

Initial Environmental Examination Report

Project Number: 33209-01
June 2009

Nepal: Community -Managed Irrigated Agricultural
Sector Project

Bansbote Irrigation Subproject, Dhankuta District

Project Proponent: Department of Irrigation
Prepared by Eastern Irrigation Development Division No. 3 (Dhankuta)

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 -	Hectare
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, 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

I.	INTRODUCTION	4
II.	DESCRIPTION OF THE SUBPROJECT	5
III.	DESCRIPTION OF THE ENVIRONMENT	11
	Physical Environment	11
	Ecological Resources	12
	Socio-economic Environment	12
IV.	SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS	13
V.	POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES	17
	Environmental Problems due to Subproject Location	17
	Environmental Problem Related to Project Design	17
	Environmental Problems Related to Construction Stage:	18
	Environmental Problems Resulting from Subproject Operations	20
	Realization of Enhancement Potentials	20
VI.	ANALYSIS OF ALTERNATIVES	22
VII.	INSTITUTIONAL ARRANGEMENTS	23
VIII.	ENVIRONMENTAL MANAGEMENT PLAN	25
IX.	PUBLIC CONSULTATION AND DISCLOSURE	29
X.	FINDINGS AND RECOMMENDATIONS	30
XI.	CONCLUSION	31
	Annex 1: Details of Proposed Intervention in the Subproject	32

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 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 if such effects occur 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 Bamsote 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 proposed Bansbote Irrigation Project is located in the North-west part of Dhankluta District in Koshi Zone of Eastern Development Region. The water is offtake n from the Gatte khola lies on the Hattikharka ward no: 2, named Suntale. The command area lies in the ward no. 2, 3 and 4 of Hattikharka VDC. The subproject lies at a latitude of $27^{\circ} 02' 30''$ N to $27^{\circ} 05' N$ and a longitude of $87^{\circ} 17' 30'' E$ to $87^{\circ} 20' E$. It situated at an altitude of 850-1100 m above mean sea level. The location map of subproject is shown in Figure 1.

5. **Accessibility.** The subproject area can be reached by bus up to Trishule (15 km North from Dhankuta, on Koshi highway) and thereafter 3 hours of walking distance (about 7 km west) from Trishule. The nearest market from the project site is Hile bazaar which is about 10 km from the subproject area.

6. **Existing Situation:** The farmers themselves under the leadership of late Damber Singh Limbu constructed the Bansbote Irrigation Sub- project in 1948 AD. The source of the Canal is Ghatte Khola. The total length of the canal is 4.720 km including main canal and branch canal that was dug initially under the extensive people participation. The main problem of the system is the temporary side intake without controlled gate. The uncontrolled flow enters into the canal during rainy season, damages the intake and the canal at the intake site. Minor maintenance works are carried out with people's contribution. All the beneficiaries of the system give many days in a year to repair the canal and intake point. This becomes more difficult year to year. The irrigation efficiency of the system is very low due to improper water management. Minor maintenance works are carried out with people's contribution. All the beneficiaries of the system give many days in a year to clean the canal and repair the headwork to regulate the canal system. The very increasing erosion at the diversion site makes it more difficult and costly to repair the diversion.

7. **Command Area:** The gross command area of the subproject is 100 ha and the net command area 57 ha.

8. **Walkthrough Survey:** In order to assess the existing situation of the subproject and necessary proposed intervention for improving the water availability, a joint walk through survey along with farmers and the representative of NGO selected for supporting the institutional development of WUA was carried December 27 - 29, 2008. The existing situation of the canal systems of the subproject and proposed interventions are presented in Annex 1. The problem in the system are:

- Intake does not have controlled gate. Flow is unregulated.
- No cross drain structures across the drainage crossings
- Seepage in the canal
- No regulators in the canal to regulate the flow and no outlet structures

9. **Project Components.** The existing situation of the canal systems of the subproject and proposed interventions are presented in Annex 1 and salient features of the subproject is presented in Table 1. A schematic drawing of the subproject area is presented in Figure 2. The major infrastructure improvements include the construction of a single orifice side intake, 6 superpassages; 19 nos of pipe drop structure with total length of 875 m, 14 drop structure, 2 division box, 2 tail structures, 1 aqueduct, 24 nos. outlets and 963 m lining in the system.

