "supervision diary". Describe the situation of patrol inspection and environmental

problems, analyze the causes of problems occur and responsibilities of the Agency, such as the initial treatment advice; ② reporting system; throngh the main channels of communication inside and outside, up and down, transmit information, including environmental supervision engineers' Monthly, Quarterly Report, six months' assessment progress report and monthly environmental report of the engineering contractor; ③ file notification system; environmental supervision engineers and contractors should diliver and confirm all the to do msatters through the file, and an emergency notification could be verbal, but afterwards still need to be confirmed in a written document; ④ environmental regular system; environmental conference will be held once a month to review the work of environmental protection, to put forward the existing problem and propose rectification requirements, and form implementation program. The figure below shows the flow chart of environmental supervision during construction.

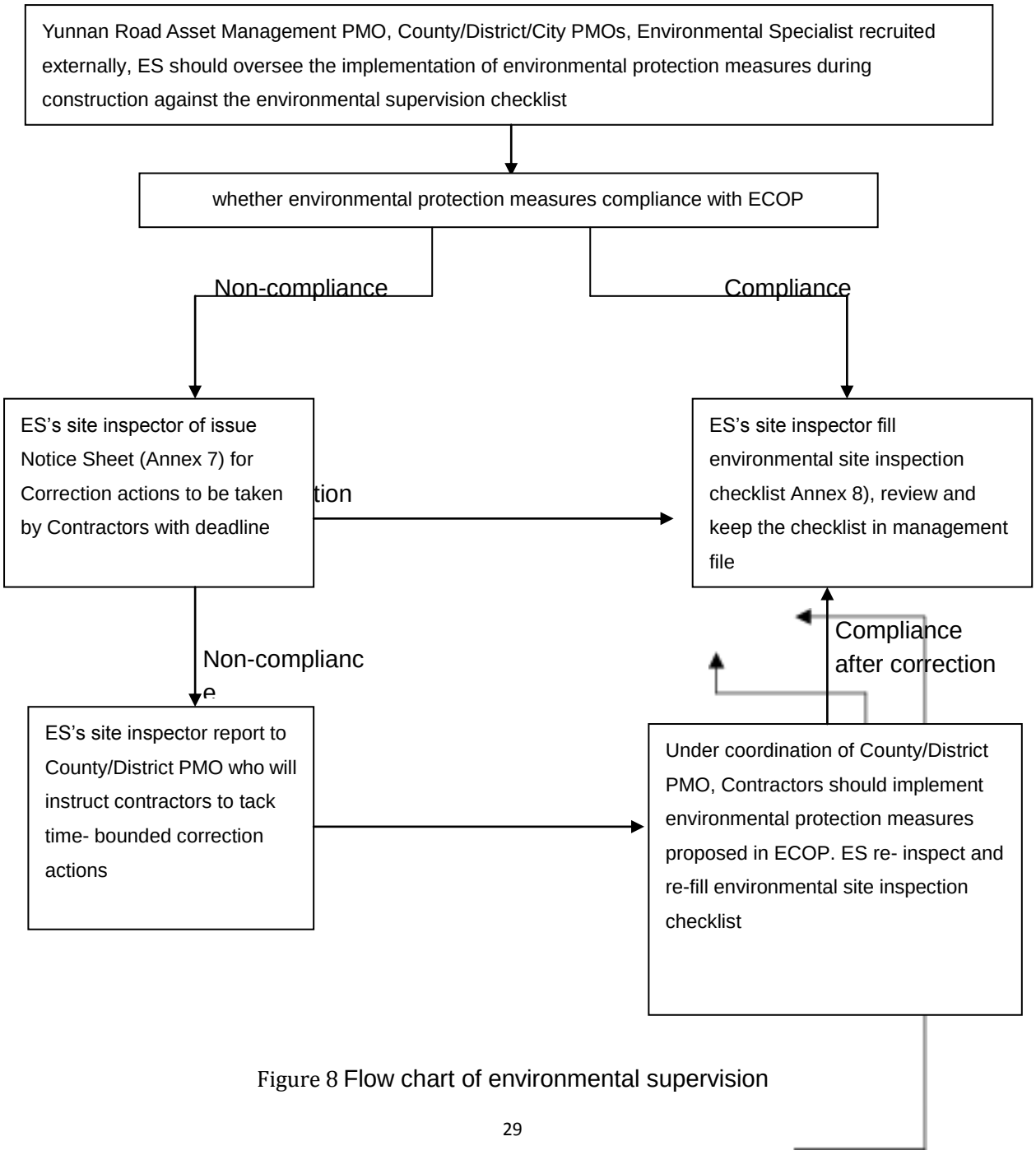


Figure 8 Flow chart of environmental supervision

3.6 Training and Capacity Building

For the successfully and effectively implementation of this project, all employees must, in particular, construction personnel should be trained with environmental knowledge and skills. The main training materials are the ECOP and environmental management plan (if any), as well as relevant national and local protection laws and requirements of environmental protection, water conservation, heritage, health and hygiene, ethnic customs and cultural protection. In principle, before the start of each new subproject, PMO should organize construction agency and supervision agency to carry out a training. During the subproject implementation, the PMO may need to organize or conduct training in accordance with the requirements of construction agency and supervision agency. Construction agency and supervision ageshould be carried out internal environmental training regularly. Environmental training and education should include the following:

- Before the project is started, the PMO should organize training courses to conduct a training for the civil contractors and construction supervision agency.
- The contractor should conduct education, training and assessmen to the construction worker in the construction site before the construction. During construction, according to the actual needs (such as for new construction personnel) , the training should be regularly carried out.
- The civil work contractor should annually conduct training content of the risk of contingency plans to the staff, and also organize drills.
- The civil work contractor shall conduct occupational health training and examination every six months for the workers engaged in toxic and hazardous, and guide the operator to properly use occupational protective equipment and personal protective supplies.
- PMO should regularly organize or require the construction agency and supervision agency to invite local health and epidemic prevention section to carry out prevention education of epidemic, STD, AIDS for the construction workers.

The specific training plan is shown as the table below.

Table 7 Training plan of the Environmental technician

Personnel	Trainging content	method	Number	Time(day)
Construction environmental personnel	Environmental basic theory and method of monitoring; preparation of the monitoring report, job training	national	2 person each construction section	2
Environmental supervision engineers, construction environmental	Environmental regulations, construction planning, environmental monitoring standards and norms	national	1-2 person each construction section, 2-4 person from the constrction agency	2

management personnel				
	Ambient air monitoring and control technology, noise monitoring and control technology	national	6	2
Environmental senior management, environmental engineers	Foreign advanced management experience and environmental traffic noise control measures	national	4	1
Total				7

3.7 Documents Management and Report

During the implementation of this ECOP, WB, PPMO, project County/District PMOs, the EA consultant, ES, contractors should keep a good document management. Requirement on document management for all the related agencies are shown in Table 8.

Table 8 Requirement on Document Management

Agency	Document Management
Yunnan Road Asset Management PMO	Prepare and oversee the implementation of ECOP of road construction, EA documents, and pigeonhole; Keep semi-annual record of report on ECOP implementation submitted by County/District PMOs, based on which, prepare project-wide report on ECOP implementation and semi-annual reports to the WB, and pigeonhole; Coordinate with other relevant agencies to address key environmental issues, keep recording of such coordination for filing all such documents;
District/City/County PMOs	Prepare Environmental Management Rules and Regulation for the respective sub-project and pigeonhole it; Prepare training program for implementing EMP and pigeonhole it; Organize survey/study/workshop on special subject, make documentation on such survey/study/workshop for filing; Keep record of any complain received during construction, and keep such record into filing system; Keep quarterly record of ES's reports for filing and report to PPMO; Sign for reception of contractor's site record and ES'S environmental site inspection checklist; verify environmental sensitive issues (if any), pigeonhole all such documents; Manage all notice sheet for correction actions to be taken by contractor, that are submitted to higher level and pigeonhole them.

External monitoring agency of environmental management	Submit an interim monitoring report to the World Bank and the environmental management implementing agencies every six months and archived. submit an annual monitoring report annually to the World Bank and the owners and archived. After six months of the completion of all environmental management, submit a comprehensive environmental management assessment report and archived.
Contractor	should keep weekly record of construction implementation status, pigeonholing the record and report to ES; Contractor and ES should work together to fill the environmental site checklist, and pigeonholing the checklist, report to the County/District PMO; At accidental/emergency case, Contractor's EMC should record the case at construction site, pigeonholing the record and report to ES; When receiving ES's notice sheet for correction action, contractor should take the action within 3 days (or 10 days if coordination from management agencies are necessary, keep record of the actions, pigeonholing the record.
Environmental Supervisor	ES should keep weekly record of contractors performance in implementing ECOP, pigeonholing the record and report to the County/District PMO ES and Contractor should work together to fill the first environmental site checklist, and pigeonholing the checklist, report to the County/District PMO; At accidental/emergency case, ES should record contractors action responsive to the case, pigeonholing the record and report to the County/District PMO; To respond to any environmental issue encountered by contractor, ES should propose solution to contractors to take correction action, including the issuing Notice Sheet for Correction actions to be taken by Contractors, filling the environmental site inspection checklist pigeonholing the checklist
EA Consultant (holder of Class A certificate for processing EIA on construction projects)	Prepare ECOP of road construction, pigeonholing the draft version, version for review and approval and final approved version; Prepare EA document, pigeonholing the draft version, version for review and approval and final approved version.

4 ECOP for environmental sensitive areas

4.1 Scope

This measure is mainly used in the design and construction stage. The site of road maintenance and emergency is partly located in environmental sensitive area, the detailed as follows:

1. Shusong maintenance station in Deqin, Diqing Prefecture (improvement of an existing station; no expansion)

The management station is an existing one and located in Shusong village, Beizilan town, Deqin County, Diqing state, away from K1924+300 meter of the national line of G214, is located in the trial plot of Baimaxueshan national nature reseve, where the construction project has been approved by Environmental Buearu. Baimaxueshan national nature reseve is located in the territory of Deqin and Weixi conty, Diqing Tibetan autonomous prefecture of north of Yunnan Province, with complex topographic feature, which is lower from north to south, connecting Qinghai-Tibet Plateau and Yunnan-Guizhou. There are abundant living resources, and it is the largest natonal nature reserve of Yunnan snub-nosed monkey.

Yunnan baima xueshan national nature reserve covers 9 towns including Shengping Town, Benzilan Town, Xiaruo Town of Deqing County, Badi Town, Yezhi Town, Kangpu Town, Baijixun Town, Pantiange Town and Tacheng Town of Weixi County, which geographic coordinates is between latitude 27°24'- 28°36', longitude 98°57'- 99°25', with total area of 281640 ha. It is from Angwuyakou in the northwest through Mayaka and Bazaya to Simuda beach; In the east it is down to the Benzilan from Jinsha river, along the highland ridge of 2838 height up to Zigaisongya, along the ridge of Gerry YaKou to Zengjiabo, passing Zhuobaluo river to Xiaruo village office, then along wtih Buyangping back mountain up to 4083 highland then down to Pami along the state-owned forestry industry to politician county line of Weixi and Deqin, along the ridge down to Nuoyong 3370 highlands. There are Xugongqing, Ruhe river, beach of Jiualpu river, Shikuadishang mountain, Acha, Rishale, Beimuzuoliangzi, Shouduo, till Masidali river in the South. There are Xianrendong, Xioayangchang, Old building, Shimenguan, Yezihoujing, Saimeidu, Zhanina, Niselonggu up to 4504 highland exit, along the bridge of Bainmaxueshan to Angwuyakou to the North.

The national road of G214 under management of Shusong maintenance stationis located in the Baimaxueshan nature reserve, all of the daily maintenance on the basis of the protection of vegetation and animal in the district, not destroying any vegetation, animals, environment in the district, etc. Completion of the conduction will play a promote and guarantee for road maintenance, which is a good way to raise will promote the maintenance of the road and construction of Baimaxueshan national nature reserve.

The status of Shusong maintenance stationand its relationship with nature reserve shown as follows:

Figure 9 the status of Shusong control station

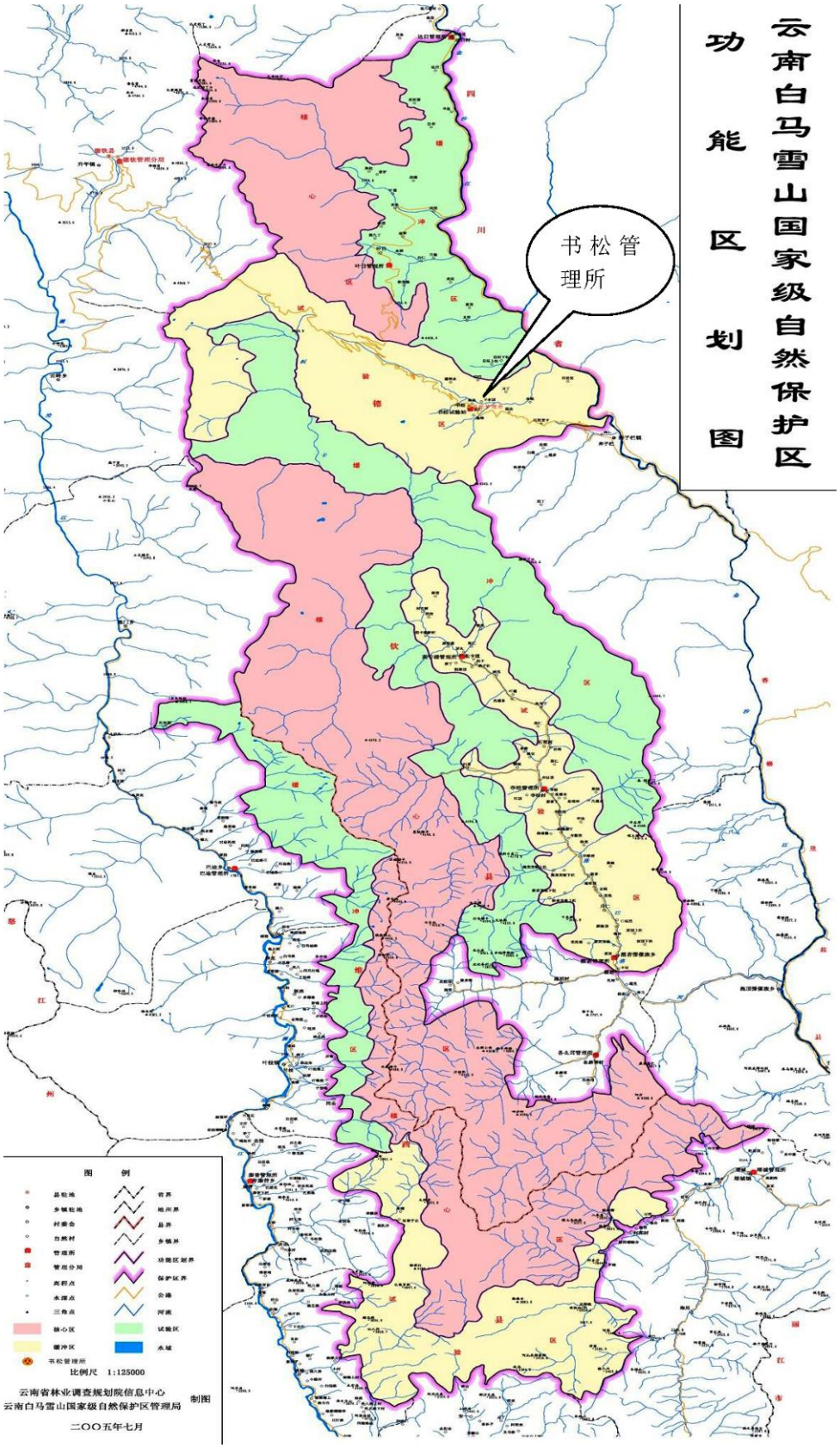


Figure 10 Geographic relationship of Shusong maintenance stationand nature reserve

2. Jiuxiang maintenance station in Yiliang, Kunming City(improvement of an existing station; no expansion)

It is located in the left of Jiuxiang-Shilin-Alugudong road K3+65 of Hui-A line. **The site of construction is 1.1km away from Jiuxiang scenic spot in the North**. It connects Jiuxiang-Shilin-Alugudong road to the South, faces to Jiuxiang-Shilin-Alugudong road in the West, to Lintiechagn village on the East. The location of project is on the intersection area of original land and traffic zone under Yiliang road management section, excluding land requisition within the scope of the original land and **obtained authorization from the local environmental protection agency**. After construction, it will take charge of maintenance of 52.241km fo provincial road. It is proposed to build temporary color steel tile mechanical warehouse of 200 m^2, to repair the old office and residential houses totall 1110 m^2. The items of construction investment: 200000 Yuan for building estimated investment, of which 1.48 million Yuan for mechanical warehouse, 1.11 million Yuan for house repairs, 20000 Yuan for site hardening, 150000 Yuan for fence (including building and maintenance).

The road managed by the targeted costruction is as passageway of the both derection of Jiuxiang scenic spot. Kunming jiuxiang is the national key scenic spot, as integrated scenery of karst cave landscape insied and karst cave landscape, cultural landscape, national characteristic inside in Yunnan province. Jiuxiagn is located in the territory of Yi and Hui nationality autonomous state, with mild climate, annual mean temperature of 14.6˚C, warm winter and cool summer, the temperature as the one of Kunming city.There are kinds of high vegetation coverage, suitable for holidaying. Jiuxiang is away 22 kilometers from The Stone Forest in the South, forming karst stereoscopic landscape as "the ground to see the stone forest, downstream jiuxiang" together with the stone forest scenic area. There are hundreds of karst caves, which is the largest domestic cave community system.

the status of 9 villages office of Yiliang maintenance stationshown as follows:

Figure 11 the status of 9 villages office of Yiliang maintenance station

Figure 12 9 village's office of Yiliang road control station

3. Shilin maintenance station, Shilin, Kunming City(improvement of an existing station; no expansion)

The targeted construction is located inside of the village of the class III zone of the Stone Forest natural heritage reserve (world natural heritage, world geological park, and national key scenic spot), belonging to the transitional zone of the Stone

Forest natural heritage reserve, 3km away from the central zone, authorized by the local envirionmental protection bureau. the road under management is of to the Stone Forest scenic area, as the main connection line of surrounding the Stone Forest scenic spot , the Stone Forest county and and Kunming- the Stone Forest road. The Stone Forest world natural heritage in the Stone Forest Yi autonomous county of Kunming city in Yunnan province, is 78 km from provincial capital of kunming, kun stone road only 50 minutes.Subtropical climate of low latitude plateau hilly monsoon climate, annual average temperature around 16 ℃, no cold winter and summer without heat, four spring-like, a cloudless blue sky, fresh air, green trees and red flowers, colorful.The stone forest is a shining pearl in south of the colorful cloud, natural scenery, folk customs, leisure vacation, scientific research as a whole, is the Chinese and foreign guests to yearn for tourism and leisure resort.

Current status of the Shilin station and the location of the Stone Forest natural heritage reserve shown as follow:

Figure 13 Current status of the Stone Forest road control station

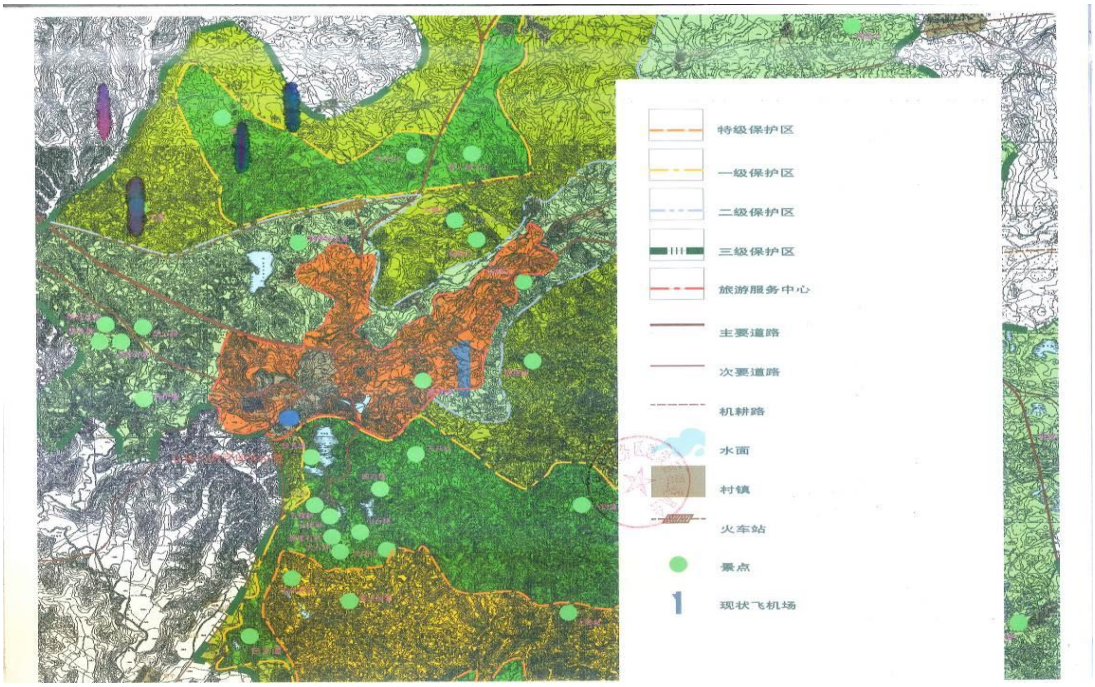


Figure 14 Stone Forest and the location of the Stone Forest natural heritage reserve

4. Moli maintenance station, Ruili, Dehong Prefecture (improvement of an existing station; no expansion)

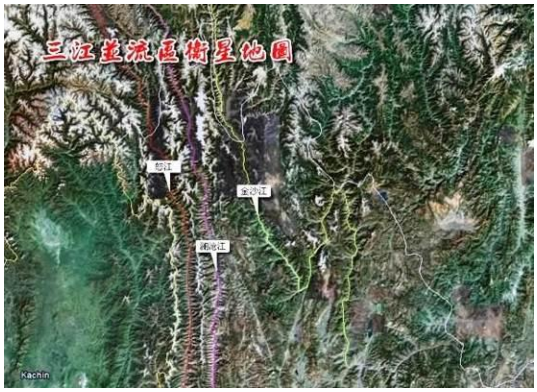
It is located in Ruili River – Daying River National Scenic Area, and has been approved by local environmental Bureau. The location is demostrated in the figre below:

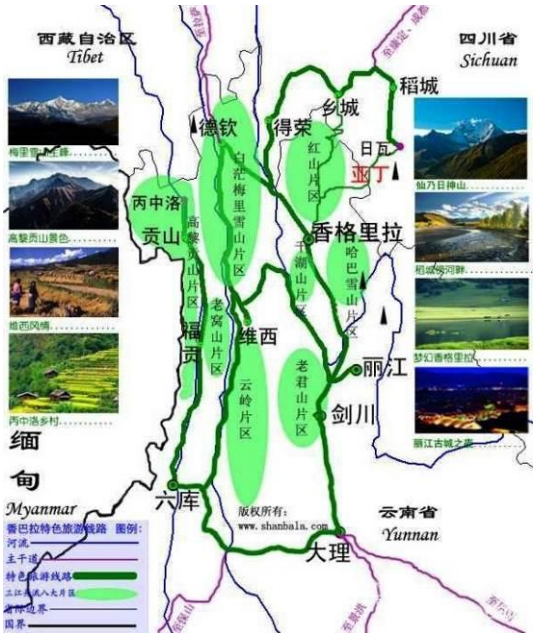
Figure 15 Location relationship of Ruilijiang river- Dayingjiang river national scenic spot

5. Nujiang Prefecture Center (improvement of an existing station; no expansion)

It is located in the Three Parallel Rivers region, which belongs to a national scenic area and is included in the World Natural Heritage List; mainly protect some bio-genetic and rare species. Three Parallel Rivers is located in the mountain range Rift Valley region of northwest Yunnan and south Tibetan Plateau, including Nujiang State, Diqing State, Lijiang City and parts of Dali States. Three Parallel Rivers jointly bred "riverside culture"for thousands of years.It is located in the intersection of East Asia, South Asia and the Tibetan Plateau of the three geographic regions, is the world's rare representatives region with alpine landforms and their evolution, and is also one of the most species rich regions of the world. Scenic spots across bridge three states of Lijiang area, Diqing Tibetan Autonomous Prefecture, Nujiang Lisu Autonomous prefecture. All sub-projects of Nujiang segment were carried out on the construction of its own land, dose not increase new land and the scale of construction is small. According to the authorities, the project site is located in farther area from the protected species. All sub-projects of Nujiang segment have achieved approved by the local EPB.

