SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

WEST HENAN AGRICULTURAL DEVELOPMENT PROJECT

IN

PEOPLE'S REPUBLIC OF CHINA

October 1998

CURRENCY EQUIVALENTS
(On 1 October 1998)

Currency Unit	-	Yuan (Y)
Y1.00	=	$0.1200
$1.00	=	Y8.30

The exchange rate of the yuan is determined under a floating exchange rate system. In this report, a rate of $1.00=Y8.3, the rate prevailing at the time of fact-finding of the project, has been used.

ABBREVIATIONS

BOD	-	Biochemical Oxygen Demand
Cd	-	Cadmium
CO	-	Carbon monoxide
COD	-	Chemical Oxygen Demand
Cr	-	Chromium
Cu	-	Copper
DO	-	Dissolved Oxygen
F	-	Fluorine
H_2s	-	Hydrogen sulfide
HEMCS	-	Henan Environmental Monitoring Central Station
N	-	Nitrogen
NH_3	-	Ammonia
NO_X	-	Nitrogen oxides
PADO	-	Poverty Alleviation and Development Office
Pb	-	Lead
pH	-	Acidity
PMO	-	Project Management Office
PRC	-	People's Republic of China
S	-	Sulfur
SEIA	-	Summary Environmental Impact Assessment
SEPA	-	State Environmental Protection Agency
SO_2	-	Sulfur dioxide
SS	-	Suspended Sediment
TSP	-	Total Suspended Particulates
Zn	-	Zinc

NOTES

(i) The fiscal year of the Government ends on 31 December.
(ii) In this Report, "$" refers to US dollars.

MEASUREMENT UNITS

dB(a)	-	decibel (audible)
ha	-	hectare
km	-	kilometer
l	-	liter
m^3/s	-	cubic meter
Nm^3	-	normal cubic meter
s	-	second
t	-	ton
yr	-	year

CONTENTS

I. INTRODUCTION

1. The West Henan Agricultural Development Project (the Project) has been proposed for Asian Development Bank funding. The Project was initially approved by the State Planning Commission (now State Development Planning Commission) in 1993. The Bank funded a project preparation technical assistance[1] undertaken in 1995. The Henan Environmental Protection Research Institute undertook an environmental impact assessment (EIA) in 1997, which was evaluated and approved by the State Environment Protection Agency (SEPA) in January 1998. This Summary Environmental Impact Assessment (SEIA) was prepared for the Project Management Office (PMO), based on the original EIA and reflects minor changes in Project design since 1997.

II. DESCRIPTION OF THE PROJECT

A. Project Concept

2. The Project aims to facilitate economic growth in West Henan (see Map) through an integrated area development approach. Agroprocessing industries will act as a mobilizing force for introducing and expanding more technically advanced horticultural and livestock production techniques suitable for adoption by households of poor farmers, which are often isolated and have limited physical assets. These integrated agricultural production complexes are regarded as "pillar industries," capitalizing on the competitive advantages offered by the unique location and natural resources of the Project counties. In addition, a water supply and irrigation scheme drawing water from the Yellow River will remove the major production constraint for a key agro-industrial base in West Henan, as well as provide "life-sustaining" irrigation and water supplies for poor rural communities. A key innovative feature of the Project design is creation of a revolving fund from the rapid repayment of loans by the agroprocessing industries to not only ensure repayment of the loan, but also to be earmarked for additional specific poverty alleviation projects in the Project counties, throughout the term of the loan.

B. Objectives

3. The primary objectives of the Project are to promote economic growth and increase farm incomes in West Henan Province, with a secondary objective of reducing poverty.

C. Scope

4. The Project is expected to be implemented over six years at a cost of approximately $215 million. It comprises four major components:[2]

(i) infrastructure support to remove water supply constraints in a key agro-industrial and poverty stricken area;
(ii) expansion of horticulture with crops suitable for adoption by poor households;
(iii) expansion of livestock, also focusing on poor households; and
(iv) expansion of agroprocessing facilities, with strong linkages to and partnerships with horticultural and livestock production households.

[1] TA No. 2402-PRC*: West Henan Agricultural Development Project*, for $600,000, approved on 29 December 1993.

[2] A fifth component, Wholesale Markets, is being considered. An assessment of potential environmental impacts and recommended mitigation measures has been done in anticipation that the component will eventually be included in the Project.

Table 1 summarizes the incremental production expected from the proposed Project.

Table 1: Project Scope

Component	Incremental Production
1. Horticulture	5,000 ha top-grafted apple orchards 1,500 ha Chinese dates 3,000 ha walnuts 500 ha kiwi fruit 2,000 ha gingko 2,000 ha medicinal plants 2,000 ha of organic vegetables 5,000 greenhouses 20 ha cut flowers and ornamental plants
2. Livestock	8,000 cattle fattening households (32,000 head of cattle) 6,000 sheep/goat breeding and raising households (60,000 head of sheep) 1,000 head/yr pure-bred pigs 3,000 head/yr first-cross breeding piggery 12,000 head/yr duck breeding farm, 80 million preserved duck eggs and 60,000 t/yr feedmill snake venom project in 100 villages (270,000 gm/yr)
3. Water Supply and Irrigation	56.3 million m^3/yr water to benefit 23,000 livestock and 52,000 people in 22 rural villages; 168,000 people in two towns; 14 industries; 1 thermal power plant; 1 coal gas plant; and 1,300 ha of irrigated fruit orchard.
4. Agroprocessing	About 9 subprojects relating to:[a] 4,125 t/yr egg powder 5 t/yr gingko extract 8,000 t/yr inline quick frozen (IQF) vegetables 9,000 t/yr pickled vegetables 10,000 t/yr apple juice concentrate 1.58 million pieces/yr of sheep skin products 100,000 pieces/yr of cattle hides 1,200 t/yr of walnuts 150,000 sets of molded timber furniture
5. Wholesale Markets[b]	2 wholesale agricultural markets in Zhengzhou 1 grain and edible oil market in Luoyang

a Flexibility is included in this component to allow some substitution based on viability and other criteria. The criteria will include environmental acceptability, including preparation and approval by the Bank of an environmental assessment for any subprojects with potentially significant environmental impacts.

b This component is tentative as of the SEIA. Potential impacts have been investigated and mitigation measures identified.

