Environmental Impacts Assessment Report on Project Construction

Project name: European Investment Bank Loan Hunan Camellia Oil Development Project

Construction entity (Seal): Foreign Fund Project Administration Office of Forestry Department of Hunan Province

Date of preparation: July 1st, 2012

Printed by State Environmental Protection Administration of China

Notes for Preparation of Environmental Impacts Assessment Report on Project Construction

An Environmental Impacts Assessment (EIA) Report shall be prepared by an entity qualified for conducting the work of environmental impacts assessment.

1. Project title shall refer to the name applied by the project at the time when it is established and approved, which shall in no case exceed 30 characters (and every two English semantic shall be deemed as one Chinese character)
2. Place of Construction shall refer to the detailed address of project location, and where a highway or railway is involved, names of start station and end station shall be provided.
3. Industry category shall be stated according to the Chinese national standards.
4. Total Investment Volume shall refer to the investment volume in total of the project.
5. Principal Targets for Environment Protection shall refer to centralized residential quarters, schools, hospitals, protected culture relics, scenery areas, water sources and ecological sensitive areas within certain radius of the project area, for which the objective, nature, size and distance from project boundary shall be set out as practical as possible.
6. Conclusion and suggestions shall include analysis results for clean production, up-to-standard discharge and total volume control of the project; a determination on effectiveness of pollution control measures; an explanation on environmental impacts by the project, and a clear-cut conclusion on feasibility of the construction project. In addition, other proposals on reducing environment impacts shall also be put forward.
7. Opinion for Preliminary Approval shall refer to replies from the competent authorities for industry category concerned, and where there is no such competent authority the opinion for Preliminary Approval may be left blank.
8. Opinion upon Approval shall refer replies from the competent authorities in charge of the project.

Environment Impacts Assessment Certification

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Project Name: European Investment Bank Loan Hunan Camellia Oil Development Project

Construction Entity: Foreign Fund Project Management Office of Forestry Department of Hunan Province

Assessment Entity: Hunan Provincial Academy of Environmental Protection Science (sealed)

Project Principal Person: DAI Qunying

Appraisers				
Name	Position	Certificated No.	Contributions	Signature
DAI Qunying	senior engineer	Registered EIA Appraiser Cert. No. A27020190700	Main report, Conclusion and suggestions	
TANG Bin	engineer	EIA Appraiser No.A27020079	General Information introduction, Environment status, protection measures and ecological thematic report	
LI Jin	engineer	EIA Appraiser No.A27020251600	Engineer Analysis and EIA	

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Project Basic Information

Project Name	European Investment Bank Loan Hunan Camellia oil Development Project				
Project Owner	Foreign Fund Project Management Office of Forestry Department of Hunan Province				
Legal Representative	LI Shuming		Contact Person	LI Shuming	
Mailing Address	Ziyuan Road 356#, Changsha, Hunan Province				
Telephone	13607484636	Fax		Post code	410000
Places of Construction	Totally 14 counties (cities) in Hunan Province, namely Liling City, Hengyang County, Hengshan County, Qidong County, Shaoyang County, Miluo City, Pingjiang County, Sangzhi County, Qiyang County, Ningyuan County, Xupu County, Zhongfang, Huayuan County and Baojing County.				
Authority for Project Establishment			Approval Code		
Nature of Construction	New project & Renovation / Expansion project		Industry Category /Code	Silviculture & Forest plantation A021	
Land area (m^2)	2.89×10^8		Afforestation Area (m^2)	2.89×10^8	
Total Investment Volume(10,000 RMB)	56000 RMB	In which, Investment on Environmental Protection	2095 RMB	Percentage of Investment on Environmental Protection in Total Investment	3.74%
EIA Cost	—	Anticipated Date of Operation	January 2018		

Project Content and Scale

1.1 Project Origin

Camellia oleifera, which is originated in China, is notable as an important source of edible oil (known as tea oil or camellia oil) obtained from its seeds. It is one of economic tree species that has competitive advantage and one of agricultural produces has great potential in the international market. In recent years, the State Council of China attached great importance to development of Camellia oil industry. They had issued a range of measures in 2007 and 2008. for example, The General Office of the State Council issued *Suggestion on promoting the development of oil production* (General Office of State Council [2007] 59), and *the State Council suggestion on promoting agriculture health development and protecting the security of supply of edible vegetable oil*

industry "(The General Office of the State Council [2008] No. 36), a proposal for giving a further boost to Camellia oil and others oil crops production. In January 2008, Premier Wen Jiabao specially made an important instruction on Camellia oil industry development, he said: "the State Forestry Administration should conjunct with the others departments to make out a scientific planning and elaborate corresponding measures on the basis of fully research. Vice Premier Hui Liangyu also instructed: "Please according Premier Wen Jiabao's instruction, make a scientific planning to promote the development of Camellia oil industry. Subsequently, the State Forestry Administration issued "State Forestry Administration's suggestion on the development of the Camellia oil industry", and elaborated the State Camellia industry Development Planning (2009~2020). In 2009 No. 1 Document of the CPC Central Committee and the State Council, *Numbers of opinion on steady promoting the development of agriculture and the continuance of increase farmer's income*, it pointed out "we shall in support of expanding economic crops production in its favorable areas, and implementing the State development planning as soon as possible, supporting appropriate regions Camellia oil develop in priority, and accelerate breeding the high-yield Camellia varieties. From June 22 to 23, 2009, on national forestry work session, it was emphasized that we should focus on developing walnut, chestnut and camellia woody oil industries. In No. 1 Document of Central government in 2010 saying "we shall boost edible oil production, speed up county level production bases construction of high quality rapeseed and peanut, and actively promote the development of camellia oleifera, walnut and other woody oil".

In order to realize the instructions of the leaders of the State Council, understood the essence of the document of State Forestry Administration, transfer Hunan's Camellia oleifera resources advantage into economic advantages, make Camellia oleifera industry to be a pillar industry with Hunan regional characteristics, Hunan Provincial Government issued *Suggestion on accelerating the development of Camellia oleifera industry*, a goal has been put forward, in Hunan, to 2015 the total Camellia oleifera area will reach 1.333 million hectare, include the production base 667,000 hectare, yield of camellia oil will reach 750 kg / ha.

International cooperation is one of effective approaches that broaden forestry financing channel, it provide an important platform for introduce of those advanced forestry concepts and technology. In recent 20 years, Hunan Province has implemented 8 international loans or grants projects in successive, namely World Bank loan national afforestation project, World Bank loan forest resources development and protection project, World Bank loan forestry development of poverty areas project, World Bank loan forestry sustainable development project, Sino-European cooperation natural forest management project, Sino-Germany financial cooperation Hunan Dongting Lake ecological afforestation project, Sino-Germany financial cooperation small farmers afforestation project in Hunan, Sino-Germany technical

cooperation in forest sustainable management policies and models of southern China. The total afforestation area in those international projects achieved 323,400 hectare, the total investment hit 1.065 billion RMB, in which 640 million RMB is foreign funded. During the implementation process of these foreign-funded projects, Hunan has accumulated rich project management and technical experience, besides this Hunan accumulated a lot of valuable research method and project promotion experience, which will contribute to the implementation of European Investment Bank loan Hunan Camellia development project. In May 2012, the Hunan Provincial Forestry Industry Survey Design and Research Institute completed the preparation of the feasibility study report of the European Investment Bank loan Hunan Camellia oleifera development project.

According to the *Environmental Impact Assessment Law* and *Ordinance on Administration for Environmental Protection of Construction Project*, all the construction projects in China should carry out the environmental impact assessment policy. Foreign Fund Project Administration Office of the Forestry Department of Hunan Province consigned project environmental impact assessment task to Hunan Academy of Environmental Sciences undertook the EIB loan project. They established a work team for the project, and finished this project environmental impact assessment report on the basis of data collection and site survey, according to regulations and technical specifications of the national and local environmental law.

1.2 Necessity of the project construction

(1)It is the needs of alleviate edible oil supply -demand contradiction

So far only Chinese camellia oil can fully suffice the health nutritional requirements in whole world, as one kinds of cookery oil, its quality even better than olive oil from Mediterranean. China tea oil is known for its excellent quality, as a popular goods selling well on international market. With the standards of people's living improvement, organic food tea oil will be more and more popular in thousands of households. Currently, Camellia plantation area has exceeded 3 million hectares in the whole country, annual camellia seeds yield is about 890,000 tons, Camellia oil output is about 250,000 tons a year. However, in recent years, in domestic self-sufficiency vegetable fats and oils demand exceed the supply. According to statistics data, in 2010, consumption of edible vegetable oil in China was about 24.75 million tons, olive oil consumption more than 600,000 tons, market demand for camellia oil is greater than olive oil, wherefore the gap between demand and supply was more than 350,000 tons, tea oil-based vegetable oil supply falls short of demand. Meanwhile, with flourish of the camellia oil intensive processing enterprises, Camellia oil resources demand become increase. We hope when the project completed within 25 years, oil tea seeds annual yield will be reach 51,200 tons, camellia seeds total yield will reach 1.281 million ton. Therefore, Camellia production base construction will to facilitate alleviating the edible oil supply and demand contraction.

(2) It is the needs of realize development planning of Hunan Camellia oleifera industry

Hunan Province is the core region of Camellia oleifera industry development in nationwide, according to the planning of the Hunan Provincial Government, in 2015, Hunan Province will realize establish high-yielding Camellia oleifera plantation 667,000 ha, with annual output 300,000 tons, annual revenue from Camellia oleifera will reach 15 billion RMB. According to deployment of the Forestry Department of Hunan Province, within five years, Hunan Province aims at build a tea oil "industrial belt" extend thousands miles. The main Camellia oleifera produce area are Changsha, Zhuzhou, Hengyang, Chenzhou, Yongzhou, Changde, Huaihua and Xiangxi, along both sides of BeiJing-Zhuhai, Changsha-Zhangjiajie,Xiangtan-Shaoyang(Hunan Section of Shanghai-Ruili), Hengyang-Zaomupu highways, the project new plantation of high-yielding Camellia oleifera and low-yielding stands improvement would extend thousand miles, radiation and driven 50 key Camellia produce counties. Thus construction of the project would promote the realization of the development planning of Hunan Camellia industry.

(3) It is the needs of realize Hunan strategic of transfer resource advantages into economic advantage

Hunan is one of the three main provinces of Camellia produce areas in China, Hunan is called “Camellia oil hometown”. Currently, Hunan existing Camellia forest area is 1,278,700 ha, accounting for 49% of the total area of the whole country, ranking first in China. Hunan Camellia lies in forefront of the country, but there are still some problems can not be ignored. First, Camellia industry still in small-scale. Since our country introduce household contract responsibility policy, most of the Camellia stands operated by individual household, they neither have willingness to input nor to application the fertilize, therefore, most of Camellia forest still in the natural growth state, mostly enterprises of tea oil are in small scale of production, they short of funds, their equipment very old, and they have limited capability to development. Secondly, both tea oil yield and profit of Camellia forest management still in low level, at present about 30% of camellia stands planted before the foundation of our country, it belongs to multiple generations of coppices, in addition, since long-term neglected resulting such camellia stands in a low output, and low efficiency, that seriously dampened the enthusiasm of farmer households. Thirdly, camellia oil stands in low scientific and technology. Currently, Hunan actually use breeding good quality seeds for plantation only accounts for about 10% of the total area of the camellia forest, deficiency of technology content in cultivation and processing, enterprises are in low competitiveness, camellia industry develop is slowly. Fourth, there are limited sources of investment. Finding solution of all these problems is where the space of camellia industry development. Like the project proposed to build camellia planting and a industrial development model, make full use of the camellia resources advantage of Hunan, through “company plus cooperative plus camellia produce base” model to accelerate conversion of agricultural resources.

(4) It is the needs of improvement the project target area ecological environment

Camellia trees root system is developed, healthy green foliage, it is an evergreen species, that can tolerate drought and barren, native to a wide area, we can take full advantage of richness land resources of project area, it's a good species both in economic and ecological benefits. Project construction can increase regional forest coverage, in addition, the project will have a positive effect on soil and water conservation, carbon fixation and oxygen release, improve rural region ecological landscape and people's living environment.

(5) It is an urgent needs of expand employment opportunities and increase farmers' income

From practical view, under the local government's guidance and support, Camellia industry development has been bring considerable economic income to local farmers in recent years. Camellia forest distributed throughout Hunan hilly region, it has become a "cornucopia" for farmers to get rich. Boosting Camellia industry is facilitate to industrial structure adjustment of the project area, at the same time it prompt the development of Camellia processing enterprises, improve their products added value and bring to comprehensive benefits, and stimulate local economic growth in the project area. Once the project start, it must need a lot of labor, thus the project can solve the problem of surplus local labor force and increase their income. Meanwhile, the idled woodland can also take part in the project through the form of a lease contract, it is also can generate considerable economic benefits for farmers, the project can boost domestic consumption, stimulate rural economy, speed up local farmers poverty alleviation, and promote local economic development.

1.3 Objectives of the project construction

Breeding excellent Camellia varieties, and operation of the new technology, establish 21861.3 ha Camellia production base, in the new business model, the project plan to support part of the Camellia cooperatives, exert the project radiation and leading role, to further promote the development of Hunan Camellia industry.

1.4 Project construction site

The European Investment Bank loan Hunan Camellia Oil Development Project construction sites are Liling City, Hengyang County, Hengshan County, Qidong County, Shaoyang County, Miluo City, Pingjiang County, Sangzhi County, Qiyang County, Ningyuan County, Xupu County, Zhongfang County, Huayuan County and Baojing County, totally 14 counties (cities).

1.5 Project construction content & scale

(1) Camellia oleifera production base construction

The project will construct Camellia oleifera production base of 21,861.3 ha, of which new plantation 6807.5 ha, tending young stands 10,900 ha, the low-yielding stands improvement 4,153.8ha, and the project will construct necessary ancillary facilities.

(2) Institutional support and technology improvement

①*Support farmers to establish camellia cooperatives*. During construction period, the project support to establish 28 Camellia cooperatives, provide basic office facilities to these cooperatives and elaborate the Camellia oleifera forest management planning and other technical services.

②*Scientific research, technology extension and service*. Relying on existing agencies of forestry technology promotion in the project target area, through integrate whole intellectual capacity of forestry science and technology within Hunan Province, such as Hunan Academy of Forestry, National Camellia Engineering & Technology Research Center, Hunan Province Forest Resources and Ecological Environment Monitoring Center, Central South University of Forestry Science and Technology, provide technical support for the project, focus on Camellia oleifera strain selection and breeding standards, Camellia oleifera seedling and nursery management, Camellia oleifera forest management, environmental protection, pest & disease control and pesticide safety application, the project will carry out provincial and county levels training, training those technical personnel. The project will conduct study on Camellia forest siviculture technology, carry out plant carbon density determination, and establish a demonstration forest with 280 ha use for technology promotion.

③*Monitoring and evaluation.* Hunan Province Forest Resources and Ecological Environment Monitoring Center will being as project technical supporting institute. Project relying on their professional technical team to carry out project management monitoring, stands quality monitoring, implementation performance monitoring, and the project progress, effectiveness and impacts evaluation.

④*Project management*. Establish one provincial project office (PMO) and 14 county-level project office (CPO).Equip necessary communication, office facilities with each level project management institutions.

⑤*Construction of The National Camellia Engineering & Technology Research Center*. National Camellia Center has been settled in Hunan Provincial Academy of Forestry, the project plan to equip the Hunan-based Camellia Center with a certain number of laboratory equipment, office equipment and Camellia field experimental equipment

(3) Ancillary works

①Working path

Aims to facilitate the operation of management activities on plantation, the project planning lay working path along the contour, working path with 0.8 to 1 m width, plain and no obstructions e.g stumps, rocks, road net density at average 75 meters per hectare, the entrance and exit of the working path should connected with tractor road. According to the actual situation of the project requirements and plots site condition, we totally planning working path 510.6 km.

②Protection sheds

In order to protect prophase plantation achievements, project plan to construct one 20 m^2 protection shed per 100 hectare, normally the shed locate

entrances or center position of the stands, according to project target area, totally 58 protection sheds need to be built.

1.6 Project construction period & schedule

Project construction period is 5 years, from 2014 to 2018. In 2013, we completed feasibility studies and project prophase preparation work; in 2014 we plan to establish Camellia oleifera plantation base 6810 ha, of which new plantation 2130 ha, young forest tending 3380 ha, low-yielding stands improvement 1300 ha; in 2015 , we plan to complete establish Camellia oleifera plantation 8232.3 ha, of which new plantation 2547.5ha, young forest tending 4131ha, low-yielding stands improvement 1553.8 ha; in 2016 we plan to complete establish Camellia oleifera plantation 6819 ha, of which new plantation 2130 ha, young forest tending 3389 ha, low-yielding stands improvement 1300 ha. In 2017 ~ 2018 conduct tending activity for plantation established in 2014 ~ 2016.

1.7 Project investment and funding

According to estimate, the project total investment volume is 560 million RMB, of which, European Investment Bank loan 35 million Euros, if the exchange rate of Euro:RMB is 1:8, thus European Investment Bank loan is 280 million RMB, the loan accounts for 50 % of project total investment; provincial counterpart financing is 56 million RMB, accounts for 10% of the total investment; county counterpart financing is also 56 million RMB, accounts for 10% of the total investment; project beneficiaries self-financing is 168 million RMB, accounts for 30% of the total investment.

1.8 Project main economic index

Project main economic index in Table 1.

Table 1 Project major economic & technology index

No.	Items	Unit	Amount	Remarks
1	Area of Camellia oil produce base	ha	21861.3	
1.1	Area of Camellia oil New plantation	ha	6807.5	
1.2	Area of Camellia oil young stands tending	ha	10900.0	
1.2	Area of Camellia oil low-yield stands improvement	ha	4153.8	
2	Yield	10,000 ton	90.49	Camellia seeds
3	Project total investment volume	10,000 RMB	56000.00	
3.1	Total investment for construction	10,000 RMB	49965.15	89.22%
3.2	Interest rate of construction period	10,000 RMB	3368.18	6.02%
3.3	Initial(start-up) working capital	10,000 RMB	2666.67	4.76%
4	Finance analysis index			

	4.1	Annual revenue	10,000 RMB	30785.32		
	4.2	Annual cost	10,000 RMB	18830.63		
	4.3	Annual total amount of profit	10,000 RMB	11954.69		
	4.4	Project financial internal rate of return, FIRR	%	13.4		
	4.5	Financial Net Present Value (Base Earnings Ratio 8%)	10,000 RMB	47543.36		
	4.6	Project Investment pay-back period	year	11.36		
	4.7	Return on Investment	%	21.35		
	5	Fund source		56000.		
	5.1	European Investment Bank Loan	10,000 RMB	28000.00	50%	
	5.2	Provincial Counterpart Financing	10,000 RMB	5600.00	10%	
	5.3	County Counterpart Financing	10,000 RMB	5600.00	10%	
	5.4	Beneficiaries self-financing	10,000 RMB	16800.00	30%	

2 Project construction scheme

2.1 project overall arrangement

2.1.1 Project target county(city) selection principle

(1)The target county/city shall have convenience transportation, target plots are relatively concentrated, which facilitate to management in scale.

(2)The target county/city shall have good site condition, high productivity, which facilitate to improve project operation efficiency.

(3)The target county/city shall have richness existing Camellia forest resources, the new Camellia plantation from 2008 to 2011 should reach in a certain scale, where there have existing key Camellia industry enterprise that can play leading and radiation role.

(4)The target county/city shall have a solid local people's base, whose have enthusiasm of management Camellia forest, and with some management experience and capacity, which facilitate to complete project activities.

(5)The target county/city shall be supported by local government, which can provide a good collaborative environment.

2.1.2 Project layout

According to the project area selection principles, we screened and pre-selected 105 townships (towns) and 338 villages of 14 counties (cities) in 8 prefectures, detailed information see Table 2.

Table 2 Project Areas Distribution Table

Name of county/city	Name of township	Name of village
Total	105	338 villages
1. Liling	7	11
1	Chuangwan	Xingqiao, Lejia
2	Bansha	Leiguqiao, Babuqiao, Xiapingqiao
3	Shentan	Xiaxing
4	Qingshuijiang	Yangmudang, Jincun
5	Juchu	Zhangqiao
6	Sunjiawan	Wenjiawan
7	Nanqiao	Hongyuan
2. Hengyang	14	44
8	Hongshi	Caiyuan, Mawei, Taiping, Yuya
9	Shishi	Dongtian, Xinyuan
10	Lanlong	Jiantang
11	Xidu	Qingzhu
12	Taiyuan	Aiguo, Guangxing, Huajiang, Jianse, Zhuantang
13	Zhajiang	Wende, Taiyuan, Zhonggong, Songshi, Tongxin, Hexing
14	Da'an	Huangtang, Sanyang, Shuisi, Fengping, Mayuan, Yutang, Datou
15	Zhangmu	Ren'ai, Liren, Shuangheng, Qili, Yongxing, Caotian, Gaocheng
16	Qulan	村 Quanyuan, Saiqiao
17	Jintou	Sishui, Huashu
18	Jinlan	Shamu
19	Chaojiang	He'ao, Yongle, Chaojiang
20	Shaqiao	Yishan
21	Jiepai	Xiangshan, Taogong
3. Hengshan	4 townships	16 villages
22	Xuanzhou	Tangpu, Yanjiang, Tianjia, Hetang, Tianshui, Yushi
23	Hejia	Qingping
24	Dianmen	Qianjin, Shengli, Chayuan, Shimen, Tian'e, Baini, Yuantian, Meiqiao
25	Kaiyun	Shanzhu
4. Qidong	10 townships	15 villages
26	Chenglianxu	Youzhaping, Longjiating
27	Guoshuiping	Longquan, Longquan
28	Fengshiyan	Tuiche, Shapu, Sitang
29	Huangtupu	Sanxing
30	Hezhou	Hehua
31	Shuangqiao	Niaotang
32	Jiangjiaqiao	Luzhi
33	Zhuantang	Ouyang

34	Taihetang	Baozi	
35	Baidishi	Hechong, Dongfanghong	
5. Shaoyang	7 townships	66 villages	
36	Caiqiao	Choushan, Shuikou, Lihua, Wulong, Kunlun, Guihua, Leshan, Chengtang, Fulin, Nanlin	
37	Jinchengshi	Fanjie, Shetian, Jinliang, Daxin, Jinyuan,Shimen, Beitang, Liufang, Qiufeng, Shichong, Jinchengshi, Doushi	
38	Lijiaping	Shuangjia, Yaojiapu, Shishan, Caijiatian, Yangliu, Duwen, Ditian, Caojia	
39	Wufengpu	Yanggu, Paiqiao, Macao, Yashan, Huangni, Guolu, Shuikou	
40	Baicang	Baiyun, Hejia, Hengchong, Xique, Yinfeng, Shuanghe, Wawu, Qianqiu, Dengba, Hexin, Xinhua	
41	Huangtingshi	Huangtingshi, Pingtang, Zhushan, Yousi, Matou, Butian, Minzhu, Lengshui, Nongke, Jinfeng	
42	Changle	Shibian, Paitou, Taqiao, Jiangdong, Leshan, Xingguang, Yujia	
6. Miluo	7 townships	21 villages	
43	Bajing	Gaohua, Datong	
44	Gaojiafang	Chuanshan, Xinhua	
45	Changle	Zhiyuan, Qingshi	
46	Sanjiang	Jinqiao, Fengxing, Luoma, Qixin, Guanzhong	
47	Taolinsi	Shuangfa, Tangfang, Qingshan, Datuo	
48	Baishui	Dengjia, Xichang	
49	Huangshi	Huatang, Shiyan, Ruiling, Huangshi	
7. Pingjiang	6 townships	7 villages	
50	Tongshi	Paihang	
51	Wushi	Baiyang	
52	Yuping	Shegnkeng, Wangsi	
53	Sanshi	Gaohe	
54	Wushi	BAiyang	
55	Anding	Zhenghuang	
8. Sangzhi	2 townships	4 villages	
56	Shataping	Pengjiawan, Shuijintai	
57	Kuzhuping	Jinguluojie, Nongkezhan	
9. Qiyang	14 townships	55 villages	
58	Dacundian	Wu'ai, Yanzhuqiao, Wutangchong, Yongfuping, Congshan, Xujiachong	
59	Qiliqiao	Wojinshi	
60	Wenmingpu	Qiaozitang, Gaomatou	
61	Lijiaping	Citangping, Yaocheng	
62	Huangnitang	Shilan	
63	Meixi	Xiehe, Zhonghe	

64	Maozhu	Sanfang, Tanping, Santang, Jiqin, Zhoutang, Xiangjia, Pipa	
65	Babao	Xingliao, Daping, Zhuantang, Tianling, Qingtang, Putang	
66	Dazhongqiao	Congshan, Yangjiaojin, Maopingfang	
67	Santangkou	Sitang, Yishan	
68	Babao	Longqiao, Putang, Tianling, Huotian, Xingliao, Daping, Zhuantang	
69	Gongjiaping	Xiangtangpu, Chagnchun, Hejialing, Dapingpu, Tiesijiang, Sanxing	
70	Baishui	Ganqiang, Xiaohu, Tangjia, Sanfeng, Jinshui, Zhujiaqiao, Wenwu, Hengtang, Yangqiao, Muzi, Lengshuipu	
71	Xiaojiacun	Boshu, Jinxing, Huming	
10. Ningyuan	6 townships	18 villages	
72	Taiping	Xinbaitu, Maopingtou, Laobaitu, Niushiping, Shangxialiu, Shenwang, Lijiaku, Lingtouyuan	
73	Shuishi	Shuijinwo, Yangjiashan	
74	Zhonghe	Chaziyuan	
75	Shunling	Jiaolongtang, Machitang, Changchun, Zhumushan	
76	BOjiaping	Wazhaping	
77	Lengshui	Baimei, Xiabi	
11. Xupu	11 townships	31 villages	
78	Tanjiawan	Wexing, Hejiachong	
79	Shuiyi	Huchangping, Yanchong, Tieshanxi, Putaoxi	
80	Simeng	Huangjiazhuang, Jiujiaxi, Shanhe, Xinzhuanglong	
81	Guanyinge	Jiangchiwan, Tiexie	
82	Lontan	Zijin, Ziping, Lianhe, Zhaoshan, Yanban, Jinniu, Jinchang, Jinyan	
83	Huangmaoyuan	Jingjiang, Aijia, Maowan, Dapu	
84	Tongmuxi	Shanmen	
85	Qiaojiang	Dutou	
86	Dizhuang	Xiaolongtan	
87	Taojinping	Huangmatian, Jinmajiang	
88	Longwangjiang	Biaodonglong,Shiqinlong	
12. Zhongfang	11 townships	28 villages	
89	Luting'ao	Luting'ao, Ganziyuan, Majiaxi	
90	Dingjia	Qingshu'ao	
91	Xiaping	Qiaoshang	
92	Tongmu	Banjie	
93	Zhongfang	Yantouyuan, Niaoxi, Fangxi	
94	Luyang	Yangliuping, Jinjiachong, Xindianping, Dadou	
95	Huaqiao	Huomatang, Sachongkou, Qianqiuetian, Dongzhushan, Tangjia, Paiye, Lijiapo, Cheping	
96	Niejiacun	Shuangshan, Niejiacun, Xikou, Baiyangping	
97	Tongwan	Sanjiatian	

98	Yuanjia	Guihua	
99	Pailou	Shuiniutian	
13. Huayuan	4 townships	18 villages	
100	Changle	Zeluoping, Daluoping, Nawuche	
101	Maoer	Dongli, Tuanjie	
102	Longtan	Jinrong, Caoping, Zhangpima, Daping, Bantang, Wangla, Longtan, Tudi, Limei, Atuo	
103	Tuanjie	Yongfeng, Xiawa, Madaozi	
14. Baojin	2 Townships	4 villages	
104	Datuo	Datuo, Fuku	
105	Shuitianhe	Paijia, Kongping	

2.2 Land resource requirement of the project construction

Because project target counties (cities) are rich in Camellia plantation resources, there are plenty of land area suitable for planting Camellia, since 2008, the practice of introduce improved Camellia oleifera varieties for plantation, so currently the young tea oil forest area reached in scale, it is able to meet the needs of the project forestland resource. Project target counties (cities) land resource conditions are shown in Table 3.