The map of Three Parallel Rivers shown as below:





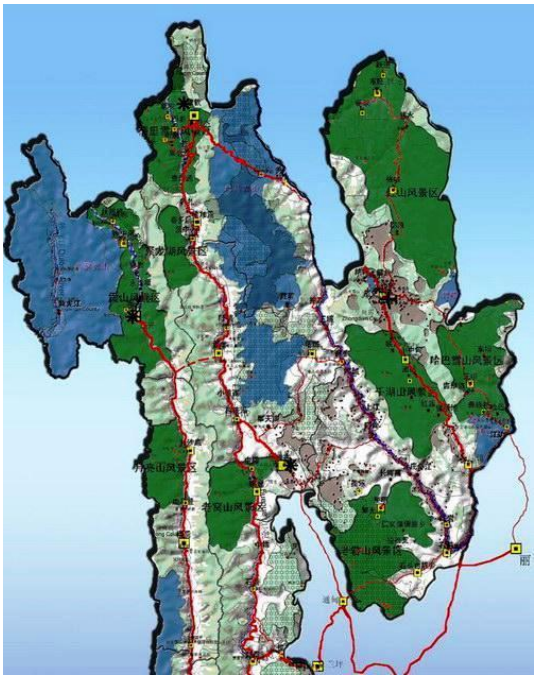


Figure 16 The map of Three Parallel Rivers

4.2 Laws and regulations applied in nature reserve

In addition to the national laws and regulations concerning the conversation area, Yunnan enacted laws and regulations, designed to protect environmentally sensitive areas above. As follows:

1. 《Nature Reserve Management Regulations of Yunnan Province》

2. 《National Nature Reserve Management Regulations of Baima Snow Mountain of Diqing Tibetan Autonomous Prefecture》
3. 《Protection Regulations of Jiu Xiang Scenic Area of Kunming》
4. 《Protection Regulations of Stone Forest Scenic Area of Kunming》
5. 《 Protection Regulations of Ruilijiang – Dayingjiang Scenic Area of Dehong Dai-Jingpo Autonomous Prefecture of Yunnan Province》
6. 《World Natural Heritage Protection Regulations of Three Parallel Rivers of Yunnan Province》

4.3 Impact Prediction Assessment of Conservation Area

4.3.1 Impact of Conservation Plant Resources

The vegetation of conservation area was mainly damage by construction. For increasing the surface of the work,led to the destruction of plants in the range of construction, should be strictly managed in the construction process, control the construction area, reduce the damage to the plant. In addition, construction excavation will change the original soil, lead to collapse, should make the necessary supporting work before the construction work while doing landscape design, and maximize the unity, harmony with the surrounding environment. Project areas will generate destruction to habitat, due to mechanical compaction during construction and construction workers trample it,so that the vegetation surrounding construction work will be destroyed. Construction process need to build some construction road leading to the construction site, if the construction mismanagement, it destroys the tree layer, shrub layer and herb laye seriously, that will cause the level of the plant community imissing and hierarchy changing.

4.3.2 Impact of Conservation Animal Resources

During the construction process, due to increased human activities, mechanical noise, night lighting, and other projects cause interference on the nearby animal, meanwhile destroying their body clock rhythm and causing physiological disorder, so that animals force to temporarily stay away from the construction area, narrowing its scope of activities. In addition, a few workers that overfish and indiscriminate hunt during the construction is one of the main factors that may exacerbate the harm to protected animals, so the construction workers should be strengthened environmental advocacy. Restrict of the ecological split or spatial segregation effects on conservation area is very small,and it does not produce separate and barrier impact on anima'sl habitats and activities as long as strengtheniong management and the wild animals occasionally found will not be hurt.

4.4 ECOP for the Environmental Sensitive Areas

4.4.1 ECOP in design phase

Despite six sub-projects above have obtain the approval of local environmental protection bureau on the domestic EIA. But Shusong management(complete function) of Diqing Deqin segment is located in the experimental area of Baima Snow Mountain National Nature Reserve; Moli management (reorganization and expansion) of Ruili highway management of Dehong total segment is located in Ruili the secondary protected areas in Ruilijiang - Dayingjiang National Scenic Area ; Nujiang segment management involves the Three Parallel Rivers World Natural Heritage.That the project mentioned above is located in nature reserves or scenic area, should comply with the relevant provisions of competent department in conservation area.

Investigation is needed to the animal and plant resources related reserves before construction to identify the species and the characteristics and natural ecological environment proposed to protect.

No piling of materials, borrowing and spoiling soil pits, construction site, camp buildings in the natural reserve as possible, with strict construction scope regulation to maximize to keep the original of natural reserve to reduce the water and soil loss; Further, To optimize site selection to use of the existing temporary road as far as possible, and choose the site with less vegetation to reduce destruction of surface vegetation for construction, to restore vegetation after construction

To involve environmental protection measures in the bidding documents and the engineering environmental supervision, and to sign contract about the responsibility of environmental protection with construction agency, and to report to clinets, administrative department of natural reserve, the local environmental protection bureau regularly; To deal with the various problems during construction among construction agency , clinets, administrative department of natural reserve local land contact/forestry department to ensure effective protection of the landscape during the construction of highway maintenance and emergency facilities.

4.4.2 ECOP in the construction phase

1. If the construction is in the range of nature reserves and scenic spots, construction techniques and plan must be strictly developed in accordance with the requirements related to the protection and pollution prevention approaches of national and protected area management departments, for the construction management and supervision of the construction environment.
2. Strictly forbid large-scale land leveling in early stage of the development, to avoid large areas of bare land, and prevent soil erosion and desertification. Strictly regulate the scope of construction activities, and vehicles and machinery should be in the

planned roads, non-random traveling and non- vegetation crush to minimize the ecological environment construction disturbance.

3. Strictly implement water conservation measures in accordance with the requirements of the EIA documents. Prohibit road building materials stacked, setting spoil taken (slag) temporary works field, construction site, construction camps, and etc. in the range of nature reserves and scenic spots. Strictly control the construction area, to the greatest extent to maintain the original appearance of protected areas, to minimize damage to the original soil structure and reduce soil erosion degree. Project abandoned materials, garbage should be piled to point focus, timely removal, and disposal sites and process must obtain the consent of the local environmental protection department. Construction waste water and waste is prohibited to discharge into river and sewage must be discharged into pollutant pool. Strict implement the dust, noise control various environmental measures, and implement discharge standards.

4. Fully use the existing temporary roads and choose fewer local vegetation, reducing vegetation damage of construction work surface, and after the construction to restore vegetation. According to nearby vegetation growth characteristics, implement "suitable tree depends on local conditions " principle, for example, if the condition is sutable for arbor, then the arbor should be planted, and shrubs as well, bushes and trees combined, girdle and tablets combined, and covering and greening with the previously stripped topsoil.

5. Scenic highway maintenance and emergency facilities should be combined with the the planning of scenic green plant landscape, to make the greening effect of road maintenance and emergency facilities can be coordinated with the Scenic Landscape Planning.

6. Protect wildlife. Increase greening efforts of road maintenance and emergency facilities, and implement greening if it has the green condition to compensate the loss of forest and land caused by construction of road maintenance and emergency facilities. The construction agency should be handle the occupation of forest land in accordance with relevant regulatory requirements and approval procedures, to give some financial compensation tending to strengthen the work of forest vegetation. Except the construction must need, do not arbitrarily cut down plants. construction agency and personnel should strictly abide by state laws, prohibiting hunting any wild animal; reduce nighttime operations, avoid light and noise disturbed nocturnal animal activity.

7. For the national protecting plants in the region of road maintenance and emergency facilities, strengthen the construction management and control of the construction area in the construction process, and not cross the construction terms and the corresponding penalties will be written into the construction contract, and be strictly enforced. Minimize deforestation and do not mess deforestation, avoiding the destruction of vegetation, and recovery in accordance with reasonable plant measures after the construction. To protect country beneficial or of important

economic or scientific value of terrestrial wildlife nearby the highway maintenance and emergency facilities, the construction team should be educated with knowledge of wildlife conservation before construction, and construction agency and personnel should strictly comply with national laws, prohibiting hunting any wild animals.

8. After the end of the project, land formation and vegetation restoration should be promptly implemenated in the temporary area, borrow pits, and spoil lands to make work finished, material over and site clearance.

9. Establish and improve the environmental risk emergency response mechanism, and strict implement development programs and the environmental risk emergency measures to prevent the risk of ecological damage to the environment caused by the accident.

10. Protected area management authorities, local Forestry / EPA are responsible for the daily supervision and management of the environment of the project.

4.4.3 ECOP in the operation stage

1. In order to reduce emissions of waste water, water-saving appliances should be given priority in the choice of water instruments use.

2. Strictly implement rain and sewage diversion system with the municipal facilities around the mechanization conservation and emergency centers, and management institutes, and sewage should be discharged into the local municipal pipe network. Aqua should be set up to collect that can not be discharged into the municipal pipe network, and then transport outward the treated sewage for agricultural irrigation.

3. Sewage collection, conveyance pipe network must be prepared to deal with seepage.

4. Strengthen the maintenance of sewage pipe network; prevent accidental discharge of sewage.

5. Use clean energy (liquefied petroleum gas or electric), canteens range hood. Do regular maintenance for such facilities to ensure its efficiency.

6. Set classification garbage bins in the project area for garbage classification, and waste batteries, waste paint and other hazardous materials should be collected respectively and processed by a qualifie agency. And appropriate management measures should be developed: ① establish a sound management system, with a clear responsibility, regular cleaning, and regular collection; ② achieve garbage processing with bags, using readily biodegradable garbage bags; ③ planned reasonable refuse collection and transport routes, to take protective measures to minimize transit garbage strewn.

7. Life garbage should be promptly transported to designated local garbage dumps for disposal. Transport process requires the use of highly efficient sealed garbage compression memory, and take deodorant measures (such as installing purification deodorant, spray plants deodorants); and timely remove and flush transport tools.

8. Vehicles entering and leaving the project area are whistle banned and the speed is limited at 20km / h or less, vehicles traveling speed control about 10km / h in the management and protection station.
9. Follow the buffer principle, buffer zone configuration facility are deployed or build a buffer zone between project activities around and the nature reserve area.
10. Determine compensation requirements for damage caused to the natural reserve.
11. Environment monitoring in the operating stage

Since the project is located in an environmentally sensitive area, the main environmental factors need to be monitored in the operating stage. The monitor sampling and analytical methods shall follow the requirements issued by the State Environmental Protection Agency, "Environmental Monitoring technical specifications" (waste water, noise part) , "Water and Wastewater Monitoring Analysis Method" and "environmental monitoring and analysis methods" and keep quality control. Monitoring data should be sort out according to time, to establish pollution monitoring data file for future reference. If abnormal data was found, timely follow-up analysis should be conducted, to identify the causes and take appropriate countermeasures. To accomplish these monitoring tasks, if the construction agency does not have monitoring condition, then it shall be entrusted to a qualified agency for monitoring. And the monitoring data, together with the implementation status of pollution control measures and reports in the operation stage and annual reports, should be regularly reported to the relevant environmental protection department.

Monitoring subjects:

(1) Wastewater: tookover mouth of sewage, commissioned the monitoring stations once a year.

(2) Noise: noise around the farm sector, once a year.

Monitoring contents:

(1) Waste water quality monitoring: wastewater quality monitoring indicators: COD, SS, NH3-N, TP, animal and vegetable oils.

(2) Noise: A continuous equivalent sound level

5 ECOP of Geological Disaster

5.1 Geological Disasters and Cause Analysis

Features of geological disasters in the project area: more disasters , wide distribution, high frequency and strength, and serious losses. The main geological disasters include: 1) earthquakes, earthquake disasters occur frequently for the motion impact of Eurasian plate, Indian plate and Pacific plate; 2) mudslides, mudslides occur frequently in areas of vegetation severe damaged, due to more mountainous, steep terrain, rainfall concentrated in Yunnan Province, 3) landslide.

The project in the construction phase may lead to the factors of geological disasters as following several aspects:

1. Natural factor: Natural factors include rainfall, the flowing river, seasonal temperature changes, earthquakes, especially the heavy rain and long continuous rainfall. It led to groundwater permeate through the slope, soften the ground and its weak side, produce pore pressure, induce collapse and river permeate through the slope constantly, weaken the slope support, and induce collapse.
2. Human factors: Human factors include excavation slope, landfill loading, mining of mineral resources, deforestation, channel seepage, splitting hilltops and quarrying. The main human factor is excavation slope, so that the original slope loss of support, form an artificial high slope. Irrational human activities will induce collapse, such as excavation toe, underground mined, reservoir storage and other human activities which changes the original balance of the slope .

From the point of international earthquake had happened, environmental problems associated with earthquakes emerging are mainly the following aspects:

1. The habitat lose and degrade , biological diversity lose, and wildlife migrate;
2. Sudden floods, persistent landslides and soil erosion, reduction of natural resources, and the destruction of forest for fuel, construction, housing purpose;
3. Health hazards caused by poor sanitation and improper waste management, traffic volume of building material increased significantly, water rivers and streams dry up, accumulation of debris on both sides of the stream;
4. Pollution of Surface water or groundwater which go with collapse of ground and building structures, and in the river recharge process, hazards caused by the accumulation of silt.

5.2 Type and Scope of Geological Disaster

Landslides, mudslides and earthquakes. The Environmental Practice will be focused on

mechanical maintenance and emergency center / management, mainly for the construction stage.

5.3 ECOP of Geological Disaster Protection

5.3.1 ECOP of Landslide Protection

1. Must be carried out on the basis of geological disasters. After the reconnaissance, risk analysis of landslide should be carried out, determine the current hazard level of landslide, take different measures for each hazard level. Before selecting landslide prevention measures, specifically survey topography, geology and hydrology conditions, study and determine the type of landslide and stage of development carefully, analyze primary and secondary factors of landslides as well as the connection of each other; combined with the importance of the project, conditions of construction and other circumstances into account. For large and complex landslides, should be avoided as far as possible. Should be considered landslide size, the degree of influence each other roads and landslides, control costs and other conditions, the design of several specific programs than choice. While avoiding difficult or economically significant unreasonable. Design several specific programs according to the scale of landslide, the mutual impact of roads and landslides, control costs and other conditions, while avoiding difficult or unreasonable economy. The project should take effective measures for landslide which may drastic transform suddenly. For large-scale and sliding slowly landslide, should planning comprehensively, govern by stages, carefully observe the effect of each phase of the project, in order to take appropriate control measures. For the large-scale landslides during construction and operation stage, should be careful to make avoiding program and the program associate with diversion route and prevention measures, decide which one to choose after comprehensive comparison. landslide should be taken preventive measures to avoid its resurrection or generating new landslide. The small and medium landslide can be performed without avoided remediation. But should notice to adjust flat and vertical position, in order to simpler renovation, smaller engineering quantity, more convenient construction, more reasonable economy. Before landslide remediation, general temporary drainage system should do to slow the progression of the landslide, and then slide the main factors for the landslide, take appropriate measures. Before landslide remediation, should make a temporary drainage system first to slow the progression of the landslide, and then take appropriate measures for main factors causing landslides sliding.

2. Surface drainage. surface water outside the landslide should be Intercept away; surface water on the landslide must focus on seepage, collect and lead as soon as possible. Underground drainage. Engineering measures excluding landslide groundwater include: sewer, blind hole and flat hole and so on. Sewer according to its function can be divided into support sewer, slope sewer and drainage ditches. Blind hole is mainly applied to layer of groundwater, that cut line and guide line, focus on the sliding surface and was buried deeply. For other aquifer on the ground, a number

of seepage wells or infiltrated pipe can be set on top of permeable tunnel, so water could be bring into the cave; for confined aquifer, water pore can be set at the bottom of the hole to bring water into the cave. The flat hole is a cost-effective measure, mainly used to exclude landslide groundwater, with features of easier construction, shorter time, saving materials and labors.

3. Weight loss. Weight loss excavate a certain amount of slip mass in the rear of the landslide to stabilize the landslide. It is suitable for push-style landslide or transformed by scattered landslides, the top of slide bed is steep, and underside is slow, sides back of the landslide are stability, not to cause landslides for the brush. In general, weight loss can reduce the Sliding force of the landslide only, cannot change its downward trend, so the weight loss is often used in conjunction with other remediation measures.

4. Retaining wall slope engineering. Gravity retaining wall With wall body weight maintain stability of retaining wall under the effect of earth pressure. Back wall slope of gravity Retaining wall generally use 1: 0.25, standing unloading platform behind the wall; the base of the wall generally was made into slope or stepped, wall height and the burial depth of the foundation must be in accordance with the nature of the foundation, requirements of bearing capacity, conditions of topography and hydrogeology, these can be determined by checking. In addition, to avoid the wall body crack caused by uneven settlement of foundation, they should setting settlement joint and expansion joint, according to the change of geological conditions and wall height and changes of the wall body.

5. Anti-slide pile is fixed to a sliding body pile, slipping through the sliding body and going deep into the stable parts of the bed. Multiple of anti-slide pile group together to support the decline of the force, to prevent it from sliding, compared with anti-sliding retaining wall, anti-slide pile’s sliding resistance is bigger, construction is complex, but the effect is remarkable, and therefore is widely used. Anti-slide pile in the landslide is one of the largest cost engineering, the optimization design is particularly important, therefore, the theory of optimization mathematical model should be used. Due to the pile structure calculation and constraint mathematical expression model is too complex, at present there is no scientific research achievements and application in this field. Feasible approach is based on experience to pile structure, size and continuous trial and check through finally. Pre-stressed anchoring.

6. Pre-stressed anchor is a new protective engineering measures developed over the past decade in slope reinforcement, there are many successful projects of prevention of highway landslide. It works well for reinforcement of rock slope and crag steep, as well as rock slope of glide plane buried depth, it can also be used to strengthen rock slope, jet-anchor and baseboard. The advantages of pre-stressed anchorage of rock mass slope is for rock mass slope, fault and weak belt to provides a powerful and "active" supporting means. Pre-stressed anchorage often combined with the anti-slide pile, form pre-stressed anchor cable anti-slide pile. It could save materials

and investment and make significant economic benefits for increasing the pile of pre-stressed anchor cable on pile, so the buried depth of pile becomes shallow, and cross section small.

7. Protection engineering of slope. Take appropriate engineering measures on mountain landslide, after the renovation, still have a loose rock mass into the line, so it is necessary to take protective measures to protect it. Plant grass on the slope, is the easiest and most economical protection measures to prevent erosion of the slope surface washed, soil erosion and weathering. It is applicable to soil and weathered bedrock or dewatered and chapped half geotechnical slope. In addition, structures protecting slope can also be used. Common engineering and its suitable conditions are briefly as follows. Revetment of dry masonry and concrete block apply to slope with water that the slope is less than 1:1, the height is below 3 m. In Large water area, filter layer or the drainage should be set up. Lattice frame protect slope. This kind of slope protection measures divided slope into lattice, prevent surface sliding. Jet-anchor and protecting slope. According to certain spacing, row spacing, angle and depth, set a certain number of anchors on the surface of the slope. Install steel mesh and shotcrete, form a protecting slope system that combine anchor bolt w thin ferroconcrete.

8. Emergency safeguard procedures of landslide

   a) Depending on the dangerous situation to evacuate personnel out of danger in time. When landslide by accelerating deformation stage into the near sliding stage, the landslide disaster is inevitable. The situation should be timely reported to the local government, government sector organize residents and property in the danger zone to ensure the safety of people's life and property.

   b) For striving for rescue time and delaying destruction of landslide mass, the destruction of hazard should be timely stopped, as a result of mining induced, should immediately stop mining activities, if channel leakage, should immediately stop drainage channels drawing off water.

   c) To the foreboding one, good evacuation plan should be developed as soon as possible, Landslide before moving, often have omen, in this case, the local government should make plan of people's evacuation plan as soon as possible, prevent causing confusion and unnecessary casualties accident.

5.3.2 ECOP of Debris Flow Protection

The engineered protection measures for regions of debris flow is mainly as follows:

1. Use engineering of water storage, water diversion and water flood to control surface runoff, cut the hydrodynamic conditions, make the soil and water separated, and stabilize the slope. Auxiliary small obstruct, platoon guide engineering stabilize the soil, are suitable for hydraulic type of debris flow gully governance.

2. Using obstruct, supporting project, hinder debris flow of solid material, stabilize ditch collapse and landslide; Meanwhile assist with project of discharge guide and cut-off water. It apply to the treatment of landslide type of debris flow .