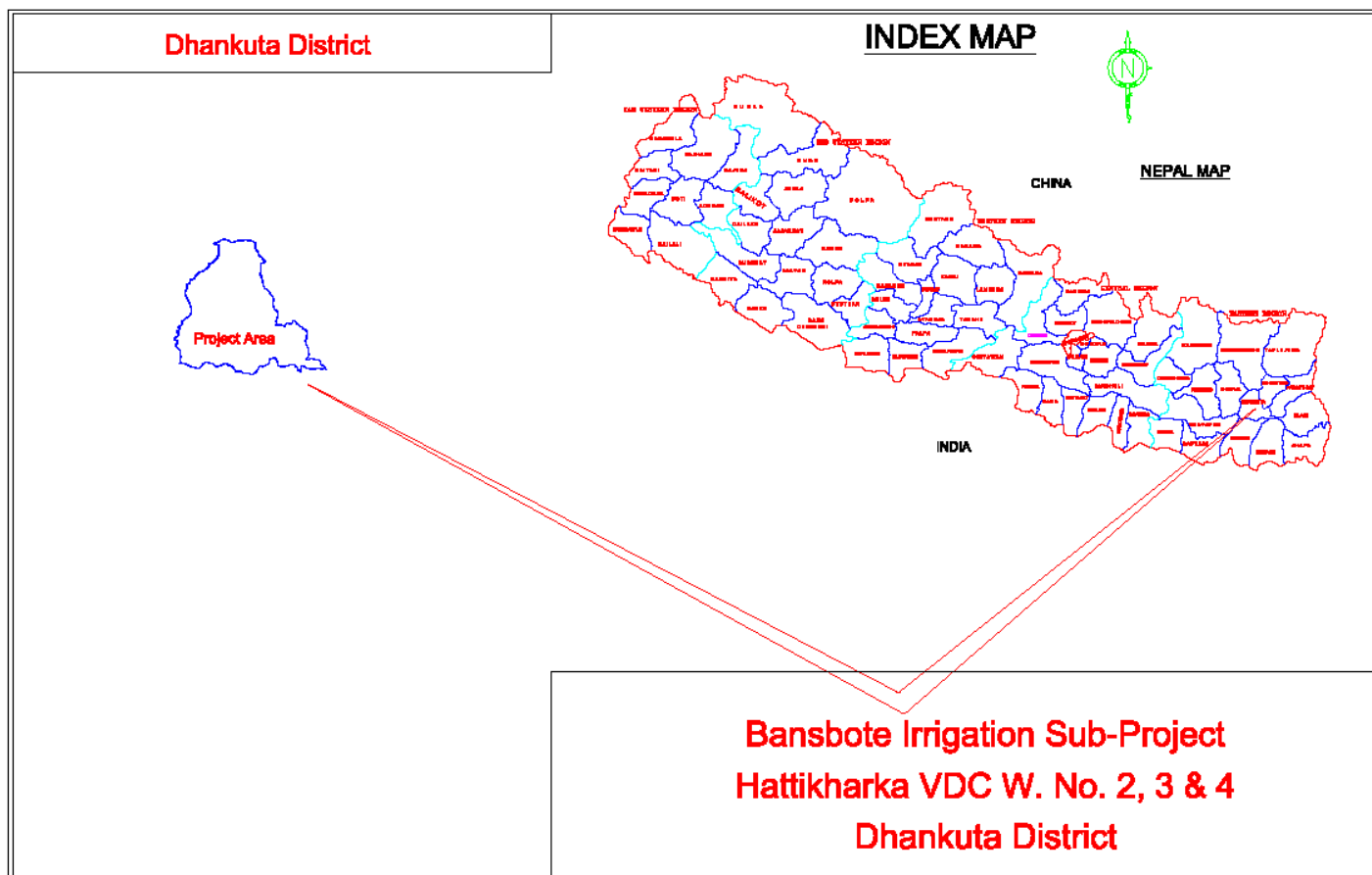