Table 3 Target counties/ cities land resources condition Unit: ha

County/City	Total land area	Woodland area	Existing Camellia forest area	Suitable for planting Camellia area	Young forest area(Improved varieties of Camellia planted in 2008)	Suitable for Stands Improvement Area
Liling City	215819.6	125857.1	46000.0	2803.6	3000.0	13500.0
Hengyang County	255861	134546.9	22400.0	15029.9	1500.0	18000.0
Hengshan County	93397.4	51711.7	8320.5	978.7	700.0	6000.0
Qidong County	187118	76451.6	4999.5	3595.2	1748.0	3369.8
Shaoyang County	200200.5	97497.4	31133.3	2297.3	3267.0	30000.0
Miluo City	153050	64174.8	7000.0	900.7	1800.0	1500.0
Pingjiang County	412518	289132.6	41870.0	15337.8	5400.0	20000.0
Sangzhi County	347183.3	256349.2	4866.7	1956.6	1942.5	4000.0
Qiyang County	199746	102714.1	31113.3	7628.6	3653.3	13973.3
Ningyuan County	251287	111696.3	19900.0	15771.4	3500.0	13120.0
Xupu County	344004	235429.1	23300.0	1965.2	1600.0	4300.0
Zhongfang County	141835.6	101572.2	21929.9	2061.1	2042.8	8806.2
Huayuan County	110870	68407.3	11000.0	1688.8	433.4	8000.0
Baojing	174587.6	129131.4	5153.0	31613.8	460.0	4500.0

County						
Total	2615797.4	1584267.7	278986.2	85795.2	31047	149069.3
Project Counstruction	-	-	-	6807.5	10900	4153.8

2.3 Project main technical measures

2.3.1 Camellia oleifera high-yielding silvicultural techniques

(1) Plantation sites selection

The plantation site should select from elevation below 500 meters, slope gradient below 25 °, soil layer thickness above than 60 cm, fertile soil, pH 4.5 to 6.5, red soil and yellow red soil of barren hills, wasteland, slash, holt, or production in decline period Camellia stands.According to forest intensive management requirements, we select conglomerate plots, good fertility and plots in open area in priority.

(2) Land clearing

After selection of suitable plantation plots, according to annual planning and working design, conduct ground clearance 3 months before the plantation, the activity mainly to clear the residual wood on the ground, shrubs, stumps etc. To facilitate sonner later the construction work operation.

(3) Site preparation

Site preparation will be carried out in 3 months before planting. According to the sub-compartment slope gredient, soil condition, vegetation situation, the hole reclamation method mainly adopted in land preparation.

Holes reclamation. Holes specification: length width and depth is 70 cm × 70 cm × 60 cm. 1 month before planting earth up, take topsoil filled the planting hole. In order to prevent soil erosion, it is needed excavation a level ditch every 4 to 5 rows along the contour, the ditch bottom width 30 cm, deepth 30 cm. Site preparation and ditch excavation mainly are artificial construction, topsoil of excavation could use for filling in-site, it won't produce residue soil.

(4) Application base fertilizer

Camellia afforestation should use Camellia oleifera special fertilizer (basal) 1650 kg/ha. Basal fertilizer volume should be based on the Camellia soil testing and fertilizer recommendation indicator. Allication base fertilizer when covering soil, the base fertilizer should be applied in the bottom of the hole and fully mixture with backfill soil, filling soil and until backfill soil settlement then planting the seedling.

(5) Use improved camellia varieties and high quality seedling

Calss I and class II qualified seedlings shall be use in Camellia afforestation, it is recommanded adpot container seedlings for afforestation. Camellia improved varieties is superior camellia clones and excellent pedigree which be registration or confirmation by national or provincial forest species committee. We strictly implement rules that tree seed production license, tree seed deal license, tree seed quality certification, plant quarantine certificate and tree seed tag. In short, it is "seedling / seed stock four certificates one tag" and quarantine system.

(6) Planting

①Planting density. Planting density is 1667 ／ha, the appropriate plant spacing is 2.0 × 3.0 m.

②Planting season. Camellia planting normally from late November to next

year early March.

③Silvicultural techniques. We use seedling planting. When doing planting, keep the seedlings straight, keep seedling root stretch, impacted soil, keep appropriate root depth, planted two-year old graft bare root seedlings on 3 centimeters (two fingers deep) original soil, tight compaction. Keep root system protected when excavating seedling, long-distance transport seedlings shall be covering slurry, avoid to direct sunlight and wind. Two-year old graft seedling used for afforestation of which should be properly trimmed part of the lateral branches and leaves. Afforestation activity should assorted different camellia varieties, selection more than five elite synchronous flowering and fruit camellia clones, planting by rows or small blocks.

(7) Young stands tending

Young forest tending activity is to consolidate the Camellia oleifera afforestation achievements,it is one of important measures that ensure Camellia seeds yield stable or high-yielding, for, Camellia oleifera young forest tending activity mainly include following steps:

①Enrichment planting. In the planting season, replanting same variety Class I or 2-year old big seedlings on gaps of the plantation, ensure camellia seedling survival rate more than 95%.

②Cultivating and weeding. Within 1 to 3 years after planting, every year carry on cultivation and weeding 2 times, respectively in late spring early summer and autumn. Earth up the seedling and maintenance trapeziform section. In the third year, carry on once time of thoroughly deep digging (20~25 centimeters depth). Reasonable intercropping is propositional.It is recommended that use plowing instead tending, Intercropping species mainly are leguminous crops such as peanuts, soy beans, horsebeans, peas etc. Never intercropping with stalk crops such as sorghum, corn and vine crops such as sweet potatoes, watermelon. Intercropping plant should keep distance of more than 50 cm from the tree stump. It is recommended intercroping green fertilizer plant, and conduct green manure burying.

③Top-dressing fertilization. From the second year, in spring (March) apply available fertilizer, such as special fertilizer for Camellia plant or urea. In winter (November) apply wintering fertilizer, such as special base fertilizer for Camellia plants, manure, bio-organic fertilizer and so on. Top-dressing fertilizer dose should be determined based on the growth potential of tea oil plant and soil testing fertilizer recommandation indicators. Usually we adpot ditch application method, 0.1 kg per plant once time.

(8) Prunning

After planting, headed trunk at 30 to 50 cm heading height, in the next four years, pruning every year, cultivate the main branch and side branches, forming a high yield tree shape. Remove disease branches, worm branches, adequacy prunning some foot branches, removal sprout in season after prunning.

2.3.2 Camellia oleifera young forest tending technique

(1) Site selection

It is recommended that selection stands from the site condition well, elevation below 500 meters, slope gradient below 25 °, soil layer thickness above than 60 cm Camellia forest, soil fertile, pH 4.5 to 6.5, comparatively, the forest form evenly, management in higher level, stands density above 1200 plants / ha, the seedling survival rate more than 85%, the seedling evenly distributed in the stands,the plantation eatablished in 2008 ~ 2011 which

planted seedling of improved Camellia varieties.

(2)Cultivating and weeding.

The first two years after planting, every year carry on cultivation and weeding 2 times, respectively in late spring early summer (preceding the end of May) and autumn(after September). Earth up the seedling and maintenance trapeziform section. In the third year, carry on once time of thoroughly deep hoeing (20~25 centimeters depth).In the fourth and fifth years, carry on once time of thoroughly shallow hoeing (15 centimeters depth). In the sixth year, carry on once time of thoroughly deep hoeing (20~25 centimeters depth).

(3) Intercropping

Through reasonable intercropping, young forest could realize the purpose of farming on mountains cultivate the mountains, integrate useage and cultivate, application plowing instead tending. Intercropping species mainly are soybean, peanut, rapeseed, green manure, herbs. Intercropping should settle planting ridge, either assure crop harvest, or ensure Camellia plant growth.

(4) Top-dressing fertilization

After planting, first two years, mainly apply nitrogen fertilizer to promote the of saplings nutritional growth. Fertilization volume is urea 50 g / plant. From the third year, plant beginning to bear fruit, apply urea 50 ~100 g, phosphorus and potassium fertilizer 100 ~150 g, as for adult tree, apply organic fertilizer 25 ~ 50 kg in winter, apply compound fertilizer 0.5 ~1 kg in spring and summer. Fertilization methods: basal fertilizer should be applied in ditch around the crown periphery. Top-dressing fertilizer should be applied into the shallow ditch around the crown.

(5)Saplings prunning.

When the saplings grow up to 1.2 meters height, removal the terminal bud, remains 4 to 5 strong main branches. The main branches on the trunk should leave a 10 to 15 cm intervals space and evenly distributed. If the main branches space between too far, we should remain the strong branches as deputy main branch, in order to take full advantage of growth space and expand the scope of fruiting. The saplings Prunning intensity on saplings should keep in low-grade not heavy prunning, through pruning and shaping, making the sapling canopy into a natural round shape and natural crown layer shape. November to next February is appropriate prunning time. Shoots sprout in Spring is the main source of fruiting branches, it should be preserved as much as possible when we put the prunning practice.Usually, Camellia flower buds concentrated at the top branches, adult tree should be sparsely prunning, give priority of low-intensity prunning, it would be inadvisable to stub cutting, mainly cutting deadwood, disease the worm branches, foot branches, overlapping branches, wasteshoots, inside thin branches.

(6) Enrichment planting.

Young forest of which seedling survival rate between 85 to 90% need replanting. Replanting should take big holes (70 cm × 70 cm × 60 cm), land preparation, use strong seedling for replanting. The hole should be applied sufficient base fertilizer (manure and decomposing phosphate). Early spring is appropriate season for replanting, when we practical planting activity, seedlings root should be extended, plants should be in straight, filling soil should be compacted.

2.3.3 Low-yielding camellia stands improvement technique

(1) Site selection

It is recommended that selection stands grow on red soil,its elevation below 500 meters, slope gradient below 25 °, soil layer thickness above than 60 cm Camellia forest, soil fertile, pH 4.5 to 6.5. We choose category I and category II low-yeilding camellia forest as the targets of stands improvement. Category I stands is the site condition preferably, forest form neatly, tree age in moderate,management level high, annual camellia oil yield above 5kg, Category II stands the site condition is ok,forest form irregular, majority plants in middle-age or stong age, the senior, weakness, sickness and inferior individuals account for about 1/3, the forest management level mediocre, annual camellia oil yield about 3~5kg/ mu,such stands experienced tending and fertilization management, annual camellia oil output of these stands can achieve more than 20kg/ ha.

(2) Management measures

Low-yielding Camellia stands improvement main measures are land clearing, density adjustment, prunning and reclaimation digging, water and soil conservation, rational fertilization, inferior individual transformation, enrichment planting totally 8 technical measures.

①*Land clearing*. Removal all the other trees, vines shrubs and weeds in the forest, transfer mixture forest into Camellia monoculture stands, and removal the disease, old and bad camellia plants.

②*Density adjustment*.For those too dense sites conduct thinning cutting, too thin sites conduct enrichment planting with improved camellis vatiety seedlings, adjustment the dense or sparse stands into moderate density Camellia forest, according to the site conditions, reserve 1200 plants per hectare.

③*Prunning*. Cut off the dead branches, worm branches, overlapping branches, parasitic branches, wasteshoots, inside weakness branches, foot branches, drooping branches facilitate to cultivate a nice tree structure.

④*Reclaimation and digging*. In the first year winter, it is need once time deep digging, the digging depth outside of canopy would more than 20 cm, the digging depth within the crown can slightly shallow. It is recommended adopt strip digging manner, digging one strip, leave one strip, rotation strip digging, the wholely digging would be finished in two years. Hereafter three years, every 3 years need once time deep digging, every year need once shallow digging.

⑤*Water and soil conservation*. Along the horizontal direction of mountain dig level ditches. The ditch with bottom width more than 30 cm, depth 30 cm, the length depending on site condition, normally 1 to 1.5 meters length. Interspace of ditches 8 m where there slope gradient less than 15 °, 6 m where there slope gradient above 15 °, jointly with the reclamation activity, annually clearing ditches once time. Areas where condition permits, jointly with the reclamation activity, built terrace along the contur year after year, to prevent soil erosion.

⑥*Rational fertilization*.According Camellia oleifera growth and fruiting status and different growth stages,on basis of camellia soil testing indicator and fertilizer recommendation scheme, apply fertilizer precisely. Give priority to Camellia specialty fertilizer and manure, it is recommended that green manure application on mountains, residual cakes of extract camellia oil back to mountains. Apply P fertilizer in the plenty seeds years, while apply nitrogen fertilizer or compound fertilizer in poor seeds years. In autumn and winter mainly application organic fertilizer, spring and summer mainly application N, P

compounded fertilizer. Combined with winter reclamation, application composting fermentation manure, in the first year the amount of Camellia special fertilizer is 120 kg per hectare. The amount of summer top-dressing N, P compound fertilizer 0.2 to 0.3 kg per plant. Fertilization method: combined with reclaimation, apply fertilizer into the ditches in the crown of the outer edge. It is recommended plant green fertilizer plants, and green manure burying.

⑦*Inferior plant transformation*. In better site conditions of young forest and middle age forest, we can use large tree crown transformpartially fruiting or less fruiting individuals into improved plants, consquently increas the stands overall yield.

2.4 Seedling design

2.4.1 Seedling demand amounts

If we calculate nursery stock demand on the basis of the project afforestation area, planting density, added seedlings loss coefficient 10%, European Investment Bank loans, Hunan Province Camellia development project demand a total of Camellia oleifera 15,952,500 seedlings.

2.4.2 Seedling varieties

Improved varieties and strong seedling are crucial to the success of the project afforestation, therefore, camellia varieties must be selected from which has been subject to appraisal or get national certification and growth well in the project area. The proposed varieties: Xianglin 1, Xianglin 70, Xianglin 78, Xianglin 104, Xianglin XLC15, XLJ14,.

2.4.3 Seedling supply

Camellia seedlings of the project unified supervised, by Seedling Station of Forestry Department of Hunan Province, seedlings which being used for the project plantation with must owned“four certificates and one tag”, in addition, class I seedlings rate should be more than 95%. Seedling supply adpot the bidding system, in the provincial wide, all the qulified seedlings supply entities can participate in the bidding.

Hunan Province Camellia nursery area is 160 hectare, annual nursery seedling yield is 135 million seedlings, Camellia seeding supply amount is about 80 million. Hunan Province has been established 26 scion nurseries, its area is 135 hectares, Camellia scions output is about 200 million/ year. Project target counties/cities seedling demand & supply amount see Table 4.

Table 4 Project target Counties/Cities seedling demand & supply amount Unit:10,000 seedlings

County/City	Seedling demand amount		Seedling supply amount
	New plantation	Young stand	
Total	1235.56	359.69	3320.00
Liling City	54.45	34.94	100.00
Hengyang County	54.45	34.94	200.00
Hengshan County	137.52	19.8	150.00
Qidong County	54.45	23.1	
Shaoyang County	90.75	29.7	200.00
Miluo City	54.45	26.4	300.00
Pingyang County	45.38	24.46	200.00
Sangzhi County	90.75	23.1	300.00
Qiyang County	145.2	33	120.00
Ningyuan County	90.75	33	800.00
Xupu County	163.35	33	200.00
Zhongfang County	90.75	29.7	350.00

Huayuan County	90.71	11.25	100.00
Baojing County	72.6	3.3	300.00

Seedling transporting should strictly conform to Forestry Department provincial seedling transportation regulations, strengthen supervision and administration, assign technical staff go to nursery base for in-situ supervise seedling digging, to measure up according to Camellia seedling quality standard, to guarantee seedlings quality.

2.5 Objective of Camellia production base construction and products quality target

We aimed at through scientific application of fertilizers and management, camellia new plantation and young forest tending area can achieve annual camellia oil output more than 30 kg/ha; through tending, fertilization management,the low-yielding camellia stands improvement area can achieve annual camellia oil output more than 20 kg / ha.We aimed at pressed products of camellia oil's quality target reach Grade 2, namely oil Colour yellow 35 max, red 3 max; it has camellia oil inherent smell and taste, no abnormal flavour, clear, transparent; none of solvent residue be detected; insoluble impurities 0.05 max; acid value 2.5; heating test (280 degrees) trace leachables and extractables, yellow value unchanged, red value increase 4.0 max, blue value increase 0.5 max.

2.6 Forest protection

2.6.1 Forest fire prevention

(1) Strengthen organization and guidance, establish a full-scale system of forest fire prevention

Forest fire prevention task is one of important tasks for camellia industrial base construction. We must value awareness of fire prevention, saying "hidden fire disaster dangerous than naked fire, prevention rather than rescue, great responsibility overweight than mountain". Eliminate the occurrence of forest fire. We recommend put project camellia base included in local forest fire prevention system, under the project target counties (cities) forest fire prevention headquarters guidance, take advantages of the local forest fire prevention facilities and equipment, unified deploy forest fire prevention tasks. Project target township principal will take role of primary person responsibile for forest fire prevention. Definited relevant personnel responsibilitie, obligation and right. Establish forest fire prevention organization jointly with surrounding communities, clear fire prevention area, the provisions of the joint fire prevention system and fire prevention measures.

(2) Strengthen forest protection and fire prevention publicize

Settlement permanent forest fire prevention signboard surrounding the base and along the main roads; make use of radio, television, and slogans strengthen publicize and education to residents of the surrounding community, disseminate knowledge of forest fire prevention, buildup awareness of fire prevention, inform project area all households, all the people known well about fire prevention, to guarantee protection achievements of the base construction.

(3) Planning of ranger staff

According to project feasibility study result, the project totally needed 220 rangers. It is required ranger patrol and check rigorously in the project area, in Forest Fire Prevention During the prohibitive period of forest fire, fire is prohibated in open areas. All the machines or wild fire possible cause forest

fire should be strictly supervised.

2.6.2 Forest Pest Management

As for pest control, we will carry out the guideline "give priority to prevention, scientific prevention and control according to the law, regulations and rules, improve forest health". According to the occur ency regularity of the pest law of forestry pest, establish the integrated pest prevention and control system.

(1)Do well in pest quarantine, prohibits cuttings, seeds, seedlings with pest transfer in or transfer out;

(2)Cleanse the environment, investigate the stands and surrounding area environment before the plantation, control the source of insect and pathogen, do the forest tending without delay, pay attention to stands health, improve the camellia itself resistance to pests , reduce the incidence of pests and diseases.

(3)Do well the pests forecasting, if occurring pests and diseases, use the low toxicity, high-effiency, short-period residues pesticide and carry out chemical control in time, reduce the damage to minimum.

Camellia pest control methods are shown in Table 5. The main pesticides toxicological characteristics are shown in Table 6

Table 5 the Camellia major pest control method table

	Pest & Disease	symptoms	Prevention and control methods
	Camellia anthrax disease	This disease damage camellia plants buds, leaves, shoots and stems, flower buds, flowers and fruits	① Betimes prevention and control Camellia anthra bacteria damage Camellia plants leaves and fruit Prevention weevil, Donacia provosti Fairmai dissemination anthrax bacteria. ② According to the characteristics of the diseas occurrence, regularly spraying PMA and Bordeau mixture (1% Bordeaux mixture 0.5% PMA) 3 to times. spraying once when newly shoot growth the spring (March to April), diseases medium ter (June) spray once, the disease incidence seriou period (July to August) ,added 1 to 2% of the te seed cake solution increase viscous spray onc every two weeks, the effect of better. ③ Removal the diseased plants pruning and remov disease foliage.
	Meliola camelliae (Gatt.)	Meliola camelliae (Gatt.) The black, circular coal spot in the disease incidence leaves and twigs, with the black spot expanding and increasing, formation of thick coal layer at the leaf surface, which seriously impeded leave photosynthesis, gradually the plants withered, the damage ranging from yield reduced to plant died.	① Intensify management, heavy pruning the Camell Forest has occurred disease, the cut branche should move out the forest and burned. ② Pay attention to control aphids and coccid, us 40% dimethoate emulsion 1800 times solution 50% dichlorvos EC 500 to 1000 times solution the turpentine mixture of 20 times spraying. Whe the disease occurred, use half lime amou Bordeaux mixture to prevention and control (ha lime amount is 500g copper sulfate, 250 g lim 50kg water mixture).

3	Agaricodochium camelliae Liu, Wei et Fan.	Agaricodochium camelliae Liu, Wei et Fan. The disease damage Camellia leaves and fruits, causing great leaves and fruits fallen, in dry season, branches withered, plants death.	①reclamation and deep digging in winter and spring, removal of diseased leaves and diseased fruits to reduce over- wintering bacteria. ②Before the occurrence of disease, do well the prevention work. Usually before in late May spraying mixture of Bordeaux 0.8% and 5% PMA or spraying twice 50% Thriam 400 to 600 times dilute solution (spray once every 10 days). If water source is inconvenient, application mixture 1:10 PMA and lime.
4	Camellia oleifera root rot disease	Camellia oleifera root rot disease mainly damage one-year old seedlings, bacteria first infection seedlings radicle near the ground, area of initially infected in brown, cling some white hairy, it extended rapidly upwards to soil surface. Infected seedling root roting, leaf wilting, fallen, plants died	① integrate prevention: pay attention to soil texture, drainage, etc. from nursery site selection; ② Chemical control: removal the diseased plants, application slaked lime mixed with soil coverage, or 50% Thriam, 50% carbendazim irrigate the plants roots.
5	Euproctis pseudoconspersa Strand.	Euproctis pseudoconspersa Strand. The larvae eat the leaves, if occurred excessively, young shoots, tender bark and tender fruits would be eaten. Serious harm when the leaves are eaten, plants damaged like being burned, if the disease for several years some plants would be death.	① killing insect pupae: utilize earth up obstructing roots, earth up 7 to 10 cm, compacted, make the pupaes hidden in soil can't be in eclosion, or burned pupae in litter layer on surface ground; (2) removal of over-wintering egg masses, commonly, egg masses attached on the leaf back, target obvious, over-wintering eggs existing up to five months, we can combined with trim in winter, removal egg masses, burned it. Soap leach larvae, or sliced soap or cottonseed oil soap, with a small amount of boiled dissolved, then immersed insect foliage in soapy water, then quick remove out, the insects killing rate up to 100%
6	Camellia geometrid	The larvae eat the leaves cause harmless to plants. When it rampant occurred, the old leaves and tender stems would be eaten, make tea oil tree only remaining branches, then gradually withered and died. The entire Camellia forest would be eaten, looks like be burned, reduced the production.	①Artificial capture the larvae, if Camellia geometrid larvae become 4-ages, then pesticide killing have poor efficiency. ② pestcide control: apply 3% trichlorfon powder, 75 to 90 kg/ha, 90% the trichlorfon crystal add water 1200 times, 750 kg /ha, effect of killing pest is 91.4 to 100%. Apply Tobacco leaf, kerosene, sulfur, lime, soap mixture into unrefined pesticide, against the 1-age ~ 3-age larvae, it effective.
7	Lepidoptera	Lepidoptera larvae damage leaves, Camellia leaves, the whole plant can be eaten, causing part of tea oil tree withered and died.	Its eggs agglomerate,we can be combined with winter digging and reclaimation, removal; adult insect has phototaxis,its eclosion peak in in mid-September, we can use light trapping larvae in third, group dwelling with DDT emulsion 250 times spraying; see when picked the larval and remove.

8	Para-metriotestheae Kusnetzov.	Para-metriotestheae Kusnetzov. In larvae early stage, it feeding the mesophyll, after over-winter, it damage spring shoots, infestation shoots enlargement, terminal bud dehydration and wilting, then withered, its impact Camellia fruiting.	① artificial cut off insects shoot, in hot summer dry season, insects shoot leaves turned yellow, shoot become thick and swollen or dead insects tip, insects shoot can be cut off and burned. (2) If the pest originated center of the forest, Apply pesticide to killing the over-wintering pests, appropriate time is March, Before the over-wintering larvae began to shift to eat shoots, use 500 to 1000 times dichlorvos emulsion or trichlorfon spray can kill larvae in the leaves, prevention effect more than 95%.

Table 6 Main application pesticides toxicological characteristics

Pesticides	Toxicological characteristics.
Phenyl mercuric acetate	Phenyl mercuric acetate.Melting point at 149 ℃, insoluble in water, slightly soluble in ethanol, benzene,easily soluble in acetic acid, acetone, stability well, it is belongs to high toxic poison with organic mercury and lipophilic. The rat acute oral LD50 is 35mg/kg, its mainly damage nervous system. Combustible if encounter flame, decomposed at high temperature and release toxic gas. Incursion pathway: inhalation, ingestion or percutaneous absorption. No matter what way incursion, it can arise stomatitis, oral intake can cause acute gastroenteritis; Neuro and psychiatric symptom include neurasthenia syndrome, mental disorders, coma, paralysis, tremors, ataxia, centrality vision narrow, etc.; it can cause kidneys and liver damage, occur jaundice, hepatomegaly, tenderness ache , liver function abnormalities.
Bordeaux mixture	Bordeaux mixture is a kind of protective fungicide. The active ingredients is alkali copper sulfate, which can effectively prevent spores germinate, preventing pathogen infection, and it can induce leaves become dark green, robust growth, improve tree resistance to disease. The preparation with broad spectrum bactericidal, long duration of effectiveness, the bacteria will not produce resistance, low toxicity for human and animals, but if human intake large quantities by oral, it can cause fatal gastroenteritis. The rat acute Path oral LD50 is 4g/kg.
Dimethoate	Dimethoate is a kind of systemic organic phosphorus insecticide, miticide, slightly soluble in water, soluble in most organic solvents, such as alcohol, ketone, ether, ester, benzene, toluene. Stable in aqueous solution, but in the case of lye is readily hydrolyzed methylthio isomer converted into heat, the case of fire, combustible high fever, thermal decomposition and release of phosphorus, sulfur oxides and other toxic gases. The medium toxic pesticides, rat acute oral LD50 320-380mg/kg
Dichlorvo	Dichlorvos. The scientific name of O, O-dimethyl-O-(2,2 -dichlorovinyl)-phosphate ester, a kind of the organic phosphorus insecticides, industrial products are colorless to light brown liquid, it can be dissolved in an

s	organic solvent, easily hydrolysis, if there are alkali it decompose more faster. Moderate toxicity for evolved animals, volatile and easily through respiratory tract or skin enter higher animals fresh, rats acute oral LD50 is 56 ~ 80mg/kg. Combustible in case of encounter flame, heating decomposition and emit phosphorus oxide and chloride toxic gases.
Thiram	Mixture of thiram, ziram, methylarsine, soluble in chloroform, carbon disulfide, slightly soluble in water. Unstable in alkaline solution, decomposition invalidation the case of encounter acid or moisture. Industrial production is white powder, fish odor, stable at normal temperature, no suction effect, but penetration well. It is a moderately toxic fungicide. The rat acute oral LD50 is 480 mg / kg, it has a stimulating effect on skin and mucous membranes.
Carbendazim	Carbendazim is a kind of tasteless powder, sublimation at 215 ~ 217 ℃, melting a 290 ℃,it decomposition at 306 ℃,insoluble in water, slightly soluble in acetone, chloroform and the other organic solvents. It can be dissolved in mineral acid and acetic acid, formation homologous salt, chemically stable. It is belong to high efficiency and low toxicity fungicide, absorption therapeutic and protection effect, low toxicity for human and animals.

2.7 Ancillary works

2.7.1 Working path

Aims to facilitate the operation of management activities on plantation, the project planning settle working path along the contour, working path with 0.8 to 1 m width, plain and no obstructions e.g stumps, rocks, road net density at average 75 meters per hectare, the entrance and exit of the working path should connected with tractor road. According to the actual situation of the project requirements and plots site condition, we totally planning working path 510.6 km. working path construction will take artificial construction, and make full use of existing walking path, the of Earthwork excavation amount very small, excavation earth can basically be used as backfilling,therefore,non-remaining residual soil generate.

2.7.2 Protection shelter

In order to protect prophase plantation achievements, in this planning, construct a protection shed of 20 m^2 every 100 hectares, generally shelters location plantation entrances or center position, according to the project target area, project need build 69 protection shelters.

2.8 Project technical support system

2.8.1 Research in the project

The project plan to carry out research on Camellia forest siviculture and production technology, Camellia seedling nursery, cultivation experiment and carbon density mensuration.

（1）Camellia forest siviculture technology: combined with EIB project, carry out the Camellia seedling and cultivation experiment;

（2）Camellia carbon density mensuration: measurement of Camellia forest carbon density.

2.8.2 Project technology promotion and service system

At present, Hunan has completed 137 forestry science and technology promotion agencies above the county level, including one provincial agency, 14 of which is prefecture-level/city-level, 122 of which is county-level, 1,922 of which is township level. The project target counties forestry bureau all set up sub-agencies such as resource sub-section, silvicultural sub-section, technology promotion sub-section, or set up camellia and forestry workstation, Forestry Science and Technology Extension Station, and every town has a forestry workstation. Meanwhile, the National Camellia Engineering Technology Research Center located in Hunan Provincial Academy of Forestry Sciences. Existing forestry science and technology extension system and technical strength can provide service to Camellia industry. In addition, we have possessed certain technology fundation.