3. Using the drainage channels, aqueducts and other projects, exclude landslides and control debris flow .

4. In the specific implementation of the debris flow prevention, they should take comprehensive treatment of slope, channel and upstream and downstream as a whole. Usually in the upstream reaches of the valley, is mainly to govern water, midstream to cure soil, downstream to the exhaust. through stabilizing slope and cutting water upstream ,obstruct and protecting slope midstream, reduce the debris flow of solid material, control the scale, changing the nature of the debris flow, this is conducive to drainage downstream to control hazards of debris flow.

5. Taking strict ban on gully of debris flow, forbid the human activities such as wasteland and farming, grazing, quarrying and mining which may cause soil erosion and the instability of the mountain. Adjust measures to local conditions, plant tree and grass and quickly restore vegetation. Such as build forests of water conservation upstream, build forests of construction of soil and water conservation midstream, and all kinds of protective forest downstream. Adjust the structure of agricultural production, increase farmers' income, solve the problem of rural energy, such as converting cultivated land into forests of steep slope, slope - to - terrace, paddy field to upland on unstable mountain , vigorously developing economical forests and firewood forests.

5.3.3 ECOP of Earthquake protection

1. Completes the EIA of disaster. To fully estimate the situation, make judgment and survey is an important work after the earthquake disaster. They should eliminate the environmental impact, master the hazard degree of damage to the environment, recover the damaged governance infrastructure and ecological environment as soon as possible, avoid to produce greater environmental disaster. Departments of environmental protection should focus on water and air pollutants and the protective measures of hazardous pollutants. Earthquake is prone to collapse, make the water blocked, therefore, the pollution of water should be taken measures timely in order to prevent the pollution.

2. Pay attention to the infrastructure construction, do good job for environmental protection. In order to reduce the environmental hazards resulted from the geological disasters, units involving dangerous goods should pay attention to the shockproof measures of production conditions, strengthen production equipment, improve the shock resistance performance. Related departments should formulate environmental contingency plans, such as dangerous goods should be in safety zone to avoid bringing damage to the people caused by earthquake disasters and geological disasters induced by it. In addition, the anti-seismic measures is also very necessary. That anti-shock treatment on infrastructure, treatment of slope, stability improved and

so on, are able to play a protective effect of protecting the surrounding water.

3. Establish emergency mechanism of the forecast warning and disaster relief on the chain of natural disaster. Natural disasters will form the disaster chain, such as catastrophe have big disease, climate disasters often induced landslides, debris flow and collapse causing greater harm. It is difficult for human to take measures of flood and earthquake at present. Large-scale landslide and debris flow is also difficult to control. Human beings should learn to coexist with these natural disasters and avoid them timely, further study forecast warning mechanism of natural disaster, in order to protect the human survival and reduce the loss of life and property.

4. Strengthen knowledge popularization of environmental disaster to improve the awareness of disaster prevention and reduction. Earthquake is the inevitable phenomenon in the process of evolution of the earth, it is not possible for human to prevent all of that, we'd better know the basic knowledge of the occurrence and development for geological disaster, and the possibility of environmental hazards, in order to take effective measures to prevent and control, or take action of evacuation and mitigation timely to reduce losses, it can be done. Earthquake is the result of the nature regulation movement, the occurrence of disasters will bring great impacts to our life and environment, we should further explore the influence of earthquake on the local environment and resources, do a good job in disaster prevention and post-disaster reconstruction, minimize losses to maintain a good ecological environment.

6 ECOP of Emergency Center and Management

6.1 Site selection

This ECOP is applicable to the project list including: all mechanized maintenance of new reconstructions and emergency center, environmental management of the maintenance stationduring construction stage and operation stage. mechanized maintenance and emergency center, the location of the maintenance stationshould follow the principle of site selection in the table below.

Table 9 the requirements of site selection on mechanized maintenance and emergency center as well as control station

Involved area	Excluded area
• basic farmland or other farmland, paddy fields and economic crops •sensitive areas of water protected zone, natural protected zone, scenic spots, forest parks and so on. • land with vegetation cover well •collapse and danger zone of landslide •susceptible area of debris flow • Land for special purposes	• land for construction • wasteland • derelict land • other inferior land

Highway management information system which this project need to be build and improve is mainly in the data center of Highway Bureau, with no need for a new requisite land; the private network of traffic around and the construction of the data sub-center salso concentrate in the office building of state highway total segment, system construction don't need a new requisition of land.

The land of mechanized maintenance and emergency centers about total highway segment and highway segment, and highway managements are 3606.5 Mu, including its own land about 3503.8 Mu, new land 102.7 Mu. Among them, the total area of 225 highway managements are 1659.9 Mu, all for the use of its own land for expansion; 63 mechanized maintenance and emergency centers about total highway segment is 1087.3 Mu, including 1022.6 Mu of its own land, 64.7 Mu of new land; The area of 16 mechanized maintenance and emergency centers about total highway segment is 859.3 Mu, which using original land are 821.3 Mu, new requisition land is 38.0 Mu.

It fully reflects the principle of economical use of land and make full use of existing facilities from the covers of each maintenance center, that conforms to the provisions of MOT related maintenance class and maintenance center, There is no need to take new land.

6.2 Analysis on Environmental Impact Source

6.2.1 Environmental Impact Analysis of Construction Stage

1. Constructive dust effect on the ambient air.
2. Constructive wastewater and domestic sewage effect on water environment.
3. Mechanical noise of construction effect on acoustic environment
4. Construction earthwork constructive waste and domestic garbage effect on environment
5. Project covering and destruction of vegetation effect on ecological environment.

6.2.2 Environmental Impact Analysis of Operation Stage

1. Life lampblack of workers in Mechanized maintenance and emergency centers as well as managements effect on ambient air.
2. Domestic sewage of workers in Mechanized maintenance and emergency centers as well as managements effect on water environment.
3. Household garbage of workers in Mechanized maintenance and emergency centers as well as managements effect on environment.

6.3 ECOP of Construction Stage

6.3.1 Site Cleaning

The range of Site Cleaning

Site clearing including existing structure of mechanized maintenance and emergency centers / managements, concrete structures, old road pavements of marketization pilot projects on maintenance large medium repairing, vegetation cleared, topsoil dogged, side ditch, rubbish, off scum and other materials which supervisor specified. Its scope includes permanent and temporary construction, stock ground, deposing dumping sites, that the all areas need to clean up. Mainly used in the preparation of construction.

ECOP of site cleaning

1. Clearing vegetation of the principal part of the construction site on the surface, must extend to 5 m at least of the largest excavation line or based line of building as construction drawing shown.
2. Vegetation clearing of the principal part of the project, the scope of excavation roots must extend to 3 m of the largest excavation line, filling line and the building foundation outside as construction drawing shown.

3. The natural vegetation near the cleanup area should be paid attention to protecting, the contractors are responsible for compensation due to the destruction of the forest resources caused by improper construction in the cleanup area, as well as adverse effects on environmental protection.
4. Within the scope of land clearing, the cutting timber and the material Having Commercial Value should be owned by the employer, the contractor should follow the supervisor instructions to piled up at designated places.
5. Worthless combustible materials, should be burned soon. They must take the necessary measures during fire burned and be responsible for the consequences.
6. the clearance matter cannot be burnt out or seriously affect the environment, must be buried in designated areas following the commissioner, buried objects should not impede the natural drainage or contamination of rivers.
7. Cultural relics found in the site clearance, should according to the provisions of chapter 19
8. 123 Dredging depth of topsoil should follow supervisor's direction, and ship organic soil to designated area. Prevent soil losing by erosion. stockpiles end organic soil should be used in engineered environmental protection. It should be in accordance with the requirements of the contract or the environmental overall planning of employer, rational use organic soil.
9. The garbage, organic residue and soil humus of the original ground surface of pits (100 ~ 300 mm), grass, roots, the roots of the crops should be removed within the scope of land, and pile in designated area or dumping site of waste aggregates; after site clearance completed, full fill pits within the land range, so that the density could reach the requirements.
10. Removal of existing structures or obstacles need blasting or other operations, must complete before the new project if the new structure are damaged, all of the available materials should be avoided unnecessary losses and stored in the specified location . All demolition pits backfilled and compact to density requirements.
11. In the demolition of other obstacles, should arrange properly with the normal traffic and drainage before it can be removed. The underground part of the original structure, the invisible depth and scope should be accord with the requirement of project supervisor instructions for processing.

6.3.2 Construction pavement

the site requirement of construction road

（1）Scope of application

Construction roads is suitable for the mechanized maintenance and emergency center

(provincial level) of newly-built highway total segments, the mechanized maintenance and emergency center (state/city level) of county highway section, highway management and new technology, test segment of new materials market-oriented maintenance. For the existing station or the site of renovation and expansion at the center, generally use the existing road, do not need construction roads.

Large-medium scale maintenance marketed-oriented pilot projects are carried out on existing roads. During construction using demi closed construction and demi open passage way, need no construction road.

(2) Location Principle

When construction road needed, site selection should follow the table below.

Table 10 site selection standard of construction road

avoid	prefer
• basic farmland or other farmland, paddy fields and economic crops •sensitive areas of water protected zone, scenic spots, natural protected zone, forest parks and so on. •house site •forest land • 200mthe land within 200 m of river land area • depression or paddy field • land with vegetation cover well • collapse and danger zone of landslide •susceptible area of debris flow • Land for special purposes	• County/Township/ Village roads •wasteland •derelict land • other inferior land

Analysis on environmental impact of construction road

The environmental impact of road construction is mainly reflected in the following:

1. Cars and equipment's produce dust pollution during operation.

2. Cars generated noise pollution during the operation.

3. Temporary covering damage vegetation and cause water and soil loss.

ECOP of construction road

1. Make full use of the existing road as the construction roads, while transform the road. For new construction road, then try to reduce the high filling and excavation, make best efforts in water and soil conservation; when building, the construction roads should be harden. road can be reusable load-bearing brick (component) for processing.

2. For new construction road, then try to reduce the high filling and excavation, make best efforts in water and soil conservation; when building, the construction roads should be harden. road can be reusable load-bearing brick (component) for processing; General aisle, can repeat laying use of permeable brick.

3. Before building new construction road, strip topsoil, surface soil should be temporarily piled up in the relatively flat field, and lay block by bags soil base temporarily, peripheral set up temporarily drainage and settling measures, and use the dust-proof net cover, service for ecological restoration of road after the construction.

4. For reducing the number of shortcut, construction road and construction camp combine together as far as possible.

5. Construction road should be regular maintenance and cleaning every day, producing

dust sections should be water spraying.

6. Reduce the noise impact on the environment by controlling the speed of the car, NO HORN, it is forbidden to transport at daytime 12:00 ~ 14:00 and night 22:00 ~ 6:00 and other measures.

7. After the construction, the new construction road should carry on the ecological restoration, at least recover to the previous construction form.

8. Local destructive roads, should be changed or protect, recover and green the road, and make compensation for the local government in order to maintain the benefit of the local government and residents.

6.3.3 EOCP of Stone and Soil Quarry and Borrow Pits

Site Selection of Stone and Soil Quarry and Borrow Pits

（1）Scope

The construction of the project includes sand stone and soil quarry and borrow pits. The ECOP focus on mechanized conservation and emergency center / management. Mainly used in the construction period.

（2）principle of site selection

Site selection of stone and soil quarry and borrow pits should follow the principles of the table:

Table 11 The site selection standard of stone quarry and soil borrowing pits

avoid	**prefer**
• basic farmland or other farmland, paddy fields and economic crops •house site •forest land •200m the land within 200 m of river land area •sensitive areas of scenic spots, natural protected zone, water protected zone, forest parks and so on. •depression or paddy field • land with vegetation cover well • collapse and danger zone of landslide •susceptible area of debris flow •Land for special purposes	•wasteland •derelict land • other inferior land

Environment impact analysis on setting of stone and soil quarry and borrow pits

1. Destroy vegetation and increase intensity of water and soil loss
2. Vegetation diversity of slope is higher than flat ground, there are shrubs, grass and dry crops, vegetation disappears after excavation, plus certain gradient (height difference), increase soil erosion modulus within local area. Stone and soil quarry and borrow pits will produce water and soil erosion easily if not regret as soon.
3. Affect the landscape. Stone and soil quarry send borrow pit will destroy the original topography landform and natural scenery of vegetation.
4. Mechanical noise of stone and soil quarry and borrow pits impacts on sound environment.
5. Dust of stone and soil quarry and borrow pits impacts on ambient air
6. Surface soil of stone and soil quarry and borrow pits will produce water and soil erosion easily if not stock properly.

According to site selection and environmental impact, stone and soil quarry and borrowing pits should comply with following requirements:

1. Material stone should be exploited nearby, take advantage of the project itself spoil, make full use of the existing legal local quarries and borrow pits, mitigate the impact of stone mining and borrow earth on the ecological environment.
2. Material stone should built rainwater ditches, avoid soil and water loss landslide, debris flow and other geological disasters when mining in rainy season.
3. Avoid digging deep in the construction, maintain a balance between excavation and fill as much as possible and, coordinated within the spoil in other construction projects if debit, avoid setting borrow pits separately, borrow pits impact on the environment can be eliminated fundamentally.
4. Conducting quarrying and borrow earth should be concentrated, reduce the number of stone and soil quarry and borrowing pits.
5. During the process of quarrying and borrowing earth, homework should be paid attention to water spraying to reduce the dust pollution on earth excavation.
6. For preventing water and soil loss, sections and drains should be settled in stone and soil quarry and borrow pits, avoid the loss of the sediment with runoff in the drain directly into surface water to affect water quality.
7. In the excavation work, should conserve the topsoil, used for land reclamation, surface soil should be temporarily piled up in the relatively flat field, and lay block by bags soil base temporarily, peripheral set up temporarily drainage and settling measures, and use the dust-proof net cover, service for ecological restoration of road after the construction.

8. Follow the simple principle and easy maintenance, use the form of halo sols, deserts and greening, formulate plant community landscape, recover natural ecology of stone and soil quarry and borrow pits, reduce water and soil loss.

9. Strictly control the construction time, within the scope of the noise impact, if any settlement and other sensitive target, forbid quarrying and borrow earth at daytime 12:00 ~ 14:00 and night 22:00 ~ 6:00.

6.3.4 ECOP of waste soil and slag

Site selection of waste soil and slag

The ECOP aim at Mechanized Conservation and Emergency Center/Management, waste slag of large-medium scale maintenance market-oriented pilot. Mainly used in the construction period and the completed site recovery.

Site selection principle of waste soil and slag should follow the table below.

Table 12 the site selection of waste soil and slag

avoid	prefer
• basic farmland or other farmland, paddy fields and economic crops •house site •forest land • land within 200 m of river land area • Sensitive areas of scenic spots, natural protected zone, water protected zone, forest parks and so on. •depression or paddy field •land with vegetation cover well • collapse and danger zone of landslide •susceptible area of debris flow • Land for special purposes	•wasteland • derelict land •other inferior land • The col or low-lying zones

Analysis on Environmental Impact Source of waste soil and slag

Construction process may produce an amount of slag, mainly including redundant earth-rock, deserted road materials, waste rock and mud of site clearance, if disposal unreasonable, it will bring the following environmental impact:

1. Surface of dumping site for waste aggregates exposed, if do not take any measures, it will cause serious dust pollution.

2. Dumping site for waste aggregates fail to block or waterproof and temporarily work, it

will cause water and soil loss.

3. Destruction of surface vegetation, can cause adverse effect on the ecological environment.

ECOP of waste soil and slag

1. If any discard, should consider first in situ or bid for the rest of this project, or back to use for vegetation restoration of, the removal to avoid soil field setting up separately, fundamentally eliminate the earth's impact on the environment.

2. IF it cannot be utilized, should investigate the specified local residue building, if any, should pick up residue in formalities by the regulation and carry to given location.

3. Dumping site for waste aggregates should be hierarchical compacted, which can effectively inhibit the generation of dust

4. Taking the mode of water spraying dust, reduce dust pollution from surface exposed.

5. For preventing water and soil loss, sections and drains should be settled in stone and soil quarry and borrow pits, avoid the loss of the sediment with runoff in the drain directly into surface water to affect water quality.

6. Before the dumping site for waste aggregates, should conserve the topsoil, used for land reclamation, surface soil should be temporarily piled up in the relatively flat field, and lay block by bags soil base temporarily, peripheral set up temporarily drainage and settling measures, and use the dust-proof net cover, service for ecological restoration of dumping site for waste aggregates after the construction.

7. Follow the simple principle and easy maintenance, use the form of halo sols, deserts and greening, formulate plant community landscape, recover natural ecology of dumping site for waste aggregates, reduce water and soil loss.

8. Prohibit abandon and heap of soil

6.3.5 Construction camp

ECOP of construction site

(1)Scope

The site includes mechanized conservation, emergency center/management of construction camps, concrete mixing plant, asphalt mixing plant (mainly related to the conservation of new materials market test section) and so on. Construction camp can be

divided into construction living camp, construction production camp, construction living and production camp according to their different functions. Construction living camp provide living accommodation; Construction production camp is mainly used in building materials stacked, concrete mixing, precast production. Construction living and production camp is a place which set of production and life as a whole, it includes all the features mentioned above two. Asphalt mixing plant is mainly used in the market of new materials, maintenance test section, mixing asphalt Pavement required. this site environment practice is mainly applied to the construction period.

（2）Site selection

Requirement site selection shown in the table below

Table 13 Site selection of construction plots

avoid	prefer
• the land of home, school and other major sensitive spot and upwind within 200 m •basic farmland • house site •forest land •land within 200 m of river land area •land upstream 1000m and downstream 500m of drinking water sources for water spot, and avoid protection of drinking water source; sensitive areas of scenic spots, natural protected zone, forest parks and so on. • depression or paddy field • land with vegetation cover well • collapse and danger zone of landslide • susceptible area of debris flow • Land for special purposes	• Hire local houses •wasteland •derelict land • The land of relatively high terrain • The col or low-lying zones

（3）The environmental impact analysis on construction sites

The environmental impact analysis on construction sites includes mechanical noise of the construction, wastewater production and sewage discharge, dust and soot of construction, environment impact on waste of construction and life. See the table below:

Table 14 Effect of contradiction on environment

Site category	Environmental elements	environmental influence
Production of the camp	water environment	Constructive wastewater effect on water environment.
	ambient air	Constructive dust effect on the ambient air
	acoustic environment	Mechanical noise of construction effect on acoustic environment
	solid waste	Constructive waste effect on environment
life of the camp	water	Sewage generated by personnel life and accommodation of

	environment	constructors effect on water environment
	ambient air	Energy, heating, lampblack of constructors effect on air environment
	acoustic environment	Shouts of constructors effect on sound environment
	solid waste	Living garbage effect on the environment
	social environment	Entering of constructors effect on the local social environment
asphalt mixing station	acoustic environment	asphalt fume effect on air environment
	acoustic environment	Mixing machinery noise effect on the sound environment

（4）ECOP of construction site

According to the requirements of the site selection and combined the actual project, site selection should follow requirements below:

1. Try to rent the existing or nearby homes, and set up collection point and bucket of the living garbage; Life energy and heating electricity or other clean energy.
2. Constructors should abide the local village regulations, civilized construction, handle the relationship with the local residents well.
3. If necessary, the production campsite set up latrine and tank of production wastewater, wastewater after precipitation using for the production, sanitary sewage (constructor going to the toilet) after latrine hire local farmers for outward transport and agricultural irrigation, turn the soil buried after construction; recycle waste of construction as much as possible that cannot be recycled, need to transport to a designated area, not indiscriminate disposal of litter.
4. Before construction, it should conserve the topsoil, used for land reclamation, surface soil should be temporarily piled up in the relatively flat field, and lay block by bags soil base temporarily, peripheral set up temporarily drainage and settling measures, and use the dust-proof net cover, use for turning the soil planting and green planting after the construction.
5. No special concrete mixing station suggested, outsourcing if need. With regard to the remote location without concrete to sale nearby, to set temporary concrete mixing station away from the sensitive spot such as residence, school and hospital, at least 200 meters away down the wind with local perennial dominant wind direction.

ECOP of site operation

1. Construction working hours are to be 8:00—20:00. At the mid-day time from 12:00—14:00 for lunch break, construction should be suspended. Construction activity during nighttime would be restricted. If nighttime construction is really unavoidable, permit should be obtained from local construction administrations and

approved by environmental protection administration. Announcement should be made to residents at adjacent area.

2. The construction materials involved in the projects include sand, aggregated rocks and concrete. Impropriate transportation, stockpiling and utilization of these materials can cause environmental impacts of different scale. Subsequently counterpart environmental prevention measures shall be adopted to mitigate impacts. Followings are measures proposed to manage transportation, storage and use of constriction materials:

3. Quite trucks are to be used. The operation of trucks should be arranged strictly during daytime. Contractors vehicles management should be strengthened to reduce hauling at nighttime in unusual working period.

4. Speed of trucks should be limited. When passing through environmental protection targets (such as hospitals, residential quarters, schools), vehicles should reduce speed.

5. Traffic signs for vehicle drive in and out should be placed. Drivers should drive trucks with civility and safety.

6. Dusty material (such as cement, lime) should be hauled in tankers. Hauling dusty material in bulk would be prohibited. Vehicles hauling sands and stones should be equipment with facilities to prevent falling and scattering. Vehicles should not be overloaded with sands and stones to avoid fly dust driven by wind. The hauling routes should be properly planned and vehicles carry dusty loads should be covered or watered to prevent fly dust generation along hauling routes and minimize fly dust impact from hauling vehicles to environmental sensitive point.

7. Site for stockpiling of dusty materials would be selected at 300 m .leeward of environmental sensitive site. Such stockpiles should be as covered or even fenced, watered regularly. In the worse weather conditions, the stockpiles would be covered with felt.

8. Contractors' vehicles should be regularly checked and well maintained to reduce dusty-generating activities.

9. Access roads should be paved with harden surface or watered to reduce vehicle tires' rolling on the road and minimize impact of fly dust on air.

10. During construction, management on and use and hauling of particulate and dusty materials should be strengthened. Dusty work side should be maintained clean and periodically watered.

11. Main constructions equipment for irrigation and drainage facility works may include: loader, road roller, bulldozer, excavator, agitator, vibrator, rammer, etc. Noise and tail gases emitted from these equipment, or the leakage of the equipment may impact on regional environment. To minimize these impacts, following mitigation measures are proposed:

a) Construction equipment's should be placed in designated site orderly without occupying additional land area to reduce destruction to vegetation and soil;

b) Quite equipment should be selected as much as possible;

c) Muffler can be installed on noisy equipment, i.e., install muffler on vent pipe. Meanwhile, vibration absorption can be installed on foundation of equipment's;

d) Fuel-powered mechanical equipment and vehicles should be operated when they are on normal conditions to ensure their emission comply with discharging standards.

e) Rational use of equipment's with strengthens maintenance and repairmen to prevent potential impact of fuel running, leaking, dripping on surface water and soil environment

6.4 ECOP of start stage

1. To give a priority to use water-saving appliances in order to reduce wastewater.

2. To discharged sewage into the local municipal pipe network around municipal facilities of mechanized maintenance and emergency center; If not, to set pit latrine after used for outbound agricultural irrigation of sewage collection.