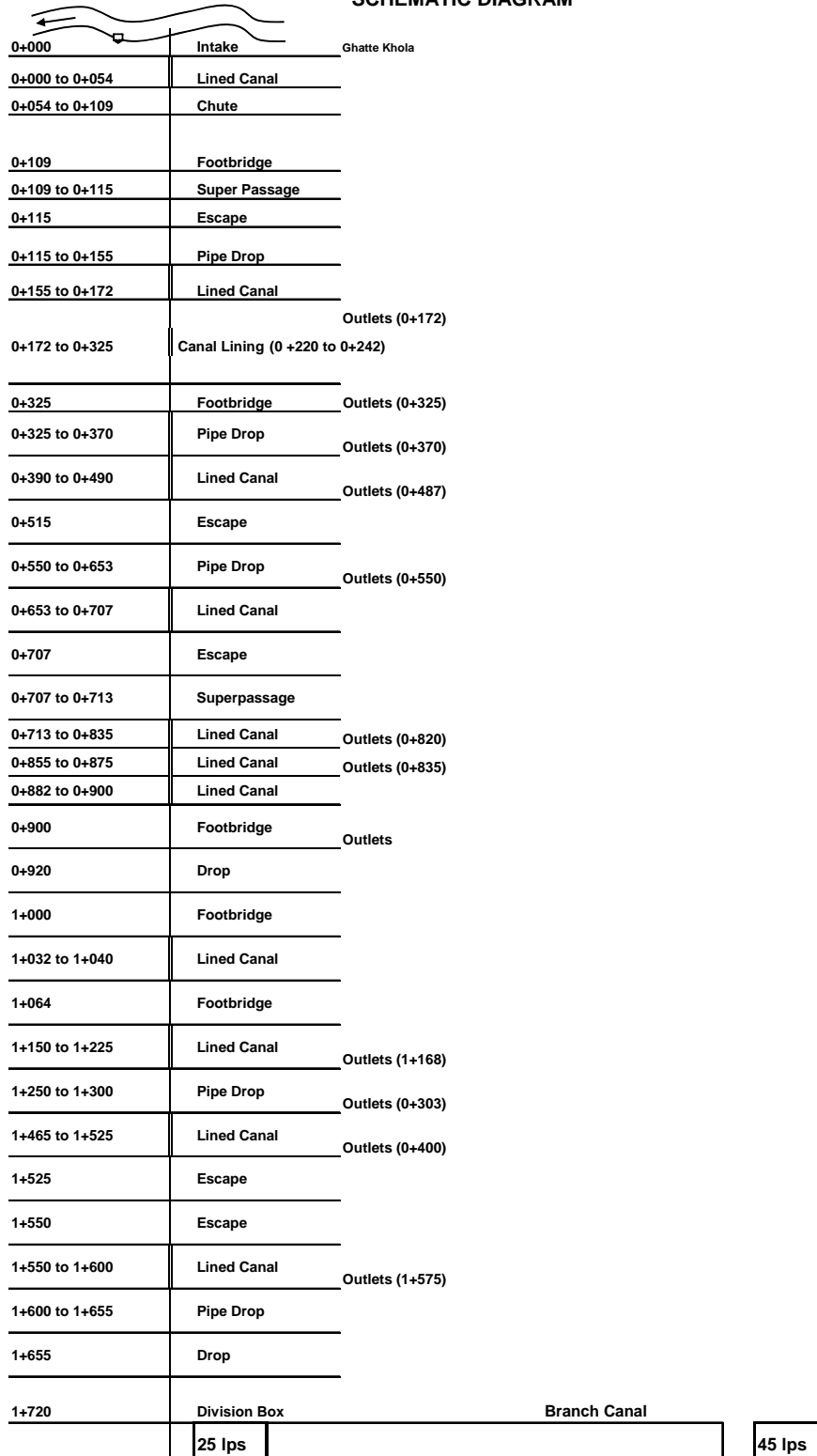