Source: Henan PMO, 1998.

1. Horticulture Component

5. The oversupply of low quality apples in the Project area suggests that a shift to the high quality Red Fuji variety (or other high value varieties), through top-grafting of 5,000 hectares (ha) of existing trees, will assist in restructuring the apple production base. To meet the increasing demand as living standards improve, the Project will include 2,000 ha of vegetable production in periurban areas. To balance out production between peak- and off-

seasons, the revised Project design includes 5,000 plastic greenhouses for vegetable production. Also, 20 ha of cut flowers and ornamental plants will meet the growing consumer demand for these products.

2. Livestock Component

6. In view of the changing consumer preference towards leaner pork, the Project will improve pig breeds in the Project area through a 1,000 head pure-breed piggery head and a 3,000 head/year (yr) first-cross (grandparent) piggery. In addition, in response to perceived market demand, a 1-million-duck egg project and a 270,000 gram-per-year snake venom development project are proposed.

3. Water Supply and Irrigation Component

7. The Huaiba Water Supply Scheme involves lifting water (with a flow rate of 3 cubic meters per second [m^3/s] from the Yellow River at Huaiba Xipuo Village in Mianchi County; settling the heavy sediment load in three radial flow tanks; pumping the water 31.7 kilometers (km) to a regulating reservoir (Xiduancun); and distributing the water to irrigation, domestic, and industrial users. The headworks on the Yellow River are already under construction due to the rising waters behind the Xiaolangdi Reservoir, which will inundate part of the first stage pumping station. A small village with 130 people in 39 households on the bank of the Yellow River will be relocated. The access road and electricity supply to the pumping station are also under construction, using local funds. The Xiduancun reservoir will be constructed on the Jianhe River above the town of Mianchi. At full supply the reservoir has an area of 1.78 km^2 and a total storage volume of 24.6 million m^3. The dam will be an earthfill embankment of 1 million m^3 with a height of 47 m. The reservoir will flood 4 villages, requiring 1,443 people in 338 households to be resettled. Thirteen small brick kilns, a small aluminum smelter, and 3 km of main road will also be flooded, and several power and telegraph transmission lines will need to be relocated.

4. Agroprocessing

8. From an original list of 17 possible agroprocessing subprojects, a core set of 9 subprojects has been proposed. The agroprocessing subprojects are intended to be vertically integrated with the agricultural production components, thus attracting poor farmers into industrialized agriculture.

5. Wholesale Markets

9. To strengthen the exchange of goods between urban and rural areas and create some employment opportunities for workers laid off in Zhengzhou and Luoyang, three wholesale and retail markets for vegetables, fruit, meat, and edible oil produced in the Project area, are proposed.

III. DESCRIPTION OF THE ENVIRONMENT

10. The Project area lies between 32.35^o-35.15^o North latitude and 110.21^o-113.45^o East longitude, covering 52,954 km^2 or 37 percent of Henan Province. Mountains and hills account for 79 percent of the Project area, while the plains account for 21 percent. The mountain ranges, such as Funiu, Qinling, Xiao, and Xionger, range in elevation from 1,000-2,000 m above sea level. Hilly areas and the loess plateau are at 200-1,000 m above sea level, while the Nanyang and Luoyang basins and the eastern plains are 70-200 m above sea level.

11. West Henan is located in a transitional climatic belt, between the warm temperate zone and the north subtropical zone. The Project area rainfall ranges from 600-1,200 millimeters (mm) yearly, concentrated mainly in July to September, when 70 percent of the annual rainfall occurs. With Funiu Mountain as the approximate dividing line, the natural vegetation consists of warm temperate zone deciduous forests to the south, and mixed coniferous and broadleaf forests to the north.

12. As part of an inland province, the Project area extends across four major river valleys – Haihe, Huaihe, Yangtze, and Yellow River. Rivers originating in the Project area include the Baihe, Shayinghe, Tanghe, and Yiluohe. Most of the rivers, especially the Yellow River, are heavily laden with sediment. Forty percent of the Project area comprises loess (wind-blown sands) soils, which are highly erodible. Other soils in the Project area are generally low in organic matter and potassium.

13. The Project area covers 32 counties, with a total population of 18.1 million, 20.3 percent of the Province's population. Population density is 3.4 people/ha. The agricultural population of 15.7 million accounts for 86 percent of the Project area population. Only 1.3 million ha is cultivated, providing 0.07 ha/capita of arable land. Of the 32 counties, 12 are designated as national poverty counties. Thirty percent of the households in the Project area are below the national poverty line (Y630/capita/yr in 1993 constant prices). Ethnically, 98.5 percent of the Project area population belongs to the majority Han group and the remainder to 18 different minority groups. The Muslim Hui constitute 60 percent of the ethnic minorities, followed by Manchus, Mongols, and other groups.