3. To use clean energy (liquefied petroleum gas or electricity), to install smoke lampblack machine in dining room, also with regular maintenance.

4. To take separation system of rain and sewage, To discharged sewage into the local municipal pipe network around municipal facilities of mechanized maintenance and emergency center; If not, to set pit latrine after used for outbound agricultural irrigation of sewage collection.

5. To prepare for maintenance of sewage collectionadn transmission network , no accident of wastewater discharge.

6. To establish classification and recycling collectors, dangerous things should be separately collected by qualified agency such as waste battery, waste paint. And to formulate corresponding management measure: (1) to establish a perfect management system, regular cleaning and collecting; (2) to use degradable garbage bags; (3) to plan reasonable garbage collection and transportation route, to take protective measures to minimize trash scattered in transit.

7. To transfer household garbage timely to the local designated site, to use high efficient closed rubbish compression storage with deodorant measures (such as purification deodorizer, plant deodorant, etc.);Timely transporting and flushing transfer tools.

8. No honking and speed limited under 20 km/h of the vehicle in and out of the project

area, speed limited about 10 km/h in management station.

9. Emergency configuration: to prevent harm to surrounding nature reserves when dealing with emergency events. Exhaust to take air pollution controlling measures; to set spilling disposal equipment to prevent water pollution.

10. To comply to the principle of buffer, to construct buffer facilities between nature reserve and its periphery.

6.5 ECOP of Pollution control

6.5.1 ECOP of sewage treatment

Application scope

After construction and completion operations of Mechanized Conservation and Emergency Center/Management Institute, the sewage and waste mainly generated includes wastewater from production (wastewater pit, mechanical vehicles and supplies washing water, wash water concrete mix, etc.), sewage, runoff wastewater from road surface stations, etc. Generated sewage (waste) water will cause pollution to the surrounding surface water and groundwater.

ECOP of sewage (waste) water treatment in the construction stage

1. Engineering contract should clearly have the terms of prevention leakage of construction materials during transport, stacking space shall not be located in/near lakes and rivers, to avoid construction materials into the water with the rain, causing surface water pollution.
2. Construction materials such as oil, chemicals and other harmful substances disposal site should be setting with blocking or surrounding measures with Gabon cloth covering to reduce erosion caused by storm water pollution.
3. Prevent the pile drilling and construction waste slag discharging into surface water bodies, and set up necessary water drains to divert construction waste if construction site is nearby river/lake, with soil slope of water drains compacted in a timely manner.
4. Set construction site sedimentation tank reuse the construction wastewater after precipitation.
5. Try to use advanced equipment and machinery, in order to effectively reduce the mechanical maintenance times of run, drip, leak quantity, and thus reduce the amount of oily wastewater. In the inevitable run, drip, drain oil absorption process, the use of the solid-state materials as much as possible (such as cotton, wood, oil-absorbing paper), will be transformed the collected waste oil into solid material, avoiding excessive oily wastewater. Regarding the leaks of the oil into the soil should

be collected using the scraping device to seal, and be transported to a qualified disposal site with centralized treatment.

6. The maintenance of machinery, equipment and transport vehicles should try to be centralized on nearby service points to facilitate the collection of oily wastewater; in the case that can't centralized, since the amount of oily wastewater produced is generally not more than 0.5m3 / d, so it can all absorb mixed sequestration using solid oil absorbent material and then transport outward.

7. Set advection sedimentation tank in the construction site and mechanical repair place. Oily wastewater collected by the sedimentation tank, after simple treatment with the acid-base neutralization, precipitation, grease, slag, etc., the concentration of oils and other pollutants is reduced, sedimentation tank will be overburden and buried after the construction is completed.

8. Immersion oil waste collected after the measures of packing seal, will be transport outward along with other hazardous solid waste of the construction camps. The selection of outward transport site will be the near disposal sites with such waste disposal qualification.

9. Construction camps should be far away from rivers and other water bodies concentrated area, and modified septic tanks should be set in the vicinity of the construction of camps, to collect sewage and food washing feces. Stool can be used to fertile land, and washing sewage collecting and catering to the grease trap for treatment, together with fecal water into the septic tank treatment, to achieve quality standards for agricultural irrigation. Commission the farms in the village nearby regularly cleaned and collected the septic tank sludge. After the end of the construction, the septic tanks should be casing buried. Recommended to use the nearby residential housing as a construction camp, and make water control measures to prevent sewage into the water.

10. Dining and washing of construction workers should use centralized form of management, such as centralized dining, washing, etc., to minimize the amount of sewage generated. Control the amount of detergent in the washing process, in order to reduce detergent content in the water.

11. In the construction stage, retaining walls and drainage facilities should be set up in the vicinity to prevent construction spoil and waste water into the wells, while prohibiting temporary spoil yard and construction materials yard in the range of 50m surrounding the wells to avoid adverse effects on the well water quality form the construction spoil and construction materials.

12. The main source of road surface runoff sewage around the station are mainly from rainfall, according to the analog data, the average pH of rainwater runoff about 7.4, SS concentration average at about 100mg/L, the average concentration of BOD5about 5.0, the average oil concentration about 11.25mg/L. The road surface runoff drainage will have some negative impact to the water quality, but the impact is limited to the initial rainfall (usually in about 20 minutes), with the temporary increase

in rainfall, reducing the concentration of rain, impact on surface water body decreases, overall, the impact on surface runoff water is very small.

6.5.2 ECOP of waste gas treatment

The gas type and environmental impact in the construction stage

The ECOP will be focused on mechanical maintenance and emergency center/ management institute during the construction stage. Air pollution generated mainly include the following three aspects:

(1) Dust pollution

Project dust is mainly from road maintenance and emergency facilities construction phase as well as earthwork excavation, and dust generated by wind from the wasteland filling the prescription, and scattered dust generated during the waste handling and transportation, machinery tires and crawler grind powdery substances accessing to the construction site and rolling dust formation during handling construction materials, and dust generated when stacked.

The main impact on the air environment during the construction is dust. Dust the resulting dry excavation of the surface, part suspending in the air, another part falling to the ground and buildings near the surface with the wind; dirt piled in the process of excavation, in large wind, will produce dust raised: during the handling and transport, it will cause some stirring up dust and spills; when rainfall spreads entrained dirt road, the dried dust will rise again due to vehicle movement or windy; during the backfill excavation process, it will also cause a lot of dust; supplies handling, transport, piling process will inevitably lead to spills and emissions.

Dust pollution generated by the excavation, backfill, demolition and material handling process of the engineering earthwork, secondary dust caused by transport vehicles, the adverse effects are obvious in windy weather. For road maintenance, emergency facilities, and adjacent buildings and grounds surrounding environment sensitive point, the impact is more obvious. Effective prevention and control measures must be taken during the construction stage, and then the impact will be controlled to a lesser degree.

(2) Automobile exhaust

(3) The construction and site selection of the conservation and emergency centers are basically five kilometers away from the existing residential area outside the town, so in the basic construction and operation of stage it does not produce environmental impact on the existing residential area residents. Part of the asphalt mixing plant, asphalt inside the curing process may produce asphalt breathed polluted environment, but due to work shorter and more concentrated, and mainly work in the field of highway, this effect can be

ignored. But the project still need to constructed and operated in strict accordance with the environmental protection measures for construction work recommended by the EIA report, asphalt mixing plant production and operations should avoid the limelight weather operations in residential areas, to avoid the impact on the environment and neighborhoods.

ECOP of Air pollution control in the construction stage

To reduce the generated impact to the ambient air of construction activities and mechanical equipment, it should strengthen environmental management, to take appropriate preventive measures for different sources:

1. Implement a closed construction in the construction, and construction earth should be piled up to be fixed site. Use of sprinklers and covering other measures on the mound and pile work surface, can effectively control dust, and dust cover must be stamped on the bucket during transport.

2. During construction, excavation should be arranged in the non-rainy season, and increasing the intensity of construction, shortening the time of earthmoving bare stockpiling to reduce the amount of secondary dust pollution and soil erosion.

3. The construction road needs to be harden, and set the wheels soil washing equipment to ensure that vehicles exiting the site without soil into the city at the site exit. The vehicle transportation routes should avoid ambient air sensitive points, such as urban residence, hospitals, schools and other groups concentrated area. Do not throw muck handling volley, and designate a person to clean the road surface water regularly to prevent dust.

4. In general material storage field, the selection of lime mixing station should be away from a centralized office, the residential areas and other areas. Select construction machinery and vehicles with good operating conditions.

5. Fuel construction machinery and vehicles must use under normal conditions, to ensure that exhaust meets emission standards.

6. Rationally use equipment, and strengthen the equipment maintenance and repair.

Through the implementation of these control measures, it will cause less air pollution impact on the surrounding environment in the construction phase of the project, and the prevention and control measures are feasible.

6.5.3 ECOP of solid waste

Management methods of construction solid waste and environment impact

The ECOP is aiming to the Mechanized Maintenance and Emergency Center/Management Institute. The solid waste of road maintenance and emergency during construction including:

① Solid construction wastes generated during construction stage:

Solid wastes is generated during construction stage mainly originates from waste aggregates, digging, waste soil after backfilling. Waste soil can results in traffic and pollution if not properly treated in the process of storage and transportation. The vehicle carrying the waste soil will aggrandize the load of the road so that cause traffic jam, as well the leakage of soil maybe bring harm to the surroundings. Dogged soil chaotic man because water and soil loss when rainstorm. Especially, the construction site in area of center city, runoff will be discharged into Municipal drainage by yellow mud, which will cause block of drainage after deposition, which will cause water pollution together with cement and waste oil.

② Domestic wastes generated by operational staff: should be collected by the construction staff and transfer to the assigned site.

ECOP of solid waste management during construction stage

1. Construction waste in the spot.

For a few of consumption of water stone and soil in the project, so the limited ones will be used for level or road greening, the rest one will be collected and transferred to the assigned site.

2. Domestic wastes generated by operational staff: should be collected by the construction staff and transfer to the assigned site.

6.5.4 ECOP of sound and vibration control

Construction sound, vibration types and environmental impact

The ECOP is aiming to the Mechanized Maintenance and Emergency Center/Management Institute, especially for the construction stage.

（1）Sound

Mechanical equipment and vehicle utilized during construction stage includes nay and bulldozer. The sound source intensities is between 90-115dB(A), see the table below:

Table 15 Main sound source and the intensities during construction stage

No.	Equipment	Construction items	Sound source in densities dB(A)	Production Style
1	Bulldozer.	Level the ground	110	Interval
2	Nay	Level the ground	100	Interval
3	Pile driver	Level the ground	115	Continuous
4	Vibrating spear	Civil engineering	105	Random
5	Concrete mixer	Civil engineering	105	Interval

The sudden and unsteady state sound source have an effect on the acoustic environment near the project, especially the residence and enterprise and public institution. The results of sound impact prediction shown as the table.

Table 16 The results of sound impact prediction Unit: dB(A)

Sound source	intensities	Distance away from the sound source（m）										note
		5	10	20	40	60	80	100	200	300	500	
pile driver	115	101	95	89	83	79	77	75	69	65	61	1
		91	85	79	73	69	67	65	59	55	51	2
bulldozer	110	96	90	84	78	74	72	70	64	60	56	1
		86	80	74	68	64	62	60	54	50	46	2
vibrating spear	105	91	85	79	73	69	67	65	59	55	53	1
		81	75	69	63	59	57	55	49	45	43	2
Nay	100	86	80	74	68	64	62	60	54	50	48	1
		76	70	64	58	54	52	50	44	40	38	2

Note: “1” indicates the condition without shielding effect ; “2” indicates the condition of with shielding effect。

As the table, to predict the result of sound impact with and without the shielding effect of building , trees and atmosphere in the construction spot. Scope of influence of sound functional zone shown as the table during construction stage.

]Table 17 Scope of influence of sound functional zone shown as the table during construction stage.

category	Daytime		Nighttime		Note
	Standard dB(A)	Scope of influence （m）	Standard dB(A)	Scope of influence （m）	
1zone	55	30	45	80	

From the table, the maximum noise impact range in the construction field could be get: for class1 zone, 30m in daytime and 80m in nighttime. No construction in nighttime In order to protect the surrounding institutes and the residents. The construction agency should also contact residents in the sensitive area in advance to reasonably arrange construction plan and avoid construction for the rest time.

In order to effectively protect the sensitive spot, the construction agency should cover environmental protection measures in the proposal in bidding, to identify responsibility and

obligation of environmental protection and reduce the effect on the sensitive spot as much as possible.

（2）Vibration

The process of piling during construction is frequently utilized circulation method and direct circulation, among which the latter uses rotary drilling. In the process of piling driving. Around the neighboring residential areas and buildings of foundation construction, the strong vibration force and noise brings serious regional environmental pollution as to cause the different degrees of damage to buildings along the way. Powerful structural vibration can cause damage biological in adaptation nearby buildings, because not only vibration wave spreads around the source also the high direction and ground, with long distance.

Noise generated during construction stage can be classified to drilling vibration and mechanical noise in the stage of before construction, as well operational vibration and noise in the stage of construction and before it. Different vibrational properties are produced by different technique and equipment's in the different stages of operation. Intensity and direction of the impact on the surroundings is changing when the machinery moves in the scope of construction. Construction vibration includes steady and unsteady vibration, vibration as well pulse. As one of the environmental vibration, intensity and direction of the construction vibration rabies due to the different construction stage, especially the huge impact of the vibration of the pilling driving construction on the surrounding environment.

Eco Sound or vibration control during construction stage

1. Firstly, to ask for noise control to the manufacturers of primary and auxiliary equipment, especially for the one with noise level higher than 85dB(A), it is necessary to take sound insulation measure; The larger fixed machinery and equipment shall be equipped with vibration damping frame.
2. To abide by the principle of "separation of silence and noise", to respectively set the equipment's centralized, away from the working zone and office requiring quiet.
3. To set silencer for the sound source and have sound absorption treatment indoor; sound proof door and window should be equipped around the building envelope; or to use sound-absorbing ceiling to reduce the interior noise and outside radiation caused by noise.
4. Virescence nearby enclosure.

The sound could conform to the limiting value of class 2 under the standard of GB12348-2008 after taking the measures.

Preventative measures to vibration include control at the source of pollution, control over

transfer channel, and protection on buildings, reasonable planning and lay-out and scientific-sound management measures Regarding management of vibration source, renovation to transportation vehicles and maintenance should be delivered and reinforced, where new techniques of vibration mitigation should be adopted. Control over transfer channels can be delivered through establishment of vibration interception ditch and fence that could screen vibration and mitigate the environmental impacts associated with vibration. Other options are change of function of buildings and other measures that can mitigate the impacts associated with environmentally sensitive targets.

6.6 ECOP of ecological protection

Scope of ecological protection

It is applicative site recovery during and after construction. The Mechanized Maintenance and Emergency Center/Management Institute proposed to build or rebuild or expansion in the project distributes all towns/counties of Yunnan Province, when a few of land will be explored, among which most are centralized on the uncultivated land so that vegetation will be destroyed as limited as possible.

The region proposed to ecological recovery as bellows:

1. The destroyed land around the center zone of construction;

2. The land within the scope of production area;

3. Construction road developed;

4. The land within camp buildings;

5. Stone and soil quarry and borrow pits

Management measures for ecological conservation

1. Improve layout of construction site by minimizing scope of activities and mitigating impacts on vegetation.

2. Out sourced construction material, such as gravel, sand and cement, transportation should be limited in time scale and land acquisition in order to minimize impacts on vegetation. After completion of project, timely cleaning of project site and vegetation are encouraged to recover damaged plant.

3. Base on the results obtained from field survey, plants that are not resettled and lodged should be preserved by temporary fence.

4. No marks should be attached on the trees apart from identification mark. No parking of vehicles and equipment's within the preserved area of plants.

5. Temporary interception ditches should be construction on site in order to provide flood diverting tunnels to compensate damaged surface run-off tunnels on site. The storm water can be diverted and avoid further erosion to the project by surface run-off.

6. The construction contractors should limit timescale for land acquisition and earth works, without compromising quality of project. Digging and fill of side slope should be delivered instantly and stably in order to minimize impact on other areas off site.

7. To conduct ecological restoration on the construction site before acceptance check after construction.

6.7 ECOP of landscape

Scope and analysis of landscape impact

The ECOP will focus on the Mechanized Maintenance and Emergency Center/Management Institute. It is applicative for during and after construction stage.

The landscape of construction will be destroyed caused by excavation of center construction , borrowing from stone and soil quarry, piling up on the waste collection site, which will not harmonize with the landscape around. In order to control the negative impact caused by construction, The ECOP suggests the measure as follows:

Measure of landscape impact

1. In order to keep compatibility and coordination between the project and the surrounding landscape. 1) The side slope for filling and excavation should connect with ground with circular arc slope to improve the visual effect. 2) Slope surface should maintain a certain rough, so that the surface can be taken measures of protection and planting. 3) Retaining wall can be covered by plant such as shrubs or evergreen tree to improve the visual effect.

2. Because construction road is located on both sides along the road. It is suggested to enhance the environmental protection propaganda, environmental protection consciousness of the related staff. It is prohibited to show life an production waste.

3. Temporary location of the waste slag or building materials, It is strict to operate in the area of regulation. And it is prohibited to throw any waste to pollute the environment.

4. To clear the site of waste slag, stock ground, construction road and the center

construction area and to level the ground to recover the site as possible.

6.8 ECOP of Cultural Heritage

It is applicative for construction stage. If there are any chance found or suspected to be cultural relics in mechanized maintenance and emergency center or Management Institute during construction, Construction agency should follow requirement stipulated in Law of the People's Republic of China on the Protection of Cultural Relics (December 29, 2007) and The World Banks material and cultural resources policy to protect the site immediately, report to local Cultural Relics Bureau for identification and initiation. No construction works could be resumed until the site are approved with by cultural relics bureau. Procedures to report cultural heritage are shown in the figure below. If objects are chance found and suspected to be cultural relics, contractors should:

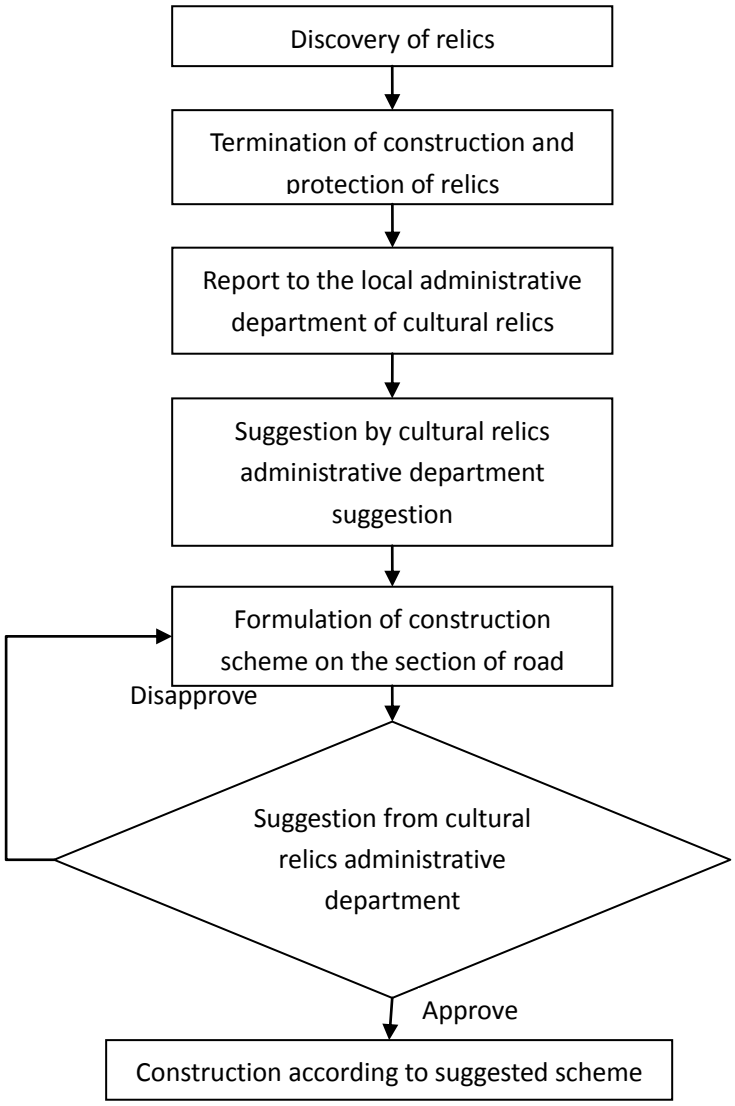


Figure 17 Procedures to report cultural heritage during construction

1. Suspend construction activities at the chance found site and inform EMC immediately

to take further measures to protect the site;

2. The contractor should report to the competent department of cultural relics appraisal process;

3. Once defined by experts as cultural relics, immediately regular protection range;

4. If it is truly urgent or natural damage, it is needed to rescue or excavate the cultural relics;

5. Rescue and excavation of cultural relics must be used by professionals dedicated equipment, the contractor should not conduct without authorization;

6. Once be judged as a key cultural relics discovered, engineering to be demonstrate whether to build in another location.

6.9 ECOP of Safety and Health During Construction

Analysis of Safety and Health during Construction

Contractors and regulatory agencies have responsibility to take every measure to ensure safety of workers and structures around the construction sites and to prevent them from accidental damages. Contractors with capacity of safeguard their workers occupational health and safety should be selected. Provisions on risk management should be included in the bid document and contract. Management safety, health under irrigation and drainage facility covers design and operation of general facilities, communication, training, and supervision risk to peoples.