Figure 1: Location Map of the Subproject

**BANSBOTE IRRIGATION PROJECT, DHANKUTA
SCHEMATIC DIAGRAM**



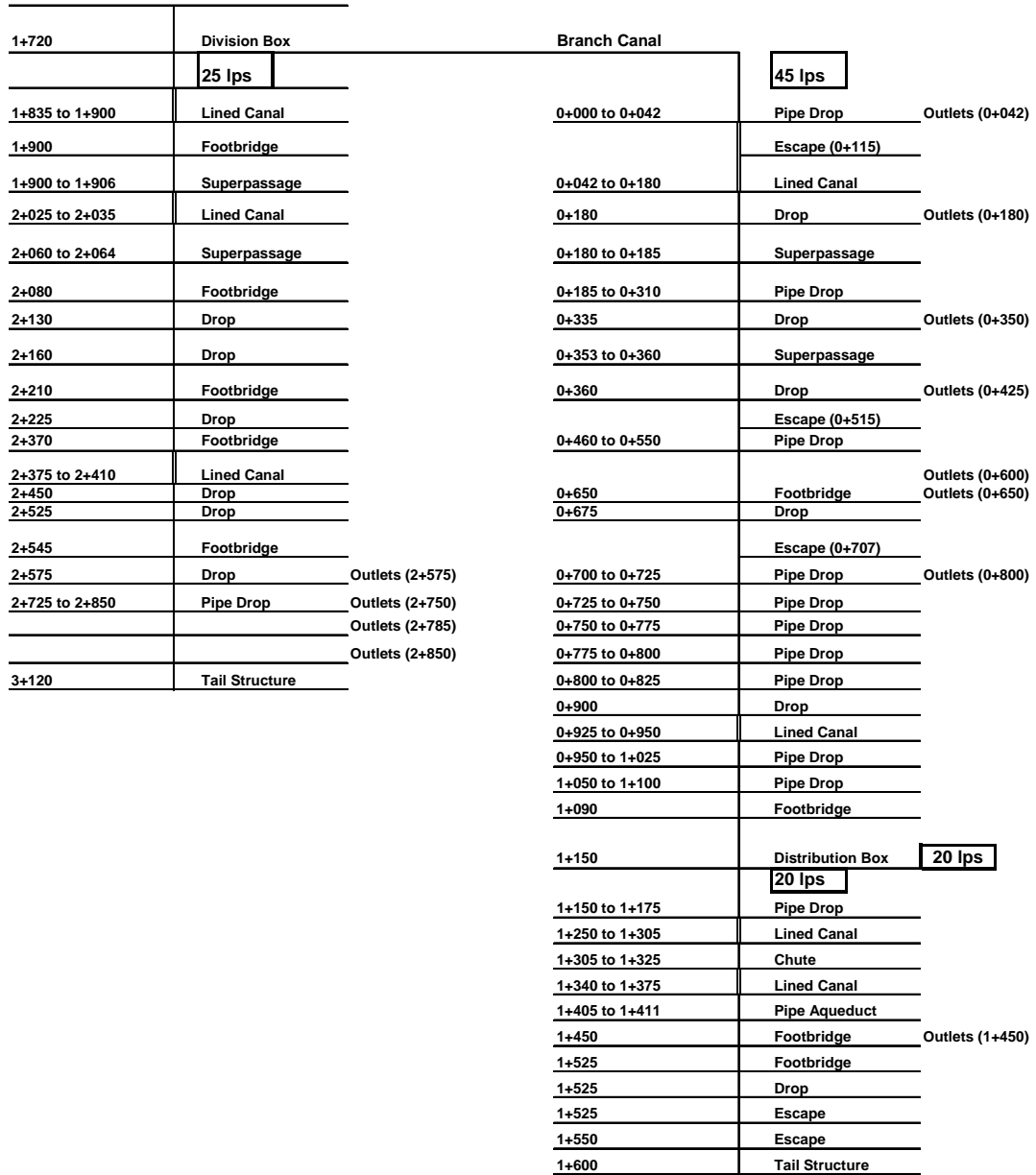


Figure 2: Schematic Diagram of the Subproject

Table 1: Salient Features of the Bansbote Irrigation Subproject

1. Name of Subproject	Bansbote Irrigation Subproject
2. Subproject Classification	Rehabilitation
3. Location (VDC and Ward No)	Hattikharka, Ward No: 2, 3, and 4
4. District	Dhankuta
5. District Headquarter	Dhankuta
6. Zone	Koshi
7. Development Region	Eastern
8. Number of Households	111
9. General Elevation of the Subproject Area	970 msl
10. Slope and Topography of the Subproject Area	rolling to moderately steep (18 to 30% slope)
11. Population	681
12. Total Canal Length	
a) Main Canal	3.12 km
b) Branch Canal	1 number/1.6 km
13. Gross Command Area	100 ha
14. Net Command Area	57 ha
15. Cropping Intensity	193% (present) & 232% (future)
16. Name Of Water Source	Ghatte Khola
17. Type Of Water Source	Perennial
18. Catchment Area	5.54 km ² (in Hydrological Region-I)
19. Canal Type	Earthen & Lined canal
20. Canal Discharge	90 liter per second
21. Side Slope	1:0 (Lined Canal), 1:0.5 (Earthen Canal)
22. Bed Slope	Shown in the L-Section in Detailed Design
23. Diversion Structure	Single orifice side intake
24. Proposed Subproject Interventions	
Side Intake	1 no.
Aqueduct	1 no.
Division Box	2 nos.
Pipe Drop Structure	19 nos.
Outlet	24 nos.
Super Passage	6 nos.
Escape	5 nos.
Vertical Drop	14 nos.
Footbridge	14 nos.
Tail Structure	2 nos.
Lining	963 m
25. Number of people directly involved during construction (estimate)	Skilled: 1,285 man days Unskilled: 6,743 man days
26. Construction/Rehabilitation Period (months)	7 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

10. **Topography.** The Subproject area lies in mid-mountain range and is situated at an altitude 970 m mean sea level. The terrain is sloped towards Okhre Khola. The subproject area is made up of agricultural land.

