

# Initial Environmental Examination Report

Loan Number: 2102 NEP  
May 2010

Nepal: Community-Managed Irrigated Agricultural  
Sector Project

Kali Koshi No. 1 Paini Irrigation Subproject, Morang  
District

Project Proponent: Department of Irrigation  
Prepared by Eastern Irrigation Development Division No. 2 (Sunsari)

This Initial Environmental Examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

## ABBREVIATIONS

ADB	- Asian Development Bank
CMIASP	- Community-Managed Irrigated Agricultural Sector Project
CPMO	- Center Project Management Office
DADO	- District Agriculture Development Office
DB	- Design Branch
DDC	- District Development Committee
DOI	- Department of Irrigation
EB	- Environment Branch
EMP	- Environmental Monitoring Plan
FMIS	- Farmer-managed irrigation systems
ha	- Hectar
IDD	- Irrigation Development Division
IDSD	- Irrigation Development Sub-division
IEE	- Initial Environmental Examination
IPM	- Integrated Pest Management
ISPM	- Institutional Strengthening and Project Management
km	- Kilo Meter
lps	- Liter Per Second
MEQCB	- Monitoring, Evaluation, and Quality Control Branch
MoEST	- Ministry of Environment of Science and Technology
NGO	- Non Governmental Organization
O&M	- Operation and Maintenance
PDMED	- Planning, Design, Monitoring and Evaluation Division
RCC	- Reinforce Concrete Cement
Rs.	- Rupees
SISP	- Second Irrigation Sector Project
SWD	- Surface Water Division
VDC	- Village Development Committee
VRB	- Village Road Bridge
WECS	- Water Energy Commission Secretariat
WUA	- Water User's Association
Zol	- Zone of Influence

## WEIGHTS AND MEASURES

ha	- hectare
km	- kilometer
l	- liter
m	- meter
mo	- month
s	- second
t	- ton
yr	- year

## CURRENCY EQUIVALENTS

(as of 31 March 2009)

Currency Unit - Nepalese Rupee (NR)

NR 1.00	=	\$0.01226
\$1.00	=	NRs 81.54

## NOTE

In this report, "\$" refers to US Dollars.

## **GLOSSARY**

Terai	The southernmost strip of land in Nepal, bordered to the north by Himalayan foothills and to the south by the Ganges River. The area was originally covered with tropical vegetation, but has been almost completely converted to agricultural production. The Terai is now the breadbasket of Nepal and is covered with farms.
Command Area	It is the agriculture or cultivable area which receives assured irrigation through canals, waters, courses, and field channels up to farmers' field.

## **TABLE OF CONTENTS**

<b>I.</b>	<b>INTRODUCTION</b>	<b>4</b>
<b>II.</b>	<b>DESCRIPTION OF THE SUBPROJECT</b>	<b>4</b>
<b>III.</b>	<b>DESCRIPTION OF THE ENVIRONMENT</b>	<b>6</b>
	Physical Environment	6
	Water Resources.	7
	Ecological Resources	7
	Socio-economic Environment	7
<b>IV.</b>	<b>SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS</b>	<b>8</b>
<b>V.</b>	<b>POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES</b>	<b>11</b>
	Environmental Problem Related to Subproject Design	11
	Environmental Problems Related to Construction Stage	12
	Environmental Problems Resulting from Subproject Operations	14
	Realization of Enhancement Potentials	15
<b>VI.</b>	<b>ANALYSIS OF ALTERNATIVES</b>	<b>16</b>
<b>VII.</b>	<b>INSTITUTIONAL ARRANGEMENTS</b>	<b>16</b>
<b>VIII.</b>	<b>ENVIRONMENTAL MANAGEMENT PLAN</b>	<b>17</b>
<b>IX.</b>	<b>PUBLIC CONSULTATION AND DISCLOSURE</b>	<b>22</b>
<b>X.</b>	<b>FINDINGS AND RECOMMENDATIONS</b>	<b>22</b>
<b>XI.</b>	<b>CONCLUSION</b>	<b>23</b>

## I. INTRODUCTION

1. The Community-Managed Irrigated Agricultural Sector Project is designed to improve the agricultural productivity and sustainability of farmer-managed irrigation systems (FMISs) while strengthening the policies, investment plans, and institutions for irrigated agriculture, following the lessons learned during the Loan 1437-NEP: Second Irrigation Sector Project (SISP). The Project is located in the Eastern and Central regions of Nepal and comprises two parts: (i) participatory irrigated agriculture development for FMIS; and (ii) institutional strengthening and project management (ISPM). Under the first part, 210 FMIS will be rehabilitated, resulting in improvements in irrigated agriculture over 34,000 hectares (ha) benefiting about 270,000 people. The second component comprises the development and implementation of improved institutional mechanisms for FMIS development, further improved policies and regulations, strengthening of the key stakeholder agencies and their linkages.

2. An initial environmental examination (IEE) was undertaken for the core subprojects based on data collected during the Detailed Design Period. The overall objective of the IEE is to analyze the adverse environmental impacts arising from site selection, design, construction, and operation of the Project is such effects occurs and its mitigation to acceptable levels through implementation of a set of clearly defined and costed mitigation measures which have been included in the Project cost estimates. For each additional subproject, an IEE, and an environmental impact assessment (EIA) if warranted, will be carried out in accordance with the Bank's guidelines and relevant government's environmental requirements during the preparation of subproject feasibility studies.

3. This Initial Environmental Examination (IEE) Report for the Kali Koshi Paini Irrigation Subproject has been prepared to meet the Asian Development Bank's (ADB) requirements for environmental assessment process and documentation prior to Subproject approval, following the procedures in ADB's Environmental Assessment Guidelines (2003), and the Project's Environmental Assessment and Review Procedures.