Safety and Health Measures during Construction

1. Contractors should have responsibility to obey by national and local regulation and requirement on safety, to avoid accidental event, and to ensure their workers' safe and health.
2. Integrity of all structures in the project sites should be ensured. The structure of temporary structures should be safe and reliable and be resistant to the strike of local atrocious weather;
3. Contractors should ensure the provision of up to the mustard first aids. Tools for first aids should be provided. Written procedures for dealing with emergency cased should be established for remote construction site so that the patients can be sent to the appropriate hospitals;
4. Training on occupational health and safety to the new construction workers should be provided to introduce to them the basic working rules, personnel protection rules, and ways to prevent themselves or others from being hurts;

5. Appropriate signs should be placed at risk area (such as power supply room, compressor room etc.) , equipment's, materials, indicating safety measures, emergency exits;
6. Construction equipment should be selected and installed with vibration absorption to prevent hands and arms of workers from strong vibration when they are using hands tools or electricity-powered tools or if they stand or sit on surface of vibrating equipment.
7. Equipment's should be designed and installed to eliminate lock-up risk and ensure that equipment edges will not scoring people;
8. Warning signs should be placed on all electricity-powered equipment and cables. All electrical wires, cables, potable electrical tools should be examined to identify if there are any breakage or exposed wires/cables. Working voltage of equipment should be controlled within the allowable maximum voltage. Electric equipment operated under damp conditions should be subject to double insulations with earthling;
9. All workers participating or assisting welding operations should be provided with eye protection devices, such as welding goggles or face shield;
10. Install protective rails (with bars in between and baffles on sides) at the edges of fragile and risky area. In the meantime, construction workers should be equipped with falling prevention device;
11. Contractors should furnish their workers with personnel protective equipment. Sufficient protection should be made for workers themselves, other workers, and visitors. Protective equipment's should be easily accessible and usable with convenient;
12. Procedures and systems for recording and reporting occupational accident, diseases, risks should be established by contractors;
13. Construction workers should be trained on health, such as the carrying out communication strategy, strengthening face-to-face consultation. Individuals are encouraged to take personnel protection measures and use condom to avoid transmitting of disease to others; The use of mosquito repellents, mosquito net are highly recommended to prevent workers from by being bite.

6.10 ECOP of hazardous waste and chemical waste

Scope of application, environmental impact and measure of hazardous wastes and chemical waste

The ECOP will focus on the pilot projects of mechanized maintenance and emergency center/Management Institute and large-medium scale maintenance marketization, involving construction stage and start stage. Some paint, fuel, etc. will be inevitably used during construction of the project. if not be properly treated, these hazardous material will

bring harm to construction personnel and the public along the road constructing, have a severe impact on the environment and cause serious consequences once explosion, combustion or leakage.

Management measures to store hazardous and chemical products are as follows:

1. Hazardous and chemical products should be labeled;
2. Storage of hazardous and chemical products should comply with the requirements stated in the certificate for storage;
3. When hazardous and chemical products are delivered to the construction site, receiver should carefully examine if they are packed well and if there is any leakage. When leakage is spotted, such products should be rejected and returned;
4. When maintaining the equipment's, waste diesel oil, waste engine oil and waste lubricant should be collected by specific container, stockpiled and cleaned frequently in the hazardous waste disposal;
5. The ground of such store house should be lined to prevent leakage. Such store house should be furnished with such emergency responsive materials as absorption kit/sand/woodchips.

Risk preventative measures

1. Establishment of corresponding network and leading team for emergency responding and appointment of focal person for delivery of work;
2. The County/District PMO will take the lead to coordinate with other line agencies, such as environmental administration, security bureau, fire distinguish brigade, environmental monitoring station and water boards to form emergency corresponding network. The organizations with capacity of responding to emergency accidents should take the lead to set up transportation accident responding team, responsible with emergency accident associated with transportation of hazardous waste;
3. By delivery of survey, stringent management principles on transportation of hazardous waste and inflammables & explosive products should be complied, in order to reinforce management and prevention of emergency environmental contamination accidents;
4. Management on hazardous chemical produced should be enhanced by development of responding plan for hazardous waste and inflammables & explosive products. The transportation process should be registered with local security bureau. Training among management staff and practitioners should be delivered in advance and certificate is required before taking the role, in order to avoid leakage accident;
5. During transportation process, both driver and passengers should keep focused and carefully observe sign posts aside, in particular when passing through residential area and rivers. Parking and stop-over should be limited;

6. Speed limit sign posts and alarming signs should be attached on both sides of the bridge, clearly stating emergency call number and reminder made to the drivers.

Risk responding plan

Contractors should develop a detailed responding plan and carry out coordinated actions. Responsible person and roles played by relevant departments should be clearly identified, in order to guarantee that accidents have been controlled within shortest notice and damage to environment is minimized. The emergency plan developed for the project should be integrated into regional emergency plan, targeting at mobilizing rescuing capacity and quick responding to accidents associated with hazardous and chemical products and, subsequently, minimizing the damage and loss induced by accidents. Executive department for handling the hazardous waste and inflammables & explosive products should be established, which will be responsible for coordinated organizing and delivery of rescuing works. Main components included in the plans are:

1. Report to the police and contacts details

2. Classified responding procedures

3. Emergency environmental monitoring, rescuing and control measures

4. Evacuation of staff and organization of evacuation

5. Recovery measures

6. Training program

Recovery measures to accidents involve recovery of contaminated soil and water. As for seriously contaminated soil, surface soil that is contaminated should be peeled off and sent to center for hazardous waste for further disposal. For polluted water, active purification measures should be adopted, such as filtering of floating pollutants, which is to be sent to WWTP for burning.

7 ECOP for road maintenance marketization pilot

7.1 Standard of site selection

The ECOP will be applicable to environmental management during construction stage and operation stage of all maintenance project marketization pilot in the list.

Marketization pilot project of large-medium-scale maintenance will practice on the road existed, excluding extending the basis of road and land acquisition, which will be focused on new technology of maintenance and popularization and application of the new material, not involving the aspects of base of road, bridge and security.

Referring to the climate partition method of bituminous pavement usability of “technical manual of road bituminous pavement”(JTG F40-2004), 16 cities /state of Yunnan Province is divided into four climate categories by high temperature, low temperature and precipitation, including hot summer-warm winter-moist, hot summer-warm winter humid, hotter summer-warm winter-moist, hot summer-cold winter-humid. The detail shown in the tab 10.1-1. The pilot section of the road and the items of projects shown in the tab 1.3-4.

Table 18 Climate zone of Yunnan Province

Climate zone	**Toponymy**
Hot summer-warm winter-moist	Red river, Wenshan, Nujiang river Lin cang, Baoshan
Hot summer-warm winter humid	Kunming, Yuxi, Chuxiong, Dali, Qujing, Lijiang
Hotter summer-warm winter-moist	Xishuangbanna, Dehong, Puer
Hot summer-cold winter-humid	Diqing, Zhaotong

Note: the climate zone quotes from “technical manual of road bituminous pavement”

The maintenance pilot project respectively selected two pilot sections of road from the proposed maintenance measures according to “Yunnan road asset project-maintenance project marketization pilot plan”. It is proposed that the pilot section of road is representative in artery road in Yunnan Province, covering four climate categories of Yunnan Province as possible and the technical level of the pilot sections is suitable for the one of maintenance in order to the scientificity and rationality of the pilot project. New process and material for energy saving should be popularized to improve efficiency of environmental protection depending on technological innovation, during which energy-saving and environmental- protection technology should be promoted to eliminate the process and equipment with heavy pollution and poor technique

Based on the experience, contrast the technical feature and application scope between three preventive conservation measures including proposed micro-surfacing, modified asphalt macadam seal, slurry seal and substratum cold-recycling large-medium scale

maintenance measures, it is found that micro-surfacing for better usability and applicability is fit for using in the serious climate condition such as hot summer or cold winter, namely it is reasonable to apply to micro-surfacing in one section of the road respectively from the climate zones of Hot summer-warm winter-moist and Hot summer-cold winter-humid; for the measures of modified asphalt macadam seal and slurry seal, both of them will be respectively applied to two section of the road of the climate zone of Hot summer-warm winter humid, which the broadest climate zone. The successful experience will be got from the pilot project so as to promote utilization of the most suitable measure in the region of Yunnan. Substratum cold-recycling technique will be respectively applied to a large-medium scale repair section of the road in the zones of Hot summer-warm winter-moist and Hot summer-warm winter humid, which is convenient to analysis the applicability of the Substratum cold-recycling technique in the humid area, to lay the root for application, popularization and improvement of the technique in Yunnan Province.

7.2 Analysis of source of environmental impact

7.2.1 Analysis of environmental impact before construction stage

The project is implementing on the road existing, excluding land occupation and remove.

7.2.2 Analysis of environmental impact during construction stage

The activities has effect on environment during construction mainly covers clearing site, catching and dumping waste aggregates, operating machinery, boiling bitumen, sewage from the builders and household garbage from builders.

7.2.3 Analysis of environmental impact during construction start stage

The environmental impact of road start stage has a positive effect of promoting the development of economy and society, but also environmental pollution caused by the transportation. Environment impact during start stage of road are mainly from the aspects as follows: noise produced in the process of vehicle, off gas from the vehicle, polluted waste water from the service facilities along the roads, solid waste and something polluted caused by accidental such as poisonous material leakage carried on vehicles, subgrade slope landslide, road maintenance etc. Influence on the operation stage of the environment for pollution. The environmental impact during start stage is focused on the effect of contamination.

7.3 Environmental Code of Practice

7.3.1 Environmental code of practice during design stage

1. Ecological environment and landscape protection

To temporarily stripping the fertile surface soil layer of the temporary region during construction design stage;

To design how to stack and prevent water and soil loss;

To ensure that the surface mellow soil can be used for land reclamation or beautification of landscape greening.

2. Water environment protection

To design the sewage treatment facility in order to recycle or discharge of sewage.

3. Environment protection of sound and atmosphere

To demonstrate technically and economically according to measure and regulation to mitigate the environmental impact of sound in the ECOP.

To set reasonably set the site of machine and material

4. Social environment protection

① To consider the opinion from the public in term of line selection, passageway setting and environment protection

② To reduce the disturbing issue to infrastructure such as existing road, irrigation works, dewatering communication and electricity as possible

7.3.2 Environmental code of practice during construction stage

Before construction, It is necessary to strictly examine the regulation of temporary facilities in the scope of construction to reduce the occupation of farmland and forest as well to facilitate the construction. Constriction should be in strict accordance with the design, to avoid destroying vegetation, no land occupation during the construction.

To treat the waste slag and temporary surface soil in strict accordance with the construction planning, to forbid piling the waste slag and surface soil at random beyond the construction area.

To regulate traffic channel of the vehicle to avoid travelling arbitrarily so that destroy the vegetation. After construction, to conduct land reclamation for the temporary land and to cultivate plants to avoid water and soil loss.

To set soil and water conservation measures such as catch water needed, revetment barricade and so on according to the practical conditions.

The construction of temporary cover should be set on the non-cultivated land as far as possible to reduce the cultivated land utilization. Before temporary occupation, to pile up the original land surface tillage soil aside, after construction, to bulldoze the mellow solid.

1. To strengthen environmental protection education for the related leaders of construction, technical personnel and construction personnel, to emphasize the importance of environmental protection. During construction stage, the related staff should voluntarily protect the environment, natural resources and human landscape, not harm wildlife, not wanton killing birds, not disorderly cut down trees, abandoned slag should be treated according to the design requirements. It is forbidden to dump solid such as waste soil, stone, tailings, waste water, waste residue.
2. To reasonably arrange the schedule, to prepare the safeguard procedures for the rainy season to reduce rainfall runoff flowing into the rivers. To strengthen environmental management, banning solid and liquid waste, directly flowing into rivers, to emphasize soil and water conservation, namely "simultaneous construction and guard". Processing waste water should be set for central treatment of sedimentation tank and add neutralizing until standard discharge. After construction, sedimentation tank should be removed or covered by vegetation.
3. Implement the comprehensive measures of soil and water conservation (engineering measures and biological measures as well management measures), specially corresponding intercept measures should be completed before the rainy season, as well the corresponding emergency measures (such as crops straw or plastic mulch for the unfinished slope, etc.). After construction, greening and recovery should conducted timely.
4. The dispersed materials such as cement, sand, ash should be in bags or covered by a tarpaulin, shelter measures should be taken for materials storage during construction stage.
5. To sprinkle on the unpaved road to reduce dust pollution; to increase sprinkling on the road through residential areas, schools, kindergartens, hospitals and so on.
6. No pitch mixing unit in the pilot project site.
7. If necessary, concrete mixing station site should be far away from residential areas, schools, hospitals and other sensitive location, and located further than 200m away from the downwind of the local perennial dominant wind direction.
8. The construction agency has to apply to machines and vehicle qualified the national related standard, to choose machinery and technology with low noise as far as possible, large fixed machinery and equipment shall be equipped with damping vibration stand, at the same time, to strengthen the maintenance of all kinds of equipment’s to work efficiently to fundamentally reduce the noise.
9. To reasonably deal with discharge and treatment during construction stage of the project. To recycle the waste materials as much as possible to reduce the

maintenance cost and get positive environmental protection effect. Garbage collection facilities and stabbers must be equipped to transfer the garbage to the waste transfer station. Pit toilet should be set in the scattered construction site, with regular cleaning and disinfecting, which can be used for fertilizing and greening.

10. To set warning sign to remind on the section of the line passing resident area and intersection between the targeted section of the road and line existing; To set reasonably temporary barricade to separate the construction site with outside. If necessary, special staff should be to direct the traffic.
11. Not to pile up the waste aggregates at random, but to pile up to the assigned site, especially the intersection between the road and the irrigation ditch, to reduce the effect of construction.
12. Full-time hygienist, dustproof such as respirator and goggles should be provided to offer medical security for the worker.
13. It is necessary for construction agency to notice the complaints hotline of environment protection, and the client should contact with local environment protection sector in term of the issues in order to deal with in time.

7.3.3 Environmental code of practice during start stage

After the pilot project, afforestation should be implemented to recover the vegetation as early.

To avoid artifact so as to integrate the vegetation and surrounding.

To build tree lawn in both sides of the road, if permission of the reality, to widen the tree lawn.

To select the species, structure and hierarchy to improve the efficiency of environmental protection.

Shrub should be planted at the foot of the slope, the moisture of tree and shrub should be planted on the line from gutter way to watershed of the road.

The species selected should avoid using the local plants, the ones suffering diseases and pests and invasion species, at the same time, it is necessary to strengthen the management of greening plants and maintenance to ensure the survival rate.

1. To strengthen traffic management, to forbid vehicles with overweight exhaust on the road. To maintain the surface pavement of the road to keep the road level and reduce noise.
2. To strengthen the management of motor vehicles, to strictly enforce the speed limit and prohibit overloading traffic management requirements; To set the forbidden

symbols on the line through the village, residential areas, schools and other sections. To reduce noise pollution sources strictly as far as possible, To limit vehicles with heavy noise so as to reduce the disturbing noise.

3. Acoustic environment protection measures of the area with sensitively acoustic: To set noise reduction tree lawn, sound insulation, sound insulation doors and windows, higher wall, road surface with low noise, to avoid the area with sensitively acoustic, to change use function in the way of the first row of houses. Ecotype of noise barrier can be uses. To plant local species to reduce. Landscape and light shade should be considered in construction.

4. The relevant waste must be classified in the collection pool. firstly , the garbage should be classified to recycle the available, as to the unavailable, to be treated in the nearest waste transfer station and recycling after consultation with municipal departments to coordinate. Garbage has to experience garbage collection pool, but it has not to be piled up or discharged into rivers and farmland around. To prohibit discharging garbage into the surrounding water, arable land, and all kinds of nature reserve.

8 Public consultation of ECOP

The ECOP will be mainly for road asset management project and all sub-projects in Yunnan. It focuses on project preparation phase and construction phase.

Public participation is a two-way communication between the project construction agency and the public. The establishment of normal mechanisms for public participation in environmental supervision and management allows the public to keep abreast of information on environmental issues of the project affected area and to have the opportunity to express their views through the normal channels , so that makes the decision-making process in the project more scientific and democratic, which is very important for decision-making and the smooth implementation of this building program.

8.1 Objectives of public participation

The objective of the public participation is to make the public participate and understand the construction purpose, size, construction sites, and pollution prevention and control measures to be taken and the surrounding environment may be brought during the process and after the completion of operation of the project, to make the public put forward comments, and finally get their understanding, support and cooperation.

Through consultation with the local people about the results of their long-term live, experience of living environment and intuitive feelings, it can assist to analyze the status quo can assist environmental quality and level of each element of the region, in order to objectively reflect the extent of the environmental assessment, for the protection of the vital interests of the public.

8.2 General requirement

Public consultation includes questionnaire and forum discussion. The general requirement and content is demonstrated as follows:

Table 19Subjects of the forum

Subjects	Suggestion	note
(1) General suggestion of the building (rebuilding)		
(2) What aspects ate the positive impact of the project?		
(3) Suggestion and advice to the project		
① Site selection and recovery of construction site, asphalt mixing station, quarry, borrow area and waste slag		
② The key issue of environmental sensitive areas（protection area）		
③ Safety problem（especially earthquake debris flow, landslide）		
④ Matters about environmental protection during construction and start stage		
⑤ Matters about impact of ecology and landscape		
⑥ Matters about water and soil loss as well slope protection		
⑦ Matters about social impact		
⑧ Matters of construction stage of maintenance pilot section of the road		

Table 20 Questionnaire individual）

Name: _____ Gender: _____ Age: _____ Education: _____ Occupation: ___ Residence: _____
Introduction of the project: Among to enhance the road management of the entire Province in China, introduce the latest concept of road assets management to achieve modernization, informatization and scientization of road assets, World Bank loan-Yunnan road assets management project has passed the investigation of China's National Development and Reform Commission (NDRC) and enrolled into planning of World Bank loan. The project will cover 16 states/cities of Yunnan Province. The project is proposed to get the targets as follows by the World Bank loan, (1) to research advanced road assets management and maintenance technology introduced and construct and perfect the emergency system of road maintenance; (2) To integrate and utilize the existing information system and build road asset management information system based on the modern computer and network technology; (3) to strengthen management ability and road asset maintenance and efficiency of Yunnan Provincial to ensure the safety of transportation and improve transport capacity and service level of road network in Yunnan Province. The executing agency of the project is Communications Department of Yunnan Province (on behalf of Yunnan Province government); the enforcement body is Bureau of Yunnan Province Road. The project recently covers national-provincial trunk road in Yunnan province, it is expected to expended to highway and rural road, total investment of 1.5 billion Yuan (us $250 million, including loan of $150 million from world bank), the contents of the project includes three parts: (1) Yunnan road assets management and information system;(2) to strengthen Yunnan road maintenance emergency ability; (3) to strengthen the institutions ability of Yunnan highway asset management. Duration of Construction is 2015-2017. **The corresponding projects in all states/cities shown in annex 1**
1、What do you think about the project?: approve□ disapprove□ do not care□
2、What will the project bring for you?: positive effect□ negative effect□ Nothing□
3、What do you think of the environment quality of your residence? goo□ neutral□ bad□
4、What is the main environmental problems of the location of the project? atmospheric pollution□ water pollution□ noise pollution□ ecology destroy□
5、What do you care about the environmental issue during construction of the project? noise□ geological disaster□ ecology destroy□ landscape destroy□ atmospheric pollution□ water pollution□
6、What Wii be the main environmental impact during start stage? noise□ off gas□ water pollution□ dust□
7、What do you respect to get the compensation after land acquisition and remove? money□ settlement in other place□ other□（explanation）
8、What do you think of the effect of the project on local economic development? large□ slight□ Nothing□
9、Can you accept the environmental impact issues arising from the project construction? yes□ no□ i don't mind□
10、Do you comply with the land acquisition, demolition and resettlement? YES□ NO□ YES WITH CONDITION□
11、Which mitigation measure would you chose to mitigate the impact? green belt along the road □ sound-proof facilities□ keep distance from the residents □ others□
Other advice:

Please write-in □ if you approve

Table 21 Questionnaire group）

Name of the agency: _____ Contact: _____
Among to enhance the road management of the entire Province in China, introduce the latest concept of road assets management to achieve modernization, informatization and scientization of road assets, World Bank loan-Yunnan road assets management project has passed the investigation of China's National Development and Reform Commission (NDRC) and enrolled into planning of World Bank loan. The project will cover 16 states/cities of Yunnan Province. The project is proposed to get the targets as follows by the World Bank loan, (1) to research advanced road assets management and maintenance technology introduced and construct and perfect the emergency system of road maintenance; (2) To intergrate and utilize the existing information system and build road asset management information system based on the modern computer and network technology; (3) to strengthen management ability and road asset maintenance and efficiency of Yunnan Provincial to ensure the safety of transportation and improve transport capacity and service level of road network in Yunnan Province. The executing agency of the project is Communications Department of Yunnan Province (on behalf of Yunnan Province government), the enforcement body is Bureau of Yunnan Province Road. The project recently covers national-provincial trunk road in Yunnan province, it is expected to expended to highway and rural road, total investment of 1.5 billion Yuan (us $250 million, including loan of $150 million from world bank), the contents of the project includes three parts: (1) Yunnan road assets management and information system;(2) to strengthen Yunnan road maintenance emergency ability; (3) to strengthen the institutions ability of Yunnan highway asset management. Duration of Construction is 2015-2017. **The corresponding projects in all states/cities shown in annex 1**
1、What do you think about the project?: approve□ disapprove□ do not care□
2、Whether construction of the project is in favor of local or sectional economic development? positive□ negative□ Nothing□
3、How is the environmental quality along the road of the project? good□ neutral□ bad□
4、What is the main environmental problems of the location of the project? atmospheric pollution□ water pollution□ noise pollution□ ecology destroy□
5、What do you care about the environmental issue during construction of the project? noise□ geological disaster□ ecology destroy□ landscape destroy□ atmospheric pollution□ water pollution□
6、What Wii be the main environmental impact during start stage? noise□ off gas□ water pollution□ dust□
7、Whether construction of the project is in favor of life quality of local public ? positive□ negative□ Nothing□
8、Whether construction of the project is in favor of tourist industries? positive□ negative□ Nothing□
9、How will the effect of construction on the environment and agriculture resource along the road proposed? positive□ negative□ Nothing□
Other advice: （items excluded in the table or ones involved in the table but excluded in the options）

Please write-in □ if you approve

8.3 Basic information

8.3.1 Information disclosure

Yunnan Provincial Highway Bureau and 16 State (Municipal) General Road Sections published ECOP information disclosure on official websites since July 15th, 2014 consulting public opinions. (http://www.ynsglj.com/Item/4730.aspx)

Figure 18 Website of information disclosure

8.3.2 Questionnaire

Questionnaire (Individual)

In 16 states (cities), Yunnan Provincial Highway Bureau released 740 questionnaires (individual) and collected 731 available questionnaires submitted by civil servants, workers, farmers, teachers, doctors, retirees etc.

Table 22 Questionnaire (individual) collection

		人数	比例	备注
Gender	Male	522	68.6	4 unfilled
	Female	235	30.9	
Age	<25	88	11.6	1 unfilled
	26-35	187	24.6	
	36-60	452	59.9	
	>60	33	4.3	
Education	University/college	168	22.1	4 unfilled
	High school	155	20.4	
	Junior school/below	434	57	
Occupation	Civil servant	53	7	29 unfilled
	worker	91	12	
	farmer	287	37.3	
	Other	301	39.5	

Questionnaire (Group)

In 16 states (cities), Yunnan Provincial Highway Bureau released 236 questionnaires (group) and collected 236 available questionnaires submitted by county/village government, Nature Reserve Management Committee, Environmental Protection Bureau, Construction Bureau, Land Resource Bureau, village committee, school, hospital, etc.