11. **Climate.** The subproject area has three distinct seasons, spring, monsoon and winter. The sub-project area has a sub-tropical climate, the hottest month being July/August. The climate is tropical during the summer and subtropical during the winters, so as can be expected in the Eastern area of Nepal. The spring season is warm and dry, summers are warm, wet and humid and winters are cool and normally dry. In the same way, the months of November to March are cool and dry, March to June is hot and dry, July to August is warm and humid and September to October is pleasant. The warm temperate climate allows for cultivating three crops a year. As there are no long term discharge records for this river, the flood discharge is sought to be estimated based on the rainfall and catchment characteristics. The average annual rainfall recorded at Station Dhankuta (Station No- 1307) is 922 mm and is presented below. More than 80% of the rainfall is concentrated during the four months of the year, June through September. Following are some important hydro-meteorological observations:

- Mean annual rainfall – varies from 8.4 mm minimum in November to 307.9 mm maximum in July;
- Mean monthly maximum temperature: varies from 17.8 °C in January to 27.7 °C in June
- Mean monthly minimum temperature: varies from 6.8 °C in January to 20.6 °C in July
- Minimum evaporation: 1.4 mm in December
- Maximum evaporation: 3.9 mm in June

12. **Soils.** The project area is mainly divided into head, middle and tail canal reach. The soil type in the head reach /headwork site is hard rock and boulder mixed soil whereas other reach consists of boulder mixed soil, rocks and ordinary soils such as sandy loam. The canal passes through stable region but most of the reach are highly porous and needs extensive canal lining work.