## II. DESCRIPTION OF THE SUBPROJECT

1. **Subproject Location.** The subproject lies between 26°36'9" N to 26°37'30" N latitude and 87°01'21" E to 87°30'00" E longitude. The subproject command area lies in the Ward No. 5, 7 and 8, Bayarban VDC, Morang District. (Refer Main Report for location map of subproject)

2. **Accessibility.** The subproject area can be easily accessed through East-West highway, which is about 5 km south from Kanepokhari. Gravelled and village road provides linkage to almost all the command area.

3. **Command Area.** The gross command area of the subproject is 173 ha and the net command area 140 ha. (Refer Table 1 for Salient Features of the Subproject)

**Table 1: Salient Features of the Kali Koshi Paini Irrigation Subproject**

1.	Name of the Subproject	:	Kali Koshi No. 1 Paini Irrigation Sub-Project		
2.	Sub-Project Classification	:	Rehabilitation		
3.	Location (Ward No. & VDC)	:	Bayarban VDC – 5, 7 & 8		
4.	District	:	Morang		
5.	District Headquarter	:	Biratnagar		
6.	Zone	:	Koshi		
7.	Development Region	:	Eastern		
8.	No. of Households	:	325		
9.	Population	:	1,494		
10.	Total Canal Length				
	a) Main Canal	:	2.485 km		
	b) Branch Canal	:	1.443 km		
	c) Tertiary Canal	:	2.282 Km		
11.	Gross Command Area	:	173 ha.		
12.	Net Command Area	:	140 ha.		
13.	Name of Source	:	Kali Koshi Khola		
14.	Type of Source	:	Spring fed (Perennial)		
15.	Catchment Area	:	0.45 km <sup>2</sup>		
16.	Canal Discharge at the intake	:	0.23 m <sup>3</sup> /sec		
17.	Existing Diversion Structure	:	Temporary Sand Bag Type Weir		
18.	Physical facilities proposed		Reshaping Rehab Extension		
	Headworks		RCC Core wall Weir and RCC Intake		
			Main Canal	Branch Canal	Tertiary Canal
	- Proportional Distributor		1		
	- Slab VRB (nos)	:	3	3	
	- Hume Pipe VRB	:	2	2	
	- Foot Bridge (nos)	:	1	20	
	- Superpassage (nos)	:	1		
	- Aqueduct (nos)	:	2	1	1
	- Outlet (nos)	:	8	8	
	- Lining (m)		368	100	
19.	Total estimated cost including contingency & VAT	:	NRs. 18,987,870.00		
20.	Cost Per Hectare	:	NRs. 135,627.64		
22.	Total Civil Work Cost	:	NRs 13,664,092.11		
23.	WUA Contribution	:	NRs. 410,386.78		
24.	Economic Internal Rate of Return (EIRR)	:	19.7%		
25.	B/C Ratio at 12%	:	1.52		

Notes: VDC = Village Development Committee; msl = meters above sea level; km = kilometers; ha = hectares; km<sup>2</sup>= square kilometers; RCC = reinforced concrete cement; VRB = Village Road Bridge

### III. DESCRIPTION OF THE ENVIRONMENT

#### Physical Environment

4. **Topography.** The subproject is located in the Terai plains in an agricultural area with land that slopes gently from north-west to south-east at an elevation of just under 108 m above msl. The subproject lies between the left bank of the Rate Khola and the right bank of Bhaluwa Khola. The existing main canal after reaching the command area tends to follow the ridge line. The branch canals run along contour line and irrigates to one side. The canals are earthen but with little seepage loss as could be observed in some places.

5. **Climate.** The subproject area has three distinct seasons, spring, monsoon, and winter. The climate of the subproject area is mainly sub-tropical and humid. It has hot and humid climate during summer and moderately high rainfall during the monsoon. There is no meteorological station in the project area itself, however, the nearest meteorological station at Biratnagar Airport (Station No: - 1319) is used for the meteorological data reference, which is about 4 km from Biratnagar and 47 km from the subproject area. The recorded data of precipitation, maximum and minimum air temperature, wind speed, relative humidity of Station No.: - 1319 is used for the analysis of crop water requirement. The river does not dry up completely since its long stretch is fed by perennial springs. The following are some important hydro-meteorological observations:

- **Rainfall:** Mean annual rainfall – varies from 7.6 mm minimum in December to 550.1 mm maximum in July
- **Temperatures:** Mean monthly maximum: - varies from 22.5°C in January to 33.8 °C in April
- **Temperatures:** Mean monthly minimum: - varies from 9.0°C in January to 25.6 °C in August
- **Humidity:** Relative humidity: - varies from 82.4% in July to 52.6 in April
- **Evaporation:** Minimum = 1.8 mm in January and maximum = 6.1 mm in April

6. **Soils.** Three pits were dug and soil samples were taken from surface layer. The soil sample was analyzed in Regional Soil Laboratory, Jhumka and soil laboratory results are given below. The soil samples were taken from head, middle and tail canal reach of subproject area. The soil pH of all three sites is slightly acidic. Soil pH of head reach is 6.1, middle is 5.7 and tail reach is 6.3. The soil of subproject area is Sandy Loam to Silt Loam. The Nitrogen content of soil of each canal reaches is of low to medium level. Phosphorus content of soil in the project area is low to high. Potassium content of soil of command area is of low to medium level. Therefore, farmers of the command area should judiciously use the plant nutrient based on recommended rate. Organic matters content of soils of project area is low to medium level. Soil and texture of soil of the project area are suitable for crop production. Paddy can be grown

successfully but soil of project area is best suited for maize, wheat, oil crops, pulses, potato and vegetables cultivation.