8.3.3 Forum

In 5 key environmental sensitive area, Yunnan Provincial Highway Bureau held public forums to consult public opinion with participants from Nature Reserve Management Committee, Environmental Protection Bureau, village, etc.

Table 23 Forum arrangement

No.	Subproject	Date
1.	Dehong-Ruili Road Section	July 21st, 2014
2.	Nujiang Road Section	July 22nd, 2014
3.	Diqing-Deqin Road Section	July 23rd, 2014
4.	Kunming-Yiliang Road Section	July 25th, 2014
5.	Kunming-Shilin Road Section	July 25th, 2014

Figure 19 Public forum

The registration form of public forums is attached in **Appendix 9**。

8.4 Result and analysis

8.4.1 Questionnaire result

Based on statistic analysis on individual and group questionnaires, the following result is obtained:

Table 24 Statistic of questionnaire (individual)

No.	Question	Option	No.	Percentage
1.	General Comment	Support	718	94.3
		Against	1	0.001
		Do not care	36	4.7
2.	Project brings your life and income	Positive affect	481	63.2
		Negative affect	9	1.2
		Do not care	255	33.5
3.	What is current local environment	Good	453	59.5
		Fair	270	35.5
		Poor	32	4.2
4.	What is local environment problem	Air	126	16.6
		Water	80	10.5
		Noise	301	39.6
		Ecological system	183	24
5.	What is your most concern	Noise	361	47.4
		Geological disaster	59	7.4
		Ecological damage	138	18.1
		Landscape destruction	41	5.4
		Water pollution	74	9.7
		Air pollution	78	10.2
6.	Environmental impact in operation phase	Noise	351	46.1
		Exhaust gas	92	12.1
		Water pollution	66	8.6
		Dust	181	23.8
7.	Preferred compensation in case of resettlement	Monetary	502	66
		Relocation	157	20.6
		Other	33	4.3
8.	This project affects local economy	Great	663	87.1
		Little	69	9.1
		None	13	1.7
9.	Is Environmental impact acceptable	Yes	671	88.2
		No	17	2.2
		Do not care	66	8.7
10.	Obey resettlement	Yes	506	66.5
		No	11	1.4
		Conditional	205	26.9
11.	Mitigation effect	Green	537	70.6
		Sound Barrier	76	10
		Keep distance	86	11.3
		Other	54	7.1

From individual questionnaire statistics, 94.3% support the construction of project, 63.2% of people think that the project will bring beneficial effects, 59. % think that the current residence environment is better, 39.6% worried about noise pollution, 24% worried about ecological destruction, noise, dust and ecological destruction， that is people’s concern during construction and operation period. If involved demolition, 66% of people willing to obey and tended to monetary compensation, 88.2% think that the project's environmental impact is acceptable, 70.6% think can take greening mitigation measures

.Table 25 Statistic of questionnaire (Group)

No.	Question	Option	No.	Percentage
1.	General Comment	Support	232	98.7
		Against	0	0
		Do not care	2	0.9
2.	Project brings economic development of region and department	Positive affect	190	80.9
		Negative affect	24	10.2
		Do not care	34	14.5
3.	What is environment quality along project	Good	164	69.8
		Fair	62	26.4
		Poor	5	2.1
4.	What is local environment problem	Air	47	0.2
		Water	22	9.4
		Noise	91	38.7
		Ecological system	48	20.4
5.	What is your most concern of the project	Noise	104	44.3
		Geological disaster	26	11.2
		Ecological damage	55	23.4
		Landscape destruction	4	1.7
		Water pollution	14	6
		Air pollution	27	11.5
6.	Environmental impact in operation phase	Noise	97	41.3
		Exhaust gas	33	14
		Water pollution	23	9.8
		Dust	49	20.9
7.	This project improves quality of people's lives	Positive affect	220	93.6
		Negative affect	0	0
		Do not care	12	5.1
8.	IS this project beneficial for the tourism industry	Positive affect	186	56.4
		Negative affect	0	0
		Do not care	144	43.6
9.	This project impact ecological and agriculture resources	Great	14	6
		Little	112	47.7
		None	102	43.4

From group questionnaire statistics, 98.7% of the groups support projects, 80.9% deem that the project is beneficial to the department of region and the development, 69.8% said the environment along the project quality is better, more than 50% of the groups concerned about the noise, dust and ecological damage problems, 93.6% of people think that the project improve public quality of life in this region, more than 80% of the group think that the project impact on the ecological environment and agricultural resources little or none.

8.4.2 Forum comments

During July 21-25, 2014, Yunnan Provincial Highway Bureau conducted public forum in 5 key environmental sensitive areas consulting public options from government authorities and individuals, in specific:

- **General Comments**: Subprojects government authorities support project construction for that this project will bring social and economic benefit to local area in mid and long term;
- **Nature Reserve Management Committee**: Support project construction, and must obey nature reserve master plan and related regulation during construction and operation phase;
- **Environmental Protection Sector**: Support project construction, and i) clean construction trash during asphalt mixing operation; ii) take care of sewage water discharge; iii) keep construction style traditional;
- **Construction Sector**: Support project construction, and must obey national approval regulation;
- **Transport Sector**: Support project construction, and advise to strengthen information disclosure and dissemination;
- **Water Sector**: Support project construction, and must obey national water approval regulation. It is advised to pay attention to site selection of sand stockyard regarding safety and planning issue;
- **Forest Sector**: Support project construction, and advise to plant local species to keep environment featured;
- **Individuals**: Support project construction, and this project is good for local economic and social development;

The comments and advices have been incorporated to Chapter 4.

8.5 ECOP of information disclosure

1. Set bulletin board at the entrance to the construction site, to announce the project name, the main construction contents, construction time and other information, and

bulletin complaints, proposed contacts and contact details as well;

2. Arrange on-site environmental engineers to answer the public questions on environmental protection;

3. As requirements of the construction process, if it needs continuous construction at night, relevant procedures should go through and notice should be published to the surrounding residents, and bulletin information should include starting and ending time of continuous operation at night and the construction permit issues by the environmental protection departments in charge of;

4. If it needs to interrupt municipal services (including water, electricity, telephone and bus lines, etc.) because of the construction, notice to inform the public should be posted at least five days at the project site and the affected households, and indicate the beginning and ending time of the interrupt service;

5. All public reaction comments, questions should be recorded, archived. Questions from the public should be timely answered, responded, and answers to all the comments and responded results both should be recorded and archived, and accept the inspection from the supervision agency.

Appendix 1 Lists of subproject information involving environmental impact

The list of Mechanized maintenance and emergency centers of road management section

Name	Items	Type of constructio
Kunming road management section	Mechanized maintenance and emergency centers	Extension
Quinn road management section	Mechanized maintenance and emergency centers	Construction
Dali road management section	Mechanized maintenance and emergency centers	Extension
Red river road management section	Mechanized maintenance and emergency centers	Construction
Purer road management section	Mechanized maintenance and emergency centers	Construction
Baoshan road management section	Mechanized maintenance and emergency centers	Construction
Xishuangbanna road management section	Mechanized maintenance and emergency centers	Construction
Dehong road mangement secton	Mechanized maintenance and emergency centers	Extention
Nujiang river road mangement secton	Mechanized maintenance and emergency centers	Extention
Zhaotong road mangement secton	Mechanized maintenance and emergency centers	Construction
Lincang road mangement secton	Mechanized maintenance and emergency centers	Construction
Ljiang road mangement secton	Mechanized maintenance and emergency centers	Construction
Diqing road mangement secton	Mechanized maintenance and emergency centers	Finished
Yuxi road mangement secton	Mechanized maintenance and emergency centers	Extension
Chuxiong road management section	Mechanized maintenance and emergency centers	Construction
Wenshan road management section	Mechanized maintenance and emergency centers	Extension

List of Mechanized maintenance and emergency centers of County road management

No	Name of the section	Name of centers	Line of road		Coverage(km)	Number of centers			Ordinary road	B road
						Subtotal()	Reconstruction	Construction		
	Subtotal				10537	63	37	26	27	35
(1)	Kunming road management section				943.371	6	4	2	0	5
1	Chongming	Yang street	G213line of Lan-Mo		226.827	1	1			1
2	Xundian	Tiansheng bridge	G213 Line of Lanmo		109.768	1	1			1
3	Luguan	Tuan street	S213 Line of Luping		311.925	1	1			1
4	Yiliang	Dong shan	Dahuagntian		149.15	1	1			1
5	Shilin	Suobusuo	G326 Line of Xiuhe		145.701	1		1		1
6	Jinning	Chenggoan	Line of Lanmo			1		1		
(2)	Qujing road management section				806.183	4	4	0	4	0
1	Xuanwei	Maotianshu	G326 Line of Ziuhe		262.55	1	1		1	
2	Huize	Huize（Yili stone quarry）	S209 Line of Hui'a		415.344	1	1		1	
3	Luoping	Zuantian slope	S202 Line of Fuba		78	1	1		1	
4	Malong	Sayi river	G320 Line of Hurui		50.289	1	1		1	
(3)	Zhaotong road management section				640.876	5	3	2	3	2
1	Yanjin	Tuowan of Jinyan section	Line of Yisui		139	1	1		1	
2	Shuifu	Gaotan of Shuifu	Line of Yisui		76	1	1		1	
3	Qioajia	Yjiashan of Qiaojia	Line of Zhaoqiao		135	1		1		1
4	Zhenxiong	Yuankong of	Zhenfeng		200	1		1		1
5	Ludian				90.876	1	1		1	
(4)	Yuxi road management section				679.837	5	1	4	1	4
1	Xinping	Xinping	Line of Jingda		280.438	1		1		1
2	Yuanjiag	Yuanjiag	Line of Lanmo		158.783	1	1		1	
3	E'shan	E'shan	Line of Lanmo		108.023	1		1		1
4	Jiangchuan	Jiangchuan	Line of Jiangtong		71.307	1		1		1
5	Huaning	Huaning	Line of Kunfu		61.286	1		1		1
(5)	Wenshan road management section				688.6	4	1	3	3	1
1	Yanshan	Yanshan	YanwenSecondary roads (S207 Line of Yihe)		231.46	1		1	1	
2	Malipo	Malipo	S208 Line of Zhnachuan		93	1	1			1
3	Qiubei	Qiubei	S102 Line of Kunfu		112	1		1	1	
4	Fujing	Fujing	G323 Line of Ruilin		252.14	1		1	1	
(6)	Red river road management section				1271.609	6	3	3	2	4
1	Luxi	Luxi	Line of Zhanchuan	K	204.662	1	1			1
2	Jinping	Jinping	Line of Luanjin		283.227	1		1		1
3	Jianshui	Jianshui	Line of Jiping		177.252	1	1		1	
4	Shiping	Shiping	Line of G323	K	193.562	1	1		1	
5	Yuanyang	Yuanyang	Line of Mihe	K	268.48	1		1		1
6	Pingbian	Pingbian	Line of Xiuhe秀	K	144.426	1		1		1
(7)	Pu'er road management section				1139.219	5	5	0	4	1
1	Mojiang	Shuanglo	Lianzhu town, Mojiang County		260	1	1		1	
2	Jingdong	Hiuyao	Wenlong town, Jingdong County		114.2	1	1		1	
3	Zhenyuan	Liandi	Zheng town, Zhenyuan County		232	1	1		1	
4	Lancang	Zhutang	Zhutang town, Lanzagn County		352.019	1	1			1
5	Menglian	Mangjie	Line of Kunmeng		181	1	1		1	
(8)	Xishuanbanna road management section				486.625	1	0	1	0	1
3	Mengla	Nangong mountains	G213 Line of Xijing		486.625	1		1		1
(9)	Lincang road management section				641.23	4	1	3	0	4
1	Yunxian county	Changling slope of Yun county	Line of Xijing(G214)			1		1		1
2	Gengma	十公里化站	Line of Jingqing (S219)		303.748	1	1	0		1
3	Cangyuan	Kemu	Line of Gengyong(S231)		205.49	1		1		1
4	Zehnkang	扣闷59交	Line of Huangxiao(S236)		131.992	1	0	1		1

No	Name of the section	Name of centers	Line of road		Coverage	Number of centers			Ordinary road	B road
					短触里程	subtotal	Reconstruction	Construction		
	Subtotal				10537	63	37	26	27	35
(10)	Chuxiong road management section				554.482	5	5	0	2	3
1	Mouding	Changqing			115.82	1	1			1
2	Yongren	Yijiu station	Line of S217		72.336	1	1			1
3	Yuanmou	DAshui of Yuanmou road management	Line of G180		82	1	1			1
4	Wuding	Sahlang	Luping		124.062	1	1		1	
5	Shuangbo	Damaidi	Line of Yishuang		160.264	1	1		1	
(11)	Dali road management section				728.238	6	2	4	1	5
1	Xiangyun	Qinghua cave	Line of Ruiohu		160.94	1	1			1
2	Yongping	Huanglianpu akeluo	Line of Yangmei	K2+00	144	1		1	1	0
3	Bingchuan	Xinping	Line of Xiangbin		93.66	1	1		0	1
4	Geqing	Taoshu river	Line of Dali		72.1	1		1	0	1
5	Yunlong	Xinrong	Line of Lanyang		157.838	1		1	0	1
6	Midu	Qieli	Xianglin Road		99.7	1		1	0	1
(12)	Lijiang road management section				294.088	2	2	0	2	0
1	Huaping	Tianxing	S216		107.088	1	1		1	
2	Ninglang	Fengzi yan	S218		187	1	1		1	
(13)	Diqing road management section				269	1	1	0	1	0
1	Deqin	Zaka	G214 Line of Xijing		269	1	1		1	
(14)	Baoshan road management section				528.623	3	3	0	2	1
1	Longling	Longshanka	S235 Line of Baoban （Line of Qilong）		281.55	1	1		1	
3	Shidian	Shuichagn	S232Line of Yongbao (Line of Baoshi)	S	158.71	1	1			1
3	Longyang	Dongfeng	X192 Line of Baoteng		88.363	1	1		1	
(15)	Edhong road management section				328.115	3	1	2	0	3
1	Longchuan	Longchuan	X214 Line of Zhangcheng		111.814	1		1		1
2	Yingjiang	Yingjiang	X224 Line of Xinbing		115.32	1	1			1
3	Lianghe	Lianghe river 59	S234 Line of Baorui		100.981	1		1		1
(16)	Nu river road management section				378.395	3	1	2	2	1
1	Gongshan mountain	Niulangdang	S237 Line of Bingrui		33.686	1		1	1	
2	Fugong	Lumadeng	S237 Line of Bingrui		186.339	1	1		1	
4	Lanping	Yanjiao	S303 line of Hualan		158.37	1		1		1

List of the road management section

No.	Name of agency	Number（Plots）	Area （m^2）	**Note**
	subtotal	**225**	215173.7	
1	Kunming general road section	22	22221	
2	Qujing general road section	17	23078.7	
3	Dali general road section	24	11320	
4	Red rivr general road section	13	15560	
5	Pr'er general road section	20	11210	
6	Baoshan general road section	10	11600	
7	Xishuangbannan general road section	6	20189	
8	Dehong general road section	10	6780	
9	Nujiang river general road section	6	20391	
10	Zhaotong general road section general road section	12	14760	
11	Lincang general road section	20	20092	
12	Lijiang general road section	10	12175	
13	Diqng general road section	5	5700	
14	Yuxi general road section	18	8110	
15	Chuxiong	16	6870	
16	Wenshan general road section	16	5117	

List of pilot projects of road maintenance marketization

Technique	No. of line	Name of road section	Charged Agency	Distance of the road targeted （km）	Investment estimation （10 should Yuan）	Note
Basis cold reclaimed of bituminous pavement	G324	Yiliang~Shilin	Kunming general section	20	4000	Hot summer-warm winter-moist
	G326	Shilin~Mile	Red river generag section	20	4000	Hot summer-warm winter-humid
Synchronous Surface Dressing of modified asphalt	沾船线	Pingyuan street~Wenshan	Wenshan general section	40	600	Hot summer-warm winter-humid
	S228	Jinhchangling ~Liuku	Nujiang general section	40	600	Hot summer-warm winter-humid
Slurry surfacing of bituminous pavement	G320	Mangshi ~Ruili	Dehong general section	40	720	Hotter summer-warm winter-humid
	G214	Menghai~Jinghong	Bannna	40	720	Hotter
micro-surfacing of bituminous pavement	G213	Maliuwan~Zhaotong	Zhaotong general section	40	1160	Hot summer-cold winter-moist
	G214	Xianggelila~Songyuan bridge	Diqing general section	40	1360	Hot summer-cold winter-moist
Total				280	13160	

Appendix 2: List of natural reserve areas oin Yunnan Province（2013）

No.	Name	The city/county	Total area （ha）	Objects protected	Rank	Related Department
1	Yunnan Jiaozihshan national natural reserve	Dongchuan district、Luquan county	16456	Coniferous forest, humid evergreen broad-leaf forest on middle mountain and rare animals and plants	National	Forestry
2	Yunan huize heijinghe national natural reserve	Huize county	12910.64	black-necked crane and wetlands ecosystem	National	Environmental protection
3	Yunna ailaoshan national natural reserve	Chuxiong City, Xinping,Nanhua,Shuangbai,Jingdong,Zhenyuan County	67700	humid evergreen broad-leaf forest on middle mountainand wild animals and plnats such as gibbon	National	Forestry
4	Yunnan yuanjinag national natural reserve	Yuanjiang County	22300	The dry-hot valleys (DHV); shrub grass、subtropical animals and plants	National	Forestry
5	Heijingihe national natural reserve in Dabaoshan, Yunnan	Zhaoyang Strict, Zhaotong City	19200	rare bird such asblack-necked crane and its habitat	National	Forestry

6	Yunnan yaoshan national natural reserve	Qioajia County	20141	Alpine water-source forest and medicinal plant	National	Forestry
7	Yunnan Wulinagshan national natural reserve	Jingdong Xounty, Nanjian County, Dali City	30938.1	Subtropical evergreen broad-leaf forest, rare animals and plants and its habitat such as Black crested gibbon	National	Forestry
8	Yunnan yongde snow mountain national natural reserve	Yongde County	17541	Subtropical evergreen broad-leaf forest and wild animals and plants	National	Forestry
9	Yunnan nangunhe national natural reserve	Cangyuan County, Gengma County	50887	Elephas maximus、Bengal tiger and forest ecosystem	National	Forestry
10	Yunnan daweishan national natural reserve	Gejiu City, Pingbian, Hekou, Mengzi County	43992.6	Broad-leaved forest and rare animals	National	Forestry
11	Yunnan jinping watershed national natural reserve	Jinping County	42027	South Asian tropical montane mossy evergreen broad-leaved forest and rare animals and plants	National	Forestry
12	Yunan huanglianshan National	Lv chun County	65058	Subtropical evergreen broad-leaved forest, subtropical evergreen broad-leaved forest wildlife, wildlife	National	Forestry

13	Yunnan wenshan National	Wenshan and Xichou County	26867	Zhongshan south Asian tropical monsoon evergreen broad-leaved forest, subtropical karst mountane mossy evergreen broad-leaved forest and wildlife	National	Forestry
14	Xishuangbannan national natural reserve	Jinghong City, Menghai and Mengla County	241776	Tropical forest ecosystems and rare wild animals and plants	National	Forestry
15	Banna river basin national natural reserve	Jinghong City and Menghai County	26600	Tropical monsoon forest and wildlife	National	Environmental protection
16	Cangshanerhai national natural reserve	Dali City	79700	Fault lakes, and ancient glacial traces, zhon mountain fir, rhododendron forest	National	Environmental protection
17	Yunnan yunlong tianxhi national natural reserve	Yunlong County	6630	Yunnan pine forest, plateau lakes and rare animals	National	Forestry
18	Yunnnan gaoligong national natural reserve	Longyang strict, Tengchong, Lushui ,Fugong ,Gongshan	405200	Forest vegetation perpendicular band spectrum, rare animals and plants	National	Forestry
19	Yunnan baima snow mountain national natural reserve	Deqin and Weixi County	276400	Alpine coniferous forest, Yunnan golden monkeys	National	Forestry

20	rare fish the upper reaches of Yangtze River the of upper reaches of Yangtze	Zhenxiong and Weixin County	136.163	Paddlefish, sturgeon, mullet, giant salamander, otters, and so on	National	Agriculture
21	Yunnan Wumengshan national natural reserve	Yongshan ,Yilaing, Daguan and Yanjin County	26186.65	Forest ecosystem as well as the national key protection of rare and endangered plant and animal species resources and their habitats, natural moso bamboo forest	National	Forestry
22	Tongbiguan national natural reserve	Yingjiang and Longchuan County, Ruili City	51650.5	The indo-burmese monsoon forest and bridled gibbon	Provincial	Forestry
23	Meishu village natural reserve	Jinning County	58	The indo-burmese monsoon forest and bridled gibbon	Provincial	国土
24	Fuyuan shibalianshan natural reserve area	Fuyuan County	1213	Yunnan camellia wild tea germplasm base and community	Provincial	Forestry
25	Huizhe driving natural reserve area	Huize County	8282	China germplasm resources	Provincial	Forestry
26	Haifeng natural reserve area	Zhanyi County	26610	Karst landscape, forest and wildlife	Provincial	Forestry

27	Zhujiangyuan natural reserve area	Zhanyi and Xuanwei County	117934	River and forest ecological system	Provincial	Forestry
28	Chengjiang river maotianshan natural reserve area	Chengjaing County	1800	The Cambrian fossils	Provincial	国土
29	Beihai river wedland natural reserve area	Tengchong County	1629	wetlands ecosystem	Provincial	Forestry
30	Xiaoheishan natural reserve area	Longling and Longyang County	6293.4	Low tropical, subtropical moist zhongshan evergreen broad-leaved forest	Provincial	Forestry
31	Lashihai plateau wetland natural reserve area	Yulong County	6523	Plateau wetland ecological system, rare and endangered plants and animals	Provincial	Forestry
32	Yulong snow mountain natural reserve area	Yulong County	26000	Glacial traces, mountain forests, rare animals and plants	Provincial	Forestry
33	Ninglang gulu lanke natural reserve area	Ninglang County	8133	The plateau lakes, mountain forest and waterfowl	Provincial	Forestry