14. In relation to environmental quality, the rural portion of the Project area suffers from soil erosion and deforestation, while urban areas have serious air quality and water quality problems. Luoyang and Sanmenxia Cities have excessive sulfur dioxide levels, Zhengzhou has high nitrogen oxide levels, and all cities in the Project area have excessive particulate matter concentrations. Jiaozuo City has total suspended particulate levels averaging 0.536 milligrams/m^3, 1.7 times the standard.

15. Water quality was measured at 19 cross sections on ten rivers in the Project area. For the 11 parameters measured, 3 sampling locations fall into Class II, 8 are in Class III, 4 are in Class IV, and 4 are in Class V or worse. The most seriously polluted river reaches are Jialuhe River, Laoguanhe River, Manghe River, and Luohe River (at Luoyang Manshui Bridge). For example, the Jialuhe River at Zhongmu Highway Bridge has a mean Biochemical Oxygen Demand (BOD) value of 54.2 milligrams per liter [mg/L] (c.f. Class V standard – 10 mg/L) and ammonia levels averaging 0.38 mg/L (c.f. Class V standard – 0.2 mg/L).

IV. ALTERNATIVES

16. As this Project was originally approved by the former State Planning Commission in 1993, a wide range of alternatives have been considered, including the "no project" alternative, during five years of project processing. Originally 17 agroprocessing subprojects were included, but by the time of loan fact-finding only 9 core agroprocessing subprojects remained. Some further reduction in the proportion of the loan devoted to agroprocessing may still be considered. Several agroprocessing subprojects were deleted because of environmental considerations, such as the tussah silk reeling subproject of Pingdingshan Reeling Factory, the silk dyeing subproject of Zhenping Silk Scouring and Dyeing Factory, and the silk weaving subproject of Zhenping Silk Weaving Factory. Other agroprocessing subprojects were dropped because of market, management, and financial considerations. In the livestock component,

intensive piggery subprojects were removed because of recent changes in market prices, but this will also reduce the potential for adverse environmental impacts.

17. Several alternatives have been considered for mitigation measures. Generally, the EIA has recommended alternative dust removal devices for treating boiler gas emissions, which are more effective and efficient than those initially considered by the subproject proponents. In two cases, higher chimneys were proposed to more effectively disburse smoke and gas emissions. In several cases, the EIA team proposed wastewater treatment systems that were more effective than those originally proposed by the subproject proponents. All these more efficient and effective alternatives will be adopted as part of the design of the subprojects financed by the loan.

18. In the livestock component, the EIA noted the likelihood of seasonal shortages of forage in the grassland areas. As alternatives, improved pastures utilizing legumes and supplemental feeding were proposed and accepted. In the horticulture component, it was noted that the total oak and cork utilization proposed by the subproject proponent would exceed supply from the local forest areas. Accordingly, this subproject was also deleted.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Horticulture Component

19. This component will involve planting a range of horticultural crops on sloping land, such as apples, walnuts, Chinese dates, gingko, eucommia, magnolia, ornamental plants, and cut flowers. The main environmental implication of the component is the need to establish back-sloping, broad terraces on sloping land, which in some cases will be irrigated (generally using trickle irrigation). In the short term, terrace construction can lead to increased soil erosion, while in the long term terraces actually reduce soil erosion rates. Terraces may not be constructed on slopes steeper than 25 degrees, and it is expected that these lands will eventually be returned to forest cover under ongoing Government programs. The key mitigation measures for terracing include (i) careful design and layout of the terraces; (ii) immediate establishment of ground cover crops and vegetation of the risers; and (iii) intercropping of tree seedlings and annual crops, until canopy cover is reached. As soil erosion rates in the Project area are very high (500-2,000 tons[t]/km^2/yr) and almost half of the Project area is eroded, the horticulture component, covering 21 counties, should have a strong demonstration effect regarding the benefits of soil conservation.

20. The other main environmental implication of the component is possible pollution from excessive use of fertilizers and pesticides. The component will require an estimated 13,000 t/yr of urea; 12,000 t/yr of phosphatic fertilizer; and 2,000 t/yr of pesticides and herbicides. Generally, horticulture does not require high rates of fertilizer or pesticide application, compared to more intensive crop agriculture. Nevertheless, to mitigate the potential impacts it is recommended to (i) use more effective, low-toxicity, nonresidual pesticides; (ii) provide technical training to horticultural workers, especially in relation to integrated pest management; (iii) apply the relevant standards on pesticide formulation, dosage rates, application methods, safe interval periods, and maximum permissible residue levels; (iv) use organic fertilizers; and (v) monitor pesticide levels in the soil and in the horticultural products.

B. Livestock Component

21. The main livestock activities proposed under the Project are for pure-bred pigs, cattle, sheep, ducks, and snakes (for snake venom). The main environmental implications of

this component are (i) possible overgrazing of grasslands, (ii) waste discharge, and (iii) infectious diseases. The EIA provides evaluation indices for these three factors for each county involved. The analysis of forage availability concludes that only six counties would have adequate grasslands, without supplemental feeding. Overgrazing of mountainous meadows would cause or worsen soil erosion and endanger the ecological stability of surrounding forest areas. To mitigate against this impact, supplemental feeding using crop straw and agricultural by-products will be supported under the Project.

