

Initial Environmental Examination Document

Project Number: 33209-01
June 2009

Nepal: Community -Managed Irrigated Agricultural
Sector Project

Terso Kulo Irrigation Subproject, Kavre District

Project Proponent: Department of Irrigation
Prepared by Eastern Irrigation Development Division No. 7 (Kavre)

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 -	Hector
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.

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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 will be 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 stakeholders 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 can be mitigated 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 Terso Kulo 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 and Arrangements.

II. DESCRIPTION OF THE SUBPROJECT

4. **Project Location.** The subproject is located in Ward numbers 5 and 6 of Panchkhal VDC and Ward numbers 1, 2, 3, and 4 of Hokersa VDC of Kavrepalanchowk District in Bagmati Zone of Central Development Region, Nepal. The command area is located between the latitude 27°37'54" to 27°38'57"N and longitude 85°36'58"E to 85°38'57"E. The elevation of the area is about 845 to 865 m above msl.

5. **Accessibility.** The subproject area is easily accessible through a gravel motorable road 2.2 km North-East from Panchkhal which is 25 km north from Banepa. Headwork site is 2.5 km south-west from Panchkhal Bazaar. The nearest market is Panchkhal from the subproject area.

6. **Existing Situation.** The Terso Kulo ISP is improvement of existing FMIS. The existing system has been diverting water from Jhiku Khola. This system is in operation since last 6 generations. The farmers have dug the irrigation canal and had been managing with their own effort. The main canal after diverting water from Jhiku Khola runs for 250 m as its idle length, parallel to the river. When the canal enters into the command area it is aligned along the road, crossing the area until the tail end of the canal reaches Tersokulo Village. The main canal crosses the main road twice.

7. As the course of river changes from time to time, they had to change intake point accordingly. Recently they have moved the intake location again and diverting the water with brush wood diversion which gets washed out during the monsoon and has to be rebuilt every year. Now they are expending about 50 to 300 rupees per ropani¹ for annual operation and maintenance of canal depending on the intake and canal situation. Irrigation water for the command area is now being supplied from the temporary intake site. But the head section of the canal has GI pipe canal, which was installed 3 years ago at the cost of Rs 150,000 in addition to labor and is in good condition. However, it could not supply enough discharge for the entire command area. Due to lack of permanent diversion system the main canal discharge is not sufficient to supply irrigation water to meet water requirement up to the tail end of the command area. Because of this constraint WUA are currently allocating available water on rotational basis.

8. The Terso Kulo Irrigation System is a rehabilitation scheme. The proposed interventions are the construction of permanent intake structure at the original diversion site of the system, river course stabilization and improvement of the canal system and provision of necessary structures.

9. **Command Area.** The gross command area is 60 ha and net command area is 50 ha. All the command area is presently irrigated but lower section of command area receives water occasionally. A layout map of the sub project area is presented in Figure 2.

10. **Project Components.** The existing situation of the canal systems of the subproject and proposed interventions are presented in Annex 1. The major infrastructure improvements include the construction of the side intake at the Jhiku Khola, rehabilitation of canals such as canal lining, bank protection, canal reshaping, construction of division boxes, outlets, cross

¹ 1 ropani =0.05 ha

drainage structures such as aqueducts, escape structures, syphon etc. The salient features of the subproject is presented in Table 1.