### **Water Resources.**

7. **Area and Condition of Watershed.** Kali Koshi Khola, the source of irrigation water, is a spring fed perennial source. It originates from the community forest about 500 km north from the headwork site in the Bhabar Zone. The catchments area at the proposed headwork is about only 0.45 km<sup>2</sup>.

8. **Available Hydrological Records and Water Resources Assessment.** Kali Koshi Khola is a small spring fed source and there exists no functional stream flow gauging stations along the Kali Koshi basin. The discharge in the Kali Koshi Khola measured at the diversion point was 270 l/s on 5<sup>th</sup> February, 2008. Nevertheless, no measured data are available indicating the mean monthly flows of the khola. The catchment area is 0.45 km<sup>2</sup> and discharge was measured during on 5<sup>th</sup> Feb 2008.

9. The source of the khola is spring fed perennial source and there is not much fluctuation of the source discharge. The 80% predicated monthly flow is about 1/3<sup>rd</sup> of the reliable monthly flow, which shows that the scarcity of water to irrigate the command area. The farmers have been irrigating their fields for many years on which basis the design discharge is considered. The predicted data of the mean monthly flows is utilized to carry out the water balance analysis. The mean flow was used for designing - which is more reliable and justifiable, instead of the 80% reliable flow.

### **Ecological Resources**

10. **Vegetation and Forest.** There are no national or community forests within the command area.

11. **Wildlife.** As reported by the local people, there is no wildlife within the command area.

12. **Aquatic life.** Among the aquatic species, Buduna, Asla, and Baam are found in the source River.

### **Socio-economic Environment**

13. The Kalikoshi Paini No 1 irrigation subproject covers Bayarban V.D.C ward no 5, 7 and 8. Total numbers of households 325 with average family size of 4.6 people and population is estimated at 1,494. The average family size of the female headed households is apparently small in size.

14. Ethnically, the settlement has a mixed type of social structure.

15. The main occupation of people in the area is farming. The sample household survey revealed that majority of households depends on agriculture for their livelihood. Landless and marginal farmers meet their needs by working as agriculture labor.

16. The literacy rate was found to correlate with the size of land holding of a family, literacy being higher among small farmers and marginal landless than medium land holders. Percentage of high school going is higher in all the categories of farm size.

17. Ninety two percent of the sample household have Pukka house (cement mortared) while 90% household have access to electricity. Ninety three percent household have their own toilets. There is no community drinking water supply system. Almost all have tubewell with hand pump are the only source of drinking water.

18. Seasonal migration within and outside the country was reported, last year 50% of landless, marginal farmers went to abroad for earning as there was no opportunity to earn here. Under small and medium farm categories 37.5% and 35.3% people went outside the country for job. For few months, small and medium farmers also went outside of business for job. Permanently only 26.2% farmers resided at home.

19. Seventy one percent of sample household contributed their labor in operation of canal out of those 18% worked for headwork while 14% worked in main canal and 38% of households did repair and maintainers of Branch canals.

#### IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS

20. **Delineation of geographical boundary of zone of influence (Zoi):** The project area will be delineated under three category (i) high impact area: the permanent impact from the project such as permanent land loss and dewatered zone will be considered as high impact area. Such area will include the area where the project infrastructures will be located such as headworks, canal alignment and canal structures (ii) Moderate impact area: This will cover the area where land loss will be temporary during the construction period only. They will include camp sites, quarry sites; borrow areas, labor camp sites etc. (iii) low impact area: This will cover the adjoining areas within 200 to 500m (depending upon the settlement pattern) from the boundary of the subproject area of the VDC that are likely to be affected. The screening of the potential impacts is presented in Table 2.

**Table 2: Screening of Potential Impacts**

SN	Parameters	Impact		Remarks
		Yes	No	
1	<b>Environmental Problems due to Subproject Location</b>			
1.1	Encroachment into Areas of Conservation Significance		√	There are no conservation areas (wetlands and protected forests) within the Subproject command area
1.2	Impediments to Movements of Wildlife, Livestock and People		√	Being an existing system there won't be any additional impediments.
1.3	Encroachment on Historical and Cultural Sites		√	There are no historical, cultural, and religious sites within the Subproject command area
1.4	Water Resource Conflicts		√	There has not been conflict related to water sharing in the subproject.