22. Wastewater from intensive livestock farms (4,000 pigs) comprises urine, feces, flushing water from the pens, and sanitary wastes from the farm workers (in total about 7,000 t/yr). Such wastes are high in organic matter, ammonium, and malodorous gases. To mitigate the potentially harmful discharge of such wastes to the environment, wastewater is either treated in septic tanks, with treated water released to field irrigation, or is sent directly to fermentation tanks to produce methane gas, which can be used to heat the piggery in winter. Solid wastes include excrement, feed residues, solid wastes from personnel, and boiler cinders. The organic solid wastes, after drying, can be used as fertilizer, or could be added to the fermentation tanks for methane production. The small amount of boiler cinders can be used for road surfacing. To overcome the odor problems, proper ventilation of gases is needed and pig farms should be at least 200 m away from residential areas.

C. Huaiba Water Supply and Irrigation Scheme

23. In general, the Huaiba Water Supply and Irrigation Scheme will improve the living environment of 220,000 beneficiaries in Yima City and Mianchi County, who currently have access to piped water supply for only a few hours each day. The subproject will also provide water for 1,300 ha of irrigation and drinking water for 23,000 head of livestock.

24. During construction, the subproject will have localized, temporary impacts due to wastewater discharge, gas emissions from construction equipment, dust, construction residues, and noise along the construction corridor. These impacts will be minimized by (i) treating wastewater in septic tanks and oil through oil separation, prior to discharge; (ii) controlling equipment exhaust systems and sprinkling water on dusty areas; (iii) using surplus excavated material to partially fill a gully, which will then be covered with soil and revegetated; (iv) sound-proofing construction equipment and protecting workers from excessive noise; and (v) revegetating the pipeline route and banks of the main irrigation channels. Construction material will come from the main borrow area of the regulating reservoir, about 1.5 km upstream of the dam site, near D-ingcun village, and for rockfill, from an existing limestone quarry 8.5 km northwest of the dam site. Sand for filter material will have to be transported from up to 150 km from the site.

25. The inundation area will be cleared of potential sources of health risks and pollution, including houses, kilns, and other structures. Fauna and flora in the area are impoverished due to intense human use, and so no significant impacts on biological resources are expected.

26. The total water drawn by the subproject amounts to about 87 million m^3/yr, which is equivalent to 0.24 percent of the average annual flow at the intake point. The 1 in 2,000 year monthly low flow at the intake is 331 m^3/s, of which the off-take (3 m^3/s) would be less than 1 percent. Although the Yellow River often dries up at its mouth for several months each year, the subproject would have negligible impact on river flows. Raw water from the Yellow River is generally Class III or better. However, the Yellow River carries a heavy sediment load. The three radial sedimentation basins (100 m diameter, funnel shaped basins with water inlets and

sand outlets in the center) will operate more than 100 days each year. When the silt level in the Yellow River exceeds 50 kilogram/m^3, water will not be pumped from the river and during this time the reservoir will be drawn down. The 521,000 t/yr of sand removed by the radial flow tanks will be returned to the river, mainly from June to October each year. The maximum increase in the suspended sediment load of the Yellow River will be 0.35 percent greater than background levels. The intake point will be located in the tailwaters of the Xiaolangdi Reservoir, which will have a much greater impact of sedimentation than the subproject.

27. To protect water quality in the regulating reservoir, considerable pollution control will be required in various industries in the upstream catchment. Industrial and mining enterprises in the catchment include the Caoyao colliery, Chencun colliery, and Chencun coking mill. Waste discharge from these industries results in current water quality at the dam site exceeding Class V standards. Wastewater from the Caoyao colliery will be treated and discharged directly to the Jianhe River. The Chencun colliery and coking plant will be closed down. In future, the establishment of polluting industries will not be permitted in the catchment and greater attention will be paid to pollution control. To control sedimentation from soil erosion in the catchment of the regulating reservoir, terracing and other soil conservation measures (such as tree planting around the reservoir margins to prevent slumping) will be implemented. The live storage is expected to remain available for at least 50 years. Controls on the use of persistent pesticides on agricultural production in the catchment will be introduced. Residential areas will not be permitted to discharge wastewater to the reservoir. The local government will draw up reservoir water protection regulations in accordance with the raw water quality requirements.

28. For urban uses of the water from the Huaiba Water Supply Scheme, secondary treatment of the water will be undertaken, making the water suitable for drinking. Yima City and Mianchi County intend to install domestic sewerage collection and treatment by the year 2000, to coincide with this expansion of the water supply. All industries drawing water from the scheme will be required to install wastewater treatment systems.

29. The EIA examined the probability of accidents, such as a break in the regulating dam, water pipeline leakages, landslips and bank slumping, and accidental water pollution. A dam break, due to a 1 in 2,000 year flood, would threaten railways, highways, property and life with an 11 m high flood crest. However, an advanced warning system will be developed based on experience gained at numerous other sites in the People's Republic of China, allowing safe evacuation. The potential for landslips and bank slumping will be minimized by planting trees and shrubs along the reservoir perimeter. For the other possible accidents, remedial measures can be readily implemented should the need arise.

30. Yima City and Mianchi Prefecture will construct water treatment facilities by the year 2000 to ensure that the increased supply of water does not result in commensurate increases in untreated sewage. All industries supplied by the Project will be required to install waste treatment facilities that will meet national environmental standards. Highly polluting industries in the catchment of the reservoir will be closed to protect water quality.

D. Agroprocessing Component

31. Currently, nine agroprocessing enterprises are proposed for inclusion in the Project (pickled and frozen vegetables, leather and woolly sheepskins, apple juice, gingko extract, walnut products, dried egg, and molded furniture).