13. **Water Resources.** The source of the water is Ghatte Khola which is a perennial type. The catchment area is relatively small (5.54 km²) and is well vegetated. It originates from Bar Danda (1900 m amsl) and flows due north. It drains to Okhre Khola near Suntale village, which finally drains to river named Mangmaya. Most of this catchment area is located inside the dense forest and the good forest cover in this area, which provides the catchment with a high water retaining capacity. It limits the occurrence of flash flood, provides the river with a relatively stable flow regime and provides considerable perennial spring flows. This gives the river considerably higher base flow than is normally expected from streams with such a small catchment area in the hill range.

Ecological Resources

14. **Vegetation and Forest.** There is no national forest or community forest within the sub project command area. There are a number of trees of different species of timber, fodder, fuel wood and fruits within the subproject command area and homesteads but they are not going to be affected by the sub project activities.

15. **Wildlife.** As reported by the local people, jackals, rabbit, porcupine and monkeys have been seen within the sub project command area whereas wild boar is also reported to be occasional visitors.

16. **Aquatic life.** No Fish species as such have been reported in the Ghatte Khola.

Socio-economic Environment

17. The Bansbote Irrigation Sub-Project covers Hattikharka VDC ward no. 2, 3 and 4 of Dhankuta District. The total number of households in the project area is 111 with the total population 681 and average family size is 6.4. The female headed households are apparently small in percentage (4.72%). There are 12.61% landless households. Ethnically, the settlement has a mixed type of social structure. The settlement of Bansbote has Janajati (73.8 %) as the ethnic majority. Among other ethnic communities, Brahmin/Chhetri (6.4%), Dalit (19.8 %) are the inhabitants of the command area.

18. The main occupation of people in the subproject area is agriculture. Apart from crop farming, other income source is vegetable farming. Most of the farmers raise chickens, pigs, pigeons, ducks, goats, cows and buffaloes for the purpose of meat and milk. The labor force from higher and middle level families is more involved in urban based businesses and foreign employment as well as government service. Poor and ultra poor groups are involved in local labor. The average daily wages of labor for men is 150 to 175 and for women 100 to 150 Nepalese rupees. The main source of agricultural labor for the command area is the local poor group. Mostly landless farmers go to work in large farmer's fields and some of them take land on lease for farming on contractual basis.

19. Most of the farmer in the subproject area could not receive education due to lack of school facility and awareness. Within the command area there is one primary school but no any higher secondary school. Most of the people considered literate in the area have not completed the higher secondary level. The number of female children attending local school is found very low than male children. Among the children, school drop-out is common, even from the primary school located within the village. They prefer to join the labor force for family support. Most of the households own Kachhi house (made up of wooden and bamboo) and have access to electricity. There is community drinking water supply system in the command area. The population has access to primary health facilities as one health post which is at one hour walking distance from the command area.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS

20. **Delineation of geographical boundary of zone of influence (ZoI).** : The sub 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, 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.

21. The subproject area will receive irrigation water from the existing system of the Bansbote irrigation system, with improvement by the construction of the simple Single Orifice Side Intake with the provision of regulated gate. The screening of the potential impacts 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 Subproject irrigation system being in operation for more than fifty years as farmers-managed scheme, system for water use has been established and no records are available showing any evidence of misunderstanding or conflicts among users.
1.5	Flooding and Drainage Hazards	√		Water flow in the canal is unregulated. Excess water is overflowed from many places. The Subproject will provide regulator with gates, escapes and canal crossing at necessary points.
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 proposed intervention is the construction of side intake at the existing diversion point and improvement in the canal system. This improvement further improves the whole system and hence there won't be erosion problem.
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