SN	Parameters	Impact		Remarks
		Yes	No	
1.5	Flooding and Drainage Hazards		√	The subproject will construct control structures at intake that will prevent overflowing in the canals.
1.6	Displacement of People and Property		√	Since the canal is along the existing system, there won't be any displacement of people and property.
<b>2</b>	<b>Environmental Problems related to Subproject Design</b>			
2.1	Erosion and Landslide along Canal Alignment	√		The subproject will construct outlets that will prevent canal bank erosion.
2.2	Downstream Water Quality Problems		√	The subproject is a rehabilitation project therefore no other water sources (e.g. groundwater) will be utilized. Therefore quality of water supply will not change
2.3	Suitability of Natural Water for Irrigation		√	The water sources have been used prior to rehabilitation works. There will be no changes in water use during the Subproject implementation and water quality is good.
2.4	Over pumping of Groundwater		√	Groundwater will not be used in this Subproject.
2.5	Adequacy of Drainage Planning		√	No drainage problem has been foreseen in the command area.
2.6	Disruption of Existing Farmer Cooperative Systems		√	There are no existing farmers' cooperatives within the command area.
2.7	Use of Chemicals in Agriculture and Horticulture	√		Use of chemical fertilizers and pesticides is likely to be increased due to the improved irrigated agriculture practice
2.8	Selection of Pesticides	√		Selection and use of pesticides may be a problem.
2.9	Land Use Conflicts		√	The land use within the command area has been established prior to the implementation of the Subproject. No records are available showing misunderstanding or conflicts among different land uses.
2.10	Inadequacies in Water Distribution		√	Necessary improvement work in the system and improved efficiency of the canal system will increase the discharge in the canal. Inadequacy in water distribution will not occur.
2.11	Canal Management	√		Since the subproject is to combine two systems, the canal management will have to be worked out.
2.12	Passageways	√		Sufficient facilities of passageways are provided by constructing number of crossing structures.
2.13	Scouring Hazards		√	The system has been in operation for many years. Canal beds are stable
<b>3</b>	<b>Environmental Problems Related to Construction Stage</b>			
3.1	Excavation	√		Only excavation at structure sites. Being an existing canal no new excavation.
3.2	Construction material sites (Quarry Sites)		√	The construction work will require sand, aggregates and stones which can be fulfilled from the local market or local quarry. Operation of quarry site for the subproject may not be feasible.
3.3	Work camp location and operation	√		The contractor will have to establish work camp for the construction activities

SN	Parameters	Impact		Remarks
		Yes	No	
3.4	Labor camp		√	Most of the unskilled and some of skilled manpower will be fulfilled from the local area. Hence labor camp will not be operated. Some of the outside labor will be reside in the work camp itself.
3.5	Stockpiling of materials	√		The construction material will be stored at the convenient locations for the construction activities.
3.6	Operation of construction equipment and transport	√		No heavy construction equipments are needed. Only small dewatering pumps, mixers, vibrators, etc will be used which do not contribute major air pollution. Tractors and trucks would be used for material transportation.
3.7	Occupational health and safety	√		Occupational health and safety of the workers will be the major concern.
3.8	Temporary Closure of Irrigation System	√		Construction activities are likely to disturb the supply of irrigation water.
4	<b>Environmental Problems Resulting from Subproject Operations</b>			
4.1	Effect on downstream water use		√	The proposed intervention will not be abstracting more water than existing quantity. Hence effect on downstream users has not been foreseen.
4.2	Adverse soil modifications		√	The proposed subproject is the rehabilitation of the existing irrigation system, adverse soil modification will not occur due to the proposed subproject implementation.
4.3	Changes in groundwater hydrology	√		The Subproject will improve the irrigation system which will likely recharge the groundwater tables within the command area.
4.4	Mosquito Breeding	√		Water ponding within the command area may lead to increase in incidence of waterborne disease and mosquito breeding.
4.5	Hazards associated with the use of toxic chemicals	√		Use of pesticides for the pest control could be hazardous to the people and live stock
4.6	Hazards associated with the use of mineral fertilizer	√		Increased use of fertilizers likely due to improved irrigation system, These may find its ways to surface and ground waters which could be hazardous.
5	<b>Realization of Enhancement Potentials</b>			
5.1	Employment to the local people	√		Construction activities will require construction labors. Local people will get opportunity in employment. In addition farmers have to share the construction cost which will be mostly usually in terms of labor force.
5.2	Community water supply in command area		√	The command area has existing water supply schemes. Canal waters are not used for domestic purpose and will not be used as such after Subproject implementation.
5.3	Aquaculture in command area		√	Farmers are not practicing aquaculture within the command area. It is unlikely that this will change during Subproject implementation.
5.4	Livelihood programs for landless households	√		Construction activities will require both skill and unskilled laborers. The Subproject will also provide livelihood trainings to enhance economic conditions of landless households.

SN	Parameters	Impact		Remarks
		Yes	No	
5.5	Feasibility of cooperatives	√		The subproject will implement institutional development activities to strengthen capacity of water users associations which could function as a cooperative to support the farmers.

21. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen. The two activities in which the subproject interacts physically with the environment are during construction and operation, so these are the two activities which may incur most significant environmental impacts. The subproject will not cause any significant adverse environmental impacts because: (i) most of the individual elements of the Subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation; and (iii) mitigation measures are devised for any negative environmental impacts (iv) the subprojects intends to combine two FMISs. Though the farmers have agreed to share the water from one diversion, the farmers at the tail end will be at the disadvantage side compare to head reach farmers.

22. These potential environmental impacts may be direct or indirect, and reversible or irreversible. The magnitude of the impacts may be high, medium or low and such impacts may be of site-specific, local, regional or of national extent. Furthermore, some impacts may be short-term, particularly related with the upgrading stage, medium-term and long-term duration.

## V. POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

### Environmental Problem Related to Subproject Design

23. **Erosion and Landslide along Canal Alignment.** The subproject will construct outlet structures to prevent canal bank erosion. This is positive impact of high magnitude, local extent and long term duration.

24. **Use of Chemicals in Agriculture and Horticulture:** The subproject area being located close to the big market, the availability of chemical fertilizers is very convenient. Although the use of chemical fertilizers is currently low, it may increase as the project encourages irrigated agricultural practices. Excess use of chemical fertilizers in the field may percolate into the groundwater or run down into surface water along with the runoff. But it (the excess use) would be very rare in practice. Considering the rareness of the occurrence, this impact has been considered of low magnitude, local extent and long term duration.

25. *The agricultural development plan has recommended the optimum dose of required chemical fertilizers for each of the proposed crops.*

26. **Selection of Pesticides:** Majority of farmers of the project area are not aware of the toxicity of the pesticides. Presently, only few farmers are using pesticides. As reported, they have not undertaken integrated pest management (IPM) training program. Hence, farmers need training on integrated pest management.