1. Processed Vegetables

32. The processed vegetable enterprises are Type C subprojects, involving minimal pollution. The main sources of waste products are gas emissions (particulates and sulfur dioxide) from boilers; wastewater from cleaning and cooling; sanitary wastes from factory workers; noise from processing equipment; and solid wastes (organic and boiler cinders). These wastes will be controlled or treated with standard mitigation measures. Gas emissions will be treated with dust scrubbers or multitube rotary dusters. Cleaning and cooling water will be sterilized and recycled. Sanitary wastes will be treated in septic tanks. Organic solid wastes will be used as stock feed or fertilizer. Cinders can be used as road surfacing material. On balance, these enterprises are unlikely to have a significant impact on the surrounding environment.

2. Leather and Sheepskins

33. Processing of animal skins can be highly polluting (Type A), leading the Government to close down many small, inefficient operations throughout the country. The Pingdingshan Leather Group Co. plans to expand its operations from 60,000 to 160,000 cattle hides per year, and put in modern waste treatment facilities so that it is no longer in danger of being closed down. Gas emissions from the coal-fired boilers will be controlled by a ceramic multitube rotary duster or venturi water scrubber (two types of air treatment systems, with greater than 92 percent removal efficiency, so that smoke discharge can be reduced below the standard of 250 milligrams per normal cubic meter ($mg/Nm^{3)}$. Treatment of wastewater will use the chrome tanning liquid recycling technology developed by Henan Environment Protection Institute and the physicochemical/biochemical treatment technology developed by Huahaiqing Environment Protection Company. The inlet and outlet water quality projections are given in Table 2. After the subproject is implemented existing pollution in the Shuangmiao and Beiruhe Rivers will be reduced by 40 percent and 11 percent respectively, although the rivers will remain polluted until other industries (such as small pulp mills) are brought under similar control.

Table 2: Water Quality from Leather Processing Plant

Item	COD	BOD_5	Suspended Sediment	Sulfide	Chloride	pH
Inlet Water Quality (mg/L)	2,560	1,275	545	140	2,770	10.1
Outlet Water Quality (mg/L)	200	120	100	1.0	250	6-9
Treatment Efficiency (%)	92.0	90.0	82.0	99.0	91.0	~
Discharge Standard	300	150	200	1.0	n.a.	6-9

34. At 200,000 hides, the amount of solid waste is about 1,800 t/yr. Leather scraps will be sorted and used in local handicraft industries. Offcuts will be used to make industrial gelatin, and the remainder of waste hair and scraps will be used as organic fertilizer. Boiler cinder can be used as road paving material or in house construction. Dried sludge is suitable for use as fertilizer. In addition, noise reduction measures will be taken, specifically by restricting residential development within 200 m of the plant. This buffer zone of trees and fields will also help reduce the impact of bad odors in summer.

35. The Jiaozhou Sheepskin and Wool Company processes raw sheep skins into garment lining, automotive cushions and seat backs, carpets and tapestry, various leather products, and woolly sheepskins. The raw sheepskins are tanned, dyed, dried, and shorn before cutting and sewing the semi-finished woolly sheep skins into the final products. The

main pollutants are boiler gas, solid wastes, and wastewater. The current boilers do not meet air quality standards, but the expansion project will require taller chimneys (30 m) and paragneiss dust scrubbers, which will enable emissions to be well below the relevant standard. After expansion, the plant will produce 4,550 t/d of wastewater, which will be treated by the Sangpo Sewage Treatment Plant, which will discharge treated water with Suspended Sediment (SS), chemical oxygen demand (COD), and BOD_5 of 15, 25, and 25 mg/L respectively. Sludge from the sewage treatment plant is dried and treated before burial. The 1,000 t/yr of boiler cinders can be used in building and road paving. The 1,121 t/yr of offcuts, fat, skin, and meat is salvaged and fed into production of feed additives.

36. The Laomang River, which is the main receiving environment, is already quite polluted (Class V or worse). Because the Project will introduce efficient waste treatment facilities to existing processing plants, the subproject will actually improve the quality of this river by about 10 percent. However, the river will remain polluted unless a comprehensive pollution control program is implemented in the watershed, a task beyond the scope of the Project.

3. Concentrated Apple Juice

37. Apple juice concentrate plants are regarded as Class C subprojects, with negligible pollution potential. The main process involves washing the raw apples, crushing, cooking, concentration, storage, mixing, and packaging. The main waste products are boiler gases, solid wastes, sanitary wastes and washing water. The gas emissions are treated by venturi wet scrubbers, washing water is settled and re-used to the maximum extent possible, sanitary wastes are treated by a septic tank, cinder wastes are used for road paving, and organic solid wastes are used for composting or animal feed. The residual pollutant levels are all within the relevant standards. Accordingly, the overall impact on the environment is acceptable.

4. Gingko Extract

38. Gingko leaf extraction involves a fairly simple process of crushing the dried leaves, alcohol extraction, concentration of the extract, drying, and packing the product as a dried powder. Future plans include packing instant gingko extract in small sachets and possibly in pill form for medicinal uses. The existing factory will be expanded to process 750 t/yr of dried leaves, but will remain a relatively small plant. The main sources of environmental impact are noise from crushing, processing and sanitary wastewater, solid wastes from leaf residues, and air emissions from the boiler and concentration process.