SL	Parameters	Impact		Remarks
		Yes	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		√	The command area is in the hill slope, hence drainage will not be a problem.
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	√		No significant use of fertilizers at present. Farmers may use after system improvement.
2.8	Selection of Pesticides		√	Presently no use of pesticides. After system improvement farmers may need Integrated Pest Management (IPM) training program.
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	√		The operation and maintenance (O&M) of the existing irrigation system has been in place prior to implementation of the Subproject.
2.12	Passageways	√		Sufficient facilities of passageways are provided by constructing covered pipe canals and other crossing structures.
2.13	Scooping Hazards		√	The system has been in operation for many years. Canal beds are stable. Scooping problems has not been reported except in intake location where breaching occurs in monsoon season.
3	Environmental Problems Related to Construction Stage			
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 317 m ³ sand 2 02 m ³ of aggregates 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 6,723 unskilled and 1,285 skilled. Assuming actual construction working season of 7 months, the average labour requirement per day would be 32 unskilled and 7 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	√		No heavy construction equipments are

SL	Parameters	Impact		Remarks
		Yes	No	
	transport			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 upto the road head only
3.7	• Occupational health and safety	√		Occupational health and safety of the workers would have to be taken care during construction.
3.8	Temporary Closure of Irrigation System	√		Contractors would schedule construction activities in discussion with WUA, so it will be expected to have minimum obstruction.
4	Environmental Problems Resulting from Project Operations			
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 being an existing one and in hill area there may not be significant change in ground water table.
4.4	Mosquito Breeding		√	Being a hill area mosquito breeding is not a problem.
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	√		Presently farmers do not use chemical fertilizers. But after development it might be in use. The use of chemical fertilizers may find its ways to surface waters which could be 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 (tap water). 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.
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.

22. 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.

23. 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 Problems due to Subproject Location

24. **Flooding and Drainage Hazards:** The command area is already in irrigation but water flow in the canal is unregulated. The excess water in the canal is overtopped from many places. There are erosion problems at a number of places where the water from the agriculture land flows out into the natural drains. The proposed intervention will be regulating the flow in the canal with the provision of regulator with gates and escape structures at necessary points. These interventions will produce positive impact of high magnitude, local extent and long term duration.

25. *The escape structures will be provided as necessary at the river crossing structures such as intake, super passages and aqueduct.*

Environmental Problem Related to Project Design

26. **Watershed erosion:** The construction of the permanent intake with the provision of regulated gate is going to prevent the erosion in the vicinity of the intake location. This is the positive impact of high magnitude, local extent and long term duration.

27. **Use of Chemicals in Agriculture and Horticulture:** Though these are not in use at present, the use of chemical fertilizers is likely to 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.

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

29. **Canal Management:** The proposed project intends to operate by providing outlets from main canal and one branch canal. The operation and maintenance of the system will be the responsibility of the farmers themselves. This system being in practice for many years, farmers are quite experienced in managing the system and with further provision of outlets and necessary system improvements O & M for them would be further easier. Hence this impact has been considered of low magnitude, local extent and long term duration.

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

31. **Passageway:** There are some passageways in the existing canals which is not adequate for movement of the people. Hence additional passageways, 8 foot bridges, 945 m pipe crossing in 15 places and 6 superpassages have been proposed. This is a positive impact of high magnitude, local in extent and long term duration.

Environmental Problems Related to Construction Stage:

32. 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.

33. 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 19 months.

34. 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.

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

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

37. **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.

38. *Mitigation measures include: (i) Being a small system, its rehabilitation will not use heavy machine and equipments hence air and noise pollution will be insignificant. However, 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.

39. 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.

40. 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.

41. 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 materials during transportation and stockpiling may result in deposition and possible damage to vegetation, crops, and water resources.

42. 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

43. 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.

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.

44. **Temporary closure of irrigation system.** The construction activity in the canal system may disturb the supply of the irrigation water for a relatively short period.

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. **Hazards 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 project 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.

47. **Mitigation Measures:** IPM training will be provided under the agriculture development plan.