27. *Include IPM training under agriculture development program. The cost of this training will be covered from ADP.*

28. **Canal Management:** The proposed project intends to combine two FMIS together. The main canal will be carrying the water for both systems. The operation and maintenance of the systems will be the responsibility of the farmers themselves. Each of the individual system has their own canal management process, which has been practiced for many years. But operation and maintenance of the main canal will have to be worked out, which should not be a problem as they have practiced such works for many years. Hence this impact has been considered of low magnitude, local extent and long term duration.

29. *Any type of contribution for the operation and maintenance of the canal system are being carried out in proportion to the land holding, which holds good for the combined system also. However this will be worked out by the coordination committee of two individual systems. **Water management** plan will be developed for the operation of the system.*

30. **Passageway:** There are some passageways in the existing canals which is not adequate for movement of the people. Hence additional passageways have been proposed. This is a positive impact of high magnitude, local in extent and long term duration.

### **Environmental Problems Related to Construction Stage**

31. The subproject will use labor-based, environment-friendly, and participatory approach, the important features of which are:

- Use of local people as labor, hand tools and small equipment, rather than heavy machinery for construction.
- Balancing cut and fill and reuse of excavated materials as construction materials, and thus not generating excess spoils as far as possible.
- Use of bio-engineering techniques: integrated use of vegetation, simple civil engineering structures, and proper water management systems for slope protection.

32. Significant adverse environmental impacts are not expected during the construction stage mainly because: (i) rehabilitation works can be constructed without causing major disruption to irrigation users; (ii) most construction will be conducted by small teams of farmers working on short lengths at a time so most impacts will be localized and short in duration; and (iii) the overall construction program will be relatively short for a project of this nature, and is expected to be completed in 8 months.

33. During the construction phase most of the potential negative environmental impacts are associated with the activities of the construction contractor(s). By including environmental management clauses in the individual contract documents, the potential for adverse impacts can be significantly reduced.

34. **Excavations.** Excavation will be at the structures locations. But as the structures are small, quantity of excavation would not cause serious adverse effects that cause silt runoff, induced erosion and loss of cropland and vegetation. After construction, most of the excavated material would be reutilized in backfilling work.

35. *Mitigation measures include: (i) confine excavation operations to the dry season; (ii) use of silt traps; and (iii) spoils of any in excess shall be disposed of in locations that will not promote instability and result in destruction of property, vegetation, irrigation and drinking water supply. Disposal near wetlands, protected areas, and other areas that will inconvenience or deprive local residents of their livelihood shall not be allowed. Acidic and saline spoils shall not be spread into agricultural land.*

36. **Work Camp Location and Operation.** Potential environmental impacts include (i) temporary air and noise pollution from machine operation; (ii) water pollution from storage and use of fuel, oils, solvents, and lubricants; (iii) unhygienic conditions from laborers.

37. *Mitigation measures include: (i) The Contractor shall consult with WUA and or VDC before locating project offices, sheds, and construction plants; (ii) camps shall not be located near settlements or near drinking water supply intakes; (iii) no trees shall be cut and removal of vegetation shall be minimized; (iv) water and pit latrines facilities shall be provided for laborers; (v) used oil and lubricants shall be recovered and reused or removed from site by the Contractor; (vi) at conclusion of the Subproject, all wreckage, rubbish, or temporary works that are no longer required shall be removed or given to local residents; (vii) all temporary structures, including office buildings, shelters, and latrines shall be removed; (viii) sites shall be restored to near natural or stable conditions; (ix) exposed areas shall be planted with suitable vegetation; and (x) the Subproject proponent shall report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of the works.*

38. **Stockpiling of Materials (Storage of topsoil, fill material, gravel, aggregates, and other construction materials).** Potential environmental impacts include (i) siltation and pollution of surface water resulting from uncontrolled runoff from storage piles; and (ii) disturbance to private property.

39. *Mitigation measures include: (i) stockpiling shall not be permitted during the rainy season unless covered by a suitable material; (ii) stripped material shall not be stored where natural drainage will be disrupted; (iii) protection of materials from erosion prior to rainy season; and (iv) storage on private property will be allowed only if written permission is obtained from the owner or authorized lessee.*

40. **Operation of construction equipment and transport:** As no heavy construction equipments are needed, the subproject activities will not contribute major air pollution and excessive noise. However high concentration of airborne dust particles due to construction

materials may result in deposition and possible damage to vegetation, crops, and water resources.

41. Mitigation measures include: (i) stockpiled sand and soil shall be slightly wetted before loading particularly in windy conditions; (ii) vehicles transporting sand and soil shall be covered with a tarpaulin; and (iii) limit and control working practices through contract provisions such as: (a) avoid noise-generating activities at night; (b) consult with local community to inform them of the nature, duration, and likely effects of the construction work; (c) schedule work during dry season

42. **Occupational health and safety:** In the construction sites, there will be movement of local peoples. Despite precautions, possibility of accidents could not be ruled out completely as many types of equipment will be under operation. Hence, construction activities may pose safety concern to local peoples as well as workers. Although the health and safety will be major concern during the construction stage, magnitude of the impacts has been evaluated as low since provision of health and safety measures are mandatory in any of the construction contracts and due to small scale of construction. The extent will be site specific and duration will be of short term.

43. *Accidental insurance will be covered for all construction workers and staff. An amount has been allocated for the buying the accident insurance policy of the workers. This cost shall be covered from the environmental management cost. In order to minimize the unwanted accidents and possible effects of dust and gaseous emission to construction workers, the project will ensure adequate safety measures such as provision of helmets, masks, ear plugs, road signs, warning signals etc.*

44. **Temporary closure of irrigation system.** The construction activity in the canal system may disturb the supply of the irrigation water. Hence the provision of temporary closure of irrigation system will have to be made with due consultation with WUA.