39. The maximum noise volume will be 75-86 decibels (audible) [dB(a)] at source, while the daytime standard for urban areas is 70 dB(a). Workers will be protected from excessive noise, and structural or vegetative buffers can effectively dampen noise provided the plant remains a reasonable distance from residential areas. Contact oxidation of the wastewaters will allow processing wastewater to reach Class 1 standards, suitable for discharge to the nearest river. Sanitary wastewater will be treated by standard septic tank treatment. Waste gases will be treated by a ceramic multitube or paragneiss wet scrubber, either of which would enable the standard of 250 mg/Nm^3 to be attained. The leaf residues can be used as organic fertilizer or composted for mushroom media. Boiler cinders can be used as road paving material.

5. Walnut Products

40. Walnut processing is regarded as a Type C subproject with negligible adverse environmental impact. Any wastewater will be settled and either reused or treated in septic tanks. Solid wastes are generally reusable, for example, walnut shells as activated carbon.

6. Processed Egg Products

41. Liquid and dried egg processing are also regarded as Type C subprojects, with negligible adverse environmental impact. Wastewater will be treated biochemically to meet discharge standards.

7. Molded Furniture

42. The molded furniture factory involves sawing timber, coating, pressing, assembly, and painting or varnishing. The raw material will come from nearby plantation forests. The main sources of potential environmental impact are noise; waste gases from the painting area and the boiler; boiler and sanitary wastewater; and boiler cinders. Waste gases will be treated through a multitube rotary dust scrubber and 30 m high chimney and mechanical exhausts in the paint area. Boiler water can be directly discharged or reused and sanitary wastewater will be treated in a septic tank, with overflows of treated water discharged to an irrigation canal. Isolating saws and protecting workers in this area will reduce noise. Boiler cinders will be used as road paving material. There will be minimal environmental impact from this plant.

8. Overall Assessment

43. The main sources of waste from this Project emanate from the livestock and agroprocessing components. Appropriate mitigation measures have been provided for in all subprojects and the State Environment Protection Agency (SEPA) in its evaluation of the EIA concluded that the proposed mitigation measures are appropriate and SEPA agreed that the Project should proceed.

E. Wholesale Markets Component (tentative)

44. The proposed wholesale markets (two in Zhengzhou and one in Luoyang) would market vegetables, fruits, meat, grains, and cooking oil from the Project area. If included in the final Project design, this component would have minor environmental impacts, mainly related to disposal of solid wastes, sanitary wastes, noise, and air pollution from vehicles. Mitigation measures would include recycling of most solid wastes as livestock feed, installation of septic tanks for treatment of sanitary wastes and wash-down water, and careful location to avoid the impacts of noise and additional traffic on sensitive areas (such as hospitals, schools, or residential areas).

F. Relocation and Resettlement

45. Resettlement of 377 households (1,573 persons) is required for the Huaiba Water Supply and Irrigation subproject, while 16 households will suffer some land loss but need not be resettled. At the headworks, 39 households (130 people) in Huaiba Xipo village will be resettled. In this village, living conditions are very poor, with most people living in stone/wood houses or caves. Several residences would have been inundated, in any case, by the tailwaters of the Xiaolangdi Reservoir, under construction 108 km downstream. A new village, with

brick/concrete houses, was constructed near the original settlement at a cost of Y1 million and livelihood assistance is being provided by the local government resettlement office.

46. In the Xiduancun regulating reservoir, Xiduancun, Houhe, Chencun, and Louqan villages will be partially or completely inundated. In these villages, 338 households (1,443 people) have been relocated to four new settlements, within the administrative boundaries of their original villages and no more than 1 km away. Resettled villagers (i) are provided with cash compensation; (ii) can choose their own building standards and designs; (iii) enjoy improved village facilities, such as schools, clinics, roads, water and power; (iv) are given livelihood assistance totaling Y1 million; and (v) receive subsidized water supplies at a tariff of Y0.6/m^3. A property measurement and registration group, made up of villagers and local officials, classifies, measures, calculates, and pays compensation to the affected families. The compensation package is provided in bank transfers to the resettled families, who are free to chose their own building design and standards. The allowances for public facilities, roads, water, and power are given to the village committees, which take charge of the construction. Property compensation is paid according to progress of house construction, with 70 percent up front to purchase construction materials.

G. Poverty Targeting

47. To have a meaningful impact on poverty reduction (i) Project activities are mainly focused on poverty counties in West Henan; (ii) at least one third of the Project beneficiaries would involve households below the provincial poverty line [as recorded by the Poverty Alleviation and Development Office (PADO)]; (iii) a revolving fund, established from early repayment of loans to agroprocessing industries, would be partially (20 percent) earmarked for poverty alleviation programs in the Project counties; and (iv) PADO will assist with monitoring the impacts of the Project on lifting people out of poverty. Beneficiary analysis shows that at least 380,000 households (about 1.7 million people) would benefit from the Project.

H. Gender

48. The social analysis of this Project clearly demonstrated the beneficial impacts on women and children. With the increased availability of off-farm employment, female household members have taken a more dominant role in agriculture. In attitudinal surveys regarding gender relations, most couples interviewed considered that partners were equal but had differing abilities. Generally, the family remains an undifferentiated economic unit in which both spouses jointly discuss major decisions.

VI. ECONOMIC ASSESSMENT

49. Table 3 provides an overview of the estimated Project costs prior to appraisal. The estimated economic and financial internal rates of return are 25.2 percent and16.6 percent, respectively.

50. The social benefits of the Project are substantial. At least 380,000 households (1.7 million people) would benefit. A large portion of these households is currently below the poverty threshold and the Project would help to lift more than 120,000 households above the provincial poverty line.