34	Sun river natural reserve area	Pu'er City	14892	Buffalo and other rare animals and forest ecosystem	Provincial	Forestry
35	Nuozhadu natural reserve area	Pu'er City	18997	Forest and wildlife	Provincial	Forestry
36	Mojing river spinulose natural reserve area	Mojiang County	6222	spinulose tree and its habitat	Provincial	Forestry
37	Weiyuan jiang natural reserve area	Jinggu County	7704	Simao pine forest and wild animals such as the slow loris	Provincial	Forestry
38	Menglianlong natural reserve area	Menglian County	54	Dracaena cambodiana and its habitat	Provincial	Forestry
39	Lincang lancangjiang natural reserve area	Fengqing,Linxinag, Yun, Shuang jiang, and Gengma County	89504	Forest vegetation, rare animals and plants	Provincial	Forestry
40	Nanpenghe natural reserve area	Zhenkang County	36970	Forest ecosystem	Provincial	Forestry

41	Zixishan natural reserve area	Chuxiong County	16000	Forest ecosystem, rare animals and plants	Provincial	Forestry
42	Diaolingshan natural reserve area	Lufeng County	613	Forest ecosystem, rare animals and plants	Provincial	Forestry
43	Baiyaoyuyan natural reserve area of Yanzidong, jianshui	Jianshui County	1601	White waist swifts breeding population and its habitat, karst cave landscape	Provincial	其他
44	Yuanyangguanyinshan natural reserve area	Yuanyang County	16187.1	Subtropical zhongshan mossy evergreen broad-leaved forest	Provincial	Forestry
45	Amushan natural reserve area	Red river County	14756	Forest and wildlife	Provincial	Forestry
46	Malipo Maguan Laojunhsan natural reserve area	M County alipo and Maguan	4509	Monsoon evergreen broad-leaved forest, mountane mossy evergreen broad-leaved forest	Provincial	Forestry
47	Malipo laoshan natural reserve area	Malipi County	20500	Monsoon evergreen broad-leaved forest, mountane mossy evergreen broad-leaved forest	Provincial	Forestry

48	Maguan golinqing natural reserve area	Maguan County	6832.6	Tropical monsoon forest, forest, limestone mountain forest and tropical wildlife	Provincial	Forestry
49	Qiubei puzhehei natural reserve area	Qiubei County	10746	Wild animals and plants, plateau lakes	Provincial	Forestry
50	Guannan eight treasure natural reserve area	Guangnan County	5232	Wild animals and plants, plateau lakes	Provincial	Forestry
51	Funing tuoniangjiang natural reserve area	Funing County	15725	The waters of the wetland and forest ecosystem in the karst mountainous region	Provincial	Forestry
52	Qinghua green peafowl natural reserve area	Weishan mountain County	1000	Green peacocks and other rare animals	Provincial	Forestry
53	Yongping jinguangsi natural reserve area	Xianggelila County	9584	Forest and wildlife	Provincial	Forestry
54	Jianhu kake wetland natural reserve area	Xianggelila County	4630.28	Wetland ecosystem and migratory birds	Provincial	Forestry

55	Lanping Yunling natural reserve area	Xianggelila County	75894	Cold-temperate virgin forest ecological and Yunnan golden monkey	Provincial	Forestry
56	Bitahai natural reserve area	Xianggelila County	14133	Alpine coniferous forest, the plateau lakes, and wild animals	Provincial	Forestry
57	Haba snow mountain natural reserve area	Xianggelila County	21908	Mountain forests and rare animals Yunnan golden monkey	Provincial	Forestry
58	Napahai natural reserve area	Xianggelila County	2400	The black-necked crane and other rare birds and their habitats	Provincial	Forestry
59	Xundian black-necked crane natural reserve area	Xunmian County	7217.3	The black-necked crane and its habitat	Provincial	Forestry
60	Shuanghe monande natural reserve area	Anning County	23503	Semi-humid evergreen broad-leaved forest and pine forest in Yunnan	City-level	Forestry
61	Jinshanjiang basin Aquatic animal reserve area	Qujing County	2500	Locally special fish	City-level	Agriculture

62	Zhujiang basin Aquatic animal reserve area	Qujing County	870	Locally special fish	City-level	Agriculture
63	Shizong Junzishan natural reserve area	Shizong County	3067	Cuckoo	City-level	Forestry
64	Wanfeng natural reserve area	Luopin County	58327	Forest vegetation and water conservation forests	City-level	Forestry
65	Red tower mountain natural reserve area	Yuxi City	5696	Forest vegetation and water conservation forests	City-level	Forestry
66	Yinmen longqu qpring natural reserve area	Yimen County	11367	water conservation forests	City-level	Forestry
67	Yubai ding tree farm natural reserve area	Eshan mountain County	6933	water conservation forests	City-level	Forestry
68	Bailao forset natural reserve area	Yanjin County	2200	clouded leopard and Chinese yew and forest vegetation	City-level	Forestry

69	Laolishan natural reserve area	Yanjin County	297.4	natural forest	City-level	Forestry
70	Wulain feng natural reserve area	Yongshan County	35420	Forest and taxus Yunnanensis and clouded leopard, black bears and other wild animals	City-level	Forestry
71	Twenty hills natural reserve area	Suijiang County	10989	Natural forest	City-level	Forestry
72	Yina natural reserve area	Zhenxiong County	685	Stocking and its habitat	City-level	Forestry
73	Yuanjiawan natural reserve area	Zhenxiong County	1634	Forests and rare wild animals and plants	City-level	Forestry
74	Great snow mountain natural reserve area	Weixin County	2153.3	Forest and dovetree, blue sheep, black bears and other rare animals and plants	City-level	Forestry
75	Yongluoba natural reserve area	Shu County ifu	2484	Forest and wildlife	City-level	Forestry

76	Chuxiong west mountain natural reserve area	Chuxiong County	3550.4	The forest resources and the natural landscape	City-level	Housing construction
77	Three peaks mountain natural reserve area	Chuxiong City	41415	Water-source forest and rare animals	City-level	Forestry
78	White bamboo mountain natural reserve area	Shuangbai County	8389.05	Forest ecosystems and rare animals	City-level	Forestry
79	Dinosaur river natural reserve area	Shuangbai County	10235	water conservation forest	City-level	Forestry
80	Huafoshan natural reserve area	Mouding County	667	Forest ecosystems and rare animals	City-level	Forestry
81	Mouding white horse mountain natural reserve area	Mouding County	15821.13	Forest ecosystems and rare animals	City-level	Forestry
82	Dajianshan mountain natural reserve area	Yao’an County	9085.1	Water-source forest and rare animals	City-level	Forestry

83	pepper farmland natural reserve area	Yao'an County	33193	Water-source forest and rare animals	City-level	Forestry
84	Tanhua mountain natural reserve area	Dayao County	1231.4	The forest and the natural scenery	City-level	Forestry
85	Fangshan mountian natural reserve area	Yongren County	667	The forest and the natural scenery	City-level	Forestry
86	Yuanmou soil forest natural reserve area	Uanmou County	1992	Forest soil geological relics	City-level	住建
87	Lion mountain natural reserve area	Wuding County	1360	The forest and the natural scenery	City-level	Forestry
88	Zhagnmujing natural reserve area	Lufeng County	3550	Forests and rare animals	City-level	Forestry
89	Nanxihe river aquatic wild natural reserve area	Hekou County	175	Aquatic wildlife	City-level	Agriculture

90	Lancangjiang –Meigong river basin Asian turtle and Gyrinocheilus	Xishuangbannan state	67	Asian giant softshell turtleand Gyrinocheilus aymonieri as their habitat	City-level	Agriculture
91	Xishuangbannan luosuo fish natural reserve area	Xishuangbannan state	720	Aquatic wild animals and their habitats	City-level	Agriculture
92	Bulong natural reserve area	Jinghong City	35333	Tropical wildlife resources	City-level	Forestry
93	Fengyang egret habitat banian natural reserve area	Dali City	67	Crane birds, the ancient banyan tree	City-level	其他
94	Butterfly spring natural reserve area	Dali City	500	The butterfly and the habitat	City-level	住建
95	Snow mountian water conservation forest	Yangti City	1000	Evergreen broad-leaved forest and wild walnut grove	City-level	Environmental protection
96	Shuimushan water conservation forest	Xiangyun County	1500	The camellia, forest vegetation	City-level	Forestry

97	Midu great black mountain natural reserve area	Midu County	14000	Forest vegetation and wildlife	City-level	Forestry
98	Midu tainshengying natural reserve area	Midu County	13000	Forests, wildlife, and historical and cultural sites	City-level	Forestry
99	Taiji ding natural reserve area	Midu County	2673	Water source conservation forests, needle broad-leaved forest	City-level	Forestry
100	Hejian dalongtan natural reserve area	Nanjian County	1073	water conservation forest	City-level	Forestry
101	Nnjiang Lantau peak migrant bird natural reserve area	Nanjiang County	2500	migratory birds and its habitat	City-level	Forestry
102	Nanjing soil forest natural reserve area	Nanjiang County	500	geological characteris	City-level	Forestry
103	Longqingchanel xiongguan natural reserve area	Weishan County	1080	Forest vegetation, migratory birds	City-level	Environmental protection

104	Weibaoshan mountain natural reserve area	Weishan County	2000	Forest and landscape resources	City-level	Environmental protection
105	Yongping bonanshan mountain natural reserve area	Yongping County	18000	Forest and fomous trees, cultural relics sites	City-level	Forestry
106	Yongping Yongguo temple natural reserve area	Yongping County	672	China, wild tea tree, lesser panda	City-level	Forestry
107	Er'yuan Cibi lake natural reserve area	Er'yuan County	800	Lakes and aquatic organisms	City-level	Environmental protection
108	Er'yuan west lake natural reserve area	Er'yuan County	700	wetlands ecosystem	City-level	Environmental protection
109	Haixihai natural reserve area	Er'yuan County	14000	Water resources conservation forests and wildlife	City-level	Environmental protection
110	Er'yuan black tiger mountain natural reserve area	Er'yuan County	9000	Forest vegetation and wildlife	City-level	Environmental protection

111	Luoping niaodiaoshan mountain natural reserve area	Er'yuan County	900	Migratory birds and the natural landscape	City-level	Environmental protection
112	Xiluoping natural reserve area	Er'yuan County	10000	Forest vegetation and wildlife	City-level	Environmental protection
113	Jianchuan shibaoshan mountain natural reserve area	Jianchuan County	2800	Original hardwood forest, landscape resources	City-level	其他
114	Heqing morning glow natural reserve area	Heqing County	800	Landscape and groundwater resources	City-level	Forestry
115	Heqing longhuashan mountain natural reserve area	Heqing County	2500	18 temple ruins and the original forest vegetation	City-level	Environmental protection
116	Heqing mutunhai wetland natural reserve area	Heqing County	400	Wetland ecosystem and wintering waterfowl	City-level	Environmental protection
117	Jiuxiang maitian river natural reserve area	Yiliang County	1867	Semi-humid evergreen broad-leaved forest	County-level	Forestry

118	Tangchi laoye mountain natural reserve area	Yiliang County	1333	Semi-humid evergreen broad-leaved forest	County-level	Forestry
119	Zhushan zongshanshen natural reserve area	Yiliang County	933	Semi-humid evergreen broad-leaved fores	County-level	Forestry
120	Cuifengshan county-level natural reserve area	Qilin Strict	1129	Semi-humid evergreen broad-leaved forest	County-level	Forestry
121	Qilin langmu mountain natural reserve area	Qilin Strict	900	Semi-humid evergreen broad-leaved fores and ancient building	County-level	Forestry
122	Liaoguo mountain natural reserve area	Qilin Strict	1450	Semi-humid evergreen broad-leaved fores	County-level	Forestry
123	Qilin wutai mountain natural reserve area	Qilin Strict	1190	forest landscape	County-level	Forestry
124	Qilin Qingfeng mountain natural reserve area	Qilin Strict	1110	Broad-leaved forest and ancient buildings	County-level	Forestry

125	Xiaoxianggu primeval forest ecosystem natural reserve area	Qilin Strict	2579	plant resources	County-level	Forestry
126	Huangcaoping water rource natural reserve area	Malong County	2950	the source of drinking water	County-level	Environmental protection
127	Color sand forset natural reserve area	Luliang County	5280	Colour landscape	County-level	其他
128	Cuiyun mountain natural reserve area	Shizong County	10.6	Semi-humid evergreen broad-leaved forest	County-level	Forestry
129	Shizon dadu reservoir natural reserve area	Shizong County	160	the source of drinking water	County-level	Forestry
130	Ding lei da qing natural reserve area	Shizong County	293	Wild animal and plant	County-level	Forestry
131	Shizon Dongfeng reservoir natural reserve area	Shizong County	4960	Forest and the source of drinking water	County-level	Forestry

132	Lubuge natural reserve area	Luoping County	7000	Wild animal and plant	County-level	Forestry
133	Huize luna Douglas fir natural reserve area natural reserve area	Huize County	1146	Douglas fir and its habitat	County-level	Forestry
134	Xiu mountain	Tonghai County	9269	Half wet evergreen broad-leaved forest	County-level	Forestry
135	Jiangchuan dalongtan natural reserve area	Jiangchuan County	6659	water conservation forest	County-level	Forestry
136	Chengjiang river liangwang mountain natural reserve area	Chengjiang County	2285	Wild flowers in Yunnan pine forest	County-level	Forestry
137	Dengloushan natural reserve area	Huaning County	6144	Wild animal and plants	County-level	Forestry
138	Yimen jiaojiadian dinosaur fossil natural reserve area	Yimen County	1000	dinosaur fossil	County-level	其他

139	Yinmen incense cedar natural reserve area	Yimen County	7800	The ancient cypress forest, Douglas fir forest and semi-humid evergreen broad-leaved forest	County-level	Forestry
140	inping moan mountain natural reserve area	Xinping County	7454	Zhongshan moist evergreen broad-leaved forest, Yunnan pine forest	County-level	Forestry
141	Xinping ailao mountain natural reserve area	Xinping County	9978	Zhongshan to wet moist evergreen broad-leaved forest, evergreen broad-leaved forest	County-level	Forestry
142	The volcano -- nature reserve area	Tengchong County	12990	Geothermal volcanoes and other natural landscape	County-level	环保
143	Changning tiantan mountain natural reserve area	Chagning County	6350	Forest ecosystems and wildlife	County-level	Forestry
144	Douglas fir, hemlock natural reserve area	Ludian County	8	Douglas fir, hemlock,	County-level	Forestry
145	Qiaojia mashu county-level natural reserve area	Qiaojia County	403	The black-necked crane and its winter wetland ecosystem	County-level	Forestry

146	Jinshanjiang suijiang special fish natural reserve area	Suijiang County	1024	Mullet, rock carp and other aquatic wildlife	County-level	Agriculture
147	Pu'er song ountain natural reserve area	Ning'er County	2700	Water-source forest and the animals and plants	County-level	Forestry
148	Mo natural reserve area jiang baka river	Mojiang County	3500	the source of drinking water	County-level	Environmental protection
149	Zhenyuanwan river source natural reserve area	Zhenhyuan County	5000	the source of drinking water	County-level	水利
150	Niuluo river natural reserve area	Jiangcheng County	4693	Forest ecosystems and wildlife	County-level	Forestry
151	Menglian south lei river Aquatic organisms natural reserve area	Menglian County	200	Aquatic wildlife	County-level	Agriculture
152	Fodian mountain natural reserve area	Ximeng County	1370	water conservation forest	County-level	Forestry

153	Mengsuo longtan natural reserve area	Ximeng County	4200	the source of drinking water	County-level	Other
154	Dedang houshan mountain natural reserve area	Yongde County	7331	subtropical evergreen broad-leaved forest	County-level	Forestry
155	Gejiu dong zongforest natural reserve area	Gejiu City	160	CaryotaurensLinn forest	County-level	Forestry
156	Haiyuan city nandong natural reserve area	Kaiyuan City	267	water conservation forest	County-level	Environmental protection
157	Jinghong tropical forset natural reserve area	Jinghong City	48543	Tropical forest	County-level	Forestry
158	Mengke river basin natural reserve area	Lianghe river County	3070	water conservation forest	County-level	Environmental protection
159	Cuiping mountain natural reserve area	Lanping County	8600	Forest ecological, natural scenery and historical sites	County-level	Environmental protection

160	Huize guniuzhai cuckoo natural reserve area	Guize County	3155.38	Natural rhododendron forest, alpine meadow and water conservation	County-level	Forestry
161	Jiming mountain natural reserve area of Daibu, Huize	Huize county	400	Natural Quercus spinosawater conservation	County-level	Forestry
162	Huize dajingyuan evergreen chinquapin natural reserve area	Huize county	352.04	Natural mangrove and water conservation	County-level	Forestry

Appendix 3: The list of forest park in Yunnan Province

No.	Name of the park	The city affiliated by
1	Jindian national forest park	Kunming City
2	Xiaobailong national forest park	Kunming City
3	Zhonglingshan national forest park	Kunming City
4	Qipanshan national forest park	Kunming City
5	Kuishan national forest park	Kunming City
6	Tianxing national forest park	Zhaotong v
7	Tongluoba national forest park	Zhaotong City
8	Wufengshan national forest park	Qujing City
9	Shibalianshan national forest park	Qujing City
10	Lubuge national forest park	Qujing City
11	Zhujiangyuan national forest park	Qujing City
12	Jinzhongshan national forest park in Huize	Qujing City
13	Zijinshan national forest park	Chuxiong City
14	Mopanshan national forest park	Yuxi City
15	Longquan national forest park	Yuxi City
16	Spring national forest park in Xinagbi	Yuxi City
17	Huayudong national forest park	Red river state
18	Taiyanghe national forest park	Pu'er City
19	Xishuangbanna national forest park	Xishuangbanna state
20	Dongshan national forest park	Dali state
21	Qinghuadong national forest park	Dali state
22	Weibaoshan national forest park	Dali state
23	Lingbaoshan national forest park	Dali state
24	Yunnan Baotiashan national forest park	Dali state
25	Laifengshan national forest park	Baoshan City
26	Zhangfeng national forest park	Dehong state
27	Xinshengqiao national forest park	Nujiang river state
28	Feilaisi national forest park	Dilin state
29	Wulaoshan national forest park	Lincang City
30	Lincang xiaodaohe provincial forest park	Lincang City
31	Dalangba provincial forest park in Lincang	Lincang City
32	Luohanshan provincial forest park	Wenshan state
33	Jiguanshan provincial forest park	Wenshan state
34	Wanting forest park	Dehong state
35	Nan'an provincial forest park	Chuxiong state
36	Wutaishan provincial forest park	Chuxiong state
37	Xiaoheijiang provincial forest park in Simao	Pu'er City
38	Watershed provincial forest park in Xuanwei	Quing City
39	Daweishan provincial forest park in Pingbian	Red river state
40	Jingpingshan provincial forest park in Mile	Red river state
41	Taibao provincial forest park in Baoshan	Baoshan City

Appendix 4: Main information of scenic area iin Yunnan Province

National scenic area，totall 12 spots:

1. The stone forest national scenic area in Lunan
2. Xishuangbanna national scenic area
3. three parallel rivers national scenic area
4. Tengchong geothermal volcanic national scenic area
5. Ruili river-Daying river national scenic area
6. Jianshui national scenic area
7. Puzhehei national scenic area
8. A'lu national scenic area
9. Jade Dragon Snow Mountain national scenic area
10. Dali national scenic area
11. Jiuxiang national scenic area
12. Dianchi river

Provincial scenic area totall 54 spots:

1. Shuangbai baihzushan scenic area
2. Huanglongtan scenic area in Heqing county
3. Taijishan scenic area in Midu
4. Qianjiazhai scenic area in Zhenyuan
5. Yangzonghai scenic area in Kunming
6. Xiaocaoba scenic area in Yiliang
7. Tuoniangjiang scenic area inFuning
8. Nandan Mountain scenic area in Shizong
9. Maguohe riverscenic area in Malong
10. Huanglian river scenic area in Daguan
11. Guanyin Mountain scenic area in Yuanyang
12. Yilonghu river scenic area in Shiping
13. Manhao scenic area in Gejiu
14. Nanxihe river scenic area in Hekou
15. Donshan Mountain scenic area in Xuanwei
16. Yilihe river scenic area in Huize
17. Tanhua Mountain scenic area in Dayao
18. Doushanguan scenic area in Yanjin
19. Laoshan Mountain scenic area in Malipo
20. Luoguqingfeng scenic area in Lanping
21. West lake scenic area in Ee'yan
22. Jianhu lake scenic area in Jinachuan
23. Nantinghe river scenic area in Gengma

24. Snow mountain scenic area in Yongde
25. Dachaoshan Mountain—Ganhaizi scenic area in Yunxian county
26. Washan Mountain scenic area in Cangyuan
27. Pu’er scenic area
28. Weiyuanjiang river scenic area in Jinggu
29. the Ancient Tea Horse Road scenic area in Simao
30. Colour sand forest scenic area
31. Foshan scenic area in Moudingshan Mountain
32. Snow mountain scenic area in Jiaozi
33. Snow mountain scenic area in Lincang
34. Bonan ancient path scenic area in Baoshan Mountain
35. Jingpingshan Mountain scenic area in E’shan Mountian
36. Jiulongchi scenic area in Yuxi
37. Man wan—Ailaoshan Mountian scenic area in Jingdong
38. Daheishan scenic area in Menlian
39. Shimenguan scenic area in Yangti
40. Daweishan Mountain scenic area in Pingbian
41. White dragon cave scenic area in Mile
42. Fangshan Mountain scenic area in Yongren
43. Lufeng scenic area
44. Yuanmou scenic area
45. Zixishan Mountain scenic area in Chuxiong
46. Yuxianhu lake scenic area in Yanshan Mountian
47. Duoyihe river——Lubu scenic area in Luoping
48. Weixin area
49. Lion Mountain area in Wuding
50. One star rivers area in Wuxian
51. Zhujiang river scenic area of Qujing
52. Eight eight treasures scenic area of Guangnan
53. Laojunshan Mountain scenic area
54. XiuShan mountain area ofTonghai