For comprehensive and effective implementation of the training and promotion programs, we plan to carry out technical courses, trainning for project key technical points, scientific research results, and advanced technology, and take measures to promote absorption and utilization of new technology.

（1）Trainning requirements

According to the characteristics of the European Investment Bank loan Hunan Province Camellia development project, during the process of definition this project technical training contents, it is necessary to consider the requirements of the project implementation, but also to consider following three points:

① Especially learn training experience and lessons of foreign investment projects which had been implemented;

② Via survey on farmers in social and economic evaluation, understood farmer households demand for technical training;

③ PPO, CPO, Township forestry station, Camellia cooperatives,Plantation entity requirements for technical training.

（2）Trainning contents

Technical training contents focus on the project technical standards and operating procedures, as well as focus on advanced and practical technology training. Including following contents:

①Project management training. Keystone is project implementation management and quality control, project capital and financial management, project procurement management.

② Camellia varieties selection and production. Focus on European Investment Bank loans Hunan Province Camellia Development Project technical standards and regulations, and technical standards and procedures in "Camellia varieties selection and breeding standards", "seedling technology and nursery management".

③Camellia forest siviculture technique training. Silviculture techniques in regulations and environmental regulations of European Investment Bank loan Hunan Province Camellia Development Project, the project focus on Camellia forest management, environmental protection, pest and disease control and the safe usage of pesticides.

（3）Training actualization

As for the project crux siviculture techniques, the achievements promotion and knowledge of the project management, we mainly taken the form of

training courses, intensive training respectively on technical and management personnel, aims to improve trainee's scientific ideas and technical level.

Training courses orderly organized by provincial training and county-level training and beneficiary level training three levels training:

Provincial training: organized by PPO, the trainees are CPO's management and technical staff, teach them how to training technicians from township forestry station, afforestation the entities, Camellia cooperatives.

①Project management training, the contents including the project implementation management and quality control, project funding and financial management, and project procurement.

② Camellia varieties selection and breeding standards, including technical standards and procedures in "Camellia varieties selection and breeding standards", "seedling technology and nursery management".

③ Camellia oleifera plantation technical training includes "the Camellia Forest Management", "environmental protection, pest control and pesticide safety usage".

County level training: the training is organized by CPO, the trainers are technical staff from township forestry station, afforestation entities, Camellia cooperatives, let the trainee learn how training forest farmers, afforestation entities construction worker, Camellia cooperatives member, ensure they can implement the project in accordance with the relevant requirements.

①Camellia varieties selection and breeding standards, including technical standards and procedures in "Camellia varieties selection and breeding standards", "seedling technology and nursery management".

②Camellia oleifera forest technique training, including Camellia forest management "and" environmental protection, pest control and pesticide safty usage ".

Beneficiary level trainning: the training is organized by CPO, the trainees are forest farmers, plantation entities construction workers, forestry cooperative members, ensure they can implement the project in accordance with the relevant requirements.

Plantation technique training contents including "the Camellia Forest Management", "environmental protection, pest control and pesticide safty usage, as well as on-site training.

2.8.3 Construction of Camellia experimental field

In order to carry on thetechnology research, the project plan to construction a camellia experimental field in National Camellia engineering technology research center. Through technology research, demonstration and extension to drive the project construction overall in high quality.

The National Camellia Engineering Research Center, the Hunan provincial Academy of Forestry will assign experts to management and observation the camellia experimental field.

2.8.4 Construction Technology Extension and Demonstration Forest

In order to play the role of technology demonstration and promotion, it is need to establish a 20 ha demonstration plot at the county level in each project county (city). In project area totally need construct high starting point, high standard, high-quality technology demonstration forest 280.0 hectares. In the demonstration plot, we plan to build sidewalk, signboards, preparation of leaflets, regular observations. Through technical radiation and demonstration, promote the project construction overall in high quality.

2.9 Project monitoring system

2.9.1 Project Monitoring

(1) Management monitoring

①Construction progress monitoring

Including monitoring construction activities of afforestation, cultivation, tending, enrichment planting, working path, management and protection shed, fire protection belt.

②Procurement monitoring

Including the monitoring the procurement schedule, procurement procedures and monitoring.

③Training and technology promotion

Including the monitoring of the project training, training materials preparation.

④Finance management

Including monitoring the completion rate of the EIB loans, counterpart funding realized rate, withdrawal and reimbursement eligibility rate.

(2) Stands quality monitoring

Including the monitoring of the survival rate of afforestation, the area of verification rate, grade I seedlings utilization rates, environmental protection measures qulified rate.

(3) Project implementation performance monitoring

①Ecological environment impacts monitoring

Water and soil conservation monitoring: monitoring rainfall, soil erosion, surface runoff, etc., focus on monitoring different afforestation models impact on water and fertilizer conservation.

Camellia forest carbon sink monitoring: carry out the measurement and monitoring of carbon sinks in the 14 project target counties (cities). Monitoring differences of increased total biomass, biomass conversion rate, the annual carbon dioxide fixed amount and other indicators among the projects.

Pest hazards monitoring: monitoring the types of pests and diseases, incidence and degree of damage and prevention times.

Due to higher requirements of site and equipment the ecological environment impacts monitoring, as for the project ecological environment impacts monitoring, we plan to selection sub-regional or selection representational sites carry on long-term continuous monitoring. It is proposed in south Hunan region, including Shaoyang County, Qidong County, Qiyang County, Hengyang County, Hengshan County, set up 2 monitoring sites in Ningyuan County, mainly use for monitoring of water and fertilizer conservation and pest control; in northwestern Hunan region, including Huayuan County, Baojing County, Sangzhi County, Zhongfang County, Xupu County set up two monitoring sites, use for monitoring water and fertilizer conservation. Carriey on Camellia carbon sinks effective monitoring in all of project area.

②Social impacts monitoring

As for social impacts monitoring, we use random sampling mentod, a conventional statistic survey method adopt by national statistical department.we selected 30 to 50 households in or out of project area as the interviewee, compare the difference of farmer households income between regions with and without projects. Investigation to take a unified way, direct investigation of county PMO or forestry station staff regularly survey commissioned by the township (town). Provincial Project Office at any time to

verify the results of the investigation.

Employment opportunities supported by the project: monitoring includes rural surplus labor force employment situation and women's employment situation.

Monitoring training for the project participants, such as county technicians, township technicians, farmers, women, ethnic minorities.

Monitoring forestry specialty cooperative capability building, including amount of project new established and improved rural specialty cooperatives, development planning prepared by these cooperatives, cooperatives capacity building.

2.9.2 Project Evaluation

Project evaluation is a key stage in the project cycle stage assessed on the basis of the monitoring of the implementation of the project, the efficiency, the effectiveness and impact, both objectively assess the degree of achievement of project objectives based on the project objectives, and its impact.

(1) Type of project evaluation

Mid-term evaluation. 2 to 3 years after the implementation of the project, according to the project implementation and monitoring results evaluation. According to the results of the evaluation, adjustment project objective and project construction program again, so that the project objectives and construction programs more feasible. The mid-term evaluation is the basis for the adjustment of the mid-term project.

Complete evaluation. Completion evaluation will be carried out when project investment be over, it is a review of the whole process of the project. Including project implementation situation, arrangement of organization - institution - management whether or not appropriate; the assumption of the financial and economic analysis whether realistic; projects ecological impact and social impact; project successful practice and inadequacies.

Post evaluation. Project post evaluation also name project impact assessment, generally it is carry out in 5 to 10 years after the end of the project (namely project fully play a benefit period), Post evaluation will be organized by the European Investment Bank when the project completed.

In this report we plan to adopt mid-term evaluation and completion evaluation.

(2) Evaluation content

① Project organize and management evaluation

Evaluate the progress of the project construction, funds management, training and technology promotion, procurement, organization and management system, various rules and regulations and rural community self-management capacity.

② Project construction quality evaluation

Evaluation of project afforestation survival rate, young forest siviculture qualified ratio, tending qualified ratio, verification area ratio.

③ Implementation performance evaluation

A. Ecological impacts evaluation

Forest coverage increase indicators: It is an indicator of evaluation project area forest coverage increase percentage.

Water and fertilizer conservation indicators: include increase of soil water retention, surface runoff, reduction of erosion modulus, loss of soil nutrient,

runoff coefficient, etc.

Camellia plantation carbon sink increase indicators: evaluation project area total biomass increase amount, biomass conversion rate, carbon dioxide fixation amount etc.

B. Social impact evaluation

Employment improvement: evaluation surplus labor employment situation in rural, women's employment situation, labor force labor popularization rate.

Farmers' technical level improvement: evaluation farmers from project area through project planning, management decision, all kinds of technical training and information exchange and other activities, whom get more scientific and technological knowledge and the extent of understand these knowledge.

Farmers understand about the project: farmers understand about the implementation of the projects, the improvement of the ecological environment, and farmers get satisfaction from current living conditions.

(3)Arrangements of monitoring and evaluating implementation

Provincial Project Office make their responsible for organizing the project monitoring center to carry out monitoring and evaluation task, equipped each monitoring point with necessary facilities and tools, ensuring monitoring activities timely and going smoothly.

At the end of each monitoring, PPO would organize summary of monitoring results, data analysis and reporting, respectively summary monitoring and evaluation results, submit report of project implementation progress monitoring within one year to European Investment Bank.

Project Monitoring Center is plan to set up in Hunan Province Forest Resources and Ecological Environment Monitoring Center. This agency will carry out monitoring in accordance with monitoring plan and monitoring system had been established, carry out specific dynamic monitoring of the progress and quality of project construction, effectiveness of the financing application, environmental impacts, and technique progress, etc.

2.10 Supporting development of Camellia cooperatives

Collective forestry right policy reform is the third major rural reform, if forestry want to achieve greater efficiency, forest property rights and ownership must to be clarified, track way of large-scale oriented and intensive management-oriented. Dealing with the balance of deepen the reform and development of industrial at the same time, actively explore establish new forestry management entity, build up Camellia cooperatives on the basis of respect wishes and willingness of the masses farmers, make sense of consolidate the results of collective forest right system reform, deepen counterpart reform, invigorate rural forestry economy, guarantee farmers legitimate rights and interests, and increasing farmers' income.

Through the implementation of this project, and support the construction of Camellia cooperatives capacity building, Added office equipment to Camellia cooperatives, elaborate Camellia management planning, providing management and technical training and other services to boost of Hunan collective forest rights of land tenure reform policy implementation. The specific contents are as follow:

(1) In each of project target counties (cities), support to establish two Camellia cooperatives. Consolidate 8 Camellia cooperatives at the end of the first year, consolidate 18 Camellia cooperatives at the end of the second year, cumulative consolidate 28 Camellia cooperatives at the end of the third year.

(2) Provide subsidy to each Camellia cooperative for purchase of desktop computers, printers, office furniture and other office equipment.

(3) Elaborated Camellia management planning, and to establish a solid foundation for reasonable and scientific management Camellia cooperatives.

(4)Provide management and technical training and promotion services to Camellia cooperatives.

3 Project organization and management

3.1 Project management institutions

3.1.1 Provincial project management organization

(1) Project Coordination Group

At present, Hunan has set up a foreign forest project leadership group, Vice Governor in charge of forestry shoulder the group leader, group members are whose in charge of Provincial Development and Reform Commission, Department of Finance, Department of Forestry. The project plan to set up a project coordination group under the frame of existing provincial forestry foreign fund agency, coordination group mainly responsible for administrative and decision-making of the project, appraisal outline of the project plan, realize counterpart funding in accordance with requirement, coordination, research and find resolution of major issues during process of project implementation.

(2) Project Office

Project office will be set up in Provincial Forestry Department, the project office as an executive agency of provincial project (implementation), it shall submit regular report on progress of the project and important issues to coordination group, coordinate and handling problem in the project implementation process. Project office is responsible for organization and full implementation of the project, including organize and approval of project overall design, plan adjustment, quality supervision, inspection and acceptance check, financing management and loan reimbursement, etc.

① According to the practice of project activities and requirements, elaborate procedures of the project construction design, inspection and acceptance check.

② Responsible for project silviculture activities organization and implementation, procurement of materials and equipment, technology training and promotion, supporting of forestry reform policy, monitoring and evaluation, etc construction task, as well as responsible for check the quality of the project target counties construction work.

③ Responsible for project sites of below the county level selection, implementation content adjustment and approval.

④Responsible for management and use of project funds, withdrawals and reimbursement transaction, inspection and supervision implement and use of national counterpart funding at all levels.

⑤ Responsible for elaborate annual financial statement of accounts, cooperate audit department carry out the annual audit of the project.

⑥ Responsible for elaborate and report annual project plan, procurement plan and funding use plan, preparation of preliminary progress reports, interim reports and the completion report.

⑦ Responsible for the reception mission of European Investment Bank, and others relevant department inspection and instruction of project.

(3) Project Monitoring Center (PMC)

PMC conduct monitoring of the project plan implementation in accordance

with the established monitoring system. Through monitoring of project management, monitoring of the stand quality, and monitoring of implementation performance, etc. Aims at monitoring dynamic of the progress and quality of the plantation and siviculture, funding use effectiveness, environmental impacts, implementation performance, in order to find problems and solve the problems, provided information for the decision-making departments, to make necessary adjustments and arrangements of the project , ensure smoothly realization of the overall goal of the project.

(4) Project's scientific and technological supporting group

The group shall provide technical and management consulting for the project. Assist training of the project, assist project executive agency to elaborate project implementation plan and annual work plan, introduction advanced concept, technology and management experience of forestry, give recommends for deficiency in the implementation of the project, coordinate the limiting factor, and assessment socio-economic the beneficiaries impacts of the implementation of the project.

3.1.2 county-level project management agency

(1)County project leading group

Governor (Mayor) take group leader of the county project leading group, group members consist of principals from County (City) Development and Reform Bureau, Finance Bureau, Forestry Bureau. The group is the leadership and decision-making agency of the project, responsible for approval establishment forestry companies, Camellia oleifera cooperatives and Camellia big holders, as well as county level counterpart funding, coordinating the relationship between various units, ensure smoothly implementation of the project.

(2) County Project Office (CPO)

CPO set up in County (City) Forestry Bureau. Under the direct leadership of the county project leading group, CPO responsible for organize project full implementation, including the adjustment of project construction design and planning, quality supervision and inspection and acceptance check, financing management and loan withdrawal reimbursement, etc.

① According to practical of project activities and requirement, preparation project the annual construction design.

② Responsible for the organization and implementation of the project plantation and siviculture activities, material procurement, technique training and promotion, forestry reform policy supporting, monitoring and evaluation, and inspect quality of construction activities being completed by forest entity.

③Put self-financing into effect, proper management and usage of project financing, organize withdrawals reimbursement.

④ Responsible for elaborate the county annual financial statement of accounts (including provincial and municipal usage project funds), coordinate with the audit departments for the project annual audit work.

⑤ Responsible for the preparation and reported annual project plan, procurement plan and financing using plan, prepare preliminary progress reports, interim reports and completion report, collect data and information of project implementation, feedback to the Provincial Project Office betimes.

⑥Responsible for the reception mission of European Investment Bank, and others relevant department inspection and instruction of project.

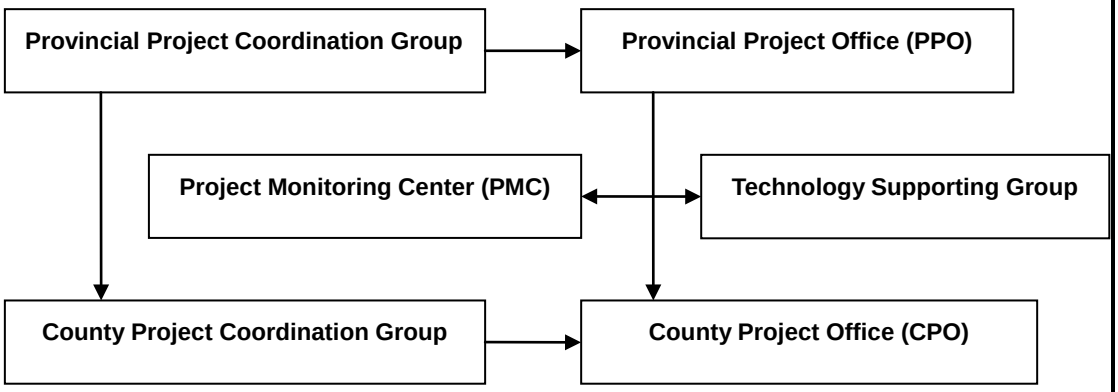

Fig 1 Project Management Institution Sketch

3.2 Project management

3.2.1 Plan management

(1) Plan approval procedure

①Overall project design will be organized by Provincial Project Office and responsible for approval and inform the project counties/cities, annual construction design will be elaborated by CPOs, and CPOs report the annual planning to PPO for archives management.

②Duration of the project implementation, we need adjustment loan fund category, increase or decrease or change project target townships, villages, and project plots, adjustment project plantation and siviculture areas, firstly, it is need CPO application and report to PPO for approval.

③As for the management of the project plan, we carry out unified plan and management at different levels. CPO elaborate annual plan, submitted it to PPO for approval. Annual plan which get approval from PPO and distribute to project target counties.

(2) Annual plan elaboration

①CPO according to approved project overall design and practice, combine plantation and siviculture construction design, stands and seedling preparation, counterpart funding situation, and the usage of European Investment Bank loan to elaborate annual plan.

②Annual plan include tasks of plantation, material procurement, supporting Camellia cooperatives, monitoring and evaluation, and funding use plan.

③Before November 5 of each year, CPO submit report of next year annual plan to PPO, including work plan, procurement plan, the loan use plan, counterpart funding fulfill plan and guarantee completion of the approved annual plan and corresponding project activities.

(3) Inspection and supervision of plan implementation

①Annual implementation plan distributed by PPO, it is the basis of the target counties implementation of project activities and control the amount of the annual loan funding. Once the annual plan has been distributed, it must be strictly carried out, prohibit change randomly. Special project target county need adjustment plantation area, which need do well in plantation construction design, seedlings preparation, fulfill the counterpart funds, and report it to PPO for approval.

②County level project management section, according to provisions of the

project monitoring and evaluation plan, carry out checking and supervise progress of the project plan implementation. Regularly contrast the difference implementation, analyze the reasons, give measures of improvement, and form a analysis report, included in the project progress reports, reported to the provincial PMO.

3.2.2 Technology Management

PPO and the scientific and technological supporting group responsible for project construction relevant technical training, consulting, research and promotion, elaborate the outline of the project and execution plan of the project, instruction CPO conduct annual construction work design, organize technology promotion, establish database information system, strengthen project archives management, evaluation of project progress and quality. CPO with forestry technique training center, institute of forestry, and township (town) forestry station jointly consist a multi-level technology management and service network, implement procedure management, make clear job responsibilities, ensure the effectiveness of the project construction.

3.2.3 Funds management

Project funds including European Investment Bank loan and national counterpart fund two parts, PPO will set up a special account for project funds, adopt special account management, earmarking, unified distribution, unification manage, prohibit misappropriation of funds. Project funds management procedures carry out reimbursement system, according to verification area of construction, construction progress and construction quality installment and transfer funds in different phases, in order to achieve reasonable invest of the funds and achieve project implementation profit. Project office would manage funds strictly according to accounting system, and accept the supervision and inspection of authorities and auditing departments.

Project office of each level would has a full-time chief accountant, and keep the position relatively stable, if there are staff adjustment, it is need report to PPO and get approval.

3.2.4 Material management

It is recommended that project target counties CPO responsible for planning and deployment seedlings, fertilizer, manure and other needed material, ensure planning duration smoothly completion of the project.

3.2.5 Project construction work management

Firstly, pay attention to inspection, acceptance and quality control. Implementation construction strictly accordance with design of construction. After completion of the construction, carry out inspection and acceptance according the construction process (seedlings, soil preparation, planting, tending) in every phases and grade. Secondly, it is needed to strengthen seedling management, strictly accordance with the fixed-site supplying plant species, fixed-site seedling nursery, fixed-site supplying seedling "three fixed-sites" requirement, selection improved varieties, breeding vitality seedling, use Grade I seedling for afforestation. Thirdly, strictly in accordance with the requirements of working design, insist suitable site for suitable tree species, scientific land preparation, reasonable density, carefully planting, timely tending, to ensure the quality of construction. Fourth, pay attention to pest control, forest fire protection, prevent deforestation and illegal cutting, to consolidate the results of the project.

3.2.6 Archive Management

①Project archives implement provincial, county (city) and operation entities three levels classification management, and special staff responsible for archives management.

②Establishing project archive management rule, do well in pigeonhole the archives, borrowed file needs return, and data conservation.

③Archives management staff should keep relatively stable, if there are job transfers, it should be fit staff in time, and make well transition.

④Archive file divided into document archives, afforestation and management technical files and financial records three categories, each category is divided into a number of subcategories. In which, document archives and afforestation management technical files kept by a special staff, financial records kept by finance staff. Data collation and archiving must be accurate, make record of no omitting and no interrupted, no fraud.

3.3 Operation Management

3.3.1 Management model

Through investigate and verify the project target counties (cities), mainly entities of the project implementation are companies, cooperatives, big holders (see Table 7). In which company implementation area is 12973.7 hectares, accounting for 59.35% of the implementation of the total area; cooperatives implementation area is 5785.2 hectares, accounting for 26.46% of the implementation of the total area; big holder implementation area is 3102.4 hectares, accounting for 15.39% of the implementation of the total area. Before the formal implementation of the project, CPO must sign a contract with the project implementation entities.

Table 7 EIB loan Hunan Camellia Development Project Implementing Entities unit：ha

Project	Management Entity			
	Total	Company	Cooperative	Big holder
Area	21861.3	12973.7	5785.2	3102.4
Percentage	100	59.35	26.46	15.39

3.3.2 Guarantee measures

(1) Improving policy and management in accordance with regulations

According to the actual situation of the produce base construction, establish and improve position responsibilities, scope of work, induction conditions, assessment standards, incentives and disincentives management system, ensure that there are corresponding rules and regulations coordination of all aspects, ensure that management channel smooth and the normal operation of the day-to-day work, ensure that the project is always in good stand-by state.

(2) Competition for the position

As for personnel system, it is recommended to establish a merit-based talents engagement system. Partial position can implement public recruitments, encourage competition for the job position, fittest survival, and fully mobilize the enthusiasm of employees.

(3) Training

Due to this project high technology content and technical characteristic, it is necessary to frame corresponding training program, all the relevant staff must join job training and proficiency testing. It is recommended before the start of project construction, invite consultancy experts to training staff involved in the project construction, only the qualified trainee who can participate in the project construction, so that to improve project management level, and ensure the smoothly completion of the project.

(4) Position incentive, punishment and reward mechanism

In order to encourage employees to give full play to each person's ingenuity, it should be clear that responsibility, rights and interests of each position, through regular assessment, ensure cash reward and punishment.

(5) Exerting "Science and technology are primary productive forces" influence on project

Project can rely on research institutes' technical strength and advanced research equipment, establish camellia company of camellia planting also incorporates camellia oil processing and products research & development, domestic advanced scientific and technological achievements promotion and application, accelerate the transformation from scientific and technological achievements to actual productive force, and provide technical services for this project.

Brief Introduction to Natural Environment and Socio-economic Condition in Project Area

Natural conditions (Topography, landform, climate, hydrological, vegetation, biodiversity, etc.)

1.Adiminstrative Divisions and Location

Project areas involve Zhuzhou, Hengyang, Yongzhou, Shaoyang, Yueyang, Huaihua, Zhangjiajie, Xiangxi Prefecture, total 8 prefectures' 14 counties/cities. scatter throughout the Hunan Province. Hunan Province is located in the middle and upper reaches of the Yangtze River, to the south of Dongting Lake, the west of Jiangxi, the north of Guangdong and the east of Guangxi, bordering ,Guizhou and Chongqing in the west, and Hubei in the north. It located at longitude 108 ° 47 'to 114 ° 15' north latitude and 24 ° 39 'to 30 ° 08'. The width from east to west is 667 kms, and lenght from north to south 774 kms, with a total area of 211,800 square kilometers.

2.Geography and Topography

The project area lies in a transition zone between the Yunnan-Guizhou Plateau, Jiangnan hills and Nanling mountain Jianghan Plain, surrounded by mountains in east, south,and west. In the middle, there are rising and falling hills, and in the northern there are lakes and plains taking the form of asymmetric horseshoe-shaped contour. To the east is Luoxiao mountain at Hunan-Jiangxi junction which has an altitude of 1000 m, and the highest hat-like peak of which reaches 2052 meters high; to the south is the Five-Ridge Mountains, mostly in north east to SW direction, which is the watershed ridge of the Yangtze River and

the Pearl River watershed; to the west, is Xuefeng Mountains in southwest to the northeast direction, with the southern section's altitude being about 1,500 meters, its highest peak being 2,021 meters, and the northern section's altitude being between approximately 500 to 1000 m; to northwest is Wuling Mountain whose altitude is above 1,000 meters, with the highest peak being 2,099 meters high; in the center, mostly are rolling hills, hilling, and alluvial plains at both valley sides.

Main landform are low mountains, rolling hills and hillock in project target region, mountain area is 10,847,200 ha, amount to 51.2% of the total land area; rolling hills area is 3,262,300ha, amount to 15.4% of the total land area; hillock area is 2,941,100 ha, amount to 13.9% of the total land area; plain area is 2,778,600 ha, amount to13.1% of the total land area; Water area is 1,354,300ha, amount to 6.4% of the total land area.

3. Soil and land use

In the project area, soil-forming parent rocks and parent materials are mainly sedimentary rocks, with others being magmatic rocks, metamorphic rocks and Quaternary deposits, respectively accounting for 45.6%, 12%, 25% and 14.4%. The soil-forming parent rock can be divided into seven categories, namely granitoids, metamorphic rocks, limestone, purple sandstone and shale, sandstone, Quaternary red clay, and lake and river alluvium. Under different conditions, soil parent materials formed twelve forest soil class twenty-five subclasses including red soil, mountain yellow soil, mountain brown soil, mountain yellow brown, red limestone soil, purple soil and mountain meadow. From the perspective of horizontal distribution, the soil can roughly be classified into two groups by the Wulu Mountain-Xuefeng Eastern Foot, the west is mainly yellow soil and the east mainly red roil.. From the perspective of vertical distribution, above the altitude of 500 to 700 meters is, mostly red soil, 600 to 700 meters is mostly yellow soil, more than 1,000 meters is mountain yellow brown soil, and between 1,600 and 1,700 meters is mainly mountain meadow. soil distribution. In northwestern Hunan and in hills in southern Hunan, there is limestone soil; in the middle reaches of the Xiangjiang River and Yuan rive there is purple soil and in the downstream of Li River and Yuan River, there are mostly modern lake and river sediments, with most having developed into paddy soil. Red soil is the main soil in project area, accounting for 36.3% of the total area.

Soil in most parts of project areas is deep and fertile, generally over 60cm deep. Its texture is mostly heavy soil, soil, light soil, with soil organic matter content being between 1.08 to 5.11%, total nitrogen content between 0.08 to 0.15%, pH value between 4.0 and 6.0. As for soil condition, it is suitable for camellia plants growth.

The project area total has rich and a wide range of land resources, The province's total land area amounts to 21,183,500 hectares, of which arable land is 3,788,000 ha, natural grassland is 6.373 million ha, and woodland area 12,923,300 ha. Among the woodland, lands with forest is 10,188,900 hectares, accounting for 78.82% of the total area, open forest land is 89,900 hectares, accounting for 0.69% of the total area, shrub land is 1,294,900 hectares, accounting for 10.02% of the total area, immature forest land is 333,000 hectares, accounting for 2.58% of the woodland area; non-forest land is 1.0127 million hectares, accounting for 7.86% of the total area, nursery land is 3,900 hectares, accounting for 0.03% of the total area. It provided favorable conditions for the development of agriculture, forestry, animal husbandry, fisheries in the project area.

4.Climate

The project area has humid subtropical monsoon climate, with a mild climate, four distinct seasons, sufficient heat, long frost-free period and plentiful rainfall, distinct wet and dry season ". Due to the impact of monsoon and located at the transitional zone where winter and summer monsoons converge with cold and warm air, weather fronts and climate run frequently, Together with the impacts of complex topography, here has variable temperature in Spring, damp, rainy, long hot summer, high temperatures and humid, much drought in Summer and short cold period in Winter. Average annual temperature is16~18℃, January coldest, average temperature is 4～8℃, July hottest, average temperature is 27～30℃, day temperature above or equal 10℃ active accumulate temperature is 5000～5800℃, first such day appear in midterm or end of March, continuance 240~260 days, none frost period is 270~310 days. Total radiation, accumulate temperature, and rainfall among April to October amount to whole year 70~85%, annual precipitate is 1200~1700mm, wind direction no significant change with season change. North direction wind popular in winter and spring, south direction wind popular in midsummer.