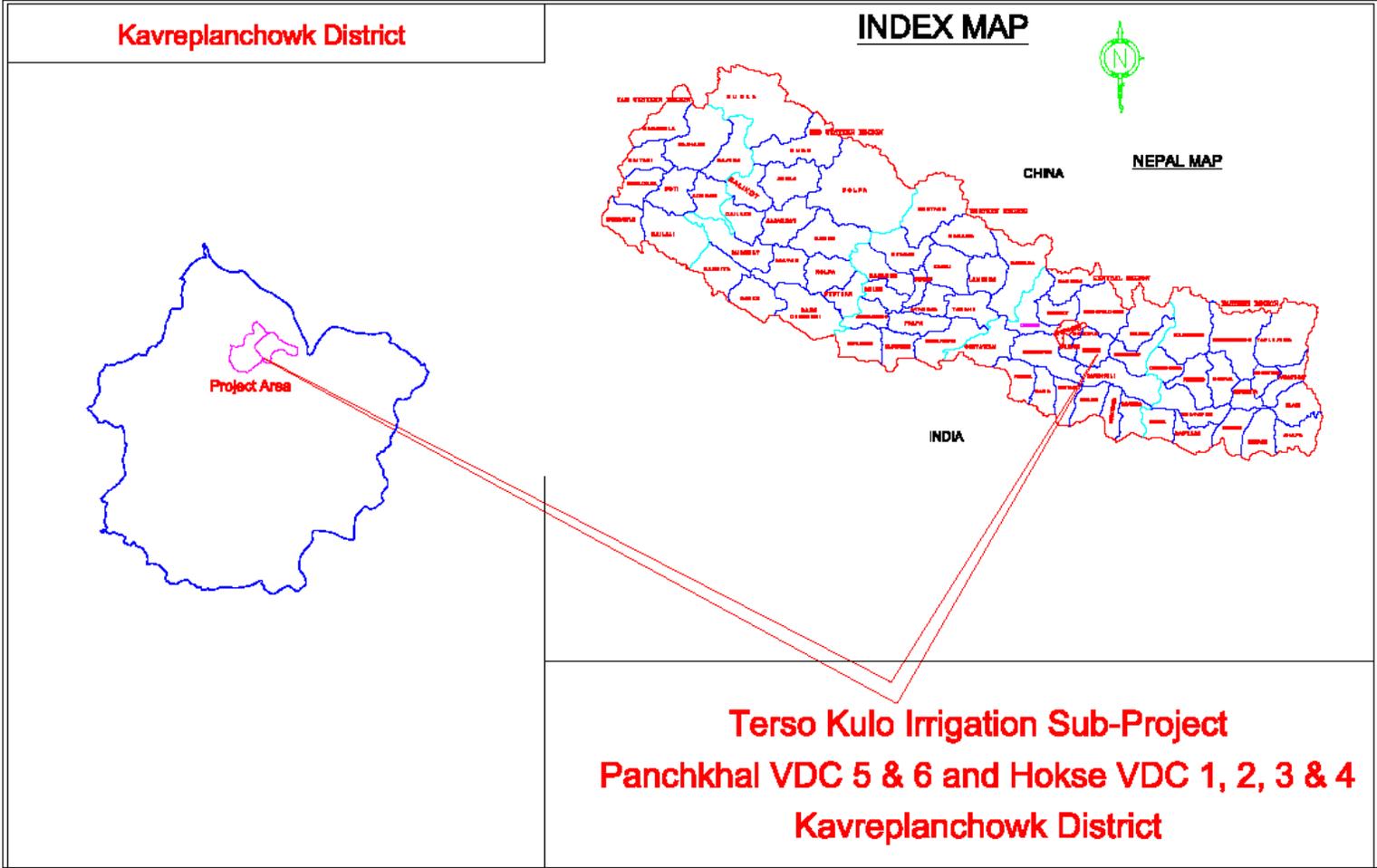


Figure 1 Location Map of the Subproject Area

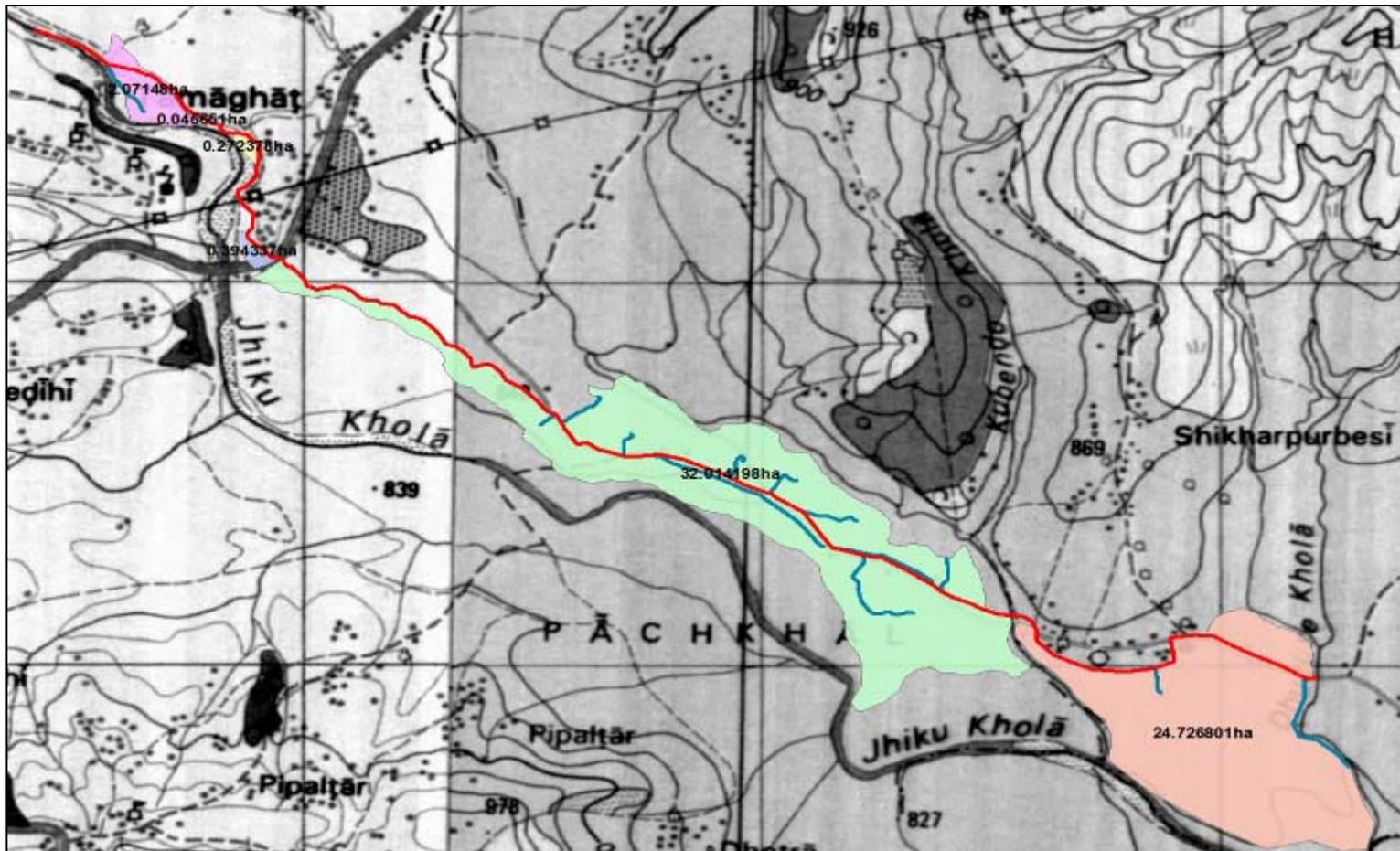


Figure 2 Layout Map of the Sub project

Table 1: Salient Features of the Terso Kulo Irrigation Subproject

1. Name of Subproject	Terso Kulo Irrigation Subproject
2. Subproject Classification	Rehabilitation
3. Location (VDC and Ward No)	Panchkhal 5 & 6, Hokse 1, 2, 3 & 4
4. District	Kavreplanchowk
5. District Headquarter	Banepa
6. Zone	Bagmati
7. Development Region	Central
8. Number of Households	184
9. General Elevation of the Subproject Area	845 msl
10. Slope and Topography of the Subproject Area	gently sloping to undulating (3 to 8% slope)
11. Population	1,090
12. Total Canal Length	
a) Main Canal	4.1 km
b) Branch (Tertiary) Canal	6 numbers/ 1.015 km
13. Gross Command Area	60 ha
14. Net Command Area	50 ha
15. Cropping Intensity (present)	243% (irrigated) & 228% (non-irrigated)
16. Cropping Intensity (future)	248%
17. Name Of Water Source	Jhiku Khola
18. Type Of Water Source	Perennial
19. Catchment Area	23.8 km ² (in Hydrological Region-3)
20. Canal Type	Earthen & Lined canal
21. Canal Discharge	90 liter per second
22. Side Slope	1:1 (Earthen Canal)