45. **Mitigation Measures:** *The construction activities will be planned in consultation with the WUA members. The intake construction will be carried out during the dry season and the alternative measures will be made to keep the canal in running conditions if the construction activities will be carried out during the canal operation time. Flexible hosing and/or diversion canals will be used to supply water to affected users. Cost of alternative arrangement for supplying the water will be part of the civil construction cost.*

## **Environmental Problems Resulting from Subproject Operations**

46. **Changes in Groundwater Hydrology.** The application of the irrigation water in the field is likely to recharge the groundwater of the subproject area vicinity and the groundwater table will rise in general. But any substantial change in groundwater hydrology is unlikely due to the proposed subproject because the subproject area is already receiving the irrigation water. The proposed subproject is rehabilitation only. Hence the impact is considered of low magnitude, local in extent and long term in duration.

47. **Mosquito Breeding:** In an irrigation project, the water is flooded in the field especially during the monsoon season, which could be the breeding ground for the mosquito, a carrier of diseases. But the proposed subproject is the rehabilitation of the existing irrigation system, which is already in operation. The proposed subproject is not going to have any additional effect on the environment. Hence the impact is considered of low magnitude, local in extent and long term in duration.

48. **Hazard associated with the Use of Toxic Chemicals:** Pesticides are the toxic chemicals that would be used in the agricultural crops whenever crops are infested by the insects. From the focused group discussion with the farmers, they seemed to be aware of the toxicity of the pesticides. Use of pesticides in the subproject area is minimum. Farmers need some IPM (integrated pest management) training so as to train the farmers in pest management without the use of pesticides. With this background, it could be assumed that impact associated with the pesticides (toxic chemicals) will be of low magnitude, local in extent and long term in duration.

49. **Hazards associated with the Use of Mineral Fertilizer.** The farmers have been using chemical fertilizers in the crops. But the quantity of usage is less than the recommended dose for the crops. The subproject intends to carry out training in the crops cultivation to increase the crops yield. Hence the use of chemical fertilizers is going to be increased with the subproject implementation. But given the proper training programs, the application dose will be optimum for the crops and it would not create any hazard as such. Hence the impact is considered of low magnitude, local in extent and long term in duration.

### **Realization of Enhancement Potentials**

50. **Employment Opportunity to the Local People.** The construction of the subproject would require both skilled and unskilled labor. Semi skilled and unskilled labors are available in the subproject area as well as its vicinity. The subproject would provide employment opportunity to the local people. In addition, the farmers will have to make their contribution, which could be in kind and cash. The farmers preferred to make contribution by providing labor.

51. **Livelihood Programs for Landless Households.** There are landless and ultra poor households in the subproject area who work as tenants for other households who own the land. The proposed subproject intends to enhance the economic condition of these households by implementing different livelihood programs.

52. **Feasibility of Cooperatives.** The existing irrigation system is being operated and maintained by the water users association. They have defined rules and regulations, which are followed by all the members. The rules and regulations are socially binding. The proposed CMIASP intends to implement a number of institutional development activities in strengthening capacities of the WUAs in agricultural production, and poverty alleviation of the subproject area. The WUA will have the key role to play in these activities. For the subproject implementation, a coordination committee is planned to be formed. The WUA could also function as the cooperatives to support the farmers in terms of making timely availability of agricultural inputs, marketing of the agricultural production, facilitating the micro credits.

## VI. ANALYSIS OF ALTERNATIVES

53. The proposed headworks is located at the traditional diversion point of the existing system which is the preferred site of the farmers and best suited from the technical consideration.

54. Since the irrigation system is the traditional system, canals already exist and there are no alternative alignments for them. Even though the proposed irrigation subproject intends to combine two traditional irrigation systems, additional link canals are not required. Both the systems have been sharing the water at present also.

## VII. INSTITUTIONAL ARRANGEMENTS

55. **Institutional requirements.** Nepal has an established legal and policy framework for environmental safeguarding in relation to projects. Environmental protection is overseen by the Ministry of Environment (MoEnv). It holds overall responsibility for environmental policy. The principal legislation for environmental safeguarding is the 1997 Environmental Protection Act (EPA) and its rules 1997 (amendment 2007). Implementation of the EPA is the responsibility of the MoEnv and the sectoral ministries. For those projects having insignificant environmental impacts, the responsibility of undertaking and approving IEEs and implementing the subsequent environmental monitoring plan (EMP) are delegated to the concerned sectoral ministries. The DOI is under the MOWR. Both DOI and MOWR have environmental sections that liaise with each other. The Environmental Section within DOI was established in 1988 and is located within the Surface Water Irrigation Division (SWID).

56. The revised Schedule 1 of Section 2 of the EPR stipulates the environmental assessment requirements for irrigation schemes. It stipulates that an initial environmental examination (IEEs) is required for the rehabilitation of irrigation schemes which has new headworks or change in the main canal alignment. Since the proposed subproject is a simple rehabilitation of the existing FMIS, a formal IEE in accordance with EPR amendment 2007 will not be required.