5 Hydrology

In the project area there is dense river network developed water, mighty water and rich water resources, with the second largest freshwater lakes - Dongting Lake inside. There is also Xiangjiang River, Zijiang River, Yuanshui River, Lishui River and 5341 long rivers over 5km long, with the total length of 99,300 km,. Among them there are 17 large rivers with the drainage area over 5000km^2 and these large river mainly belong to Xiangjiang River, Zijiang River, Yuanshui River, Lishui River branches, which run along the terrain from the south towards the north, converge into Dongting Lake and then pass the city of Mausoleum Angeles into Yangtze River, forming a comparatively complete Dongting Lake water system. But some in southern Hunan belong to Zhu River water system, and some in eastern Hunan belong to Poyang Lake and Gan River water system. In the province's major rivers, the Xiangjiang has the total length of 856km, with 670km inside Hunan and a drainage area of 94660km^2; Zijiang has a total length of 713km, with a drainage area of 28142km^2; Yuanjiang has a total length of 1033km, with 568km inside Hunan and a drainage area of 89163km^2; Lishui has a total length of 388km, and watershed area of 18496 km^2. The four major rivers and Dongting Lake's branches amount to 5315, with their length being 43,000 km. The annual runoff of all water systems is 208.5 billion m^3. the total natural water is 199.82 billion m^3, including156.52 billion cubic meters of surface water resources and 43.3 billion m^3 of underground (shallow) water.

6. Vegetation and biodiversity

The proposed project area is located in eastern China in subtropical evergreen broad-leaved forest zone, with variety of vegetation types, and exceptionally rich plant resources. Major vegetation types are evergreen broad-leaved forest, evergreen mixed coniferous and deciduous evergreen broadleaf forest, deciduous broadleaf forests, bamboo groves, Joe bamboo mixed forest and economic forest mainly including Camellia, Eucommia, Magnolia, and citrus-based, and shrub, crop and agriculture vegetation.

According to a survey, there are about 5,000 species of seed plants among which there are woody plants with 103 families, 478 genera and 2470 kinds, more

than 1000 kinds of wild economic plants, over 800 kinds of medicinal plants. Rare wild plants under state protection are 59 species, accounting for 23% of those under state protection national wide (254 species). Among them national the first class key protected wild plants are 12 kinds including silver fir, dawn redwood, dove, Bole tree, Taxus, cork, resources fir Ranalisma rostratum the Primula Pseudochirita, Brasenia Davidia involucrata var.vilmoriniana, Chinese Isoetes, the second class key protected wild plants include 45 kinds such as coarse teeth Cyathea, Cyathea Cephalotaxus oliveri, Fujian cypress, Pinus kwangtungensis (Guangdong Song), larch, Douglas fir, Torreya tree (Torreya grandis), Cercidiphyllum wild rice, camphor tree, Liriodendron, Magnolia, Magnolia biloba, sightseeing wood, water Aoki the beech (big-leaf beech), 45, and the third class protected plants are 2 kinds. Additionally, there are 44 kinds of provincial protected plants. These rare species mainly distribute secondary forest conservation well region, a teeming of protected and antiquity plant species growth in special region.

The project new camellia plantation site mainly select barren land, abandoned mountain, sparse forest land or the camellia stands of yield-declining. According to data of existing vegetation was submitted by target counties, the proposal project sites main vegetation type is plantation, such as Masson pine plantation, Chinese fir plantation, camellia oleifera plantation, shrub, brushwood; main tree species are Chinese fir, masson pine, Elceocapous, Camellia oleifera, acacia, and alder; main shrub species are Rhdodendron, couch grass, sumac, etc. seldom find rare species or protected tree species.

According to a survey, there are about 5,000 species of seed plants among which there are woody plants with 103 families, 478 genera and 2470 kinds, more than 1000 kinds of wild economic plants, over 800 kinds of medicinal plants. Rare wild plants under state protection are 59 species, accounting for 23% of those under state protection national wide (254 species). Among them national the first class key protected wild plants are 12 kinds including silver fir, dawn redwood, dove, Bole tree, Taxus, cork, resources fir Ranalisma rostratum the Primula Pseudochirita, Brasenia Davidia involucrata var.vilmoriniana, Chinese Isoetes, the second class key protected wild plants include 45 kinds such as coarse teeth Cyathea, Cyathea Cephalotaxus oliveri, Fujian cypress, Pinus kwangtungensis (Guangdong Song), larch, Douglas fir, Torreya tree (Torreya grandis), Cercidiphyllum wild rice, camphor tree, Liriodendron, Magnolia, Magnolia biloba, sightseeing wood, big-leaf beech, and the third class protected plants are 2 kinds. Additionally, there are 44 kinds of provincial protected plants.

Plant resources provide unique conditions for animals' living and reproduction. and up to now in the project area, 897 species of invertebrates belonging to 5 classes, 44 orders, 146 families. Among those mammals involve 9 orders, 28 families and 91 species , birds belong to 19 orders, 71 families and 448 kinds, reptiles include, 3 orders, 15 families and 92 species, amphibians consist of 64 kinds of amphibians orders, and fish boast of 9 families and 11 orders, 23 families and 202 species.

Most project proposal sites belong to barren land, abandoned mountainous land, sparse forest land, and low-yield camellia stands. Due to almost such vegetation is manpower vegetation, sparsely distributed, adding frequently human intervention, thus in proposal project sites, there are less amount of wildlife, ordinary species are field rat, bamboo rat, weasel, wild boar, magpie, and tomtit, seldom find rare and protection wildlife.

7.Camellia oleifera plantation resources

Hunan Province is one of camellia breeding core area. All the while Hunan camellia plantation area is first in the whole countrywide. According to newly updated statistic finding, Hunan have existing camellia plantation 1,278,700 ha, amount to 49% of total country area camellia plantation, amount to 14% of total provincial forested land area. 122 counties/cities/ districts of Hunan, besides Anxiang County and Nanxian County belongs to pure lake region counties, the others counties/cities/districts are all have conglomeration camellia plantation distribute. In which, 17 counties the area of camellia reach 6700~13300ha, 12 counties the area of camellia reach 13300~15000ha, more than 20 counties have area of camellia above 15000ha, the largest camellia area is Leiyang County, the reach 77300 ha, and it also the largest camellia area of the whole country. As for camellia distribution within the Hunan, mainly concentrate in Henyang, Huaihua, Zhuzhou, Yongzhou, Changde, Chengzhou, Xiangxi Prefecture 7 cities/prefectures. The project target 14 counties/cities existing camellia area 279,000 ha, amount to 21.8% of whole province, of which, large area of camellia counties are Lilin City, Shaoyang County, Pingjiang County, and Qiyang County. All of 14 target counties/cities have 408,400 ha area suitable for camellia planting, area of suitable for tending young stands 149,000ha, sufficient area for project land demands.

In recently years, Hunan realized high-speed development. To the end of 2010, Hunan forest coverage reached 57.01%, output of forestry reached 115 billion Yuan. Woody edible oil industry like camellia oil industry presented a promising development potential, annual yield of camellia oil reached 134,000 tons, annual revenue reached 10.72 billion Yuan, amount to 52% and 63% of the whole country respectively, both index are No.1 of the whole country. At the moment, camellia oil industry has being a new point of economic growth and economic break through, it's a key industry for county economic development, socialism new style countryside construction and greenery Hunan development.

Science middle and late 1960s, Hunan Province began to address camellia oleifera improved breeding work, from camellia production, camellia resource, camellia olerifera varieties, to target tree selection, farmhouse breeds confirmation and comparative, improved varieties identify, asexuality propagate technique research, and establishment of scions nursery, and appraisal of good camellia varieties, etc. after many years hard work, Hunan got 18 items scientific achievements, cultivated 8 good farmhouse varieties,6 improved strains, 10 good hybridize fits, and more than 110 "Xianglin" improved clones, profit from camellia plantation increased 15~60%,the camellia yield increased 5~9 times than stands under natural condition, present a promising rich-yield camellia potential.

Hunan have 2000 camellia processing company, in which, 17 enterprises have capability of processing camellia seeds above 1000 tons, distributed in Hengyang, Yongzhou, Chenzhou, Changsha, Yueyang, Loudi, etc. On the market appeared "Jinhao" "Jiuningshan", "Jintuotian", "Shanrun" refine camellia oil brands. Annual output of refine camellia oil reached 40000 ton, camellia alkali 2500 ton, residuals of camellia oil 13000 ton. The enterprises included 6 key enterprises of forestry industry, 2 Chenzhou-based, 1 Yongzhou-based, 1 Huaihua-based, 1 Zhuzhou-based, 1 Yueyang-based.

Brief introduction to social environment (social economic structures, protection of education, culture and relics)

According to the primary statistic data released in 2011, the total population of Hunan was 71.356 million, among which permanent resident population was

65.956 million. The gross regional product (GRP) of the whole industry was estimated to reach 1,963.519 billion Yuan, increased by 12.8% over the previous year. The contribution rate of primary industry was 273.366 billion Yuan, increasing by 4.2%; and that of the secondary industry hit 932.473 billion Yuan, increasing by 17%; the tertiary industry hit 757.68 billion Yuan, increasing by 11%.In accordance with the permanent resident population, per capita GRP reached to 29,828 Yuan, increased by 11.2%. The proportion of primary industry, secondary and tertiary industries in the province was 13.9%, 47.5% and 38.6% respectively. The added value of industrial sector accounted for 41.2% of GRP, increasing by 1.9% over the previous year; the added value of the high-tech industry accounted for 14.7% of GRP, up by 2.5%. the contribution rate of primary, secondary and tertiary industries to economy growth was 4.8%、61.1% and 34.1% respectively, of which, the added value of industrial sector was 56.1% and that of the productive service industry was 13.3%.The added value of non-public economy was 1,121.856 billion Yuan, up by 14.5%, accounting for 5.7% of GRP, increasing by 0.8%. In terms of regions, the GRP of Changsha-Zhuzhou-Xiangtan City cluster was 832.062 billion Yuan, increasing by 14.4% over previous year, the GRP of the City Group around Changsha-Zhuzhou-Xiangtan City Cluster WAS 1,549.908 billion Yuan, increasing by 14.2%; and GRP of southern and western Hunan reached 405.510 billion Yuan and 249.957 billion Yuan respectively, marking a growth of 13.9% and 13.2%.

Total grain sown covers an area of 4,879,000 hectares in Hunan, increasing by 1.5% over previous year; the sown area of cotton 186,200 hectares, increasing by 6.4%, sugar base covering an area around 14,500 hectares, decreased by 5.4%; the oil-bearing crops covering an area of 1295,500 hectares increased by 6.9%;The sown area of vegetable around 119,3800 hectares increased by 5.4%.

The total output of grain around Hunan Province kept in stabilized. The output of cotton increased by 4.1%, and that of oil-bearing crop production increased by 10.3%, that of tea production increased by 12.8%, that of fruit production increased by 10.2%, vegetable production increased by 6.9%, tobacco production increased by 9.8%; the output of beef, mutton, pork meat decreased 1.5%, that of poultry eggs increased by 1.9%, production of milk up by 3.9%, aquatic output up by 0.6%.

The province's total industrial added value hit 808.315 billion Yuan, an increase of 18.2% over the previous year. Scale industrial added value increased by 20.1%. Seven strategic emerging industries were up to 31.1%. High degree of processing of industrial added value increased 28.8%, the high-tech industry was up 32.4%; high degree of processing industry, high-tech industries accounted scale industrial added value accounted for 33.7% and 5.3%, respectively, over the previous year increased by 1.7 and 0.7 percentage points. Six high-energy line added value increased 16.9%. Non-public scale industrial added value increased 24.9%, 4.8 percentage points faster than the scale of industrial growth. Light and heavy industrial, light industrial added value growth of 17.0%, 21.7% growth in heavy industry. Sub-region, Changsha, Zhuzhou and large-scale industrial added value growth of 20.6%, an increase of 19.9% ring Xiangtan Urban Agglomeration, the Southern Hunan area increased by 20.8%, 20.5% growth in the Great Western Hunan.

The added value of all category industry was 808.315 billion Yuan, up by 18.2% over the previous year. Among of which, the added value of industrial enterprises above designated size increased 20.1%; the added value of seven strategic emerging industries increased 31.1%; the added value of high-processing degree industry increased 28.8%; the added value of high-tech industry increased

32.4%; the added value proportion of high-processing degree and high-tech industry in above designated size industry was 33.7% and 5.3% respectively, up by 1.7% and 0.7% over the previous year. Six energy-consuming industries increased by 16.9%; the growth rate of Non-public above designated size industry increased 24.9%, 4.8% higher than that of above designated size industry. In terms of heavy or light industry, the added value of light industry increased by 17.0%, heavy industry increased 21.7%.In terms of sub-area, the added value of industrial enterprises above designated size in Changsha-Zhuzhou-Xiangtan City cluster increased 20.6%; the City Group around Changsha-Zhuzhou-Xiangtan increased 19.9%; southern and western Hunan increased 20.8% and 20.5% respective.

The province's investment in fixed assets (excluding farmers) 1.143148 trillion Yuan, an increase of 27.9% over the previous year. The urban investment 1.056574 trillion Yuan, an increase of 27.6%; rural investment of 86.573 billion Yuan, an increase of 40.2%. The state-owned investment of 356.313 billion Yuan, an increase of 17.3%; non-state investment of 786.835 billion Yuan, an increase of 34.2%. In terms of regions, Changsha, Zhuzhou and fixed assets investment of 493.255 billion Yuan, an increase of 25.5% over the previous year; ring Xiangtan Urban Agglomeration investment of 815.02 billion Yuan, an increase of 29.3%; southern Hunan investment of 218.528 billion Yuan, an increase of 35.4%; Xiangxi regional investment of 130.115 billion Yuan, an increase of 32.5%.

Hunan fixed assets Investment (except farmhouse) reach 1143.148 billion Yuan, increasing 27.9%. Among of which, urban investment 1056.574 billion Yuan, increasing 27.6%; Rural investment 86.573 billion Yuan, increasing 40.2%; State-owned investment 356.313 billion Yuan, increasing 17.3%, Non-state-owned investment 786.835 billion Yuan, increasing 34.2%. In terms of sub-area, Fixed assets investment in Changsha-Zhuzhou-Xiangtan City cluster was 493.255 billion Yuan, increased 25.5%, Fixed assets investment in the City Group around Changsha-Zhuzhou-Xiangtan reach 815.02 billion Yuan, increasing 29.3%; Fixed assets investment in southern and western Hunan reach 218.528 and 130.115 billion Yuan respectively, increasing 35.4% and 32.5% respectively.

The province's retail sales of social consumer goods of a total of 680.903 billion Yuan, an increase of 17.9% over the previous year. Of business statistics, the urban consumer goods retail sales of 615.45 billion Yuan, an increase of 18.1%; rural consumer goods retail sales of 65.453 billion Yuan, an increase of 16.5%. Statistical patterns of consumption goods retail sales of 596.796 billion Yuan, an increase of 18.3%; food and beverage revenue of 84.107 billion Yuan, an increase of 15.1%. The sub-region, Changsha, Zhuzhou and retail sales of social consumer goods in total 293.068 billion Yuan, an increase of 17.9%; ring Xiangtan Urban Agglomeration of 520.365 billion Yuan, up 17.9 percent; southern Hunan area of 132.364 billion Yuan, an increase of 18.0% and 86.968 billion Yuan; Great Western, an increase of 17.9%.

The total retail sales of consumer goods in Hunan reach 680.903 billion Yuan, increasing 17.9% over the previous year. In terms of location of outlets, urban retail sales of consumer goods hit 615.45 billion Yuan, increasing 18.1%; rural retail sales of consumer goods hit 65.453 billion Yuan, increasing 16.5%; In terms of consumption pattern, commodity retail amounts 596.796 billion Yuan, increasing 18.3%; restaurants sales hit 84.107 billion Yuan, increasing 15.1%.In terms of sub-area, the total retail sales of consumer goods in Changsha-Zhuzhou-Xiangtan City cluster hit 293.068 billion Yuan, increasing 17.9%; the City Group around Changsha-Zhuzhou-Xiangtan hit 520.365 billion Yuan, increasing 17.9%; Southern and western Hunan reach 132.364 and 86.968 billion Yuan respectively, increasing

18.0% and 17.9% respectively.

2011 the province's colleges and universities 105. Ordinary higher education of the graduates of 28.42 million, 1.43 million earned graduate degrees, secondary vocational education graduates 22.55 million, 32.56 million high school graduates, junior high school graduates 69.27 million, 73.02 million ordinary primary school graduates, children in the garden of 163.74 million, an increase of 15.4%. Primary school age children enrollment rate of 99.88%, 100.65% graduation rate. The implementation of compulsory education security funds of 489 million Yuan and 575 million Yuan; issuing state grants vocational issuance college national scholarships, grants of 803 million Yuan, 767,000 people funded vocational students, college students 245,500.

There are 105 general higher education schools in Hunan. 284,200 undergraduates and 14,300 graduates of General Higher Education Undergraduate Program; 225,500 secondary vocational education graduate students;325,600 senior high school graduate students; 692,700 primary school graduate students;730,200 junior school student;1637,400 kinder-garden students, increasing 15.4%; School –age enrollment hit 99.88%, proportion of students entering schools of a higher school hit 100.65%. Fulfill 0.489 billion Yuan for compulsory education, provide student aid 0.575 billion Yuan for elementary vocational education, provided 0.803 billion Yuan for general higher education student aid and award, provided sustentation fund for 767000 elementary vocation students and 245500 higher education students.

The province has 15 national engineering (technology) research centers, the new 3. There are 12 state-level enterprise Key Laboratory added two. 682 national commit to various scientific and technological projects. Which bear the national "863" projects 47, 46 national research projects, Signed 5654 contracts, technology contracts turnover of 3.539 billion Yuan, 836 made the provincial and ministerial level scientific and technological achievements. The outcome of the National Science and Technology Progress Award 20 3, the State Technological Invention Award, a National Natural Science Award. 29,516 patent applications, the amount authorized by 16,064, an increase of 31.9% and 15.8%, respectively, over the previous year.

There are 15 state-level engineering(technology) research centers, including 3 new established and 12 state-level enterprises key laboratories including 2 new established in Hunan. Undertaken 682 national scientific and technology projects have been launched in Hunan, among of which, 47 of national high technology research and development Program (863 Program), 46 of National key technologies R&D Program of China. Contracted 5,654 copies of technology lisence contacts, which amount 3.539 billion Yuan. Hunan has received 836 science and technology achievements at provincial and department level, 20 projects awarded National Science and technology Awards, three project awarded national invention prize and one project awarded national prize for natural sciences, 29,516 patents application and 16,064 patents licensed, increasing 31.9% and 15.8% over the previous year respectively.

The new township cultural stations in the province in 2011 to 1058. End of 104 performing arts groups, mass art and cultural centers, 141, 129 public libraries, 82 museums and memorial halls. Radio station 13 television 15. 6,959,400 cable television subscribers, an increase of 544,800. Broadcasting coverage at the end of 92.6%, 96.8% of the TV population coverage increased by 0.6 and 0.4 percent, respectively, over the previous year. Listed as a national intangible cultural heritage protection catalog 99, 220 in the provincial protected directory. Published 8,496

kinds of books, newspapers 87 species, 248 kinds of periodicals. The books publication 346 million, the newspaper publishing 1293000000, periodical publishing 129 million.

Hunan established totally 1,058 multipurpose community centers in town and township, 104 performing arts groups, 129 libraries, 82 museums and memorial halls, 13 broadcasting stations, 15 television stations, 6,959,400 households subscriber cable television, an increase of 544,800. Broadcasting coverage 92.6%, television coverage 96.8% population, increased by 0.6 and 0.4 percent. There are 99 listed as a national intangible culture heritage protection catalog, 220 in provincial protected directory, published 8,496 books, 87 newspapers, 248 journals. Publication 346 million books and journals publishing129 million.

2. Project target counties/cities general information

14 counties (cities, districts) of the project area, including Zhouzhou, Hengyang, Yongzhou, Shaoyang, Yueyang, Huaihua, Zhangjiajie, Xiangxi prefecture, mainly involve Liling City, Hengyang County, Hengshan County, Qidong County, Qiyang County, Ningyuan County, Shaoyang County, Miluo City, Pingjiang County, Xupu County, Zhongfang County, Sangzhi County, Huayuan County, Baojing County. At the end of 2011, 14 target counties/ cities total population was 10.6943 million, amount to 14.99% of total province population. GDP amount to 7.8% of whole province.

Table 8 Project target counties/ cities economy index (2011)

County/ City	Population(10,000)	GDP(100 million RMB)	Economy growth rate(%)	GDP per capita (RMB)	Townsman income per capita(RMB)	Farmer net income(RMB)□	First, Sceond, third industry ratio
Lilin City	111.8	264.71	16.6%	27982	18280	9304.2	12.3:60.5:27.2
Hengyang County	121.68	189.21	13.5%	17122	14334	8447	28.0:40.9:31.1
Hengshan County	43.92	83.49	13.4%	19009	14808	8774	22:38:40
Qidong County	102.63	140.45	14.3%	13685	14054	4778	16.5:63.5:20
Qiyang County	105.55	158.76	13.5%	15041	17334	7451	21.8:38.8:39.4
Ningyuan County	83.94	78.97	13.6%	11221	17238	3664	28:35:37
Shaoyang County	103.9	81.08	12.2%	7796	12561.5	3055.1	28.11:37.68:34.21
Miluo City	66.5	164.9	14.8%	26689	18568	6867	15.5:57.3:27.2

Pingjiang County	106.04	116.9	14%	11024	10803	2666	23.9:44.1:32
Xupu County	90.39	69.48	14.1%	7686	12992	4281	23.69:35.88:40.43
Zhongfang County	28.13	61.58	15.5%	25976	15818	5150	13:59.8:27.2
Sangzhi County	46.25	39.53	14.9%	10018	10902	2641	13.7:23.9 :62.4
Huayuan County	30.8	54.49	3.4%	18811	14044	3790	8.45:66.3:25.25
Baojing County	27.9	37.34	6.1%	13374	13798	3705	16.4:52.3:31.3
Total	1069.43	1540.89	-	-	-	-	-
Whole province	7135.6	19635.19	12.8%	29828	18844	6567	13.9:47.5:38.6

Data source: Statistic Report of Hunan Province/ County/City

Environment quality status

Environment quality and major environment problems in project construction areas(air, surface water, groundwater, sound and ecological environment)

1. Environment status quo in project areas

The project areas include Zhuzhou, Yueyang, Changde, Hengyang, Shaoyang, Yongzhou, Huaihua, Xiangxi Autonomous Prefecture of Hunan Province. According to the Hunan environmental quality report for 2011, the environmental quality in these areas is as follows:

(1)Air quality

In 2011 the urban ambient air pollution index of Hunan province average 1.932, an increase compared with the previous year (1.830). Major pollutants affecting the urban ambient air quality in Hunan province are respirable particulate matters and sulfur dioxide. Ambient air quality of the province's 14 cities has met the second class national standards, and the qualification rate of the cities maintains 100%, and the overall ambient air quality in the province keeps good. In 2011, the concentration of respirable particles in urban ambient air in the province average 0.080 mg/m^3 annually, up 2.6% compared with 2010; the sulfur dioxide density averages 0.045mg/m3, rising by 7.1% from 2010; dioxide the annual average nitrogen concentration 0.031mg/m3, an increase of 10.7% over 2010. 14 cities sulfur dioxide, respirable particulate matter and nitrogen dioxide annual average concentration meet the national standard. Day of the province's 14 cities air quality rate of 95.9% on average. Among them, Shaoyang and Chenzhou 2, the city's daily air quality good rate of 100%; excellent rates of Hengyang, Shaoyang, Zhangjiajie, Yiyang, Chenzhou, Yongzhou, Loudi, Huaihua, Jishou nine cities in more than 95%. The primary pollutant

affecting the air quality in the province's urban environment is still respirable particulate matter. Urban precipitation in the province is still typical of sulfuric acid rain, acid rain pollution situation is still grim, 14 cities pH value was 4.78, but the heavy acid rain (pH ≤ 4.5) frequency has been reduced.

The proposed project areas are typical of rural environment, with high vegetation coverage and almost no industrial air pollution sources; the ambient air quality being good.

(2) Status of water environment

In 2011, the province's surface water quality was overall excellent. Among 97 provincial controlled sections, 3 reached Grade I, accounting for 3.1%; 46 met Grade Ⅱ, accounting for 47.4%; 40 attained Grade Ⅲ, accounting for 41.2%; 7 belonged to Grade Ⅳ, accounting for 7.2%; 1 was Grade Ⅴ, accounting for 1.0%; and no sections were Grade Ⅴ which is inferior water standard 93 cross-sections achieved water met quality objectives in functional waters, the compliance rate being 95.9%.

The major pollutants of surface water in our province is fecal coliform, ammonia nitrogen, phosphorus, and chemical oxygen demand, BOD5, arsenic, petroleum and permanganate index. Among which ammonia, chemical oxygen demand (COD) and arsenic are more prominent in some river sections. The concentration of pollutants in surface water decreased compared with the previous year, and the standard exceeding rates and superscalar factor remained roughly stable.

Xiangjiang River drainage: the surface water is excellent, with 87.5% of sections had achieved or surpassed ClassⅢwater standard. The passing rate in functional areas is 95.0% The concentration of many pollutants in every section of Xiang River water system exceeded the standard, including ammonia nitrogen, chemical oxygen demand, total phosphorus, BOD5, permanganate index, arsenic and fecal coliform, Xiangjiang River water quality is generally excellent. Water quality at 18 provincial controlled sections are at or better than ClassⅢ. and in functional areas at these sections, the compliance rate were 100.0%.

In some of the Xiangjiang River tributaries that are Xiaoshui, Chung Lingshui, Leishui, Mishui, Zhengshui, Lianshui, Lushui and Liuyang Rivers, the water quality of a total of 17 provincial controlled sections are at or better than Class Ⅲ. At Luodu town section in Chung Lingshuiriver, there is heavy arsenic contamination, and the quality of water is ClassⅣ. At the section of Zhengshui river's estuary, ammonia, chemical oxygen demand (COD) and high manganese index caused heavy pollution, and the water quality was ClassⅣ.At the Xiyanghe ferry section in Lianshui river, ammonia pollution was serious, and the water quality belonged to ClassⅣ.At the delta and Heishi ferry sections at Changsha city in Liuyang River, the total phosphorus, chemical oxygen demand, ammonia nitrogen and BOD posed heavy pollution, with the water quality being Class Ⅳ.

Zijiang River Basin: the surface water quality was overal excellent. Among 12 provincial controlled sections, 10 had Class II water, 1 had Class IV water, and 91.7% had as good as or better than Class Ⅲ water. For water quality, the compliance rate of functional areas at the sections hit 100.0%. Among these rivers, the water quality in the tributary Fuyishui river quite well, the tributary of Shaoshui river, the estuary section was heavy polluted due to ammonia nitrogen pollution, but could still meet the

requirements of water quality in functional areas.

Yuanjiang River Basin: Yuanjiang surface water quality was overall excellent. Among 21 provincial controlled sections, there are 9 Class II water sections, 11 Class III sections and 1 Class V section. Sections as good as and better than Class III account for 95.2%. The compliance rate of functional areas is 95.2%.

Yuanjiang River main stream was affected by the Guizhou entry water, and its upstream total phosphorus posed heavy pollution. The Qianyang Tuokou section of the mainstream was Class Ⅴ. And the remai ning eight other provincial controlled sections were at or better than Class III standard.

In Yuanjiang tributaries, 9 sections were Class II and 3 Class III, accounting for 75.0% and 25.0%.respectively.

Lishui River: Lishui River surface water quality was overall excellent. Among nine provincial controlled sections, one was Class Ⅰ, seven were Class II and one Class II. The compliance rate in functional areas in sections was 100.0%.

Dongting Lake Basin: 10 provincial controlled sections are Ⅱ class. The compliance rate in functional areas in sections was 100.0%. But in Dongting Lake water, total nitrogen, total phosphorus (not chosen in the evaluation of water quality section category) caused heavy pollutions, and pollution by total nitrogen was more serious than that by the total phosphorus.

The nutritional status of Dongting Lake is overall at middle levels. 10 provincial controlled sections are at middle level, and the degree of water eutrophication decreased compared with the previous year.