Table 3: Estimated Project Costs
(in $ million)

Item	Foreign Cost	Local Cost	Total
A. Horticulture Component	48.5	36.6	85.1
B. Livestock Component	16.6	9.8	26.4
C. Water Supply and Irrigation Scheme	15.3	23.1	38.4
D. Agroprocessing	18.1	21.3	39.4
E. Project Management	0.4	0.7	1.1
Base Cost	98.9	91.5	190.4
Price Contingencies	3.3	5.7	9.0
Physical Contingencies	4.9	4.5	9.5
IDC and Commitment Charge	7.3	0.0	7.3
Total Cost	**114.4**	**101.7**	**216.2**

IDC - Interest During Construction
Source: Fact-Finding Mission, 1998

51. Specific environmental expenditure, in addition to the proposed mitigation measures that are integral to the Project costs, is relatively minor. For example, the cost of closing down polluting industries in the Xiduancun Regulating Reservoir catchment is regarded as a mitigation measure to control pollution at source, rather than added to the continuous costs of water treatment. Wastewater treatment, gas emission treatment, composting of organic solid waste, noise controls, and septic tank systems are all treated as mitigation measures in the agroprocessing component. The EIA contains detailed cost tables for environmental protection measures associated with each subproject. Total environmental mitigation costs are estimated at $5 million or about 1.3 percent of the total investment costs.

52. The environmental benefits of the Project are substantial, although difficult to quantify in monetary terms. For example, the horticulture component will help to increase ground cover, install bench terraces, and reduce soil erosion on sloping hillsides. Reduced sedimentation in lakes, reservoirs, and rivers helps to increase live storage in water supply reservoirs and mitigates flooding. The Project will improve air and water quality in the catchment of the Xiduancun Reservoir, once polluting coal industries are closed. Improved wastewater treatment and dust scrubbers in existing agroprocessing industries will improve the ambient water and air quality in the vicinity of these plants.

I. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PROGRAM

53. The Henan Province Environment Protection Bureau has been delegated the responsibility to supervise and coordinate all of the environmental protection measures outlined above, and to monitor the Project according to existing environmental laws, regulations, and standards. County and city environment protection bureaus are also required to bring the subprojects into their own regular management and supervision. The PMO will establish an environmental unit to organize and supervise environmental protection measures and monitor the impacts of each subproject. Each Class A and B subproject should establish its own environmental management group, with a deputy director in charge, an experienced technician,

and two to three staff. These environmental management groups will work under the guidance and supervision of the PMO and the local environmental protection bureaus. County level agriculture and forestry officials will monitor the condition of grasslands used for the livestock component.

54. The Henan Environmental Monitoring Central Station (HEMCS), a branch of the Environment Protection Bureau, will be entrusted by the PMO to take responsibility for implementation of environmental monitoring for the whole Project. HEMCS will stipulate the monitoring technologies to be used, the appropriate standards, and quality control measures. It will also contract with the enterprises concerned and cities in the Project area to undertake specific monitoring tasks. HEMCS will compile all the relevant monitoring data and prepare regular monitoring reports. The Class A and B subprojects, such as the Huaiba Water Supply and Irrigation Scheme, will establish their own environmental monitoring stations, properly equipped with monitoring and analytical equipment and competent technicians. The proposed environmental monitoring program is outlined in Table 4.

Table 4 : Proposed Environmental Monitoring Program

Environmental Segment	Monitoring Items	Monitoring Frequency	Layout of Monitoring Points
Rural Air Quality	SO_2, TSP, dust, other pollutants	Every January and July, for 3 days each time	Around Class A and B agroprocessing projects
Surface Water Quality	Temp., pH, SS, total hardness, DO, permang-anate index, BOD_5, NH_3, nitrate, phenol, cyanide, chloride, arsenic, Cr^{6+}, Cu, oil, pesticides, fluoride.	Twice a year.	Monitoring cross sections on each river upstream and downstream of the subproject discharge locations.
Irrigation Water	Flow, temp., pH, chloride, S, Hg, Arsenic (As), Cr, Cu, Zn, fluoride, cyanide, oil, volatile phenol	Twice a year.	Observation points at headworks and middle section of the main canal.
Rural Soil	Cd, Pb, Mercury (Hg), As, Zn, Cr, pH, F, chloride, pesticide residues	Twice a year.	Observation points on farmland around potentially polluting agroprocessing plants.
Crops, Fruit and Vegetables	Chemical fertilizer, pesticide residuals, and pollutant residuals.	Once a year.	Crops collected from areas around monitored plants.
Boiler Flue Gases	Smoke, dust, SO_2, NO_x, temp.	Once each season.	Smoke from the inlet and outlet of the dust scrubber.
Leather Processing Gas Emissions	Chromic acid, Chromium trioxide, sulfuric acid, sulphate, organic matter. Malodorous gas – H_2S, NH_3	For three consecutive days, once each season. For three consecutive days, once each season.	Workshop area. Plant boundary
Molded Furniture Gas Emissions	Paint fog, dimethyl benzene	For three consecutive days, once each season.	Workshop, plant boundary
Sanitary Wastewater Discharges	Flow rates, pH, COD, BOD, SS	Once a day, for 3 days each month	Discharge point
Leather Processing Wastewater Discharges	Flow rates, COD, BOD, pH, Cr^{6+}, total Cr, NH_3-N, sulphide, chloride, oil	Once a day for sewage treatment plant. Three consecutive days each month for outlets.	Inlet and outlet of sewage treatment plant. Pollution discharge outlets from workshop and whole plant.
Woolly Sheepskin Processing Wastewater Discharges.	Flow rate, pH, COD, BOD, SS, sulphide, total Cr, oil, chromaticity, anionic detergent	Once a day for sewage treatment plant. Once a month for wastewater outlet.	Inlet and outlet of sewage treatment plant. Drainage outlet for whole plant.
Intensive Livestock Farms Wastewater Discharge	PH, SS, BOD, COD, NH_3-N, Flow rate.	For three consecutive days each month.	General drainage outlet from farm.
Fruit and Vegetable Processing Wastewater Discharge	Flow rate, pH, SS, chloride, COD.	For three consecutive days each month.	Drainage outlet for whole plant.
Other Agroprocessing (Gingko, eggs etc.) Wastewater Discharges	Flow rate, pH, SS, BOD, COD, soluble total solids	For three consecutive days each month.	Drainage outlet for whole plant.
Noise	Leq (equivalent audible weighted sound level)	Once each season	Source, plant boundary and surroundings