57. **Institutional arrangements and responsibilities.** At the DOI headquarters level, a central project management office (CPMO) has been set up with class-I engineer as full time project director, and will be responsible for overall environmental management, under technical support and guidance from Environmental Section in SWID. At the regional level, regional project support unit (RPSU) has been established with director of the Regional Irrigation Directorate as project manager of each region and will be responsible for day-to-day implementation of the Project. RPSU will have an assigned staff to manage environmental activities with the assistance of the consultants. At the field level, subproject management unit (SMU) has been established in each division headed by the chief of the irrigation development division/ subdivision (IDD/IDSD), which will undertake field operations including environmental planning and monitoring under supervision by RPSU. Specific institutional responsibilities during the subproject implementation cycle are stipulated as below.



**Table 3: Institutional Responsibilities for Environmental Management**

<b>Subproject Stage</b>	<b>Responsible Organization</b>	<b>Responsibilities</b>
Overall	ISPM Consultants	Support capacity development of environmental planning, monitoring, and management
	EB is SWID	Guidance for environmental planning, monitoring, and mitigation
	MEQCB in PDMED	Management of monitoring and evaluation data
Screening	RPSU/SMU	Screen the project results in light of environmental and other criteris
Planning	RPSU/SMU/firms <sup>1</sup>	Prepare IEE (included in SIP), minimize avoidable losses, incorporate mitigation measures, and prepare EMP
	CPMO-EB in SWD	Endorse IEE and SIP
	Subproject Appraisal Subcommittee	Approve IEE and SIP
	Ministry of Water Resources	Approve IEE (which fall under schedule 1, section 2 of EPR 1997, amendment, 2008)
WUA formation	RPSU/SMU/NGOs/COs	Strengthen WUA including monitoring capacities
Detailed Design	RPSU/SMU/firms	Assist in preparing RP, incorporate EMP into engineering design and specifications
Construction	Contractor	Implement required environmental measures
	RPSU/SMU/firms	Supervise contractor implementation of environmental measures
Agriculture and social support	RPSU/SMU/firms/NGOs	Implement specific environmental mitigation measures incorporated in the agriculture and social development plan.
Operational	DOI	provide budget to undertake annual monitoring and audit
	RPSU/SMU/NGOs (during Project)	Carry-out annual performance audit of completed schemes. Support additional mitigation measures as necessary.
	RID/IDD/IDSD/DDC/DADO (after Project)	Same as above
	WUAs	Monitor agriculture practice and impacts and report them to SMU.

Notes: DB=Design Branch; EB=Environmental Branch; MEQCB=Monitoring, Evaluation, and Quality Control Branch; PDMED=Planning, Design, Monitoring and Evaluation Division; SWD=Surface Water Division

### VIII. ENVIRONMENTAL MANAGEMENT PLAN

58. The Environmental Management Plan (EMP) is prepared to guide implementation of mitigation measures and monitoring requirements. It includes institution and their roles, environmental management activities, environmental management organizational structure and budget for mitigation measures.

59. Essentially, it will be put into operation through data collection at subproject level by SMU with the engagement of private firms as necessary and/or WUA, monitored and supervised by RPSU through regular management review and field confirmation, and processing and analysis by Monitoring and Evaluation Branch of DOI in coordination with DOA. Environmental data will be shared with Environment Division. Monitoring costs have been incorporated into the design of the PPME system for the project. The findings of the monitoring activities will be incorporated in the regular PPME reports prepared by CPMO with the

assistance of the consultants engaged under institutional strengthening and project management, and submitted to ADB.

60. Framework for implementing environmental management plan is shown by Table 4.

**Table 4: Environmental Management Plan**

SN	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
<b>1</b>	<b>Environmental Problem related to Subproject Design</b>							
	Erosion and Landslide along Canal Alignment	Provide permanent headworks	Design Office	Include in det. design	No cost	Design team	provision of permanent headworks	ISPMC
	Canal management	Prepare subproject specific water management plan and O & M Plan.	Design Office	included in det. design	No cost	Design team	Prepare site specific water management plan	ISPMC
	Passageway	Provide passageway structures	Design Office	Include in det. design	No cost	Design team	provide passage as agreed with the farmers	ISPMC
	Hazards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. Use IPM technique to control pest	Design Office	Include in Agriculture Development Plan.	No cost	Design team	Include IPM training package in Agriculture Development Plan (ADP)	ISPMC
<b>2</b>	<b>Environmental Problem related to Construction Stage</b>							
	Excavation	(i)confine operations in the dry season; (ii) spoils shall be disposed of at the designated locations	Within the sub-project	designate the spoil disposal area	Part of civil construction cost	Contractor	spoil disposal sites	SMU/WUA
	<b>Work Camp Location and Operation:</b> (i) temporary air and noise pollution from machine operation; (ii) water pollution from storage and use of fuel, oils, solvents, and lubricants	(i) Work camp will be located away from the settlement area. (ii) no trees shall be cut and removal of vegetation shall be minimized (iii) used oil and lubricants shall be recovered and reused or removed from site.	Within the subproject		Part of civil construction cost	Contractor	Location of the work camp	SMU/WUA
	unhygienic conditions from laborers	will make own arrangements for water and sanitation	Work camp		Included in environmental cost (Budget: NRs.40,000)	Contractor	disposal and sanitary facilities in the work camp	SMU/WUA
	Disturbance to original site	(v) Site will be placed back in the original site condition and shall report in writing that site has been restored to pre-project conditions before acceptance of the works.	Within the subproject		Included in environmental cost (Budget: NRs.40,000)	Contractor	Condition of the work camp site before the issue of completion certificate	SMU