23. Bed Slope	Shown in the L-Section in Detailed Design
24. Diversion Structure	Single Orifice Side Intake
25. Proposed Subproject Interventions	
Headworks Side Intake	1 no.
Hume Pipe Culvert	2 nos.
Division Box	6 nos.
Footbridge 2	nos.
HDP Pipe Syphon	2 nos.
HDP Pipe Canal	2 nos.
Escape 2	nos.
Canal Outlet	7 nos.
Canal Lining	410 m
Protection Works	2 nos.
26. Number of people directly involved during construction (estimate)	Skilled: 1,192 man days Unskilled: 3,668 man days
27. Construction/Rehabilitation Period (months)	9 months

Notes: VDC = Village Development Committee ; msl = meters above sea level; km = kilometers; ha = hectares; km²= square kilometers; RCC = reinforced concrete cement; VRB = Village Road Bridge

III. DESCRIPTION OF THE ENVIRONMENT

Physical Environment

11. **Topography.** The Ters o Kulo Irrigation Subproject is located in table-land (Taar) that slopes gently from north to south at an elevation of 845 to 865 m above msl. The subproject lies on the left bank of the Jhikhu Khola. The existing main canal is aligned along plain terraces crossing the command area and irrigate to both side. The canals are earthen with enormous seepage loss so needs lining.