Source: Henan Environment Protection Research Institute (1997), Environmental Impact Assessment West Henan Agricultural Development Project

VIII. PUBLIC INVOLVEMENT

55. As the Project involves 32 counties and 8 cities in West Henan, the EIA team devoted considerable attention to public participation. The main methods involved included public meetings, random interviews in the field, and questionnaires. More than 1,300 stakeholders were consulted formally, of which half were female. In 1995, the EIA team interviewed the National People's Congress and the PRC People's Political Consultative Committee of the relevant counties and cities, focusing on implementation and construction issues, land occupation, relocation, and resettlement. Opinions of the environmental protection bureaus at county and municipal level were sought on appropriate environmental standards and mitigation measures.

56. During monitoring of existing environmental conditions, the EIA team explained the nature of the Project, possible environmental impacts, and proposed mitigation measures to the local residents. As the residents had a good understanding of the local environmental conditions and resources, they took an active part in drawing up the most suitable protection measures.

57. At the meetings to examine the EIA outline and report on all subprojects, a large number of stakeholders from many sides offered their opinions on how to protect the environment from any adverse impacts. They studied the environmental impacts, possible pollution prevention measures, and the feasibility of the proposed environmental protection plan. They put forward valuable suggestions which were carefully considered by the EIA team. On the basis of these discussions, some potentially adverse subprojects, such as silk dyeing, were deleted, while others (such as apple planting) were reduced in scale.

58. A questionnaire regarding the whole Project was provided to deputies of National People's Congress, members of the People's Political Consultative Committee, leaders of village committees, residents, industrialists and business representatives. Responses were received from 507 males and 500 females, covering a wide range of occupations. Most of the correspondents (87 percent) knew about the Project to some extent, 99 percent felt that the Project would contribute to the area's economic development, 90 percent thought the Project would have minimal impact on the environment, and 92 percent thought the Project should be implemented quickly. Other points raised during this consultation were (i) most people hope to be employed, (ii) there is a need to bring in internationally advanced agroprocessing technology so that products can be exported and earn foreign exchange, and (iii) the environment should be protected by ensuring minimal adverse environmental impacts from construction of the Project.

59. For the Huaiba Water Supply and Irrigation Scheme, 300 questionnaires were distributed to those affected. The questionnaires asked people who may be affected by the Project about their knowledge of the Project; possible environmental impacts; attitudes toward relocation or accepting new immigrants to their village; and other pertinent questions to gauge local attitudes on the Project. More than 70 percent of the 270 responses received were from farmers or workers. The questionnaires revealed that most people to be resettled (92 percent) were very pleased or willing to move and 86 percent of the existing villagers in the resettlement areas were pleased or willing to accept the relocated villagers. Most (95 percent) hoped to be resettled nearby and wanted to continue their current occupations.

IX. CONCLUSIONS

60. The Project has clear social and economic benefits and will contribute to the reduction of poverty in the poorest counties of West Henan. About 1.7 million people will benefit from the Project. Many of the Project products can be exported and generate foreign exchange revenue, thus promoting economic development in the Province.

61. The main adverse environmental impacts potentially arise from the Class A agroprocessing subprojects (leather processing and woolly sheepskin processing) and to a lesser extent from the Class B subprojects. Mitigation measures are available for all of the anticipated environmental impacts and have been included in the Project design. The EIA identified some improvements in waste treatment technologies over those proposed initially by the subproject proponents. These will be incorporated in the Project design. The residual impacts of each agroprocessing subproject are within the relevant discharge standards.

62. Generally, the Huaiba Water Supply and Irrigation Scheme will have a positive impact on the environment, although there are some temporary adverse impacts during construction. The horticulture components will have positive impacts as they will increase the vegetative cover in sloping terrain and result in broad based terraces which are effective in reducing erosion rates. The livestock activities are generally scattered among households and will have relatively minor impacts, although intensive subprojects such as the pig breeding farms will require careful attention to treatment of wastewater. The overuse of grasslands has a potentially negative impact, which will be balanced by supplemental feeding.

63. On balance, the Project has an overall beneficial effect, once environmental, social, and economic issues are considered. Mitigation measures amounting to about 1.3 percent of the capital investment have been carefully designed and costed and will be generally effective in reducing the residual impacts. A comprehensive environmental monitoring program has been formulated to ensure that the recommended mitigation measures are implemented and effective.