Appendix 5：Summary of the Project environmental Supervision and Management

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
During design				
1	Water & soil erosion	Design reasonable construction procedures, adopt scientific construction method; select appropriate materials and borrow pits to prevent soil from erosion;	Design institutes Assessment institutes	Yunnan Road Asset Management PMO, City/County/ District PMOs, Engineering supervision institute,
2	afforest	Design re-vegetation program for areas around the structures;		
3	Farmland protection	Made compensation to land to be acquired to comply with relevant stipulations. Compensation payment should be made to the households.		
4	Air pollution	Locate borrow pits and mixing stations 200m away from sensitive points		
5	slope protection	According to the project characteristic and slope protection requirement, select the reasonable mode of slope protection.		
During construction				
1	Land resources and surface vegetation	(1) Rationale optimization of the construction site layout to reduce the scope of construction activities and reduce the extents of site vegetation destruction; (2) Construction materials to be purchased outside, such as stone, sands, cement etc. should occupy land as less as possible to minimize vegetation destruction; when the works are completed, the site should be cleaned promptly and recovered with vegetation as much as possible. (3) Based on check result of field survey, remaining trees on the construction site that are not felled or transplanted before construction commencement should be protected by fence; (4) No additional signs should be added on trees except for its identification label; No parking or stockpiles should be sited nearby by protected trees; (5) Temporary drainage ditches should be installed at construction site and flood diversion should be provided at area where surface runoff are destroyed to direct storm water away, so to avoid surface runoff erosion to the site; (6)At the pre-conditions of construction quality insurance, contractor should keep its construction duration as shorter as possible, maintain stable slope of excavation and backfilling to minimize the scope of construction disturbance. (7)For construction camps, material quarry, borrow pits were stripped of topsoil stockpiling, green for post-rehabilitation complex with soil.	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management
2	Water & Soil Erosion	1. Concrete Processing Site (1)Sites should be tightened by cement (2)One sediment pond should be equipped in concrete mixing station, where surface water effluent from the site must be sediment before integrated utilization. (3)Land recovery should be conducted post construction stage, with main missions of dismantle of construction facilities, cleaning of gravels and sands, vegetation and recovery of sites and maintain original landscapes.	Constructors Contractors	

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
		2. Access roads Farmland are found on both sides of the access roads. For reduce land acquisition, digging of drainage ditches is only carried out on one side of the road, which will be connected to drainage ditches from dumping site and road foundation. prevent water and soil loss 3. Temporary dumping site (1) Selection of location for dumping site should be taken seriously. In case existing plantation or land use have been changed and bare lands emerged, vegetation and recovery should be adopted. (2) After dumping is completed, vegetation and backfill should be made timely together with other utilization options. (3) Slope protection works and dams to the dumping site should be decided base on factors of location, character and estimated height of the waste aggregates. The stockpile of waste aggregates should be equipped with dam. (4) Geographic and topographic conditions of the borrow bits should be taken into account while designing the drainaging system of the dumping site. Existing tunnels, ditches and irrigation system for the farmland should be incorporated in order to avoid water erosion and change of runoff pattern, which can consequent in soil erosion in farmland and slopes. In case conflux is found at the surrounding area of the dumping sites, interception and drainage measures can be adopted to divert water and prevent flood. After the completion of construction activities, the construction sites and borrow bits should be recovered with indigenous vegetation to avoid invasive species.		Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management
3	Surface Water Pollution	(1) Wastewater from vehicle washing, site cleansing, ilding materials cleansing, concrete curing, sands & stone washing should be collected, directed to a sedimentation trap after dilution. The volume of temporary sedimentation trap should be enough to keep 12 hours or more detention time. The treated effluent should be fully recycled for various cleansings at the site; (2)Temporary dry latrines can be established at construction sites to fit to the project regions' sanitation conditions. Fasces should be regularly clean out and used as farmland compost.; (3)Management on construction site should be strengthened to avoid any running, tripping, spillage; soil conservancy measures should be well taken at stockpile site to avoid impact of erosion from stockpiles on environment. (4)All contractors must really implement all wastewater treatment measures to ensure construction wastewater and domestic wastewater are properly treated and disposed of (5)Strengthened education to construction workers on environmental protection awareness to prevent them	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
		from littering and illegal discharging of wastewater.		
4	Construction Noise	(1) Quite and advanced equipments should be selected as much as possible; (2) Construction working hours is to be 6:00-22:00. At the mid day time from 12:00-14:00 for lunch break, construction should be suspended. Construction activity during nighttime would be restricted. If nighttime construction is really unavoidable, permit should be obtained and announcement should be made to peoples to be affected in advance. (3) Rationally arrange construction schedules to avoid operations of more noisy mechanical equipment at the same site and same time. Construction hours should be arranged tightly to minimize the impact of noise on construction workers. (4) Noisy equipment should be provided with vibration absorption their foundations or tied up with damping materials; (5) Noise from haulage vehicles may impact to environmental sensitive points. Therefore, contractors should improve its worker' environmental awareness, get to know folk-custom of local people, arrange appropriate haulage time. When passing through local residential quarters and environmental sensitive point, drives should reduce the driving speed and stop whistling to prevent and reduce noise impact. (6) The noisy equipments should be sited on the side rather far away from local residential quarters. Construction site that are no more than 5 m away from residential quarters or schools, the site should be installed with fence with noise proof function. (7) Contractor workers are recommended to be provided with ear muff, especially those workers nearby noisy equipments. (8) All equipments should be effectively maintained periodically to keep them in goon working conditions for the purpose of extended operation life and reduced noise. (9) Stricter management stipulations on construction intensity, number of equipment operators, equipment operation rules can be made, if necessary.	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management
5	Air Pollution	(1)Access roads are to be paved with simple gravel and be watered periodically to reduce fly dust; (2)Fine particulate materials are to be stored in closed containers or covered before stockpiling, and be watered if materials' property is tolerant to effectively restrain fly dust. (3)When passing through environmental sensitive point（region）, the channel construction activities should be fenced; (4)Transferring of spoils should be done in closed vehicles to prevent materials tossing; construction debris should be sorted and stored and transferred promptly according to regulation on municipal solid waste sorting.	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
		Before transferring, construction debris should be watered. (5)Management of haulage vehicle should be strengthened. Vehicles carry dusty materials should be covered with tarpaulins; (6)Demolition work areas are to be watered to control dust. Transferring of construction wastes should be completed 3 days before the completion of demolition works. Regulations on demolition works should be abide by. (7)The dusty working areas should be sheltered and be watered. (8)Earthworks from construction site should be stockpiled and covered. Haulage vehicles should not be overloaded to avoid materials tossing. (9)Vehicles cleansing facilities should be installed at site exits, All vehicles carrying dusty loads should be covered/watered over prior to leaving the site. (10)Storage site for construction material and large board should be flattened and tightened (11)Construction sites should be kept clean and promptly sprayed with water; (12)Consideration should be given to the predominant wind directions and environmental protection targets around the construction site when locating fine particulate materials stockpiles, which should be 300 m at leeward of the environmental protection targets. (13)Incinerating of wastes is prohibited (14)Fuel-powered equipments and vehicles must be operated under normal condition to ensure their emission comply with discharging standards.		
6	Construction safety and Health	Contractors should have responsibility to obey by national and local regulation and requirement on safety, to avoid accidental event, and to ensure their workers' safe and health (1) Integrity of all structures in the project sites should be ensured. The structure of temporary structures should be safe and reliable and be resistant to the strike of local atrocious weather ; And a proper light, can cut off part of the dust and noise; (2) Contractors should ensure the provision of up to the mustard first aids. Tools for first aids should be provided. Written procedures for dealing with emergency cased should be established for remote construction site so that the patients can be sent to the appropriate hospitals; (3) Training on occupational health and safety to the new construction workers should be provided to introduce to them the basic working rules, personnel protection rules, and ways to prevent themselves or others from being hurts; (4) Right signs should be placed at risk area (such as power supply room, compressor room and so on.) , equipments, materials, indicating safety measures, emergency exits;	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
		(5) Constriction equipment should be selected and installed with vibration absorption to prevent hands and arms of workers from strong vibration when they are using hands tools or electricity-powered tools or if they stand or sit on surface of vibrating equipment. (6) Equipments should be designed and installed to eliminate lock-up risk and ensure that equipment edges will not scoring people; (7) Warning signs should be placed on all electricity-powered equipment and cables. All electrical wires, cables, potable electrical tools should be examined to identify if there are any breakage or exposed wires/cables. Working voltage of equipment should be controlled within the allowable maximum voltage. Electric equipment operated under damp conditions should be subject to double insulations with earthing; (8) All workers participating or assisting welding operations should be provided with eye protection devices, such as welding goggles or face shield; (9) Install protective rails (with bars in between and baffles on sides) at the edges of fragile and risky area. In the mean time, construction workers should be equipped with falling prevention device; (10) Contractors should furnish their workers with personnel protective equipment. Sufficient protection should be made for workers themselves, other workers, visitors. Protective equipments should be easily accessible and usable with convenient; (11) Procedures and systems for recording and reporting occupational accident, diseases, risks should be established by contractors; (12) Construction workers should be trained on health, such as the carrying out communication strategy, strengthening face-to-face consultation. Individuals are encouraged to take personnel protection measures and use condom to avoid transmitting of disease to others; The use of mosquito repellents, mosquito net are highly recommended to prevent workers from by being bite.		
7	Hazardous waste and inflammables & explosive products	(1) Chemicals should be properly stored and labeled (2) Storage of dangerous goods should comply with the requirements stated in the certificate of storage, including category and data information. (3) During the mechanical equipment maintenance, oil, etc，with special container collection. (4) equip absorb the leakage of chemicals used in antifouling emergency kits / sand / saws grinding tools and materials.	Constructors Contractors	Yunnan Road Asset Management PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management
8	Others	(1) Compensation to the land acquisition should be made without interception and appropriation to ensure vital interests of people to be affected;	Constructors Contractors	Yunnan Road Asset Management

No	Management item	Mitigation Measure	Implementat-ion agency	Supervision agency
		(2) Physical examination on construction workers should be carries out periodically to prevent incidence of epidemic diseases; (3) If cultural relies are chance found, construction activities should be suspended immediately. The case should be reported to local cultural relic's authorities. No construction activities can be resumed until the completion of appraisal and protection actions taken by cultural relics authority; (4) Safety supervisor(s) should be designated at construction sites. Warning signs and indicative night light should be installed. Live stocks and non-construction related persons will not be allowed to enter into the construction site.		PMO, City/County /District PMOs, ES, External Monitoring Institute of Environment Management

Appendix 6: Environmental Site Inspection Checklists

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
1. **Air pollution control**				
1.1 Are the construction sites watered to minimize dust generated?				
1.2 Are stockpiles of dusty materials covered or watered?				
1.3 Are all vehicles carrying dusty loads covered/watered over prior to leaving the site?				
1.4 Are demolition work areas watered?				
1.5 Are construction spoils hauled in closed container?				
1.6 For construction environment sensitive (district) whether to use road block type gear				
1.7 Whether the construction site earthwork focus on stacking, covering measures				
1.8 Are vehicles cleaned before leaving the site?				
1.9 Are building materials and larger frameworks stockpiled tidy and stable?				
1.10 Are consideration be given to the predominant wind directions and environmental protection targets around the construction site when locating fine particulate materials stockpiles, which should be 300 m at leeward of the environmental protection targets?				
1.11 Are dusty road hardened, paved with grain of sand and watered?				
1.12 Are speed control Measures applied? (e.g. speed limit sign)				
1.13 Are fuel-powered equipments and vehicles operated under normal conditions? Is dark smoke found?				
1.14 Are there any incinerations?				
1.15 Others (please specify)				

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
……				
2. **Control over water contamination**				
2.1 Are wastewater treatment system being used and properly maintained on site? (e.g. desalting tank)				
2.2 Are construction wastewater treated and recycled effectively?				
2.3 Are there any wastewater discharged to the storm drains?				
2.4 Are measures provided to properly direct effluent to silt removal facilities? (e.g. provide earth bunds / U-channels)				
2.5 Are u-channels free of silt and sediment?				
2.6 Are sedimentation traps and tanks free of silt and sediment?				
2.7 Are vehicles and cleaned before leaving the site?				
2.8 Are washing facilities Well Maintained? And are there any measures to prevent sediment overflow?				
2.9 Is sand and silt settled out In washing bay and removed periodically?				
2.10 Is the public road/area around the site entrance and site hoarding kept clean and free of muddy water?				
2.11 Is domestic water properly treated?				
2.12 Are night soils from dry latrine removed promptly?				
2.13 Whether it is strictly prohibited in the water near the pile construction materials such as asphalt, oil, chemicals				
2.14 Whether choose the mutagen city of bridge construction, and try to shorten the construction time, to reduce the disturbance of the water				
2.15 Others (please specify)				
……				

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
3. **Noise Control**				
3.1 Is the CNP (Construction Noise Permit) valid for work during restricted hours?				
3.2 Are copies of the valid CNP posted at site entrance/exit?				
3.3 Is idle plant/equipment turned off or throttled down?				
3.4 Any noise mitigation measures adopted (e.g. use noise barrier/enclosure)?				
3.5 Are silenced equipments utilized?				
3.6 Is construction activities properly scheduled?				
3.7 For the equipments that generate big noise, are they located in the area that is far from residential quarter?				
3.8 Is regular maintenance and repair delivered to all equipments?				
3.9 Are stringent management rules applied to control strength, operational guidelines and process?				
3.10 Others (please specify)				
……				
4 Waste Management				
4.1 Is the site kept clean and tidy?				
4.2 Are construction debris comprehensively utilized together with ones from small civil works and road work to be constructed in parallel?				
4.3 Are surplus construction debris stockpiled in Designated site and promptly transferred to the town landfill for disposal promptly?				
4.4 Is mellow earth in the excavated earthworks separated and used for local forestation? Are remaining earthworks used for backfilling the foundation or road works or backfilled as earth cushion of the sides of channels?				
4.5 Are construction wastes				

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
watered before being transferred:				
4.6 Are domestic waste collected in garbage bins and transferred to town landfill site for disposal?				
4.7 Are there any incineration of hazardous waste?				
4.8 Is there any oil spillage? If yes, is the contaminated soil be cleaned up immediately?				
4.9 Has the waste asbestos been handled to registered staff for disposal?				
4.10 Others (please specify)				
5. Hazardous Waste and chemical waste				
5.1 whether chemicals are properly stored and labeled				
5.2 Storage of dangerous goods stored in the certificate if comply with the storage type, and data requirements				
5.3 During the mechanical equipment maintenance, whether oil be collect by special container collection				
5.4 If equipping to absorb the leakage of chemicals use in antifouling emergency kits / sand / saw mill and other tools and materials.				
5.5 Others (please specify)				
……				
6. Protection of Flora, Fauna and Historical Heritage				
6.1 Are disturbance to terrestrial flora minimized and plants preserved?				
6.2 Is rare species of fauna Identified?				
6.3 Are they any chance found relics? If yes, ensure appropriate measures taken to preserve it				
6.4 Others (please specify)				
7. Resource Conservation				
7.1 Is water pipe leakage and wastage prevented?				
7.2 Are diesel-powered plants and equipments shut off while not in use to reduce excessive				

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
use?				
7.3 Are energy efficiency practices adopted?				
7.4 Are metal or other alternatives used to minimize the use of timber?				
7.5 Are Material storage conditions in good condition to prevent material deterioration or waste?				
7.6 Others (please specify)				
……				
8. Water & Soil Conservation				
8.1 Is surface soil peeled off and protection measures taken post to construction of road foundation?				
8.2 Is water blocking dam and temporary ditch for torrent set up?				
8.3 Is sediment pond constructed to the effluent of drainage to road foundation?				
8.4 Is ground in concrete processing site tightened with cement?				
8.5 Is sediment pond equipped to every concrete processing station?				
8.6 Are temporary conservation measures taken (e.g. straw bags tamping, mats covering, watering)				
8.7 Is vegetation measure taken (plant the area with indigenous plants)				
8.8 Is bare slope, whether in a timely manner, and reduce the exposure duration of slope				
8.9 Others (please specify)				
……				
9. Emergency Preparedness and Response				
9.1 Are all structures in construction site kept integrity				
9.2 Is the site furnished with appropriated first aid tools?				
9.3 Are warning signs and details of safety measures placed on risky site, devices, materials, emergency exits ?				
9.4 Are construction workers				

Inspection Items	Implemented		N/A	Remark
	Yes	No		**Problem observed, possible cause of nonconformity, proposed corrective and preventative actions**
furnished with appropriate personnel protective tools by contractor ?				
9.5 Is reporting, recording system established by contractor for occupational accidents, incidence of daises and accidents?				
9.6 Are workers trained on health knowledge?				
9.7 Are accidents or emergencies reported, examined? Are there any correction and prevention measures proposed?				
9.8 Others (please specify)				
……				

Stage of checking the construction:_____Date：_____Time：_____
Record weather condition_____

Signature of Site Inspector：_____ Reviewed by Environmental Supervisor：_____

Note: ①Notes can be found to fill in view of what the problem is explained for substandard conditions, rectification, preventive action recommendations and other information.
②when on-site inspection measures found unqualified or the situation is in need of improvement,ES should immediately issue "A notice sheet for correction actions to betaken by contractors" and such issuance code number in the ***Remarks,*** *the details of corrective actions taken by contractor should be recorded separately. ③This table is Yunnan Road Asset Management Project construction site environments generic, checklist for specific subprojects and specific environmental issues, can be combined with local environmental conditions and construction contents make an appropriate adjustment to the table, take the appropriate environmental protection measures.*

Appendix 7: Environmental Supervisor's Notice Sheet for Correction Actions to be taken by Contractors

Name of Project：		Construction Site	
Contract Number and Location：		Status of Construction：	
Main issues inspected:			
Contractor's analysis on the root course of the issue and proposed correction measure：			
Comments from Local EBP (if necessary)：			
Issued by (name of ES)： date Deadline for correction： Days of complete Accepter： date			
Conclusion of re-inspection： Re-inspected by date			

Appendix 8: Checklist for post approval and acceptance of environmental measures

Name of project：		Daily weather conditions：	
Name of construction site：		Inspector：	
Current phase of construction		Contract No and Project Site	
Date of environmental supervision		Detailed timing	

Inspection Items	Implemented		N/A	Remark
	Yes	No		problem observed, possible cause of nonconformity and/or proposed corrective/preventative actions
1 Have the waste aggregates generated from construction site cleaned and transferred to landfill sites in each project town?				
2 Is protective measures taken to protect acoustic environment targets?				
3 Is the acoustic environment of surrounding sound Environment protection target meet the corresponding standards				
4 Have eco-recovery measures applied to the temporary borrow pits?				
5 As a pioneer road whether existing township road traffic is worse, traffic smoothly				
6 Whether has been removal hardened concrete mixing field				
7 Are land recovery, cultivation and vegetation measures taken on the temporary sediment ponds				
8 Is temporary tank and grit chamber removed?				
9 Are land recovery, cultivation and vegetation measures taken on settling basin and grit chamber				
10 Whether the peeled-off mellow soil is preserved and used for ecological recovery?				
11 Are cities and counties training?				
12 Is local public satisfied with the road engineering construction				

Instruction to filling-out the template: This is the inspection check list for general environmental protection .It is focused on the local environmental conditions and project content, as well as environmental measures associated. Adding of information or adjustment can be made when needed.
Any "No" recorded represents the potential breach of regulation or improvement needed. ES should immediately issue "A notice sheet for correction actions to betaken by contractors" and such issuance code number in the ***Remarks,*** *the details of corrective actions taken by contractor should be recorded separately.*

Signature of Site Inspector： Date：

Appendix 9: Regestration of forums

项目名称：利用世界银行贷款云南公路资产管理项目

会议名称：公众参与座谈会（德宏 瑞丽）

会议时间：2014 年 7月21日

会议地点：瑞丽公路管理段

会议签到表

序号	姓名	单位	联系方式
1.	张敬才	德宏公路管理总段	
2.	钱 俊	德宏公路管理总段	0692-2124734
3.	杨恩锦	瑞丽市住房和城乡建设局	0692-4142383
4.	岳帅涂石林	团结村委会	0692-4153824
5.	李剑	市环保局	0692-4143217
6.	和能文	市水利局	0692-4147779
7.	陈涛	市交通局	0692-4141309
8.	刘 旺	瑞丽公路管理段	13788268709
9.	曹翁美	瑞丽公路管理段	13887860019
10.	李艳萍	瑞丽公路管理段	13988281886
11.	和可尽	瑞丽公路管理段	15988261569
12.	依 团	团结村委会	13888252949
13.	李云	市国土资源局	13887860158
14.	施进军	公路局领导	15126000677
15.	李国华	环评单位代表（中瑞瑞德）	15110235936

项目名称：利用世界银行贷款云南公路资产管理项目

会议名称：公众参与座谈会 （怒江总段）

会议时间：2014 年 7 月 22日

会议地点：怒江公路管理总段

会议签到表

序号	姓名	单位	联系方式
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16.	[illegible]	13988688328 怒江发改委	
17.	张[illegible]	总指办公室、	13508866916
18.	付[illegible]	总指办公室	18608863228
19.	[illegible]	怒江州环保局	18308861209
20.	和国[illegible]	怒江州交通运输局	13988687790
21.	和金福	怒江州林业局	13988670831
22.	李国[illegible]	环评单位(中环瑞德)	15110235906
23.	施杰[illegible]	怒江州水务局	13988676009
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项目名称：利用世界银行贷款云南公路资产管理项目

会议名称：公众参与座谈会

会议时间：2014 年 7 月 03 日

会议地点：迪庆公路管理总段德钦段

会议签到表

序号	姓名	单位	联系方式
1.	朱杏英	环保局	13988763366
2.	[illegible]	省??局	13988724200
3.	何建明	迪庆总段	13988761986
4.	张布	群众代表	13988755665
5.	李国帅	环评单位代表（ZZD）	15110235906
6.	施汝华	公路局代表	15126000677
7.	张阿楼	德钦公路管理段	13988700098
8.	阿普	书格村委会	13888738001
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项目名称：利用世界银行贷款云南公路资产管理项目

会议名称：公众参与座谈会（昆明总段、宜良段、石林段）

会议时间：2014 年 7 月 25 日

会议地点：宜良公路管理段

会议签到表

序号	姓名	单位	联系方式
1.	[illegible]	昆明公路总段	13888368768
2.	[illegible]	九乡镇街居委会[illegible]村	15087477716
3.	罗[illegible]平	九乡镇街居委会[illegible]新村	13330466383
4.	王[illegible]	宜良住建局	13577119837
5.	李[illegible]	九乡风景名胜区	15887175668
6.	黄力	石林县[illegible]局	13888211822
7.	[illegible]	石林县小箐村	13099976996
8.	黄国才	石林公路管理段	13700660059
9.	谢汉杰	〃 〃	13888077127
10.	李国帅	环境评价单位（中环[illegible]）	15110235906
11.	施洪平	云南省公路局	15126000627
12.	徐和清	宜良公路管理段	13518799389
13.	许[illegible]	〃 〃	13888123999
14.	董[illegible]	〃 〃	13708483699
15.	李[illegible]	〃 〃	13708483778

16.	黄志勋	县林业保护局	13888602043
17.	刘丽仙	石林风景区服务及建设管理委员会	13608884867
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