12. **Climate.** The climate of the region is mainly subtropical characterized by hot humid climate during summer and moderately high rainfall during the monsoon. The region shows seasonal differences with all four seasons. There is a meteorological station in the project area at Pachkhal. The hydro-meteorological conditions observed are summarized as under;

- Mean monthly rainfall - 3.4 in November to 313.0 mm in July
- Mean monthly maximum temperature – varies from 21.0°C in January to 32.4°C in June
- Mean monthly minimum temperature – varies from 4.3°C in January to 22.4°C in July
- Relative Humidity - 94.6% in December to 74.8% in April
- Minimum evaporation – 1.8 mm
- Maximum evaporation – 5.5 mm

13. **Soils.** The soil texture of the command area is clay-loam (sand- 32.8%, silt – 37.8% and Clay – 29.4 %) and soil reaction is slightly acidic in nature (p H 5.6). The nutrient content of the soil is medium with respect to Total Nitrogen (0.09 %), Potassium (168 kg/ha), and Organic matter (1.74%) but the available Phosphorous content is found to be high (105.85 kg/ha).

14. **Water Resources.** Jhikhu Khola, the source of irrigation water, is a spring fed perennial stream. It originates from community forest about 9 km north from headworks site in the hill. The catchment area at the proposed intake is about 30.5 km². The discharge in the Jhikhu Khola was 78 liter per second (lps) in the dry season (2nd Jan 2008). Nevertheless, no measured data are available indicating the mean monthly flows of the river. The discharge was measured during the driest period.

Ecological Resources

15. **Vegetation and Forest.** There are no national or community forests within the command area. There are a number of trees of different species of timber, fodder, fuel wood within project command area but none of them will be affected due to subproject activities.

16. **Wildlife.** As reported by the local people, there are no wildlife habitats as such in the subproject area and its vicinity.

17. **Aquatic life.** According to the locals few fish species like hile, bam, and capre are found in the river especially during July, August and September. But the local people are not involved

in fishing activities as the abundance of the fish species is very low and the size of individual of the fish is also small.

Socio-economic Environment

18. Terso Kulo ISP covers ward no 5 and 6 of Panchkhal VDC and ward no 1, 2, 3 and 4 of and Hokse VDC of Kavrepalanchok District . The total number of household with some landholding in the project area is 184 with population of 1090. The average family size is 5.6. The ethnic composition of the beneficiaries of the project area among the sample households are Bhramin (70%), Dalit (9%) and Janajati (6%). Newar and Chhetri are also present in the project area.

19. The main occupation of people in the area is agriculture. 54% depend on agriculture for livelihood, 7.2% services, 28% are employed outside district and 0.8% supplement their income from business. About 25% of households meet their needs by working as agriculture labour ; among them 15.1% are women headed households.

20. Out of total population of farm households only 17% are illiterate and 83% are literate. 20.8% have attended primary education, 28.3% have completed high school education, 14.5% are in campus and 11.9% have attended university level education.

21. 37.5% of households have Kachha house and only 62.5% are cemented house. 90.6% of the households in the subproject area have facility of electricity. All of the sample households had toilet facility.

22. In Terso Kulo ISP availability of labour sometimes become a critical factor, especially during peak seasons of farming. So, the farm households generally adopt the *Parma* system for agricultural activities to avail labour in the command area. The Parma system is a traditional and indigenous labour exchange system of the command area for agricultural activities.

23. A majority of sample farmers (62.5%) produce surplus food and 31.2% of sample households reported that they produce enough to meet more than 9 months for their family. Only 6.2% households reported to work as local farm labour within the village to meet their food requirements.

24. Gender status and roles in general seems the same in all ethnic communities. Both male and female participate in agriculture for livelihoods. Women were found to be overburdened with work at home and field. Males are found more educated than female, and most of women were illiterate and hence their participation in the formal job market was found almost negligible. Overall control of women over fixed assets such as land, house, cash, bank deposit etc is only 14.4%. Women in domestic and agricultural activities handle around 90% workload.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS

25. **Delineation of geographical boundary of zone of influence (Zoi).** : The project area will be delineated under three categories (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, labour 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 sub project area of the VDC that are likely to be affected.