Other waters: The three sections including the Jingjiang mouth of the Yangtze River in Hunan, Chenglingji and Lu City meet the water quality standard of Class III. The Meitian town section at the Beijiang Wushui river, with excessive arsenic, ammonia and petroleum, belong to Class Ⅳ. The Xizhiguandang section at the Ouchi river, meets Class Ⅲ water quality standard.

In 2011 in the 14 cities where prefecture-level government in Hunan Province are located, the evaluation indicators of centralized drinking water sources, reached Class III in terms of annual averages., The compliance rate of water source areas is 100% in terms of annual averages. There are a total of 30 drinking water source areas in the 14 cities in the province, and the compliance rate of these areas is 99.6%, with an increase of 1.6 percentages compared to the previous year (98.0%). Except for those in Shaoyang and Changde Cities whose compliance rates are 98.4% and 92.0% respectively, the compliance rate of drinking water sources in these cities were 100%. Factors affecting the water quality compliance rates in urban drinking water source areas throughout the province's cities are total phosphorus and dissolved oxygen.

(3) Status of groundwater quality

In 2011, the rural groundwater environmental pollution was still serious. In pilot villages, the pollution of drinking water sources were on development, the water quality compliance rate of groundwater sources in a total of 16 pilot villages covering the 14 cities in the province, was only 25.0%, the percentage of water attaining Class Ⅳ and Ⅴ was 37.5% each in terms of amount, part of the wells was seriously polluted and lost their drinking function, the pollution of groundwater sources was striking, and

the safety of drinking water was threatened.

(4) Status of acoustic environment

In 2011, the acoustic environment of urban roads and regions in the province was in general at a good level. The range of the annual average equivalent sound level during daytime in the urban districts of the 14 cities in the province's was at 51.2 ~ 55.0dB (A), and that in the whole province is 53.5dB (A), and all cities had reached the second class standard in terms of urban district acoustic environment quality. The percentage of cities with fair urban district acoustic environment quality was 100%. The average equivalent sound level of road traffic noise in the province was between 64.2 ~ 69.9dB (A), with an average of 67.3dB (A). All cities were at or better than the standard of Class 2 in terms of urban road traffic noise. The percentage of cities with fair road traffic acoustic environment was 100%. In 57 functional areas of the province's 14 cities in daytime, the compliance rate was 85.9% and 71.4% at night.

The project area is mostly located in rural areas of the counties, with less interval traffic flow, and no significant industrial, traffic and living noise sources. Residents are basic scattered, with good acoustic environment quality.

(5) Status of ecological environment

①Plants resources

The proposed project area is located in subtropical evergreen broad-leaved forest zone in eastern China, where there are a variety of vegetation types, and exceptionally rich plant resources. Among them there are about 5,000 seed plants, in which woody plants involve 103 families, 478 genera and 2470 kinds, wild economic plants have more than 1000 breeding, medicinal plants over 800 species . There are a total of 59 kinds of rare wild plants under state protection, accounting for 23% of those under state protection nationwide.(254 species). Among those plants, national key protected wild plants are 12 species including silver fir, dawn redwood, dove tree, Bole tree, Taxus, cork, resources fir, Ranalisma rostratum, Primula Pseudochirita, Brasenia Davidia involucrata var.vilmoriniana,and Chinese Isoetes. The second class of wild rare plants under key protection 45 species such as coarse teeth Cyathea, Cyathea Cephalotaxus oliveri, Fujian cypress, Pinus kwangtungensis (Guangdong Song), larch, Douglas fir, Torreya tree (Torreya grandis), Cercidiphyllum wild rice, camphor tree, Liriodendron, Magnolia, Magnolia biloba, sightseeing wood, water Aoki the beech (big-leaf beech), the third class have 2 species. In addition, there are 44 provincial protected plant species. These rare and protected plants are mainly distributed in the areas where there are dense forest and well-protected secondary forest, Such areas are the places where many protected plants and ancient relict plants together.

Major vegetation types in the project areas are horsetail pine, fir, Camellia forest, wetland pine, bamboo forest, poplar, hardwood and shrub, shrub. Bush and shrub and grass are cuckoo, Setaria, thatched material, Rhus rubrum, thatched rare and protected plant species are rarely found.

②Animal resources

Hunan has abundant plant resources, which provides a favorable natural condition for the living and reproduction of a great variety of animals. There are 897 vertebrate species, belonging to 146 families, 44 orders and 5 classes. Among mammals include 91 species, 28 families, 9 orders; birds have 448 species,71

families, and 19 orders; reptiles involve 92 species, 15 families, 3 orders; amphibian are distributed in 64 species, 9 families, 2 orders; Fish are seen in 202 species,23 families, 11 orders in project area. There are 18 categories of animals under the first-class state protection like south China tiger, clouded leopard, golden cat, white crane and white fim dolphin, 69 species of animals included in the second-class such as macaque, stump-tailed macaque, pangolin, hellbender and cowfish. etc，and 216 China native species and 16 Hunan native species. There are various fowl species in the project area, including 22 species of state protected, composing 44% of the protected fowl species in the whole country. Among them there are the first class of rare fowl including white-headed crane，white-naped crane、yellow-abdomened tragopan、red-abdomened tragopan, white crane, black crane, white crown and long tailed pheasant, Chinese merganser, and the second class including red-abdomened golden pheasant, white-abdomened golden pheasant, whooper swans，little swans Yuanyang grass owl, etc. Mainly distributed in remote mountains and deep valleys, with good ecological environment and less human activities.

③Status of soil erosion

In the project area，terrain is mainly low mountains, hills and hillock, the parent rocks and parent materials of forming soil are chiefly sedimentary rocks，and red soil is the main type in the area. Affected by the construction and development activities, and the climatic conditions, recent satellite remote sensing survey shows that, in the 4 major river systems including the Xiangjiang, Zijiang, Yuanshui, Lishui River systems, soil erosion has the trend of extending toward upstreams. According to a multi-faceted view of soil erosion, soil erosion happens in many points and a large scale, and is typical of surface erosion and local landslides. In the whole province, except for pure Lake counties such as Anxiang County, Yuanjiang County and Nanxian County where there is no significant soil erosion, other counties and cities have various degrees of soil erosion. The province's mountainous and hilly areas account for 80.49% of the total area of the province, and the erodible soil areas account for more than half of the province's total area. Soil erosion potential factors such as abundant rainfall and frequent heavy rain, are very active, and coupled with dense population, development and use, and social and economic activities as well. Soil erosion has further been exacerbated. According to preliminary calculations, the province's annual loss of soil is about 7 × 108 t (equivalent to the loss of the 5.3 × 104hm^2 farmland soil), annual soil organic matter by surface runoffs is 48 × 106t, and losses of nitrogen, phosphorus and potassium is 1. 92 × 106t. Soil erosion leads to land degradation, and in the province, 1. 00 × 106hm^2 of first class arable land has degraded class 2 or 3. In 28% of the arable soil, organic matter content declined, with 3. 45 × $10^5$$hm^2$ of mountain degenerating into stone bare land, and 2.1 × 104km2 topsoil losing more than half of its soil, creating 67 x 105hm2 of land with low yield, with annual reduction of grain amounting to 1 4 x 109kg. In addition, soil erosion caused the discharge of sediment, silting rivers and lakes and thus causing heavier floods and droughts.

According to information provided by counties and on-site surveys, the project areas are not located in the major areas of soil erosion prevention and control, afforestation lands are chosen in barren hills, wastelands, open woodlands, whose slopes are below 25 ° and which have an altitude of 1000 meters. In barren hills and wasteland, there are normally shrubs and brushwood, with good vegetation coverage.

Accordingly, soil erosion in project areas is relatively light.

(6)Ecologically sensitive areas

Project region have forested land 0.151 billion Mu, forest coverage is 57.01%, forest stock volume 0.402 billion m^3. Existing national and provincial scenic 49 sites, 68 national and provincial forest park,45 national and provincial natural reserves. The project involve 7 national and provincial scenic spots, 9 national and provincial forest park, 4 national and provincial natural reserves (Table 8)

According to information provided by counties and on-site surveys, the project will choose plains or hilly areas as new plantation and renovation stands in the process of management, and thus the project construction doesn't involve the ecological environment of nature reserves, scenic spots, forest parks and other sensitive areas.

(7) Protection areas drinking water sources

Project target counties and cities surface water bodies main involve Xiangjiang River and Lishu River, Lushui River, zhenshui River, Miluojiang, Ningyuan River, Xushui, Youshui, etc. Each river settled centralized drinking water sources intake points, project construction must ensure t safety water supply at drinking water source areas. In the project area main drink water source conservation see Table 9. According to survey result, the centralized drinking water source areas for cities and counties usually located in the places where have convenience transportation and dense population, surrounding forests incorporated into national public benefit forest, while the project camellia plantation select sites of far from population center, and keep a distance with centralized drinking water source areas and rural groundwater wells, it can effectively reduce the pollution impact of camellia plantation chemical fertilizer on centralized drinking water sources and groundwater wells in rural areas.

2. Major environmental problems in project areas

①In the project area, surface water is still being contaminated, among the contamination, ammonia, chemical oxygen demand (COD) and arsenic contamination in some river sections are salient, mainly due to the pollution of discharged wastewater by industrial enterprises as well as agricultural non-point source pollution.

②In the project area, rural groundwater environment pollution is still serious, and the pollution of rural groundwater sources is on development, with some wells being badly contaminated, and even some losing their functions as drinking water sources. The safety of drinking water in rural areas still facing a great threat.

③In project area some region soil was polluted, especially sites nearby the mine company and industrial company, which soil was polluted by heavy mental, cause threaten to our country grain safety.

④The ecological environment of the project area is overall good, but with the impact of development and construction activities, vegetation was damaged to some degree, and comparatively serious soil erosion exists.

Major target of environmental protection(list the names and grades):

The proposed project is the first European Investment Bank loan project in Hunan, involving 14 counties and cities in Hunan Province. Project involve Lilin, Hengyang, Hengshan, Qidong, Shaoyang, Miluo, Pingjiang, Sangzhi, Qiyang, Ningyuan, Xupu, Zhongfang, Huayuan, and Baojing.The project will establish high yield camellia oleifera plantation production base 21861.3 ha, demonstration and extention camellia high yield production techniques, and promote project management capability building. The implementation of the project will enable the forest resources in the project area to improve notably in terms of quality and quantity, and has positive significance in improving forest quality and better ecological environment. Besides the obvious positive significance to local environment, it poses potential environmental problems. Main protection targets are listed below:

(1) Main ecological environment protection goals are, protecting biological diversity and rare animal and plant resources, arable land, soil, as well as ecologically sensitive targets such as nature reserves, scenic spots and forest parks within the area. Main ecologically sensitive targets in this area are shown in Table 5.

(2) Surface water environmental protection objectives are chiefly surface water bodies in the area, such as Mishui River, Zijiang River, Yuanjiang River, Lishui River, with emphasis on the protection of source water and drinking water source protection areas, in order to bring them into conformity with the requirements of corresponding water environmental function zoning and those of the water supply safety of drinking water sources. Details refer to Table 6.

(3) Groundwater environmental protection objective，is to ensures the underground well water to meet class III standards of the groundwater environmental quality standards "(GB/T14848-93). The reason is that the project areas are mainly rural areas where drinking water sources are ground wells.

(4) Ambient air and sound environmental protection objective is mainly to ensure the ambient air quality and acoustic environmental quality of the surrounding residents to meet the requirements of the first Class in the Ambient Air Quality Standards (GB 3095-2012) and the Acoustic Environment Quality Standards(GB3096-2008) respectively.

Table 9 Ecological sensitive region and key protect objects

	Name of Nature Reserve	Location	Area（ha）	Protection object	Nature Reserve level	Approval Time	Approval Department	
Sangzhi	Hunan Badagongshan National Nature Reserve	Sangzhi County	20000	Rare plant species, animal species	National level	1986	State council	C p p a fa
Zhongfang	Kanglong Nature Reserve	Zhongfang County	6667	Forest and wildlife	Provincial level	1996	Province Government	C p p a fa
Qiyang	Qiyang Small salamander Nature Reserve	Guabangshan	6060	Nature reserve	Provincial level	2004	Province Government	C p p a fa

	Ningyuan County	Jiuyishan Nature Reserve	Ningyuan County	3648	*Phyllostachys bambusoides* and ecosystem	Provincial level	1982	Province Department of Forestry	Out of project proposed area, far-forth
Scenery spots	Hengshan County	Nanyueh engshan Scenery Spot	Hengshan County	10070	Nature scene, Taoism and Buddhism culture landscape	National level	1982	State council	Out of project proposed area, far-forth
	Pingjiang County	Fushoud han-Miluo jiang Scenery Spot	Pingjiang County	1600	Culture landscape, nature scene, numerous revolution monumental buildings	National level	2006	State council	Out of project proposed area, far-forth
	Sangzhi County	Loushui Scenery Spot	Liyuan Town	20300	Fountainhead, waterfall, gorge rock forest, limestone cave, etc.	Provincial level	1995	Province Government	Out of project proposed area, far-forth
	Sangzhi County	Jiutiando ng-Chixih e Scenery Spot	Lifuta Township	250	Underground limestone cave landscape	Provincial level	1988	Province Government	Out of project proposed area, far-forth
	Ningyuan County	Jiuningsh an Scenery Spot	Ningyuan County	20000	Apex , Karst landscape, the Mausoleum of Emperor Shun, purple nephelinite, grotto art, millenary emperor temple, etc culture landscape and nature scene	Provincial level	1988	Province Government	Out of project proposed area, far-forth
	Qiyang County	Wuxi stele Scenery Spot	Wuxi Town	16	Open stele and grotto art etc C	Provincial level	1988	Province Government	Out of project proposed area, far-forth
	Baojing County	Bianchen g-Ancient Miao River Scenery	Baojing County	5500	Ancient Miao River and canyon and waterfall etc nature scene	Provincial level	2005	Province Government	Out of project proposed area, far-forth
	Miluo County	Yuchi Scenery Spot	Miluo City	4180	Strange rock and stone, waterfall, temples and relic sites	City level	1993	Yueyang City Government	Out of project proposed area
		Bajingdo ng Scenery Spot	Miluo City	4770	Mountains, reservoir, ancient temples etc culture and nature landscape	City level	1995		Out of project proposed area
Forest park	Ningyuan County	Jiuyishan National Forest Park	Ningyuan County	8226.70	Secondary forest and *Metasequoia glyptostrobodies, Koelreuteria paniculata, Ginkgo biloba, Panthera pardus* and macaque rare plant and animal species	National level	2006	State Forestry Administration	Out of project proposed area, far-forth
	Hengyang County	Gouloush an National Forest Park	Gouloufen g Forest Farm	1950.0	Secondary forest and *Lindera megephylla,Ginkgo biloba, Quercus phillyraeoides* , *Hydropotes inermis* rare plant and animal species	National level	1995	State Forestry Administration	Out of project proposed area, far-forth

	Qiyang County	Jindong National Forest Park	Jindong Forest Farm	2500	Secondary forest and *Ginkgo biloba, Cyclobalanopsis gilva* rare plant species	National level	2005	State Forestry Administration	Out of project proposed area, far-forth
	Pingjiang County	Mufushan National Forest Park	Mufushan	1701	Natural *Pinus taiwanensis and Ginkgo biloba, Pseudolarix amabilis, Emmenopterys Henryi,,* Clouded Leopard, tiger frog,, *Platysternon megacephalum,* macaque etc rare species	National level	2005	State Forestry Administration	Out of project proposed area, far-forth
	Hengshan County	Zijinshan Forest Park	Hengshan County	200	*Ginkgo biloba, Emmenopterys Henryi,*, macaque etc rare species	Provincial level	1992	Province Government	Out of project proposed area, far-forth
	Qidong County	Simingsh an Forest Park	Qidong County	3560	*Magnolia denudate,Ginkgo biloba,Phoebe zhennan Koelreuteria paniculata, Cyclocarya paliurus,Amorpha fruticosa* and Malayan pangolin rare species	Provincial level	2004	Province Government	Out of project proposed area, far-forth
	Pingjiang County	Fushoush an Forest Park	Pingjiang County	1275	*Koelreuteria paniculata, Ginkgo biloba,Taxus chinensis,* Clouded Leopard, Tragopan caboti, Aquila chrysaetos etc rare species and ecosystem	Provincial level	2004	Province Government	Out of project proposed area, far-forth
	Sangzhi County	Fengluan xi National Forest Park	Southwest ern of County	2216.6	Secondary forest and *Ginkgo biloba, Taxus chinensis, Viverridae, Malayan pangolin, Andrias davidianus* etc rare species	National level	2009	State Forestry Administration	Out of project proposed area, far-forth

Table 10 Summary protection region of drinking water source in project area

Protection region grade	Surface water bodies	Water area	Protection river length (km)	standards	Cities/ counties
Grade II	Miluojian g	From Xinshiqiao to city water plant intake upstream 1000m	4.8	III	Miluo City
Grade I	Miluojian g	From city water plant intake upstream1000m to downstream	1.2	II	Miluo City
Grade II	Miluojian g	From city water plant intake downstream 200m to nanduqiao	6.0	III	Miluo City
Grade II	Miluojian g	From Guantan ferry to county water plant intake upstream 1000m	9.3	III	Pingjiang County

Grade I	Miluojiang	From county water plant intake upstream 1000m to downstream 200m	1.2	II	Pingjiang County
Grade II	Miluojiang	From county water plant intake downstream 200m to Shibitan ferry	3.0	III	Pingjiang County
Grade I	Zhengshui	From Daishan to Hongshi barrage	1.2	II	Hengyang County
Grade I	Zhengshui	From Yintang to Wusi Village, Chishi Township	1.2	II	Hengyang County
Grade I	Zhengshui	From Fuxi Township to Taiyuan barrage	1.2	II	Hengyang County
Grade I	Zhengshui	From Youdu water plant intake upstream 1000m to downstream 200m	1.2	II	Hengyang County
Grade I	Qishui	From ChenjiaVillage to Layuan Village barrage	1.2	II	Qidong County
Grade I	Baihe	Hongqi Reservoir water area	0.7	II	Qidong County
Grade I	Qishui	Shimen Reservoir water area	0.1	II	Qidong County
Grade I	Qishui	From Shashuqiao(Shatanqiao) to Lijiaping water plant intake downstream 200m	5.2	II	Qiyang County
Grade I	Baishui	From place of Huanghuahe join Baishui to Baishui Town intake downstream 200m	2.2	II	Qiyang County
Grade I	Xiangjiang	From planning County water plant intake upstream 2000m to downstream 500m(Yangmeiyan)	2.5	II	Qiyang County
Grade I	Xiangjiang	From Xiangjiang Chemcial Plant intake upstream 1000m to downstream 200m	1.2	II	Hengshan County
Grade I	Xiangjiang	From Hengshan water plant intake upstream 1000m to downstream 200m	1.2	II	Hengshan County
Grade I	Lushui	From city region Liuxingtan barrage to tap water Lushui spare intake downstream 200m	2.7	II	Lilin City
Grade I	Ningyuan River Lingjiang River	From Chaluo to Zhuziwo	3.7	II	Ningyuan County
Grade I	Ningyuan River Lingjiang River	From Maocaoping to Hongqi Dam	4.7	II	Ningyuan County
	Ningyuan River Jiunin River	From Yuantou (Sanfenshi) to Niutoujiang Village small dam (water source area)	5.0	I	Ningyuan County

Grade I	Ningyuan River Jiunin River	From Shuishi Town Reservoir Dam to Shuishi Town intake downstream 200m	4.7	II	Ningyuan County
Grade II	Fuyishui	From Dongfanghong power station to Xiangyangba power station	16.3	III	Shaoyang County
Grade I	Fuyishui	From Xiangyangba power station to County water plant intake downstream 200m	1.4	II	Shaoyang County
Grade II	Tonghe	From Huayuan County Dalongdong power station to Shizi'an water plant intake upstream 1000m	36.0	III	Huayuan County
Grade II	Huayuan River Xiongdi River	From Leigongdong of Dalaopai Village, Jiwei Town to Zhangpima Bridge of Longtan Town and upstream other rivers branches(10.0 kilometers)	20.0	III	Huayuan County
Grade I	Huayuan River Xiongdi River	From Zhangpima Bridge of Longtan Town to county water plant intake downstream and other rivers branches within this region	3.0	II	Huayuan County
Grade II	Youshui	Gezehu reservoir water area	0.1	III	Baojing County
Grade I	Lishui	From Ganta to Nancha ferry	7.5	II	Sangzhi County
Grade I	Lishui	From Nancha ferry to Badouxi Dam	8.5	II	Sangzhi County
Grade II	Xushui	From Chetou Village ferry to county water plant intake upstream 1000m	1.8	III	Xupu County
Grade I	Xushui	From county water plant intake upstream 1000m to downstream 200m	1.2	II	Xupu County

Evaluation applicable standards

Environmental quality standards	1、Sound environmental quality noise standard refers to Sound Environmental Quality Standard (GB3096-2008) Grade I 2、Ambient air quality standard refers to Ambient Air Quality Standard (GB3095-2012) Grade II 3、Surface water source water standard refers to Surface Water Environment Quality Standard (GB3838-2002) Grade I; Class I drinking water source protection zone standard refers to the Surface Water Environment Quality Standard (GB3838-2002) Grade II; Class II drinking water source protection zone standard refers to the Surface Water Environment Quality Standard (GB3838-2002) Grade III. 4、Soil environment standard refers to Soil Environmental Quality Standards (GB151618-1995) Grade II. 5、Groundwater Standard refers to groundwater environmental quality standards (GB/T14848-93) GradeIII.
Pollutant emission standards	1、Wastewater discharge standard refers to the National Integrated Wastewater Discharge Standard (GB8978-1996) Grade I 2、Emissions standard refers to Air Pollutant Discharge Standard (GB16297-1996) Grade II. 3、Life Garbage standard refers to Solid Waste Landfill Pollution Control Standard (GB16889-2008).
Quota of total control	The project is a Sustainable Forest Management Project, it is not involve industrial pollution and total indicators in the Twelve Five-Year Planning, so it is not recommended to apply for total control indicator.

Project Construction Analysis

Process Descriptions (diagram)：

As for plantation process and major producing pollutants process, See Figure 2.

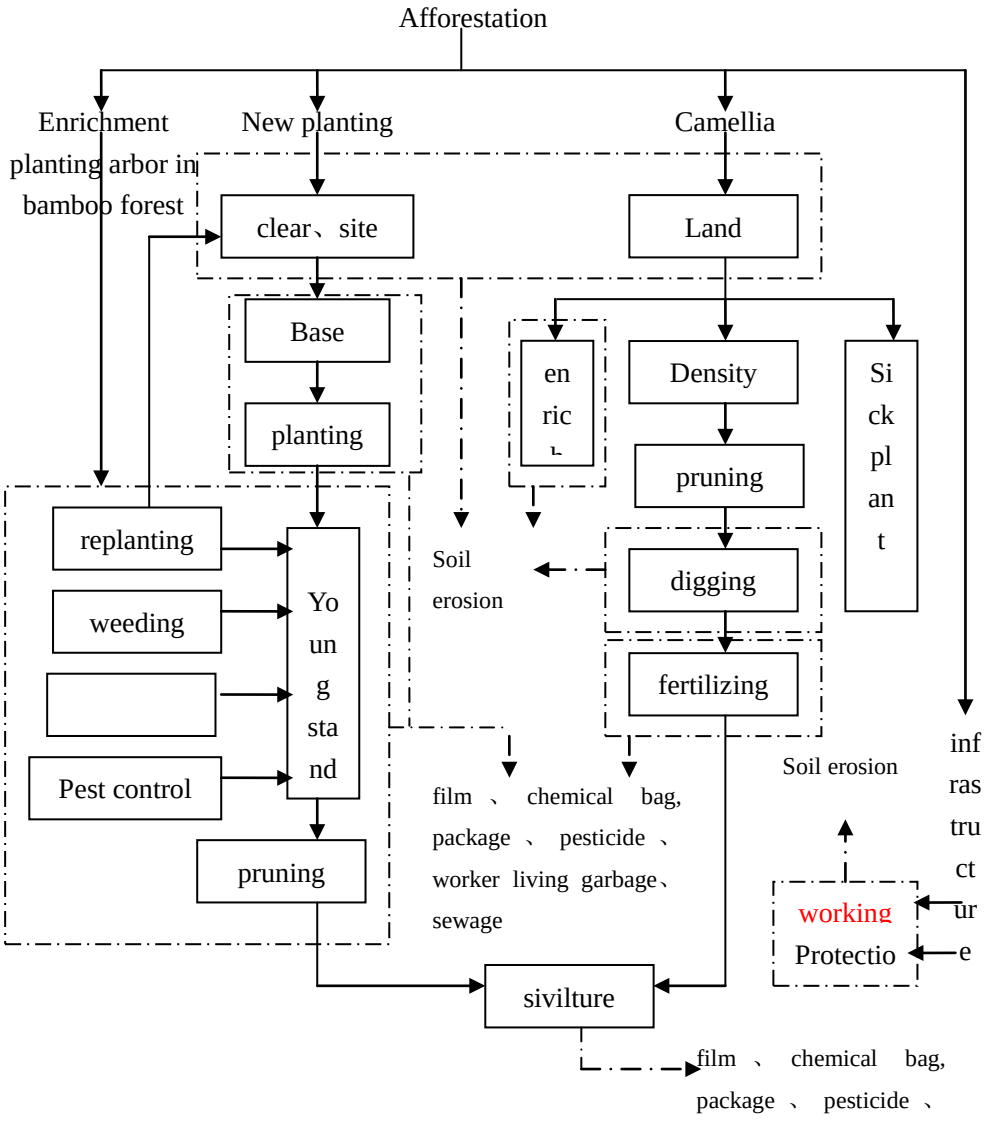

Figure 2　Project process

Project process description：

Project process description: Camellia produce base construction mainly include camellia new plantation, young stands tending and low-yield camellia stands improvement and ancillary infrastructures.

New Camellia Plantation: Land clearing means conduct ground clearance 3 months before the plantation, the activity mainly to clear the residual wood on the ground, shrubs, stumps etc. Facilitate to later the construction work operation. After land clearing conduct land prepration, main adopt holes reclamation. Holes specification: length width and depth is 70 cm × 70 cm × 60 cm. 1 month before planting earth up, take topsoil filled the planting hole. In order to prevent soil erosion, it is needed excavation a level ditch every 4 to 5 rows along the contour, the ditch

bottom width 30 cm, deepth 30 cm. Application base fertilizer should be applied in the bottom of the hole and fully mixture with backfill soil, filling soil and until backfill soil settlement then planting the seedling.Young forest tending activities are mainly include following steps, enrichement palnting, weeding, digging, apply top-dressing fertilization, and pruning.

Young Camellia oleifera forest tending: Site selection we recommended that selecte stands from the site condition well, the seedling survival rate more than 85%, the seedling evenly distributed in the stands,the plantation eatablished in 2008 ~ 2011 which planted seedling of improved Camellia varieties. The other processes of young stands tending similar with the new plantation.

Low-yielding Camellia stands improvement main measures are land clearing, density adjustment, prunning and reclaimation digging, water and soil conservation, rational fertilization, inferior individual transformation, enrichment planting totally 8 technical measures. Land clearing is removal all the other trees, vines shrubs and weeds in the forest, transfer mixture forest into Camellia monoculture stands, and removal the disease, old and bad camellia plants..For those too dense sites conduct density adjustment or thinning cutting, thin too much sites conduct enrichment planting with improved camellis vatiety seedlings, adjustment the dense or sparse stands into moderate density Camellia forest, according to the site conditions, reserve 1200 plants per hectare. Cut off the dead branches, worm branches, overlapping branches, parasitic branches, wasteshoots, inside weakness branches, foot branches, drooping branches facilitate to cultivate a nice tree structure.In the first year winter, it is need once time deep digging, the digging depth outside of canopy would more than 20 cm, the digging depth within the crown can slightly shallow. It is recommended adopt strip digging manner, digging one strip, leave one strip, rotation strip digging, the wholely digging would be finished in two years. Hereafter three years, every 3 years need once time deep digging, every year need once shallow digging.Along the horizontal direction of mountain dig level ditches. The ditch with bottom width more than 30 cm, depth 30 cm, the length depending on site condition, normally 1 to 1.5 meters length. Interspace of ditches 8 m where there slope gradient less than 15 °, 6 m where there slope gradient above 15 °, jointly with the reclamation activity, annually clearing ditches once time. Areas where condition permits, jointly with the reclamation activity, built terrace along the contur year after year, to prevent soil erosion.According Camellia oleifera growth and fruiting status and different growth stages,on basis of camellia soil testing indicator and fertilizer recommendation scheme, apply fertilizer precisely. Give priority to Camellia specialty fertilizer and manure, it is recommended that green manure application on mountains, residual cakes of extract camellia oil back to mountains. Apply P fertilizer in the plenty seeds years, while apply nitrogen fertilizer or compound fertilizer in poor seeds years. In autumn and winter mainly application organic fertilizer, spring and summer mainly application N, P compounded fertilizer. Combined with winter reclamation, application composting fermentation manure, in the first year the amount of Camellia special fertilizer is 120 kg per hectare. The amount of summer top-dressing N, P compound fertilizer 0.2 to 0.3 kg per plant. Fertilization method: combined with reclaimation, apply fertilizer into the ditches in the crown of the outer edge. It is recommended plant green fertilizer plants, and green manure burying.In better site conditions of young forest and middle age forest, we can use large tree crown transformpartially fruiting or less fruiting individuals into improved plants, consquently increas the stands overall yield.