SN	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	<b>Stockpiling of Materials:</b> (i) siltation and pollution of surface water resulting from uncontrolled runoff from storage piles; and (ii) disturbance to private property.	(i) Stockpiling will not be permitted during the rainy season unless covered by a suitable material; (ii) stripped material will not be stored where natural drainage will be disrupted; (iii) protection of materials from erosion prior to rainy season; and (iv) storage on private property will be allowed only with the written permission from the owner.	Construction sites	ensure good construction practice	Part of civil construction cost	Contractor	Inspection of the construction material stocking site.	SMU/WUA
	<b>Operation of construction equipment and transport:</b> emission of air pollutants, high concentration of airborne dust resulting and excessive noise resulting annoyance and potential hazard to human populations	(i) Stockpiled sand and soil shall be slightly wetted before loading particularly in windy conditions; (ii) vehicles transporting sand and soil shall be covered with a tarpaulin; and (iii) limit and control working practices through contract provisions.	Construction site	ensure good construction practice	Part of civil construction cost	Contractor		SMU/WUA
	Occupational health and safety	(i) Buy accident insurance to all workers. (ii) provide safety gears such helmets, boots, ear plug, mouth mask to the worker and labors	Construction site	Provide insurance & safety gears	Included in environmental cost (Budget NRs.60,000)	Contractor	insurance policy	SMU/WUA
	Temporary closure of irrigation system	Plan the head work construction during dry season	Headworks	Construction plan	No cost	Contractor	Construction plan	SMU/WUA
		Make alternative arrangement to keep the canal running	Canals	Observation	Part of civil construction cost	Contractor	Inquiry on canal closure	SMU/WUA
<b>3</b>	<b>Environmental Problems Resulting from Subproject Operations</b>							
	Hazards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. Use IPM technique to control pest	Command area	Pest control by IPM	No cost	Farmers	Use of pesticide in the crops	DADO
	Hazards associated with the use of mineral fertilizer	Use recommended dose of inorganic fertilizers	Command area	Application of fertilizers	No cost	Farmers	Use of chemical fertilizer in the crops	DADO
<b>4</b>	<b>Realization of Enhancement Potentials</b>							
	Employment to the local people	Provide employment to local people in priority	Within the Subproject	Hire local labor to the extent possible	No cost	Contractor	Payroll contractor of	WUA

<b>SN</b>	<b>Impact</b>	<b>Mitigation Measures</b>	<b>Location</b>	<b>Method</b>	<b>Cost</b>	<b>Responsible agencies for Implementation</b>	<b>Monitoring parameters</b>	<b>Responsible Agency for Monitoring</b>
	Livelihood programs for landless households	Provide Livelihood Enhancement Program (LEP) training to the targeted people	Within the subproject	Training	Include in LEP cost	SMU	Training on LEP	WUA
	Feasibility of cooperatives	Provide institutional development training	Within the subproject	Training	Include in IDP cost.	SMU	Training on IDP training	WUA

## **IX. PUBLIC CONSULTATION AND DISCLOSURE**

61. This IEE report has been prepared in close consultation with WUA members and lead farmers who participated in the walk through survey. The impact and proposed mitigation measures were discussed and agreed with farmers during the SIP endorsement by WUA general body meeting.

62. This IEE report has been in close consultation with WUA members and lead farmers who participated in the walk through survey. The walkthrough survey was carried out and the WUA endorsement meeting was conducted in December 2008. The existing situation of the headworks and canal was noted by GPS tracking. A long list of the required intervention was noted. The required intervention was prioritized in consultation with the participating farmer. The WUA members agreed with them on the proposed intervention that could be undertaken by the subproject. All the highly prioritized interventions were included whereas the medium and low priority interventions were excluded.

63. A list of the persons present in the Walkthrough Team were as follows:

1. Mr. Yograj Baral, WUA Chairman
2. Mr. Bhola Parajuli, WUA Vice Chairman
3. Mr. Madan Prasad Phuyal, WUA Secretary
4. Er Kusang Sherpa, IDD, Morang
5. Er Om Prakash Gupta, QCE, ISPMC, ERID

## **X. FINDINGS AND RECOMMENDATIONS**

64. The principal findings are that the subproject provides for inherently environmentally friendly irrigation interventions and contributes to significantly improved living conditions through (i) community emphasis on subproject design and implementation, (ii) extensive technical support in eliciting sustainable practices in irrigated agriculture and (iii) addressing institutional needs for sustained and equitable O&M.

65. The identified adverse environmental impacts will be addressed through proper planning, design, implementation, and O&M while incorporating identified mitigation measures. The screening process carried out in the IEE has not identified any significant negative environmental impacts likely to be caused by the subproject. Environmental issues were considered throughout development of the Project and necessary changes were made to the designs to reduce or avoid impacts. Potential adverse effects associated with construction activities can be mitigated by the application of standard health, safety, and environmental clauses in contract documents, close supervision, and close attention to transparency in tendering, and to quality control and supervision on site. Mitigation measures for other impacts are provided in detail in the IEE.

## **XI. CONCLUSION**

66. The subproject is not expected to give rise to any significant adverse environmental impacts, and therefore does not require an Environmental Impact Assessment beyond this IEE study.

67. The proposed subproject is rehabilitation of existing irrigation system, which is already in operation. Hence, the environmental impact during the operation phase will not be very much different than the existing situation. Rather the existing system lacks basic structures like intake, cross drains, the proposed intervention will be providing basic civil engineering structures for the operation of the canal. From the proposed intervention some adverse impacts of low magnitude have been identified during the construction stage but they are of short-term duration and could be easily mitigated. The proposed intervention will provide round year irrigation to the entire command area. Taking into consideration the adverse impact of low magnitude and extensive positive impacts, this subproject is recommended for implementation on the environmental perspectives. Mitigation of minor adverse environmental impacts can be carried out as an integral part of the subproject, during both the detailed design and implementation stages. Appropriate measures will be included in the tender documents for the civil works.