26. The project will be constructing permanent diversion structure of 35 m across the river. The diversion will be constructed at existing temporary diversion of Jhikhu Khola, which will inundate certain areas at the upstream. The area of inundation and stability of the inundation would be the major environmental impact under the physical parameters. Apart from this impact, the screening of the potential is presented in Table 2.

Table 2: Screening of Potential Impacts

SL	Parameters	Impact		Remarks
		Yes	No	
1	Environmental Problems due to Project Location			
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		√	The canal does not pose any threat of water scarcity to other users downstream.
1.5	Flooding and Drainage Hazards		√	There is not any flooding hazard due to canal water in the command area as there is HDP pipe canal in upper reach of the system.
1.6	Displacement of People and Property		√	There will be no land acquisition for this Subproject.
2	Environmental Problems related to Project Design			
2.1	Watershed Erosion	√		The Subproject will construct permanent intake structure with necessary bank protection that will prevent erosion in intake area.
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
2.4	Over pumping of Groundwater		√	Groundwater will not be used in this Subproject.
2.5	Adequacy of Drainage Planning		√	Being in hill area, drainage is not a problem.
2.6	Disruption of Existing Farmer Cooperative Systems		√	There are no existing farmer's cooperatives within the command area.
2.7	Use of Chemicals in Agriculture and	√		Being vegetable pocket area, the use of

SL	Parameters	Impact		Remarks
		Yes	No	
	Horticulture			chemical inputs is found to be quite high in the command area. The subsequent SIP will need to address this problem
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		√	Improved efficiency of the canal system will increase the discharge in the canal. Inadequacy in water distribution will not occur.
2.11	Canal Management	√		The operation and maintenance (O&M) of the existing irrigation system has been in place prior to implementation of the Subproject. The (O&M) of the main canal will be further worked out.
2.12	Passageways	√		The existing passageways are not sufficient for movement of people and livestock. The Subproject will increase the number of crossings and passageways.
2.13	Scouring Hazards		√	The system has been in operation for many years. Scouring problems has not been reported. Canal beds are stable
3	Environmental Problems Related to Construction Stage			
3.1	• Excavation	√		Excavation will be at the intake and structure sites. Canal excavation will not be required.
3.2	• Construction material sites (Quarry Sites)		√	The construction work will require 97 m ³ sand, 185 m ³ aggregates and 756 m ³ block stone which can be fulfilled from the local market or local quarry. Operation of quarry site for the sub project may not be feasible.
3.3	• Work camp location and operation	√		The contractor will have to establish work camp for the construction activities
3.4	• Labour camp		√	Total labour requirement will be about 3,668 unskilled and 1,192 skilled. Assuming actual construction working season of 4 months, the average labour requirement per day would be 30 unskilled and 10 skilled. The most of the unskilled and some of skilled manpower will be fulfilled from the local area. Hence labour camp will not be operated. Some of the outside labour will be reside within 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 addressed.
3.8	Temporary Closure of Irrigation System	√		Construction activities are likely to disturb the supply of irrigation water for a short

SL	Parameters	Impact		Remarks
		Yes	No	
				period. The effect will be minimized in consultation with WUA.
4	Environmental Problems Resulting from Project Operations			
4.1	Effect on downstream water use		√	There is regeneration of discharge on subsequent section d/s and moreover the water requirement for this system will not create adverse effect to d/s irrigation.
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 ground water and surface water which could hazardous
5	Realization of Enhancement Potentials			
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 during 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.
5.5	Feasibility of cooperatives	√		The Project will implement institutional development activities to strengthen capacity of water users associations which could function as a cooperative to support the farmers.

27. 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 most significant environmental impacts can occur. 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.

28. 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 nature. 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 Project Design

29. **Watershed Erosion:** There is erosion during monsoon in the Intake area. The construction of permanent intake structure at the diversion site with necessary bank protection will prevent the erosion. This impact is considered of high magnitude, local extent and long term duration.

30. **Use of Chemicals in Agriculture and Horticulture:** The subproject area is located very close to the Bane pa, where fertilizers and pesticides are available easily. The use of chemicals in field is likely to be increased as the project encourages irrigated agricultural practices. Excess use of chemical fertilizers in the field may percolate into groundwater or run down into surface water along with the runoff. The supply of chemical fertilizer is reliable and the rate of application of chemical fertilizers is higher than recommended doses. The practice of use insecticide and pesticide is also high. So, this impact has been considered of medium magnitude, local extent and long term duration.