Major polluting process

I Types of Pollutants during Construction

The potential impacts of the project during construction mainly include:

(1) Destroy of the original surface soil and soil erosion

The project construction area is 21861.3 hm^2. 14 counties (cities) in Hunan involved in project. At the project beginning of afforestation, it is need land preparation of clear weeds, shrubs etc. Before the planting activity, it is need to hole-cultivate for soil preparation and enrichment planting in young growth in tending process, therefore, original vegetation destruction and soil erosion it is inevitable. In addition, the forest road net, working path, skid trails and other ancillary works construction will cause a certain degree of damage to the original surface, resulting in a certain degree of soil erosion.

(2)Application of chemical fertilizers

The project silvicultural will application fertilizers, such as during the new camellia plantation establishment, it is need application base and adding ferlization,

Camellia plantation should use Camellia oleifera application special base fertilizer (basal) 1650 kg/ha. In young stands tending need top-dressing fertilization. In spring (March) apply available fertilizer, such as special fertilizer for Camellia plant or urea. In winter (November) apply wintering fertilizer, such as special base commonly use ditch application method, 0.1 kg per plant once time.

During the process of young Camellia stands tending, generally use top-dressing fertilization. After planting, first or two years, mainly apply nitrogen fertilizer to promote the of saplings nutritional growth. Fertilization volume is urea 50 g / plant. From the third year, plant beginning to bear fruit, apply urea 50 ~100 g, phosphorus and potassium fertilizer 100 ~150 g.

As for low-yield Camellia oleifera stands improvement, according plant growth and fruiting status and different growth stages, on basis of camellia soil testing indicator and fertilizer recommendation scheme, apply fertilizer precisely. Give priority to Camellia specialty fertilizer and manure, it is recommended that green manure application on mountains, residual cakes of extract camellia oil back to mountains. Apply P fertilizer in the plenty seeds years, while apply nitrogen fertilizer or compound fertilizer in poor seeds years. In autumn and winter mainly application organic fertilizer, spring and summer mainly application N, P compounded fertilizer. Combined with winter reclamation, application composting fermentation manure, in the first year the amount of Camellia special fertilizer is 120 kg per hectare. The amount of summer top-dressing N, P compound fertilizer is 0.2 to 0.3 kg per plant. Fertilization method: combined with digging, apply fertilizer into the ditches in the crown of the outer edge. It is recommended plant green fertilizer plants, and green manure burying. During the phase of construction, N fertilizer amount reach 4547.7 t/a, P fertilizer amount reach 2936.9 t/a, according to reference literature, N and P lost rate is 1.6%, 0.4% respectively, thus N and P lost amount is estimated 72.7 t/a, 11.8 t/a respectively in construction phase.

(3)Application of pesticides

Common disease of camellia oleifera are Camellia anthrax disease, Meliola camelliae (Gatt.), Camellia oleifera root rot disease, Euproctis pseudoconspersa Strand., Camellia geometrid , Lepidoptera, Para-metriotestheae Kusnetzov, etc. Therefore application pesticide in camellia stands inevitably. During construction phase, pesticide application amount reach 1633.1 t/a, according to reference literature, pesticide lost rate is 1%, pesticide lost amount is estimated 16.3 t/a.on the one hand, the application of pesticides, especially toxic and long residual pesticides likely to cause environmental pollution; On the other hand, applying pesticides process will generate waste packaging and containers, according to the State

hazardous waste Directory, pesticide waste is a kind of waste hazardous waste, and it is should unify collecting and send to dangerous waste processing center for disposal, otherwise, it will cause environmental hazards.

(4)The impact of waste packaging materials such as plastic film, chemical fiber woven bag

In order to prevent seedling roots dehydration in transport process, seedlings with soil, it is recommend packed seedling root with plastic film and chemical fiber woven parcels shipped to planting site, in addition, the fertilizer bag will also produce waste film, chemical fiber woven. These waste packaging such as plastic film, chemical fiber woven material resistant to degradation belongs white trash, if not properly collected, it will pollute environment.

(5)Forest workers living garbage and domestic wastewater

This project involves a wide range area and has heavy workload, require a large number of workers in the planting, therefore, the construction period will generate a certain amount of living garbage and domestic wastewater. Taking into account the project areas are located in rural areas, or nearby natural villages, most of the employed workers are local farmers, and daily life living at home, the project do not necessary set up centralized construction camps, thus do not produce a new garbage and domestic wastewater. Therefore, the implementation of this project would not bring living garbage and domestic wastewater.

(6)Automobile exhaust

During construction period, the project need transport seedlings, fertilizers, construction workers, construction equipment, the vehicles will exhaust emissions, but overall, there is very few emissions, and it have little effect on the project area.

II The production pollution aspects of the operation period and the types of pollutants

During project silvicultural process, it is need added fertilizer, routine inspections and strengthen pest management. Therefore, during the operation period of the impact of potential pollution include as follows:

(I) Impacts of applying pesticides during pest control process, it is inevitably to use pesticides in the silvicultural management. The overdose use of pesticides, especially toxic and long residual pesticides likely to cause environmental pollution, meanwhile, during the application of the pesticide process, if improper dispose the waste packaging and containers such hazardous waste , it will be harmful to the environment.

During construction phase, pesticide application amount approximately 2120 t/a, according to reference literature, pesticide lost rate is 1%, pesticide lost amount is estimated 21.2 t/a.

（II）The impact of fertilizers: improper application N, P fertilizer easily through surface runoff penetrate into nearby water bodies, will cause severe eutrophication.

During the period of operation, N fertilizer amount reach 7817.6 t/a, P fertilizer amount reach 11726.4 t/a, according to reference literature, N and P lost rate is 1.6%, 0.4% respectively, thus N and P lost amount is estimated 125.1 t/a, 46.9 t/a respectively.

（III）Living garbage and domestic wastewater product by Forest management worker: After the completion of the woodland, with a small amount of silvicultural management, the ranger staff living in nearby villages, the management and protection shed only a small amount of toilet wastewater collected in the form can be used aqua privies garbage collected by ranger staff themselves. Overall, not produce larger distribution, collection and processing through appropriate silvicultural management of garbage and domestic wastewater has little impact on the

environment.

The project produced major pollutants and estimated emissions

content / Type	Emission sources (No.)	Pollutants Name	Produced a concentration prior to treatment And production (units)	Emissions and concentrations of Emissions (units)
Air pollutants	construction period	vehicles Fuel exhaust	A small amount of	Small impact of the construction zone status of ambient air quality, emissions, diffusion
Water pollutants	construction period	Pesticides and fertilizers	In construction period, Loss of pesticides is about 16.3 t/a. In fertilizer N and P loss is about 72.7 t/a、11.8 t/a In operation period, Loss of pesticides is about 21.2 t/a. In fertilizer N and P loss is about 125.1 t/a, 46.9 t/a Estimate project produce living waste water1.67t/d, calculate 81 protection sheds, average 0.01 t/d per shed.	
	operation period			
Solid waste	construction period	Seedlings package and chemical fertilizer produce waste plastic film, chemical fiber woven packaging materials, garbage workers, in addition, pesticide application process pesticide packaging and containers. Recyclable material recycled as far as possible, the garbage can not be recycled, plastic film and chemical fiber woven centralized collection and processing. Commissioned pesticide packaging and containers are hazardous waste and should be focused on collecting the appropriate qualification units handled properly.		
	operation period	Commissioned after the pesticide application process pesticide packaging and containers are hazardous waste, should be focused on collecting appropriate qualification units handled properly.		
noise	The project construction noise small, and operating in remote sites, therefore, noise impact can negligible.			

Major ecological impacts

The implementation of this project has water and fertilizer, clean air and carbon fixation and oxygen of positive ecological benefits, but in the construction and operation process, it still may lead to destruction of original vegetation, soil erosion, reduce biodiversity and other negative ecological impact. The project impact on regional environment see thematic eco-environmental impact analysis in this report.

Environmental Impact Analysis

I Positive environmental impact analysis of the project construction

The implementation of the project, help woodland give full play to a wide range of features and benefits, in particular, it will significantly increase the woodland area of the project area, improve regional ecological environment. The project construction has positive impact such as conservation fertilizer and water, air purification, carbon sequestration and oxygen release.

(1) Forest coverage

After the completion of the project, addition new 5800 ha of forest resources, in the project area forest coverage rate has increased, as well as the ecological function of the forest has been strengthened.

(2) Water resource and soil conservation

Through the implementation of the project, enhance the forests water resource conservation function, meanwhile, the forest effectively curb the drought and floods natural disasters occurrence. According to related research results, we estimated that the project new plantation 6807.5 ha, increase water conservation 427.5 ton / ha/ year, totally increase water conservation 2,910,200 ton, we calculate water by1.5Yuan per ton, then per hectare water conservation profit will hit 4,365,300 Yuan, meanwhile, per hectare soil conservation reach 60 ton, we calculate soil by 3.5Yuan per ton, then profit from soil conservation will hit 1,429,500 Yuan, in addition, camellia plantation can retention fertilizer 0.6 ton /ha/year, we calculate fertilizer by 2000 Yuan per ton, then profit from fertilizer conservation will hit 8,169,000 Yuan.

(3)Soil and Water Conservation and fertilizer conservation

Through the implementation of the project, reduce soil erosion, reduced soil organic nutrient loss. At the same time, through the forest cycle, constantly increasing soil organic matter, so as to improve the fertility of the soil. According to related statistics estimated that during the project period it keep land and water area 16,733 hectares, value of fixation soil and fertilizer conservation up to 12272 million. Therefore, projects construction has obvious benefits in the soil and water conservation, fertilizer

(4) Air purification

Forest has dust adsorption , toxic gas absorption , kill bacteria, reduce noise, cleaning environment function.Forest can emmision 4.95 kg phytoncide per hectare per year, can absorb dust 68.0 tons, can absorb sulfur dioxide 180.0 kg, we calculate on such basis,,the project new plantation has 6807.5 hectares, it is emmision 33.67 tons phytoncide, adsorption dust 462,910 tons, absorption sulfur dioxide 1225.4 tons per year.calculate by purification air alternative value 195.0 yuan / ha/ year,the project air cleaning value would hit 1,327,500 Yuan / year.

(5) Carbon sequestration

The Camellia forest ecosystem carbon sinks play an important role. The Camellia forest tree species endemic to China, vigorously develop the tea-oil industry, can not only improve the coverage of forest vegetation, but also through photosynthesis storage of carbon in the atmosphere, increase of Camellia forest ecosystem carbon reserves, thereby enhancing the carbon of the province's forest ecosystems sink function. Compared to grassland or farmland, Camellia oleifera Lam is a perennial evergreen small tree, leafy surface can accumulate more litter, soil carbon storage capacity of the library has an important role in climate change mitigation. Camellia forest carbon sink is divided into the stand carbon sequestration and soil carbon sinks two aspects.

1) Forest carbon sinks

Camellia Forest Stand carbon sink consists of two parts, part of the plant carbon reserves, including the trunk, branches, leaves, roots and other components; another part of the Camellia fruit carbon storage, especially in seedling stage Camellia fruit of the highest carbon content.

According to the research results, Camellia plant carbon reserves of about 70 t / ha, equivalent to of fixed purity of 18.9 tons / ha; the calculation period Camellia of new and young forest tending average annual fruit yield of 30.0 tons per hectare, low-yielding tending and transformation of the average per hectare per year Add fruit yield of 1.1 tons, dry weight of 0.45, the production of 1 ton of dry matter to carbon

dioxide fixation to 1.63 tons, Camellia of new and young forest tending per hectare per year of carbon sequestration 24.75 tons, equivalent to 6.75 tons of pure carbon can be fixed, low-yielding tending and transformation per hectare per year of carbon sequestration 12.1 tons, 3.3 tons (pure carbon accounted for the proportion of carbon dioxide equivalent to fixed pure carbon 0.2727).

2) Soil carbon sequestration

Most of the Camellia Forest of new soil thickness greater than 60 cm soil more fertile red soil, yellow red barren hills and wasteland, slash, sparse, and the decline in production of Camellia woodland, in the Camellia forest ecosystem, soil carbon density is the most important contributors.Judging from the spatial distribution of soil carbon density decreased with increasing soil depth, soil carbon density is mainly concentrated on the soil surface. 0-60 cm soil carbon density of 148.2 t / ha, accounting for 74.0% of the total carbon density. 60-100 cm soil layer average carbon density of only 52.0 t / ha, accounting for only 26.0%.

In summary, the project Camellia forest ecosystem total annual carbon sequestration: plant carbon sinks 413,200 tons; fruit carbon sink capacity is 133,200 tons; soil carbon sink capacity is 666,900 tons to 1,213,300 tons.

(6)Others

Project construction can also affects surrounding air micro circulation system, regulate the microclimate, air purification and sheltered farmland. The project implementation would increase the vegetation cover, provides a wider habitate space for wildlife, and protect biodiversity. At the same time, construction projects can make a large area of barren hills and bare land be covered with green vegetation, create landscape benefits and a better environment for local people's production and life in the area.

II Analysis the potential negative environmental impact of the project construction and mitigation measures

In the project construction process, it will generate some negative impacts on the environment. According to the project construction characteristics in the different phases, we analyzed the negative impacts in construction and operation periods and proposed mitigation measures.

1. A brief analysis of construction period environmental impact

1.Stand selection impacts on environmental

(1)Impact analysis

In this project total construction camellia plantation area is 21861.3ha, witnin which, new plantation area is 6807.5 ha,with improper stand selection such as choosing steeper slops, wildlife habitat or drinking water source protection areas, project construction may cause vegetation, destroy, serious soil erosion, and affect the breeding and habitat environment of wildlife or damage wildlife migration channel.The application of pesticide and chemical fertilizer will also adversely affect the drinking water source protection areas.

(2)Mitigation measures

① Selection camellia forest, wastelands, slash, open woodland slope below 25 degrees.

② No selection camellia stands location within nature reserves, scenic spots, forest parks and other ecologically sensitive areas and priority choose their peripheral

2000m, without option ecological forest and special use forests protected place and its peripheral 100m, without option rare wildlife and plants concentrated zone, without the option of the river on both sides of 50m range, without the option of a drinking water source protection areas and upstream 1000m range.

③ Rational planning plantation small patch, appropriate control afforestation plot size, avoid pure plantation area too large bring negative impact on the ecological environment.

④The camellia forest base shall not select arable land and basic farmland.

Strictly implement the principle of the stands select conditions, the project selection stands model is reasonable, it can effective to mitigate the impact on local biodiversity and ecosystem stability and drinking water source protection areas.

2. Original surface soil damage& soil erosion

(1)Impact analysis

Land clearance may cause permanent or temporary disturbance of vegetation and plant resources, destruction the original vegetation, causing surface soil and nutrients loss. Incorrect slope site land preparation method may lead to serious soil erosion. In addition, replanting, reclaimtion, digging and skidding trails, working path, management sheds and other ancillary works construction will cause some degree of soil erosion

(2)Mitigation measures

①before construction organize training workers learning to soil erosion prevention knowledge, during the construction, strengthen supervision, promptly corrected incorrect construction

② Prohibited burning to clean up stand.

③ In new plantation process do not overall digging, mainly planting hole reclamation along the line "品"" -shaped arrangement, at the hill top, middle and the foot retain a certain width native vegetation, with high steep slopes, the slope top and valley, the river bank stand vegetation shall not clearing cut

④ Carry out reclamation along the contour in strip , minimize soil erosion

⑤ Between the edge of planation and farmland retention 10m wide vegetation protection belt.

⑥ After land preparation, deadwood grass cover the surface soil timely, avoid topsoil exposed, reduce soil erosion;

⑦ Skidding road, working path, and the management sheds and other ancillary works should dependent on mountains landform, avoid massive excavating and filling, as much as possible to reduce the damage to the original ground surface.

3. Impact of fertilizer application

(1)Impact Analysis

Improper fertilization, N, P in fertilizer will easy with surface runoff into nearby water bodies, result in severe eutrophication. From the Environmental Quality Survey result, Hunan Province major pollutants in surface water is fecal coliform, ammonia nitrogen, phosphorus, and chemical oxygen demand, BOD5, arsenic, petroleum and permanganate index. Xiangjiang River, Yuanjiang River, Dongting Lake water total nitrogen, total phosphorus pollution heavier; total phosphorus, TP is one of the main factors affecting Huanprovince's urban drinking water source water quality up-to-standard..

According to the analysis, the project construction period N and P loss were 72.7t/a, 11.8t/a, respectively, but the project involves the area is very wide, regional

surface water system developed, rich in water resources, water have self-purification ability, coupled with the proposed camp stands far from drinking water source protection areas, therefore, fertilizer application cause N, P loss do not have greater impact on regional surface water and drinking water source protection areas. Nevertheless, it still necessary to take effective measures to control use chemical fertilizer.

(2)Mitigation measures

① Strengthen fertilization knowledge training for the silvicultural management staff, preparation rational fertilization plan;

②Advocate use organic fertilizer(manure), applied some organic fertilizer on topsoil in land preparation, ditch grass, leaves buried next to the tree stump in tending to increase stand organic fertilizer, reducing the amount of chemical fertilizer;

③According soil reality situation and soil testing, application reasonable variety and quantity of chemical fertilizers, and fertilizer, avoid too much fertilizer, resulting fertilizer wastage and pollution environment

④Properly collection and handling fertilizer packaging, avoid fertilizer packaging residual with the rain into water body to pollution the environment. .。

⑤Afforestation site should be prohibited slection in water source , drinking water source and demarcation natural reserve region.

Implementation of these measures would not cause significant impact on the water environment.

4.Impact of pesticides application

(1)Impact Analysis

According analysis results, in camellia plant growth process, plants inevitably subject to variety of pest damage.Pesticide application amount reach 1633.1 t/a, lost amount 16.3 t/a.

Prevention and treatment of these diseases and pests, implementation comprehensive prevention and control, priority select physical and biological control measures; when other control methods invalid and pest monitoring results show that the harm degree than the economic threshold, application of a small amount of pesticides. On one hand, especially toxic, long residual pesticides application likely to cause environmental pollution; On the other hand, pesticides application will generate waste packaging and containers, primarily generated decentralized residue of glass bottles, plastic bottles and aluminum foil bag. According to the national list of hazardous waste, such pesticide waste hazardous should unify collection and commission qualified unit for disposal.Otherwise generate high environmental hazards. At present, Hunan province's rural groundwater pollution is more serious. in 2011, a total of 16 pilot villages covering 14 municipalities(prefecture) in whole province underground water sources quality up-to standard rate was only 25.0%,up to GradeIV and GradeⅤ37.5% respectively Groundwater source pollution problems are more prominent, drinking water safety is still facing a greater threat. In the process of the implementation of the project, if unreasonable application of pesticides, will aggravate drinking water contamination problem in rural areas. In addition, pesticide application also have adversely affect on the forest-dwelling animals, particularly capture pest-eating birds. Therefore, it necessary to take a series of effective measures to control the use of pesticides.

(2)Mitigation measures

① Strengthen pest quarantine, control seedlings with pests transferred from the source.

②Before afforestation purify the project area stand environment, investigate the stand and the surrounding area environmental, control Insect and pathogen source, and tending stand timely ,pay attention to stand health, improve forest itself resist pests capacity , reduce pest incidence.

③Taken biological control measures for pest control, and reduce pesticide use.

④Indispensable pestcide prevention,selection low toxicity, low-residue or pollution-free pesticides (WHO classⅢ) ,prohibit use highly toxic pesticides in order to mitigate the impact on the environment;

⑤Pay attention to spray volume, spray time and spray ways of pesticides. Avoid once sprayed overdose cause pesticides wasted and excess pesticide wastage to enter the environment, avoid application during the rainy season, especially application before the heavy rain, particularly pay attention site selection of pesticide container cleaning, the pesticide container cleaning, avoid resident,wild animals and livestock drinking water source.

⑥ Project each target city and county forest organizational entities (forest management units) must unified collection of packaging waste generated in the process of applying pesticides and containers, commission the qualified hazardous waste treatment units for proper disposal. Temporary storage before decontamination and disposal of pesticide waste packaging and containers need meet the storage of hazardous waste pollution control standards "(GB18597-2001) requirements.

⑦ Workers and forest armers before using the pestcide must accept security management, storage chemical pesticides training, avoid a direct impact of pesticide on people or contaminate water and food.

Take these measures can reduce pesticide application lead to adverse environmental impacts at the greatest extent

5.The impact of plastic film, chemical fiber woven bags waste packaging materials

(1) Impact Analysis

During the seedling transport process, in order to prevent the seedling roots dehydration ship to forestation locations, seedlings root with some soil and wrap with plastic film and chemical fiber woven bags, in addition, the bagged fertilizer will also produce waste film, chemical fiber woven bags. The waste packaging such as plastic film, chemical fiber woven material hard to degradation, if improperly collected will cause white pollution on the environment.

(2) Mitigation measures

①Collection film, chemical fiber woven bags reuse for seedlings wrap.

②Those breakage, hard to reuse films, chemical fiber woven should be unified collection and sent to local landfill for processing.

6. Forest workers domestic garbage and wastewater impact

This project involves a wide range of area with heavy workload and requires a lot of workers in the afforestation and renovation process, and during construction will generate a certain amount of domestic garbage and wastewater. The survey on the status of the environment quality shows that the surface water in the project area is still being contaminated, with ammonia, chemical oxygen demand (COD) and arsenic pollution in some river sections standing out. The underground water pollution of rural area of the project is serious, the pollution of the underground drinking water sources in rural areas is developing, among which some wells were seriously polluted and even lost their drinking functions, and drinking water safety in rural areas is still facing great threats. However, the project areas are located in rural areas and near natural

villages, most of the employed workers of the project are local farmers who live at home and require no centralized construction camps, and thus this project does not produce new garbage and life wastewater. Therefore, during construction, workers' waste and garbage will not affect the environment of the groundwater and surface water.

7. Automobile exhaust

Vehicles exhaust emissions for transporting seedlings fertilizers, construction workers and construction equipment during construction period, but overall its small emissions. The survey shows that environmental quality of the proposed project area are typical rural environment, with high vegetation coverage, almost none of industrial air pollution sources, the evaluation conclusion is regional ambient air quality good. During the construction, select exhaust up-to-standard transport vehicles,that can further reduce transport vehicle exhaust impact on surrounding atmospheric environment.Therefore, during the project construction phase vehicles exhaust emissions has little effect on the air quality of the project area.

(II) Analysis of operation period environment impact

1. Application of pesticides in forest management impact on environment

(1)Impact Analysis

According to analysis results, in operation period, pesticide application reach 2120.0 t/a, lost amount to 21.2 t/a.Application of pesticides brought about environmental problems are mainly two aspects: on the one hand, the loss of pesticides with rainwater from entering water body, toxic and long residual pesticide impact is particularly evident; On the other hand, the process of applying pesticides will generate waste packaging and containers and other hazardous waste, if no centralized collection and commission qualifications units to processing will cause potential environmental hazards. At present, Hunan province's rural groundwater environmental pollution is serious. in 2011, a total of 16 pilot villages covering 14 municipalities (prefectures)in Hunan province quality of underground water sources, up-to-stangard rate was only 25.0%, Grade IV and Grade V 37.5% respectively. Ground water source pollution problems are more prominent, and the safety of drinking water is still facing a greater threat. In the process of the project implementation, if irrational use of pesticides,it will aggravate the problem of contamination of drinking water in rural areas. Therefore, its need take a series of effective measures to control pesticides use.

(2)Mitigation measures

①Strengthen insect and pathogen control, forest tending timely, pay attention to stand health, improve the forest itself resist pests capacity, reduce pest incidence.

②Measures of pest control mainly taken biological control, reduce pesticide use.

③Try to use low toxicity and residue or pollution-free pesticides (WHO classⅢ) prohibit the use of highly toxic pesticides, in order to reduce the impact on the environment.

④Pay attention to applying pesticides such as spray volume, spray time, spray ways, avoid once sprayed overdose, causing pesticides wasted and excess pesticide wastage enter the environment, avoid spray during the rainy season, especially before heavy rain application, in addition, we should particularly pay attention to

pesticides container cleaning, cleaning site selection should avoid resident,wild animals and livestock drinking water source.

⑤Each target city and county forest organizational entities (forest management units) must unified collection of packaging waste generated from applying pesticides and container proces, commission the qualified hazardous waste treatment units for proper disposal. Before decontamination and disposal of pesticide waste packaging and containers need temporary storage and meet the storage of hazardous waste pollution control standards "(GB18597-2001) requirements.

⑥Where the worker and forest farmer must accept training of chemical pesticide security management, storage and use before using the pesticide, avoid a direct impact on people or contaminated water and food.

⑦Pesticide application should try to avoid the breeding season of the birds, and application pesticides of poisoned lighter on birds.

Through realize above metioned measures, can mitigate pesticide application may lead to adverse environmental impact of the greatest degree.

2. Impact of application fertilizer

(1)Impact analysis

Combination of the project condition analysis, currently mainly use N and P fertilizer, K fertilizer complemented in forest management. If improperly application, not only cannot realize full fertilizer effect , in case N, P penetrate into the water could easily lead to surrounding water eutrophication, in addition, cause soil compaction, soil fertility decline. From the Environmental Quality Survey results, Hunan Province of major pollutants in surface water is fecal coliform, ammonia nitrogen, phosphorus, and chemical oxygen demand (COD), arsenic, petroleum and permanganate index. Total nitrogen and total phosphorus heavy pollution in Xiangjiang River, Yuanjiang River, Dongting Lake, TP is one of the main factors affecting the Hunan urban drinking water source water quality standards.

According to result of analysis of construction, In operation period, N and P lost amount to 125.1 t/a, 46.9t/a respectively.The project 14 target counties (cities) spread around Hunan Province, involving a large area, surface water system developed, enrichment in water resources in this region, water has strong self-purification ability, coupled with silvicultural model stands far away from drink water source protection zones, thus N, P fertilizers loss will not have a significant impact on surface water bodies of Hunan province. Nevertheless, its necessary to take effective measures to control the use of chemical fertilizer.

(2)Mitigation measures

①Implementation soil testing and fertilizering based on soil nutrient deficiency situation, rational use the fertilizer type and quantity, avoid fertilizer wastage and environment pollution.

② Promote the use of organic fertilizer, such as manure, reducing the amount of fertilizer, in order to avoid soil compaction, soil fertility decline, and prevent eutrophication.

③Filling surface soil holes, bury litter tending as fertilizer technology to increase soil organic fertilizer

Premise to fertilizer structure improvement, reducing fertilizer amount, reasonable fertilization approach, the project implementation will not cause significant impact on water.

3. Impact of forest workers produce household waste and domestic wastewater

After the completion of the camellia plantation, it need to be equipped with the silvicultural management personnel, according to the project feasibility study, project require a total of 334 forest rangers, but life living in nearby villages, in the Camellia Forest management and protection shed only a small amount of toilet sewage, is expected to produce a total ofdomestic wastewater 1.67t / d, garbage 0.15t / d, 69 shelters dispersed in the project, so the average to each point, the amount of domestic wastewater and garbage generation 0.01t / d, 0.002t / d, Aqua Privies or shrub collected their own, garbage collect by ranger staff, regularly transported to local landfill processing. Overall, small amount garbage generation and scatter, if properly collected handled, garbage and domestic waste of forest worker impact on the environment is very small.