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

32. **Selection of Pesticides:** Majority of farmers of the project area are aware of the toxicity of the pesticides. Only few farmers are using pesticides. As reported, they have not undertaken any kind of integrated pest management (IPM) training. Farmers are interested on IPM rather than use of pesticides. With this background, it could be assumed that impact associated with the pesticides will be low magnitude, local in extent and long term in duration.

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

34. **Canal Management:** The proposed project intends to operate one main canal and six tertiary branch canals together. The main canal will be carrying the water for all the branch canals. The operation and maintenance of the system will be the responsibility of the farmers themselves. Each of the canal 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 been practicing such works for many years. Hence this impact has been considered of low magnitude, local extent and long term duration.

35. *Water management plan will be developed for the operation of the system.*

36. **Passageway:** There are some passageways in the existing canals which is not adequate for movement of the people. Hence additional passageways, 2 foot slabs, 2 hume pipe culverts and 2 HDP Pipe Canal have been proposed. This is a positive impact of high magnitude, local in extent and long term duration.

Environmental Problems Related to Construction Stage:

37. The Subproject will use labour-based, environment-friendly, and participatory approach, the important features of which are:

- Use of local people as labour, 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.

38. Significant adverse negative 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 9 months.

39. 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.

40. **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 increase in silt run-off, induced erosion, loss of potential cropland, loss of vegetation, and landscape degradation.

41. Mitigation measures include: (i) confine operations to the dry season; (ii) use of silt traps; and (iii) spoils 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.

42. **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.

43. *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.

44. **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.

45. *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.*

46. **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 airborne dust particles due to construction material transportation may result in deposition and possible damage to vegetation, crops, and water resources.

47. *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*

48. **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.

49. *Accidental insurance will be covered for all construction workers and staff. An amount of Rs. 40,000.00 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.*

50. **Temporary closure of irrigation system.** The construction activity in the canal system is likely to disturb the supply of the irrigation water. Hence the provision of temporary closure of irrigation system will be made in consultation with WUA.

51. **Mitigation Measures:** *The construction activities will be planned in consultation with the WUA members. The headworks 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

52. **Changes in Groundwater Hydrology.** The application of the irrigation water in the field is likely to recharge the groundwater of the sub project area vicinity and general water table will rise. But there will be no significant change in groundwater hydrology as the subproject is receiving the irrigation water from past. The proposed sub project is rehabilitation only. Hence the impact is considered low magnitude, local in extent and long term in duration.

53. **Mosquito Breeding.** This subproject area has subtropical climate. Stagnant water created due to the facility may also provide habitat for mosquito. 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 an additional effect on the environment. Hence the impact is considered to be of low magnitude, local in extent and long term in duration.

54. **Hazards associated with the Use of Toxic Chemicals.** Pesticides and insecticide used to kill pests are toxic chemicals. From the focused group discussion with the farmers; it is found that farmers are aware of the toxicity of the pesticides. But still the rate of use of pesticide is high. As reported the farmers bury the pesticide bottle or burn them after the use. They are not reused for any purposes. But there are farmers who seem insisting not to use pesticide unless and until it is essential. With this background it could be assured that impact associated with the pesticides will be of medium magnitude, local in extent and long term in duration.

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

56. *To reduce hazard related with agricultural chemicals training has to be given to the farmers about usage techniques and amount etc. The agriculture development plan will address this issue.*

Realization of Enhancement Potentials

57. **Employment Opportunity to the Local People.** The construction of the subproject would require both skilled and unskilled labour. Semi skilled and unskilled labours 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 labour.

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

59. **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 project area. The WUA will have the key role to play in these activities. For the project 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

60. The proposed intake is located at the existing intake point of Jhikhu Khola with provision of cut-off in riverbed throughout the river width. The cut-off will also help to reduce leakage of water that used to occur with present temporary diversion. Hence the proposed intake site is justifiable. There is high amount of seepage near Tama Ghat and Shree Ram Pati. Canal lining, HDP or Hume Pipe as aqueduct is proposed to reduce seepage.

61. Since the irrigation system is the traditional system, canals already exist and there are no alternative alignments for them.

VII. INSTITUTIONAL ARRANGEMENTS

62. **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, Science and Technology (MoEST). It holds overall responsibility for environmental policy. The principal legislation for environmental safeguarding is the 1997 Environmental Protection Act (EPA) and its rules 1997, amended in 1999 and amendment in 2008. Implementation of the EPA is the responsibility of the MoEST 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).

63. 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 sub project is a simple rehabilitation of the existing FMIS, a formal IEE in accordance with EPR amendment 2008 will not be required.

64. **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

Subproject Stage	Responsible Organization	Responsibilities
Overall	ISPM Consultants	Support capacity development of environmental planning, monitoring, and management
	EB in SWID	Guidance for environmental planning, monitoring, and mitigation
	MEQCB in PD MED	Management of monitoring and evaluation data
Screening RPSU/SMU		Screen the project results in light of environmental and other criteria
Planning RPSU/SMU/firms		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

65. 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.

66. 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.

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

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
1	Environmental Problem due project location							
F	flooding and drainage hazards	Provide escape structures and drainage outfalls	Design Office	Include in det. design	No cost	Design team	provide escape structures in the design	ISPMC
2	Environmental Problem related to project design							
	Canal management	Prepare sub project 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 P	provide passageway structures	Design Office	Include in det. design	No cost	Design team	provide passage as agreed with the farmers	ISPMC
H	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
3	Environmental Problem related to construction stage							
	Excavation	(i)confine operations in the dry season; (ii) use of silt traps; (iii) spoils shall be disposed of at the designated locations	Within the sub-project	designate the spoil disposal area	Part of civil construction cost	Imp: Contractor Mon: SMU/WUA	spoil disposal sites	SMU/WUA
	Quarry sites							
	Work Camp Location and Operation: (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.	(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 sub-project		Part of civil construction cost	Contractor	Location of the work camp	SMU/WUA
		(iv) will make own arrangements for water and sanitation	Work camp		Included in environmental cost (Budget: Rs	Imp: Contractor	disposal and sanitary facilities in the work	SMU/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
					30,000.00) cam		p	
		(v) Site will be placed back in the original site condition and the shall report in writing that site has been restored to pre-project conditions before acceptance of the works.	Within the sub-project		Included in environmental cost (Budget : Rs, 30,000.00)	Imp: Contractor	Condition of the work camp site before the issue of completion certificate	SMU
	Stockpiling of Materials : (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	Imp: Contractor	Inspection of the construction material stocking site.	SMU/WUA
	Operation of construction equipment and transport : emission of air pollutants, high concentration of air borne 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	Imp: Contractor	SM	U/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 labours	Construction site	Provide safety gears	Included in environmental cost (Budget Rs. 40,000.00)	Imp: Contractor	insurance policy	Mon: SMU/WUA
	Temporary closure of irrigation system	Plan the intake construction during dry season	Intake Site		No cost	Imp: Contractor	Construction plan	Mon: SMU/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
		Make a lternative arr angement t o keep the canal running	Canals		Part o f c ivil construction cost	Imp: Contractor	Enquiry o n canal closure	Mon: SMU/WUA
Environmental Problems Resulting from Project Operations								
H	azards associated with the use of toxic chemicals	Avoid u sing pesticide t o the extent possible. Use l PM technique to control pest	Command area	Pest co ntrol by IPM	No cost	Imp: Farmers	Use of pe sticide in the crops	Mon: DADO
H	azards associated with the use of mineral fertilizer	Use re commended dos e of inorganic fertilizers	Command area	Application o f fertilizers	No cost	Imp: Farmers	Use of chemical fertilizer in the crops	Mon: DADO
Realization of Enhancement Potentials								
	Employment t o t he l ocal people	Provide employment to local people in priority	Within S ub project area	Hire local labour to t he ex tent possible	No cost	Imp: Contractor	Payroll of contractor	Mon: WUA
	Livelihood pr ograms for landless households	Provide Live lihood enhancement Program (LEP) trai ning t o t he targeted people	Within s ub project area	Training l	nclude in LEP cost	Imp: SMU	Training on LEP	Mon: WUA
F	easibility of cooperatives	Provide institutional development training	Within s ub project area	Training l	nclude in Institutional development plan cost.	Imp: SMU	Training o n Institutional development training	Mon: WUA

IX. PUBLIC CONSULTATION AND DISCLOSURE

68. This IEE report has been in close consultation with WUA members and lead farmers who participated in the walk through survey. The walk through survey was carried out from 7th to 8th January 2009. 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. On 8th January, 2009 itself a formal meeting was held with the WUA members and agreed with them on the proposed intervention that could be undertaken by the project. All the highly prioritized interventions were included whereas the medium and low priority interventions were excluded.