III Analysis of the project social benefits

During the process of the project construction and operation, including afforestation, tending, management and protection, havesting, transportation and other production processes, its necessary to employ a large number of laborers, most of them are rural residents in the project areas, therefore project alleviate the pressure on employment of rural surplus labor. At the same time, the project implementation can bring considerable land rental income to forest farmer, active rural economy, accelerate local farmers alleviation poverty, project play a good role in maintaining social stability. Project construction facilitate to local industrial structure adjustment, promote the development of the wood processing industry, transportation, agricultural and other related industries, with a strong leading role , radiation on the surrounding areas, promote the project area and the surrounding areas economic continuious health development. The successful implementation of the project will contribute to the development of forest management will Hunan Province, forest stand achieve important ecological functions, directly or indirectly improve living standards in rural areas, and enhance the Hunan forest products processing or pre-processing capacity, improve forest products market competitive ablity.

IV Risk analysis and prevention measures

The risks of the project include fire, frost, drought and pests and diseases. Risk factors and the degree of risk analysis and risk prevention measures are shown in Table 7.

Table 7 Risk analysis and risk prevention measures

Factor	Analysis	Risk prevention measures	Risk level	Environmental risks

Factor	Analysis	Risk prevention measures	Risk level	Environmental risks
Fire	stands distribution large area,interweave with agricultural land, and forest farmer frequent use fire, thus fire prevention task is arduous.	Strengthen cooperation with the Forestry Bureau of project counties (cities), relying on existing local forest fire organization, conduct linked shelterbelts fire prevention; constantly improve the infrastructure construction of forest fire prevention in project area, at the junction of a gricultural land or village where fire risk coefficient higher, creat fire lines or create Firebreak Belt; strengthen publicity and education on the surrounding residents, enhance their awareness of fire prevention, ensure safety fire use of wild life, and production use of fire; formulate a detailed, responsibility to the person of the forest fire prevention system, in accordance with the relevant laws and regulations, strengthen day-to-day patrol Hill, as far as possible to detect and eliminate dangerous.	Larger	ordinary
Frost damage	Frost damage have a certain impact on the growth of Young stands	Mainly prevention through cultivation cold tolerance species or varieties in afforestation. prevent or mitigate the cold temperatures harm by Trunk white painted, fumes and other methods.	ordinary	light
Drought	Drought pose a potential threat for tree growth in the project area	Promoting drought-resistant tree species cultivation afforestation techniques can minimize the drought risk.	light	light
Pest	Serious pest harm Will lead to a sharp decline in production and even plant death.	Strengthen pest quarantine,prohibit cuttings, seeds, seedlings with pest transferred in or out; purify the environment of the project area woodland, investigation stands and the surrounding area environmental before afforestation, control Insect and pathogen source, timely tending the woodland, Care woodland health, improve forest itself resistance pests capacity to reduce pest incidence; doing forecasting, promote physical control, biological control methods, strictly use efficient, low-toxicity pesticide to chemical control, realize the project forest pest prevention and control.	Larger	ordinary

V. Analysis of the project construction compliance with the national industrial policy

(1)Analysis of compliance with the national industrial policy

This project can be classified as "industrial restructuring Guidance Catalogue" (2011), which listed in encouraged category industries the first paragraph

"agroforestry", 34 article "construction of carbon sink forests, the planting trees, grass and seedlings Project", 44 iterm “forest tending, low-yield forest renovation project”, and 66 iterm “Camellia oleifera, oil plam woody ediable oil base construction”. Therefore, project in line with the national industrial policy.

(2)Analysis of compliance with the "Hunan Forestry Development 12th Five-Year Plan

The forestry industry goal of building the "Hunan Forestry Development" 12th-Five-Year Plan "clearly stated:" the province built mainly fast growing timber, precious timber, woody grain and oil (Camellia, board, walnuts, etc.), bamboo, Chinese herbal medicine commercial forest base, realize resources cultivition base". Therefore, the project is consistent with the Forestry Development Planning.

(3)Analysis of the project compliance with Hunan Province Forestry Development "12th Five-Year Plan” camellia industry bases construction-special plan

According to the Forestry Development "12th-Five-Year plan" camellia oleifera industry base construction - special plan Charpter 2 guideline and development goals, contents of charpter 2.1 as follows: thoroughly implement the scientific concept of development, market-oriented, depend on science and technology, focus on efficiency, and make full use of land resources and existing camellia forest resources and adhere to the new planting with low-yeild forest renovation combination, to realize camellia forest intensive and scale management, emphasize both area and high yield and efficient camellia forest base construction, impel more scientific and technological innovation, improve camellia stands quality and production per unit area.

the development Goals, in 5 year(2011~2015), Hunan province's high-yield camellia forest area up to 10 million hectares, in which new palantation high yield camellia forest area up to 1,950,000 mu; stand improvement 4,350,000 mu; young stands tending 3,700,000 mu.

In summary, the project location and scale of the construction in line with the Forestry Development "12th- Five-year plan" camellia industry bases - special plan".

(4)Project target counties’ forestry sector opinion

The construction of the project involving many city’s and county’s forestry sector, in order to know the opinion of the local forestry sector about the construction of the project, we carried out county forestry bureau sight visiting and public participation investigated, according to the survey result,target county forestry sector confirmed that the project in line with local forestry development planning, they believe that the project construction will bring significant social, economic and environmental benefits, and they warmly welcome and supports the project construction.

VI Environmental protection measures and investment

The project's environmental protection measures and the investments list in Table 12.

Table 12 Projects environmental protection measures and investment (10,000 Yuan)

Stages	Project name	content, scale, numeber	investment(10,000 yuan)	remark

Construction Period	Soil and Water Conservation Measure	Bamboo ditch settlement		270	
	Solid waste	Plastic film, chemical fiber woven bags, garbage collection and disposal		70	10000 yuan / county / year, first 5 years of the project implementation
		Pesticide packaging and containers unified collection, send a qualified hazardous waste treatment units to deal with			
Operation period	Solid waste	Fertilizer bags, garbage collection and disposal		420	10000 yuan / county / year, calculate by 30 years
		Pesticide packaging and containers unified collection, send a qualified hazardous waste treatment units to deal with.			
	Ecological and environmental protection measures	Publicity signs	334	67	
		Forest fires, fire safety facilities and fire fighting equipment		500	Fireproof
		Forest pest management system	1	300	Ecological management, artificial control
		Ecological Environment Monitoring	Specific to see ecological environment monitoring budget table	468	Ecological Environment Monitoring
The total investment for environmental protection（10000 yuan)				2095	
The total investment of the project（10000 yuan）				56000	
The proportion of the total investment（%）				3.74%	

The project pollution prevention, control measures and the expected treatment effect

Content / Type	Emission sources	Pollutant name	Prevention and control measures	Expect Treatment effect
Atmospheric pollutants	Construction period	vehicle fuel emissions	Selection exhaust up-to-standard car	up-to-standard Discharge
Water pollution Contaminants	Construction period	Pesticides and fertilizers	Reasonable selection of varieties of pesticides to control the amount of pesticides and fertilizers, and pay attention to the time of application, the way	Can be effectively controlled
	Operation period	Domestic wastewater	aqua privy collection, forest, shrub	Non ground surface discharge

		Pesticides	Reasonable selection of varieties of pesticides to control the amount of pesticides and fertilizers, and pay	Can be effectively controlled
Solid Waste	Construction period	Waste packaging materials such as plastic film, chemical fiber woven	Recycled, can not be recycled with household waste collection and processing	Non-outside Discharge
		Pesticide packaging	Unified collection, commissioned a corresponding qualified hazardous waste treatment unit disposal.	Non-outside Discharge
		Garbage	Collected by the construction workers regularly sent to the local landfill processing	Non-outside Discharge
	Operation period	Garbage	Collected mainly by the ranger staff, regularly sent to the local landfill processing	Non-outside Discharge
		Hazardous solid waste	Unified collection, commissioned a corresponding qualified hazardous waste treatment unit disposal.	Non-outside Discharge
noise	Noise of this project, because the construction operated in remote place, so noise can be negligible.			

Environmental management and monitoring plan

I Environmental management

In order to ensure the smooth project implementation to minimize the environmental costs, preparation of environmental management and monitoring plan, the project counterparties complied with the plan. Environmental management and monitoring plan must be one part of the project, as a budget item list in the project the financing feasibility report and project implementation plan.

In order to ensure the environmental management and monitoring plan implementation smoothly and ensure compliance with national environmental system, project each target counties shall designate one to two full-time officials whose solely responsible for successful implementation of the project activities and monitoring section and the EIA report management, during the project construction operation at least five years period the various stages of period. CPO should also according to the afforestation scale arrange of one to two full-time staff responsible for environmental protection, participate training, their duties is ensure that all environmental management and monitoring plan to be realized in the project counties / forest level. Responsible for report the project environment related matters to provincial PMO project implementing agencies and the county Environmental Protection Agency, is also responsible for the data collection and to provide technical support to the relevant environmental officials. officials designated by the office at all levels of the project (the county and provincial) who responsible for the preparation and implementation of the project related to environmental protection materials and documents, preparation for FDA and environmental protection departments at all levels review.

During the operational phase, each CPO’s environment officials will assist the county project office to carry out the environmental monitoring plan, as well as other work included in the environmental management and monitoring plan. However, guarantee all actions in the environmental management and monitoring plan realized, the ultimate take charge by county CPO, they must ensure that the provincial PPO office achieve required environmental reports / data from the county-level smoothly.

Frame environmental management planning in order to ensure the effective implementation of the project environmental mitigation measures, see Table 13.

Table 13 Environmental Management Plan

Environmental issues	Mitigation policies and control measures	Executor	Responsible unit	Supervision unit
A. Design /Prior to the implementation stage				
1. Project proposals	1.Optimize the project, design and planning， minimize the potential negative impact on environment 2. The design and planning of the project should avoid impact environmental sensitive areas, such as nature reserves, geological parks, forest parks, wildlife habitat, and natural and cultural heritage,	PPO and Design unit	PPO(Provincial Project Office)	Provincial Environmental Protection Department(CEPD)

	reasonable arrangements the construction schedule to reduce land occupied; 3. Make sure that minimize impact on the surface water bodies and the source of drinking water, in the region; 4. The provincial PMO should strengthen the monitoring and protection of the biodiversity of the project area; 5. Make sure that the migratory routes of wild animals and their food / drinking water route will not be blocked; 6. Provincial project office and the relevant departments should be preparation the nature reserve and / or wild animal habitat subsets management plan guideline.			
2. Land Use	1. Forest road, working path, skiding trails shoulb be designed to minimize land occupation, prevention accelerate soil erosion and avoid vegetation being damaged. 2. Historical sites and cultural relics can not be used as a land for the project. 3. Greater than 25 ° slopes land do not allow for the project.	Design unit	PPO	CEP
3.pestcide usage	1. Check all the project area pesticide use, avoid to use any Class I pesticides classified by the World Health Organization .2. Select efficient pesticide alternative pesticides, encourage to use low residue pesticides.	Provincial Forest Pest Control Station	PPO	CEP
B. Implementation phase				
1. Nature reserves and wildlife habitat	1. Construction machine should be kept away from the sensitive area of the nature reserve and wildlife habitat. If the construction site is close to the sensitive area, should use appropriate protective measures (such as mufflers) to reduce the noise impact. 2. New afforested stand should avoid to broken existing natural forests, nevertheless, we should select barren grassland or low biodiversity. areas 3. Construction worker avoid enter the ecologically sensitive areas such as nature reserves, wildlife habitat, and non-hunting and prohibit destruction of wild animals and plants.	Construction contractor	PPO, CPO	Country Environmental Protection Bureau (CEPB)
2. Soil Erosion	1. No necessary overall digging in afforestation land preparation, the mainly through hole digging, arrangement planting hole "品" shape along the contour. 2 Afforestation on slopes should be completed at least one month before the	Construction contractor	PPO CPO	CEPB

	rainy season. 3. Avoid reclamation, digging and / or digging ditches on slopes greater than 25 degree in the rainy season, use sandbags, hay bales covered excavation area under slope ,reduce soil erosion. 4. To take measures to maintain and improve soil structure, fertility and biological, encourage use of organic manure and green manure. 5. Comply with afforestation design ,application organic fertilizer, only hole fertilizing or strip fertilizing, non-spreading。			
3. Natural and cultural relics	1. Strengthen advertise to public, make contractors and construction workers recognize importance of protecting cultural relics. 2. During construction, if there are cultural relics project should immediately stop construction, environmental supervision should protect the site, and immediately inform relevant departments came to investigate and study.	County Department of Cultural Affairs CPO,	PPO	CEPB
4. Minority	1. Respect the lifestyle and traditions and customs of the ethnic minorities. 2. Through distributing leaflets, training, and other ways to enhance the awareness of contractors and workers to respect the ethnic minority customs and beliefs.	Construction contractor, Environmental supervision staff	PPO	CEPB
7. Pest	1. Foreign species quarantine. 2. Reserve the valley native vegetation. 3. Avoid abuse chemical pesticides. 4. If needs to use pesticides and other chemical pesticides, you should select low toxicity and residue pesticide and control the reasonable amount ,the time and method..	Design unit	PPO	CEPB
8. Community	1. Non-occupation farmland. 2. Construction area should establish temporary health and epidemic prevention institutions, and strengthen surveillance, hygienic management and public.	CPO, Epidemic prevention departments	PPO	CEPB
C. Operational phase				
1.Flora and fauna and nature reserves	1. According to the relevant national and local laws, regulations, as well as the reporting requirements, project should strict implementation of measures for the protection of biodiversity and nature conservation.	CPO	PPO	CEPB
2. Pests and diseases and agrochemical	1. Strict comply with the pest management plan, improve pesticide efficiency, minimize pesticide of	CPO, Forest Pest	PPO	CEPB

s application	long-term negative influence on natural environment. 2. Adopt advanced silvicultural measures to enhance the ability to stand resistant to insect pests. 3. Selection of low-residue, low-toxicity pesticides. 4. Regular monitoring of serious pest populations. 5. Promotion of integrated pest management to reduce chemical use.	Control Station		
3. Soil erosion and soil fertility	1. Protect the forest aboveground vegetation, utilize soil to coverage plants. 2. Artificial weeding to ensure quality of stand tending and supervision environmental effects. 3. Application of soil testing and fertilizer technology. 4. Promote use organic fertilizer, and fungi manure. 5. Restore and protect the plants.	CPO, Construction contractor	PPO	CEPB
4. Biodiversity	1. Protection undergrowth and litter, and protection the space between the original vegetation, protect forest edge vegetation. 2. Promote comprehensive prevention and control of pests and diseases and to strengthen the management of forest health, reduce the use of chemicals. 3. Control material rolled from the hillside.	CPO, Construction contractor	PPO	CEPB
5. Community	1. Help absorb the rural surplus labor force. 2. Support the employment of minorities and women. 3. Respect the customs of the ethnic minorities.	CPO	PPO	CEPB
6.Environmental pollution	1. Reduce chemical fertilizers and pesticides, careful use timely and appropriate. 2. Choose organic manure and green manure. 3. Using ditch, pit fertilization and cover with the soil and dead branches. 4. Selection of low toxicity pesticides. 5. Recycle packaging of pesticide and fertilizer use and handling.	CPO	PPO	CEPB

II Environmental monitoring planning

1. Monitoring and indicators

The impact of the project on the environment are major ecological impact, therefore, the monitoring mainly is the effectiveness of the ecological environment monitoring, the specific monitoring content and indicators are as follows:

①Fertilizer and Water Conservation Monitoring

Monitoring include rainfall, soil erosion, surface runoff, soil water retention and other factors, and water retention and fertilizer conservation capacity in different periods monitoring.

② Forest carbon sink monitoring

Part of the project county (city) need to carry out carbon sinks monitoring and measurement. Through continuous monitoring some fixed research plot for annual fixed carbon dioxide amount, carbon sequestration amount of different tree species.

③ Pest /disease monitoring

Monitoring of pests and diseases types, the incidence, harm degree and change of control times.

2. Monitoring method

①Water and fertilizer conservation monitoring methods

In each of water and fertilizer conservation monitoring site, it is recommended that select representative slope flat and classic site conditions plot, and establish three runoff plots (runoff Field) ,in which two runoff plots built on project forest land, one control runoff plots built on non-project forest land. Structure of each sub-plot design and construct according to unified standard, which is include boundary walls, water sink, diversion sink, water pool and outside on the edge of the runoff plots gutters and runoff plots provided on both sides of the protective tape. Monitoring content involve rainfall, rainfall duration, rainfall intensity; surface runoff; soil loss. Monitoring should carry out after the rainfall.

② Forest carbon sink monitoring

Project will collect all of determination and measurement data in project operation period carbon stock changes and greenhouse gas emissions and leakage within the project boundary. It is recommended adopt continuous monitoring the fixed research plot measurement method. The main monitoring involve project activities, project border, tree growth within the project area and monitoring greenhouse gas emissions and leak due to the implementation of the project.

③ Pest monitoring methods

Setting fixed monitoring sites in stands of implement forest restoration measures and control stand which is no restoration measures, using suitable sampling methods to determine 20 to 30 standard trees, marking as fixed monitoring standard tree. Monitoring regular survey pests and diseases type, incidence and degree of harm of standard tree, record prevention measures and control times.

3. Fixed monitoring site setting

Since requirement of monitoring of the site and equipment monitoring is comparatively high, it is proposed to select representative fixed sites for the effectiveness of the ecological environment monitoring, and set fixed water and fertilizer conservation monitoring points at Qidong County, Ningyuan County and in Baojing County, Sangzhi County, set one fixed pests/diseases and carbon sequestration monitoring site in Shaoyang County, Qidong County, Hengyang County, Hengshan County, Ningyuan County. Ecological environment monitoring plan see Table 14.

Table 14 Environmental monitoring plan

Monitoring Content	Monitoring indicators	Monitoring frequency	Monitoring site	Site Number	Super vise
Moisture and Fertilizer Preservation	Soil water retention capacity and soil nutrients	The 1,3,5 year 1 time/year	Ningyuan County	1	PPO, CPO
		The 1,3,5 year 1 time/year	Qidong County	1	
	Soil erosion and Surface runoff	The 1,3,5 year 1 time/year	Sangzhi County	1	
	Soil erosion and Surface runoff	The 1,3,5 year 1 time/year	Shaoyang County	1	
Pest	Types, incidence, magnitude	2 times/ year	Qidong County	2	PPO, CPO
		3 times/ year	Qiyang County	2	
		2 times/ year	HengyangCounty	2	
		3 times/ year	HengshanCounty	2	
		3 times/ year	Ningyuan County	2	
		2 times/ year	Shaoyang County	2	
Forest carbon sinks	Carbon stocks, emissions of greenhouse gases data	The 1,3,5 year 1 time/year	QidongCounty	1	PPO, CPO
		The 1,3,5 year 1 time/year	Qiyang County	1	
		The 1,3,5 year 1 time/year	Hengyang County	1	
		The 1,3,5 year 1 time/year	Hengshan County	1	
		The 1,3,5 year 1 time/year	Ningyuan County	1	

4. Monitoring and reporting policy of organization and implementation

PPO responsible for organization and implementation the monitoring plan, and organize technicial staff establishment special monitoring group,carry out the monitoring activities, and prepare mornitoring equipment and faicilities for each monitoring site, and ensure monitoring implementation going smoothly.

At the end of each monitoring year, the PMO need organize the summary of monitoring results, data analysis and reporting, sum up and evaluation the monitoring iterm respectively, preparation project implementation progress report and summarizes the results of the evaluation in the monitoring year report to The French Development Agency, and submitted to the relevant environmental protection

department.

5. Monitoring Budgets

Total funding of the project for environment monitoring is 6.3 million Yuan, of which water and fertilizer reservation 300 million Yuan, pests and diseases control 600,000 Yuan, forest carbon sequestration 270 million Yuan. The detailed budget in Table 15.

Table 15 Ecological Environment Monitoring Budgets

Monitoring	Monitoring	Monitoring	number of	Unit cost	Total
Moisture and Fertilizer Preservation	The 1,3,5 year 1 time/year	Ningyuan County	1	15	45
		Qidong County	1	15	45
		Sangzhi County	1	15	45
Total			4		135
Pest/disease	2 times/ year	Shaoyang County	2	2	8
	3 times/ year	Qidong County	2	2	8
	2 times/ year	Qiyang County	2	2	8
	3 times/ year	Hengyang County	2	2	8
	3 times/ year	Hengshan County	2	2	8
	2 times/ year	Ningyuan County	2	2	8
Total			12		48
Forest carbon sinks,greenhouse gas emmision	The 1,3,5 year 1 time/year	Shaoyang County	1	15	45
		Qidong County	1	15	45
		Qiyang County	1	15	45
		Hengshan County	1	15	45
		Ningyuan County	1	15	45
Total			6		225
Total					468

III Environmental protection three part acceptance check contents

According to the actual situation of the project, the specific environmental measure is divided into two phases, namely the construction period and the operation period, and protection of water quality, soil and water conservation, solid waste disposal, environmental protection detailed schedule see Table 16.

Table 16 Environmental protection three part acceptance check contents

Stages	project name		Execution	Responsibility
Construction period	Water quality protection measures	Rational application of pesticides and fertilizers	process of afforestation, tending	Contractor
	Soil and Water Conservation	Clearing, land preparation	Clearing, land preparation	Contractor

	Measure	Bamboo shape ditch settlement	Clearing, land preparation	Contractor
		according landform,avoid massive digging and filling,reduce damage to the original surface	Forest road construction and protection of sheds and other infrastruction	Contractor
		Steep slope, the top of the hill and valley, the river bank woodland vegetation protection	Clearing, land preparation	Contractor
	Solid waste	Collection and processing of plastic film, chemical fiber woven	planting and fertilizing	Contractor
		The collection and disposal of garbage	Construction worker placement	Contractor
		Proper disposal of pesticide packaging and containers unified collection, commissioned by the corresponding qualification units。	Pesticide application	Contractor
	vehicle fuel emissions	Selection the car exhaust up-to-standards	Construction process	Contractor
operation period	Water quality protection measures	Rational application of pesticides and fertilizers	Civicluture and management period	Operators
	Solid waste	Fertilizer bags, garbage collection and disposal	Civicluture and management period	Operators
		Proper disposal of pesticide packaging and containers unified collection, commissioned by the qualified units.	Civicluture and management period	Operators
	Environmental protection measures	Project environmental protection publicity	Civicluture and management period	Operators
		Forest fire prevention facilities and fire-fighting equipment	Civicluture and management period	Operators
		Forest pest/disease control system	Civicluture and management period	Operators
		Environment Monitoring	Civicluture and management period	Operators

Public participation

I Purpose of public participation

From project construction to operation, it will certainly bring about favorable or unfavorable impacts on the surrounding natural and social environment, affecting the public's work, life, study, rest and entertainment both directly or indirectly. Through public participation, to listen to and understand the public's views, opinions and recommendations of this project, can make up for the possible omission and negligence that may exist in the EIA work, and help form a more comprehensive understanding and make good use of environmental resources, creating a well-designed project with practical EIA measures, laying scientific decision-making basis for the government departments and acquiring supports and understanding from the public through raising public environmental awareness, asking more people know about the significance of the project and possible environmental problems and facilitating the construction of the project goes well.

II Methods and Objects of Survey for Groups

1. Survey Methods

The survey methods in this project EIA are mainly composed of consulting at random and using questionnaire. From late May to early June 2012 the project team surveyed the attitudes, advice and suggestions of the affected public, units and groups near the project site towards environmental protection, and in this survey objects were asked to answer the questionnaire independently according to their own feelings. Thereafter the project team summarized and analysis the questionnaires and interviews

2 .Survey Objects

（1）Public Individuals

Public individuals mainly include residents near the proposed project area. In the regard of choice of the representatives of the public, the breadth and randomness of that were taken into consideration, and the structure was considered of districts, ages, culture, education and professions.

（2）Groups

Groups are chiefly composed of functional departments of the local government, village committees and enterprises near the proposed project area.

III Public Participation Survey Findings and Analysis

1. Unit Group Survey Findings

This public participated survey sent out 12 questionnaires to unit groups, and details refer to Annex 4. Those units receiving the questionnaires include the governmental departments, village committees, enterprises, state-owned forest farms, forestry administrative departments affected by the engineering, units such as Sangzhi County Forestry Bureau, Ningyuan County Forestry Bureau, Baojing County Tea leaf Office, Leiguqiao Village Committee of Bansha Township in Lilin County, Dengjiafang Village Committee of Baishui Township in Miluo City, Huaihua Hongyuan Agriculture and Forestry Development Company, Zhongfang County Fumin

Agriculture and Forestry Development Company, etc. Advice and recommendations of the findings are as follows:

（1）100% of surveyed organizations endorse the construction of this project, thinking this project would help local social and economic development, supply many more jobs, and increase the income of the villagers.

（2）All groups hold that the implementation of the project on the local will not have an adverse impact on ecological environment.

（3）67% of organizations believe that there is a favorable impact on the local forestry planning in the implementation of the project, 33% of the groups think that will not affect the local forestry planning, and no groups deem that the project would adversely affect the local forestry planning.

（4）100% of organizations think that after the completion of the project, it would be beneficial to the economic development of the project site. No one believe that project have adverse impact on local economic development.

（5）Most organizations surveyed think that the noise generated, dust and temporary occupation of land during construction have little impact on the local environment.

（6）During the Interview some organizations propose increasing project construction funds and preventing soil erosion.

In short, the local government, enterprises and social organizations near the project site support the construction of the project and are willing to contribute their effort to the project. At the same time, they also consider in the development process of this project, attention should be paid to the ecological environment, preventing soil erosion.

2. Individual Survey Findings

The individual survey used questionnaires, which was carried out on condition that the public learned the purpose. As for the selection of public representatives, different regions, ages, education, occupations were taken into consideration The questionnaires sent out total 60, and 57 copies were returned with a recovery rate of 95%. The age of the public participating in this survey range from 19 to 65, and their education level are from primary school to university, their occupations related to various industries. Details of survey objects refer to Table 17, and the basic statistic of that Table 18.

Table 17 Basic information of interviewee

No.	Name	Gende	Age	Positi	Education	Address	Telephone
1	Yaolei	male	40	cadre	-	Qiaoziwan Township, Sangzhi County	13974488468
2	Zhangzeping	male	44	worker	university	Liyuan Town, Sangzhi County	13574453573
3	Chengchiheng	male	42	cadre	-	Lifuta Town, Sangzhi County	15974443188
4	Zhuxiaochun	male	41	cadre	university	Liyuan Town, Sangzhi County	13974464211
5	Miushibing	male	44	worker	university	Liyuan Town, Sangzhi County	13637445029
6	Weixingqiang	male	44	cadre	university	Liyuan Town, Sangzhi County	13787441510
7	Duchangyong	male	42	cadre	university	Renhu Township Forestry station, Sangzhi County	15274425958
8	Liushuichun	male	43	worker	university	Liyuan Town, Sangzhi County	15174436556
9	Zoujingshan	male	60	farmer	Below middle school	Yanwo Village, Yuan Town Sangzhi County	13974486211
10	Xiangqiong	male	35	farmer	middle school	Siwei Village, Linxi Township, Sangzhi County	15974413438
11	Ding'anbiao	male	51	farmer	middle school	Xishaping Village, Xishaping Township, Sangzhi County	13974415348
12	Yuxiwen	male	43	farmer	-	Changwan Village, Chenjiahe Town, Sangzhi County	13974455115
13	Xiangdaibing	male	64	farmer	middle school	Datian Village, Qianling Town, Baojing County	13907432672
14	Xiangguocui	female	42	farmer	middle school	Datian Village, Qianling Town, Baojing County	/
15	Huangyongxiang	male	58	farmer	middle school	Datian Village, Qianling Town, Baojing County	13574392337
16	Zhangshaoying	female	56	farmer	middle school	Yangjia Village, Qianling Town, Baojing County	/
17	Pengruxue	male	65	farmer	Below middle school	Yangjia Village, Qianling Town, Baojing County	13762152909
18	Lizilin	male	32	farmer	university	Datian Village, Qianling Town, Baojing County	/
19	Caijunyang	male	35	cadre	university	Qianling Town West Gate 04#, Baojing County	15007429993
			36	farmer	middle		

Conclusions and suggestions

I Conclusions

1. Necessity of Project

Hunan is one of the three main provinces of Camellia produce areas in China, Hunan is called “Camellia oil hometown”. Currently, Hunan existing Camellia forest area is 1,278,700 ha, accounting for 49% of the total area of the whole country, ranking first in China. Hunan Camellia lies in forefront of the country, but there are still some problems can not be ignored. First, Camellia industry still in small-scale. Since our country introduce household contract responsibility policy, most of the Camellia stands operated by individual household, they neither have willingness to input nor to application the fertilize, therefore, most of Camellia forest still in the natural growth state, mostly enterprises of tea oil are in small scale of production, they short of funds, their equipment very old, and they have limited capability to development. Secondly, both tea oil yield and profit of Camellia forest management still in low level, at present about 30% of camellia stands planted before the foundation of our country, it belongs to multiple generations of coppices, in addition, since long-term neglected resulting such camellia stands in a low output, and low efficiency, that seriously dampened the enthusiasm of farmer households. Thirdly, camellia oil stands in low scientific and technology. Currently, Hunan actually use breeding good quality seeds for plantation only accounts for about 10% of the total area of the camellia forest, deficiency of technology content in cultivation and processing, enterprises are in low competitiveness, camellia industry develop is slowly. Fourth, there are limited sources of investment. Finding solution of all these problems is where the space of camellia industry development. Like the project proposed to build camellia planting and a industrial development model, make full use of the camellia resources advantage of Hunan, through “company plus cooperative plus camellia produce base” model to accelerate conversion of agricultural resources.

2. Project Content

The project will construct Camellia oleifera production base of 21,861.3 ha, of which new plantation 6,807.5 ha, young stands tending 10,900 ha, low-yielding stands improvement 4,153.8 ha, and necessary ancillary facilities construction.

3. Compliance of the Projects with Industrial Policies and Related Industrial Planning

This project can be grouped into what the 34th, 44th and 61th paragraph of article 1 in "Guiding Catalogue of Industrial Structure Adjustment (2011 version)"' Encouraging Projects defines, thus the project is in line with national industrial policies. It also be in accordance with the target of "12th Five-Year Plan of Hunan Forestry Development " and its layout and scale comply with " Camellia oleifera Industry Base Construction of Hunan Forestry Development in the Twelve Five-Year Period - Special Planning” and it is as well as comply with counties or cities local forestry development planning.

4. Environmental Quality Assessment Conclusion

The project areas are scattered throughout Hunan Province, namely Zhuzhou, Hengyang, Yongzhou, Shaoyang, Yueyang, Huaihua, Zhangjiajie, and Xiangxi

Prefecture, total 8cities/prefecture, and 14 counties/cities. According to the Hunan Environmental Quality Report for 2011, the environmental quality of the project area is as follows:

In 2011 the urban ambient air pollution index of Hunan province averages 1.932, an relative increase compared with the previous year (1.830). The pollutants affecting the urban ambient air quality in the province is inhalable particulate matter and sulfur dioxide. Ambient air quality of the province's 14 cities has met the national standards Grade II, that is 100% cities up-to-standard. The overall ambient air quality in the province keeps good. The proposed project areas are mainly of typical rural environments, with high coverage of vegetation and almost no air pollution sources, air pollution sources, and the ambient air quality in these areas is fine.

In 2011, the overall quality of the surface water in the province was excellent. Out of 97 provincial controlled sections, 3 reached Quality GradeⅠ, accounting for 3.1%, 46 reached Quality GradeⅡ, accounting for 47.4%, 40 reached Quality Grade Ⅲ, accounting for 41.2%, 7 reached Quality GradeⅣ, accounting for 7.2%, and 1 belonged to Quality GradeⅤ, accounting for 1.0%, with no sections being sub-GradeⅤ. 93 cross-section achieved water quality objectives and the attainment rate is 95.9%. The major pollutants of the province's surface water are fecal coliform, ammonia nitrogen, phosphorus, and chemical oxygen demand, BOD5, arsenic, petroleum and permanganate index. The amount of ammonia, chemical oxygen demand (COD) and arsenic are prominent in some sections of the rivers; Compared with the previous year, the concentration of pollutants in surface water relatively decreased, exceeding rates and superscalar factor remained roughly stable. In 2011, in 30 centralized drinking water sources of the 14 cities (prefectures), the annual average of all evaluation indicators reached the requirements of Quality Grade III, and the attainment rate is 100%. As for the total of 30 drinking water sources in the 14 cities throughout the province, its attainment rate was 99.6%, with an increase of 1.6 percentages compared to last year (98.0%). Except for Shaoyang and Changde Cities, whose attainment rates are 98.4% and 92.0% respectively, other 12 cities' were 100%. What factors affects the province's urban drinking water qualities are total phosphorus and dissolved oxygen.

Rural groundwater environment pollution is serious, in 2011, for the quality of the ground water sources in a total of 16 pilot villages scattered in the 14 cities (prefectures), its up-to-standard was only 25.0%, Quality GradeⅣ and GradeⅤ account for 37.5% each. Rural ground water source pollution problems are more prominent, and the safety of drinking water is still facing a greater threat.

In 2011, the acoustic environment quality in urban roads and districts in our province is generally good. In the districts of the 14 cities all around the province, the annual average daytime noise equivalent range is 51.2 ~ 55.0dB (A), and the average of the province is 53.5dB (A). All the cities have reached the Grade II standard in urban area acoustic environment quality. The rate of cities whose regional sound quality above comparative good is 100%. The project is located mostly in rural areas of the counties surrounding urban districts of cities or counties, with less interval traffic flow, or obvious industrial, traffic and life noise sources. There residences are scattered, and the acoustic environment is relatively good.

The major vegetation types in project areas is Masson pine stands, Chinese fir stands, camellia stands,hardwood thickets and shrubs. Main tree species are Chinese fir, Masson pine, Elaeocarpus, Camellia, acacia, alder etc. shrubs species and shrubby grass mainly Rhododendron, Setaria, Imperata, sumac, Loropetalum, almost no rare and protected plant species. Due to the artificial vegetation with sparse distribution and frequent human activity, there are only a small number of animal resources, such common animals as voles, bamboo rat, weasels, wild boar, magpies, tits etc. Rare and protected wild animals are hardly found. The vegetation coverage is basic good, and soil erosion is light.

5. Environmental impact assessment conclusion

Implementation of the project will facilitate to exert forest multi-function, especially in increase the forested land area and improve local environment, meanwhile, project have positive impact on soil and water conservation, purify air, carbon fixed and oxygen release, etc. The construction process will have some negative impacts on the environment. In the construction phase some problems would occur, such as the original surface damage, soil erosion, vegetation clearance deforestation, and animals would be affected by construction activities, solid and water would be polluted due to the improper use of pesticide and fertilizer, and solid waste pollution would be generated stemming from the use of packaging materials such as plastic films, chemical fiber woven, but without centralized construction camps, the project will not add life garbage, wastewater, and truck exhaust has little effect on the environment during transportation. During operation phase, the negative impacts on the environment are mainly existing in soil and water pollution stemming from the improper use of pesticide and fertilizers, pests and diseases and forest fires may also lead to the risks of the ecological environment, and the silvicultural management personnel produce limited life garbage and wastewater, its impacts being very light.

6. Prevention and Treatment of Environmental Pollution, Ecological Protection Measures and the Analysis of their Effectiveness

(1)Erosion control: Organize construction workers to learn how to prevent soil erosion and other related knowledge prior to construction; Select appropriate plantation whose slopes are limited no more than 25 ; Not using slash and burn methods, clean up the woodland ground, in reforestation site and preparation, mainly apply hole reclamation instead of full reclamation, and along the contour set bamboo ditches; on the top hillside, and foot of the mountain, retain native vegetation a certain width, not felling or cleaning up vegetation of forest land at the steep slopes, tops, valleys and river banks. Reclaim along the contour build other ancillary such as forestland tracks and protective sheds according the conditions of mountain, without widespread digging or filling; try best to use manpower to finish the work, avoiding serious damage at the surface and major soil erosion resulted from mechanical operations; during site preparation and afforestation phases, shorten work time cover excavation machines with plastic films to avoid serious soil erosion; try to work in absence of rain. With all the above measures, soil erosion caused by the construction at the surface can be effectively mitigated.

(2)Ecological protection: Select proper forestlands for afforestation or reforestation, excluding those with rich vegetation and protected ecologically

sensitive; protect rare plant species while clearing up forestlands, and recommend for a comprehensive forestation land plant resources survey by forestry professionals prior to clearance, and protect the rare plant species found in the survey at the original place or move to other places to transplanting, prohibiting casual felling; strictly protect arable land, prohibiting the use of arable land for afforestation; strengthen the propaganda and education of animal protection for construction workers, preventing construction workers from killing wild animals; Emphasize fire prevention work during construction, to prevent forest fires. Through the above measures, animal and plant resources could be well protected.

(3)Pesticide residue control: During the construction period, do a good job of pest quarantine, prevent the transfer of pests with seedlings from the source; purify woodland environment in the project area, survey the ambient environment of the farmland prior to afforestation, control Insect and pathogen sources ,engage woodland tending, and pay attention to woodland health, and improve the forest capacity of resisting diseases and insects; during the construction and operation phases, use more biological means and less pesticide; when the use of pesticide necessary, use that of low toxicity and residue, or pollution-free, and pay attention to spray volume, intervals, and patterns in case of excessive use at once, which would case pesticide waste and the excess of pesticide lost into the surroundings. Do not use pesticide in rain seasons or before heavy rain, pay attention to the pesticide Configuration and blending, container cleaning, and the choice of container cleaning sites where there should be wild animals or livestock drinking water sources; workers using pesticides and foresters must accept the training of safely management, storage and use of pesticides. With the above measures, adverse environmental impact resulted from pesticide application can be mitigated.

(4)Control fo negative impacts in the application of fertilizer: Strengthen fertilization training for the silvicultural management staff, elaborate proper fertilization plan, encourage the use of organic fertilizer (manure), during preparation and using the original topsoil to fill newly digging ditches, apply some organic fertilizer to the topsoil; during tending, use grass and leaves to bury areas surrounding tree stumps, in order to increase organic fertilizer for forestland and decrease the use of chemical fertilizer; according to the actual situation of the project, select proper types and amount of fertilizer, to avoid excessive use of fertilizer, which may cause fertilizer erosion and environmental pollution accordingly; collect fertilizer packaging and properly dispose of it, to avoid residual fertilizer on packaging to flew into water. By these measures, fertilization would not have significant impact on the water environment.

(5)Prevention and treatment of Solid Waste Pollution:

Collect plastic films, chemical fiber woven and fertilizer packages left in construction period, and reuse them to wrap seedlings, for those damaged and difficult to be reused, collect them and send to local landfills for processing; collect and properly dispose of life garbage generated by silvicultural staff in operating phase; for waste packaging and containers during construction and operation periods, each city and county organize entities (business units) to collect them and commission to handle by unites holding corresponding hazardous waste treatment qualification units. Before the disposal, temporary storage of all the pesticide and waste packages and containers must meet Control Standards for the Pollution from Storage of Hazardous

Waste "(GB18597-2001). Through the above measures, solid waste pollution should be control.

(6)Control Measures for Ecological Risks

Strengthen the prevention and control of forest fires, and in strict accordance with the relevant specifications construct Fire Barrier Zones. Enhance preventive and predictive ways, and establish professional teams in prevention and control, install necessary fire-fighting facilities, with which people can quickly extinguished the fire in the event of a fire and limit the scope of fire to a minimum; strengthen management, patrol regularly so as to prevent fire

Build advanced forecasting and monitoring system, for forest pest epidemic, and timely detect pests and diseases; adopt biological prevention and treatment method, manual capture, use of residual pesticide with high efficiency and low toxicity and rotary planting systems in order to prevent and treat pests and diseases; use pesticide to prevent and treat pests and diseases according to the type and age of them; in event of pests and diseases, make use of biological pesticides with high efficiency, low toxicity, and short retention period, in order to reduce impacts on beneficial organisms and environment, pesticides with strong toxicity or banned by the state are prohibited..

In summary, the prevention and mitigation measures required by the report are feasible economically and technically.

7. Synthesis Conclusions of EIA

This project is in line with national industrial development policies, the 12th Five-Year Plan of Hunan Forestry Development, the Planning of camellia Industry Base Construction in 12th Five-Year period of Hunan Forestry Development- Special Plan, and the forestry development planning of each city and county with project sites. The project is necessary and its environmental benefits are significant, nevertheless, it will brings some negative effects, such as damages to vegetation, soil erosion, pesticide and fertilizer pollution, through the adoption of effective pollution control and ecological protection such effects can be alleviated. The environment quality of the proposed areas is good, and the construction of the project has no obvious environmental constraints. Assessment leads to the conclusion that, on condition that all pollution control measures and ecological protection measures are in place, the project is feasible from the respect of environmental protection.

II Suggestions

1. Strictly implement a staff training program, to ensure that the project be carrid out in a scientific, reasonable and orderly way;
2. Formulate contingency plans of environmental risk, camellia forest fire prevention for instance;
3. Respect the ways of life of surrounding residents and ethnic minorities in particular, properly handle the relationship with the surrounding residents and guarantee the timely payment of labor wages
4. During pest control prevention, adopt preventive methods with priority. Meet the sustainable prevention and treatment target which has low input with high efficiency, no disaster with insects though,
5. Recommend application organic fertilizer, green fertilizer, inter-crop nitrogen

fixation plants to supply additional nutrition to seedlings, and accelerate forest establishment.

Each county should carry out soil monitoring and survey, neighboring industry plant or company sites should carry out air quality monitoring, adjustment the sites which have high heavy metal in soil, or heavy air pollution sites, transfer such sites into timber forest, ensure camellia production base construction rational profit, and make all efforts to meet requirements of greenery camellia production base.

I Prediction and Analysis of Ecological Environmental Impacts

1. During the Project Construction phase the Impacts on the Ecological Environment

①Impacts on Land Use

The project plan to establish camellia oleifera produce base 21861.3ha, including new plantation 6807.5 ha, young stands tending 10900 ha, and low-yielding stand improvement 4153.8 ha. Because young stands tending and low-yielding stands improvement belongs to stands internal transformation, their forestry land properties did not change. Areas selected for new afforestation mostly are badlands such as barren hills, wastelands and slashes, therefore, the project not involving the occupation of arable land, natural broadleaved stand and commodity forest areas, as well as having no effects on the local agricultural production. Due to we use the badland such as barren hills, wastelands and slashes, transform them into camellia oleifera plantation, so that the woodland areas will be expanded in the project area, in addition, reduction of barren hills or others type wasteland area facilitate to the development of forestry production.

Infrastructures such as forest road and working protection sheds in project areas will occupy part of stands area, however, working path 0.8~1m width, 510.6 kilometers, 69 protection shelters, 20 m^2 per shed, totally is 60.8ha, less than 0.2% of total land area. In addition, mostly of these infrastructures belongs to reconstruct, for example, working path built will take advantage of original narrow forestland tracks base, their impacts on local forestry land is limited. moreover, the labor force of the project construction mainly source from local villagers, thus no need to build temporary construction camps, In addition in the project sites, the earth work between excavation and filling could keep roughly balance thus no need setting borrowing ground. There are little impacts of temporary engineering occupation on forestland in the project areas. Propose forest road and working path establishment should taking advantage of the mountain and landform, avoid to massive excavating or filling earth work, in order to reduce the occurrence of soil erosion.

In short, after the implementation of the project, the badland including barren hills and wasteland and slashes will be transformed into high-yielding camellia oleifera plantation, fully utilization of badlands and increase of forest land area. Land use pattern changes in the project area will improve these land productivity.

②Impacts on Vegetation resources

Impacts of the project on plant resources will mainly arise from the new afforestation activity, young forest tending and low quality camellia stands improvement both almost have no impacts on plant vegetation resources. In this project, we will establish camellia new plantation 6807.5 ha, amount to 0.28% of total project land area. Clearance of the original vegetation before planting would destroy vegetation resources, reducing biomass and vegetation coverage in certain degree. Afforestation mainly takes place in barren hills, wasteland, slash, open woodland,and camellia stands in yield decline, where the original vegetation is mostly artificial hardwood and shrub vegetation growing poor, less biomass and low vegetation coverage. Clear cutting will not give rise to the obvious decrease of woodland vegetation resources, quantity and biomass. On the contrary, with the cultivation, tending and seedlings in reforestation areas, the original barren hills and wasteland will have richer vegeation and the vegetation coverage gets higher than before. In

addition, considering that ground clearance may cause the felling of some sporadic rare plants or ancient trees, attention should be paid to the protection of rare plants or ancient big trees, it is recommended for a thorough survey of rare plant species by forestry professionals prior to afforestation Proctect confirmed rare plants on site or transplant them off site Random felling is prohibited. Make good choice of afforestation land and ground clearance,ways, for the afforestation ground, it shoudn't exclude the areas with rich vegetation or protected ecological areas, for clearing, do not use slashing and burning. Adpot above mentioned measures, afforestation land's impacts on plant resources of the project area will be further reduced.

③Impacts onTerrestrial animals

During the process of the project construction, especially activities of land clearance and density adjustment, prunning, and badtree use in low-yield stands, it is likely to make the vegetation damaged temporarily, the vegetation coverage decrease, and to produce adverse effects on wild animal habitat in this area, due to the presence of construction workers and the intensified human intervention. Fortuanately, there are relatively small amount of animals. Even they are mostly common animals such as voles, bamboo rat, weasels, wild boar, magpies, big tits, and endangered wild animals are rarely found. Additionally, most of the animals such as birds, beasts will temporarily leave the place and moved to other places, affected by construction activities, their activities,scopes will narrow, but basically will not die. Accordingly, the project has not obivious impacts on wildlife, especially on the population and number of endangered wild animals, and will not cause extinction of the population. With the completion of construction, the forest will grow up high, barren hills and wasteland are covered with more vegetation, the vegetation coverage inceases, more wildlife such as birds will be attracted to habitat. Nevertheless, the training and education of animal protection for construction workers should be strengthened and killing wild animals should be prohibited.

④Impacts on Soil Erosion

In this project, we plan to establish camellia base 21861.3ha, in which new plantation 6807.5 ha, youg stands tending 10900 ha, low-yielding stands improvement 4153.8 ha, and some necessary infrastructure.During the afforestation, land clearance , soil preparation, planting will necessary involve surface excavation, and thus do harm to the original vegetation, making the soil bare, loose, its resist ability decrease，and soil prone for erosion. In addition, the construction of ancilary work including forest roads and working pathes, entails on the excavation of ground surface, resulting in some degree of soil erosion. This barren hills，wastelands, slashes, open forest lands which have altitude of 1,000 meters and slopes gradient are less than 25 ° are chosen for project afforestation forestland in this project, afforestation uses hole recalinmation for land preparation，holes being refilled with soil immediately after saplings planting, and tending transformated forest lands use stip recalinmation, with a strip digged along another remaining, and bar ditches (bamboo groove) set along the mountains in horizontal direction digging . All this will reduce the damage to the surface and shorten stacked time of loose soil, preventing soil erosion,byrunoff and slowing down soil erosion caused by construction to a certain extent.

The early period of operation and production, with the seedlings grow, the lush foliage retents precipitation developed root systems stablize solid earth, and the ecological environment will gradually be restored and improve. Soil erosion gradually reduces until it reaches a new steady state. Therefore, in the long run, the project is conducive to the prevention and control of soil erosion in the project area. However, in

order to prevent severe soil erosion in construction period, the project should take practical water conservation measures, choose appropriate land for afforestation and prohibite selecting lands with a slope greater than 25 °, use hole recalnmation in afforestation or soild preparation intead of hole recalnimation, set planting holes in 品 shape, retain a certain width of origianal vegetation zones at the hilltop, hillside and foot. Try to avoid construct in rain period, and make anti-erosion work, ancilary work including forest roads and protection sheds built taking advantage of the conditions, avoiding great digging and filling and reducing damages to the original surface and vegetation as more as possilble.The plantation and working path earth and rock work excavation need filling back betimes, prohibite pile up randomly. It shall be elaborate a copy of independent water and soil conservation scheme, before the start of production base construction,and put all measures of water and soil conservation into effect.

⑤Impacts on the Landscape

This project mainly chooses barren hills, wastelands, slashes for camellia plantation, where there is sparse vegetation. During construction, it will clear vegetation on the surface and carry out soil preparation and excavation, forming a landscape with a great contrast and appearance against the surrounding environment, and posing a visual shock for residents around the construction area. This will also give rise to the increase of soil erosion modulus, affecting downstream vegetation and water bodies, and thus the regional landscape and environmental quality adversely. In additional, the planting time during afforestation is generally during the dry season (from late November to early March), and loose surfaces will have flying dusts in the event of wind, which covers the surrounding vegetation surface, and decreases the beauty of the surrounding landscape greatly. The environment status quo Investigation shows that the project is planned to be located in rural areas, where there is mostly rural pastoral landscape, and with the presence of a large number of construction personnel, it will add inharmonic components to the original forest landscape and pastoral landscape environment. However, with the growth of the trees, and the increase of the vegetation coverage, the regional landscape ecology will be gradually restored, and even become better.

⑥Impacts on Ecologically Sensitive Areas

If project camellia production base site have natural reserve, forest park, scenic spots, ecological sensitive areas, the construction shall have negetive impacts on those area's plant and wildlife resources,landscape and ecosystem function. On the basis of site survey, the project involve 7 national or provincial scenic spots, 8 national and provincial forest park,4 natioal and provincial natural reserve, and extensive distribute ecological public benefit forest. Having given full consideration to the conditions of construction site and relevant provisions of the laws and regulations, selection sites of barren land, barren mountain, sparse forest land and camellia stands in yield-declineing period,therefore, the project does not involve ecologically sensitive areas such as nature reserves, scenic spots, forest parks. Therefore, the project construction has no impacts on ecological forest or ecologically sensitive areas including nature reserves, forest parks and scenic areas.

2. Impacts on Ecological Environment during Operation Period

①Impact on soil environment

During soil preparation and other activities, surface soil reclaimation and

weeding will bring soil erosion in case of its rainning day. So measures should b e taken for the prevention and control of soil, including temporary film covering and stopped ditches excavation to prevent soil erosion. In addition, in the process of silvicultural,when application of fertilizer is required , if the applicatin is not proper, it will not only achive the goal of making the full use of fertilizers but also cause soil to be compact and its fertility to decline, thus affecting the growth of trees. Taking the above into consideration, the project needs scientific and rational fertilization based on the needs of tree growth, and try best to use more organic fertilizer while less chemical fertilizer. Additionally, during the growth of trees, the prevention and control of pests in those needs pesticide, especially that with high toxic and long duration of residue and this will cause the poluution of soil and undergroud water, and pesticides sprayed on pests will do harm to beneficial soil organisms, thus affecting the purification of soil. Therefore, the project should apply pesticides scientificly and try to use those of low toxicity and residual(WHO Ⅲ class),. With such measures, the project construction and operation have not heavy impacts on ecologic environmental.

②Impacts on Soil Erosion

After the completion of the project and at the early operation period, activities such as tending, weeding, soil loosing, enrichment planting, and thinning in camellia plantation would lead water and soil erosion, so we try to choose the period of low rainfall to carry out these activities, in order to reduce soil erosion. With the young trees grow, the forest coverage of the project area will increase, and by then the lush forest's canopy, dryrot branches and shed leaves layer, and well-developed root systems will weaken the rainfall erosivity, improve soil structure, increase corrosion resistance of soil, and play a good role in other areas, including rainwater interception, absorption ,penetration and, evaporation, increasing rainfall permeability in soil, prolonging runoff life, reducing the volume and speed of surface runoff, modulating floods and clipping their peaks, conserving water, preventing soil erosion, maintaining soil and purifying water, and gradually better ecological environment in the end.

③Impacts on Biodiversity

After the implementation of it, the project replant and transform camellia stands of low-quality and inefficient plants mixed stands to improve biodiversity, creating a better ecological environment in the project area, and favorable conditions for the life and reproduction of terrestrial animals. Furthermore, the vegetation coverage increases, the coverage expands, and such an environment also attract some animals, mainly including birds and small beasts, to habitat and breed, increasing the biodiversity of the project area.

④Impacts on the Integrity of Regional Ecosystem

Due to the frequent human activities, in the project area farmland vegetation and woodland vegetation are major vegetation types. In region of project, there are existing vast woodland in the project area, reach 1,903,000 ha, and after the implementation of the project, camellia plantation area would reach 6807.5 ha, only accounts for a small proportion 0.28% of the total forest area in the project area. Accordingly, in the surrounding area, the implementation of the project will not cause significant changes in the distribution of vegetation types and the structure of forest plants community as well , in other words, the components are basically not changed that have dominant impacts on the regional ecological environment. Furthermore, as the core of the evaluation of the regional ecosystem, biological organisms have the

ability to adapt to environmental changes, and can mend the natural system disturbed with their production ability, maintaining the ecological balance and integrity of the natural systems. Therefore, the construction will not significantly change the integrity and continuity of local ecosystems. All in all, from an ecological point of view, the project construction is feasible.

⑤Analysis of Environment Risks

Because the project aimes at camellia production base construction, only one woody species formed large area of monoculture plantation, thus,during construction, the project area is prone to disasters such as fires, pests and diseases.Once the disaster occurs, not only it will have an impact on the project's woodlands, causing burned and death, but also the spread of it affects surrounding ecosystems and environment. In addition the use of chemical fertilizers, pesticidessoil will poise the pollution of soil, groundwater and surface water, and fertilizer with strong toxicity will have even toxic effects on animals in forest. Thus it can be seen that, the biggest risk sources of ecological environment in the project area are pests and forest fires, followed by the use of chemical fertilizers and pesticides. Therefore, effective measures should be taken that are construction of fire barriers, intallation of necessary fire-fighting facilities, inspections and application of organic manure and pesticide with high efficiency and low toxicity, to guard against the risk of the ecological environment.

II Ecological Protection measures

See the previous sections

III Conclusions of Ecological Environment Impacts Assessment

1. Construction Period Environmental Impacts

①After the implementation of the project, original barren land, barren mountain in project area be transformed into high-yielding camellia plantation, efficiency of land use would be improve, subsequently, there would have more land area. Thus the pattern of land use within the project area will change and land productivity would increase.

②The clean-up of the original vegetation in afforestation area will not cause the notable reduction of the quantity and biomass of vegetation resources in the project area, and to the contrary with the cultivation, tending and growth of seedlings, the original barren hills and wasteland have vegetation, and the vegetation coverage are higher than before afforestation before. Using onsite protection and offsite transplanting, the ground clearance has not heavy impacts on rare plants or ancient huge trees.

③It is needed to strengthen the propaganda and education construction workers for animal protection, prohibit construction workers killing wild animals. The construction has not heavy impacts on the populations and the number of wildlife, especially on those of rare and endangered wild animal, not causing the extinction of the population and the number. With the completion of the construction, the forest grows up high, barren hills and wasteland get more vegetation, the vegetation coverage increases, and more wildlife, such as birds, are attracted to habitat. All this are conducive to the growth and reproduction of animals.

④During construction, ground clearance, soil preparation, planting and weeding

will make the soil bare and loose, soil erosion resistant decrease and thus cause soil erosion. However, with the consolidation of the loose soil, the growth of the saplings and the increase of the vegetation coverage, water conservation increasingly restore, and the ecological environment gradually improve, and the amount of soil erosion reduce step by step, until it reaches a new steady state .

⑤Soil preparation and excavation in the afforestation area will form a landscape composed with bare land, which has great contrast and incompatibility compared with the surrounding environment, and thus has a great impact on the residents around the construction area visually. At the same time, the presence of a large number of construction personnel will add inharmonic components to the original forest landscape and pastoral landscape environment. However, with the growth of the trees, and the increase of the vegetation coverage, the regional landscape ecology will be gradually rehab, and even get better.

⑥The project does not involve sensitive ecological environment zones such as nature reserves, scenic spots, forest parks, and has no effects on nature reserves, forest parks, scenic spots and other ecologically sensitive zones in the project areas

2. Environmental Impacts during Operation

①With the proper application of chemical fertilizers, pesticides, the construction and operation of the project has little effect on the ecological environment of the soil..

②After the completion of forestland for the project, the developed root system of camellia plants will improve the soil structure ,enhance the corrosion resistance of soil , expand runoff life, reduce surface runoff , lower runoff velocity, modulate floods and clip their peaks , conserve water, prevent soil erosion, maintain soil and water, and purify water. The result is that the ecological environment is gradually improving.

③After the implementation of the project, the conditions of the original ecological environment will improve , creating favorable conditions for the life and reproduction of terrestrial animals, that the vegetation coverage increases, with the size of it getting larger, and that it attracts some animals, mainly birds and small beasts, to habitat and reproduce, increasing animal diversity in the project areas.

④Due to the project area is 6807.5 ha, it is the small proportion of total forest area, the implementation of project construction will not significantly change the local ecosystem integrity and functional continuity. The proposed project is not expected impact on natural system of ecological integrity in this area. From an ecological point of view, the project construction is feasible.

⑤The largest environmental risk of the project is pests/diseases and forest fires, followed by the contamination of soil, groundwater and surface water arising from ues of chemical fertilizer and pesticide, Therefore, measures should be taken to prevent the risks of ecological environment.