69. A list of the WUA members and lead farmers who participated in the Walkthrough Survey is listed below:

1. Mr Hari Pd. Humagai
2. Mr Ram Pd. Kafle
3. Mr Narayan Pd. Kafle
4. Mr Laxuman Danuwar
5. Mr Mukti Natha Dangal

X. FINDINGS AND RECOMMENDATIONS

70. 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.

71. 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 Project. Environmental issues were considered throughout development of the Project and necessary changes were made to the designs to reduce or avoid impacts. Potential negative impacts 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

72. The project is not expected to give rise to any significant negative environmental impacts, and therefore does not require an ADB Environmental Impact Assessment.

73. 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.

Annex 1: Details of Proposed Intervention in the Subproject

Canal Systems (Existing)

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	Fro m	To					
1 0+0	00	T	emp. diversion	No control	Leakage through the diversion	Diversion structure (H)	
2 0+0	24	Exis	ting Trashrack	Floating materials and solid waste enters the canal from the river	Solid waste disposal into the canal	Trashrack (M)	
3 0+0	35		Pipe inlet (Pipe canal)	Improper inlet	Water inlets to pipe canal	Pipe Inlet (M)	
4 0+0	95	Protection	Work (Gabion-10m)	Unstable Ground	Canal may collapse	Gabion wall (10m)	
6 0+1	85	Ex	isting Chamber, Branch structure, Outlet 1	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
7 0+1	90		Main Pipe canal inlet	Improper Inlet	Water inlets to underground Pipe canal	Pipe Inlet (M)	
9 0+3	57	Outl	et of Pipe canal	Improper outlet	Pipe canal outlets to open canal	Pipe Canal outlet (M)	
10 0+5	41	Out	let	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
11 0	+587	Escape	Point Proposed, Covered canal (proposed)	Escape Required	Flood flow entering the canal	Escape (H) and covered canal 26m (H)	
12 0+6	12	Exis	ting Road Crossing	Road Crosses the canal	Road crossing	Road Crossing (L)	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	Fro m	To					
13	0+65	Out	Outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
14	0+704	Ex	Existing Pipe Aqueduct	Depressed Ground condition	Affects Canal flow	Aqueduct (L)	
16	0+823	VRB		Road Crosses the canal	Road Crossing	VRB (L)	
17	0+866	0+884 Critical	Point Start, Canal Lining and side Protection	Weak Bank and leakage	Leakage from canal Section	Lining and Side protection (H)	
19	0+985	1+002	Pipe culvert at Highway (existing)	Canal crosses the highway	Highway Crossing	Repair Pipe Culvert (L)	
21	1+024	Out	Outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
22	1+086		Outlet (minor R/s)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)	
23	1+112	Outl	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)	
24	1+195	Outl	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)	
25	1+234	Outl	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)	
26	1+257	Outl	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	Fro	m	To				
27	1+3	34	Outlet	Outlet (major)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)
28	1+4	55	Outlet	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)
29	1+5	47	Outlet	Outlet (minor)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)
30	1+6	35	Outlet	Outlet (major)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)
31	1+7	86	Outlet Branch	Outlet (major), Branch	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)
32	1+7	94	Foot Bridge	Foot Bridge	Track Crossing	Damage by crossings	Foot Bridge (M)
33	1+8	05	Branch	Outlet L/S and Road crossing, outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H) & Road Crossing
34	1+8	76		Outlet r/s & l/s	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet L/S & R/S (H)
35	1+9	41	Outlet	Outlet (minor), r/s	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)
36	1+9	86	Outlet	Outlet (minor), r/s	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (M)
37	2+0	52		Main canal Left side, road Crossing, Outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H) & Road Crossing(H)

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	Fro	m					
38	2+233		Outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
39	2+186	Branch	R/S	Diversion for command area	Fulfill demand of Command area	Branch L/S	
40	2+331		Branch L/S, Outlet	No S tructure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
41	2+421		Branch L/S, Outlet	No S tructure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
42	2+531	Out	let	No S tructure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
43	2+632	Bra	nch L/S	Diversion for command area	Fulfill demand of Command area	Branch L/S	
44	2+600		Outlet	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
45	2+800	Branch	End R/S, Siphon Inlet, Outlet	No S tructure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H) and S iphon Inlet	
46	3+036	Siph	on Outlet, Crossing			Siphon Ou tlet (H) & Crossing (H)	
47	3+458		Road Crossing	Road Cross es th e canal	Road Crossing	Road Crossing (H)	
48	3+744		Outlet of Branch	No S tructure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H)	
49	3+805	Ta	il Structure	No structure	Discharge to Dhukure river	Tail Structure	