48. **Hazards associated with the Use of Mineral Fertilizer.** The farmers at present do not use chemical fertilizers in the crops significantly. The project intends to carry out training in the crops cultivation to increase the crops yield. Hence the use of chemical fertilizers may be increased with the project 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

49. **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.

50. **Livelihood Programs for Landless Households.** There are 50 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.

51. **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

52. Since the proposed subproject is an existing FMIS, there is no other option for the alternative location for intake location and canal alignment. There were options of the type of intake and lining of the canal. Depending on the topographic condition of the intake site a double orifice intake has been proposed. There were number of options for the canal lining namely: soil cement lining, plastic sheet lining, geo-textile lining and cement concrete lining. The farmers preferred to have cement concrete lining.

VII. INSTITUTIONAL ARRANGEMENTS

53. **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).

54. 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.

55. **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

56. 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.

57. 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.

58. 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 regulator with gate s and intake structure	Design Office	Include i n det. design	No cost	Design team	provision of regulated gate	ISPMC
2	Environmental Problem related to project design							
	Watershed erosion	Provide pe rmanent i ntake with regulated gate	Design Office	Include i n det. design	No cost	Design team	provision of permanent intake	ISPMC
	Canal management	Prepare sub project s pecific water management plan and O & M Plan.	Design Office	included in det. design	No cost	Design team	Prepare si te specific w ater management plan	ISPMC
	Passageway P	rovide passageway structures	Design Office	Include i n det. design	No cost	Design team	provide passage as agreed with the farmers	ISPMC
H	azards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. Use I PM technique to control pest	Design Office	Include i n Agriculture Development Plan.	No cost	Design team	Include I PM training package in A griculture Development Plan (ADP.)	ISPMC
3	Environmental Problem related to construction stage							
	Excavation	(i)confine ope rations in th e dry season; (ii) u se of s ilt t raps; (iii) spoils sh all be di sposed of a t t he designated locations	Within t he sub-project	designate t he spoil dis posal area	Part of civi l construction cost	Imp: Contractor Mon: SMU/WUA	spoil d isposal sites	SMU/WUA
	Qua rry sites							
	Work Camp Location and Operation: (i) te mporary air and noise pollution from machine op eration; (ii) water po llution from storage and us e of fuel, oils, s olvents, an d lubricants; (ii i) unh ygienic	(i) work camp w ill be located away from the settlement ar ea. (i i) n o trees sh all be c ut a nd removal o f vegetation s hall b e minimized (iii) used oi l and l ubricants s hall be recovered and reus ed or rem oved from si te. (iv) wo rk camps will n ot be a llowed in w ildlife hab itats,	Within t he sub-project		Part of civi l construction cost	Contractor	Location of the work camp	SMU/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	conditions from laborers; (iv) disturbance to wildlife	restriction and control of wildlife harassment, illegal hunting and poaching by workers.						
		(iv) will make own arrangements for water and sanitation	Work camp		Included in environmental cost (Budget: Rs 50,000.00)	Imp: Contractor	disposal and sanitary facilities in the work camp	SMU/WUA
		(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 sub-project		Included in environmental cost (Budget : Rs, 50,000.00)	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	Construction site	Provide safety gears	Included in environmental	Imp: Contractor	insurance policy	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
		such helmets, boots, ear plug, mouth mask to the worker and labours			cost (Budget Rs. 40,000.00)			
T	emporary closure of irrigation system	Plan the intake construction during dry season	Intake site		No cost	Imp: Contractor	Construction plan	Mon: SMU/WUA
		Make an alternative arrangement to keep the canal running	Canals		Part of civil construction cost	Imp: Contractor	Enquiry on canal closure	Mon: SMU/WUA
Environmental Problems Resulting from Project Operations								
H	azards 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	Imp: Farmers	Use of pesticide in the crops	Mon: DADO
H	azards associated with the use of mineral fertilizer	Use recommended dose of inorganic fertilizers	Command area	Application of fertilizers	No cost	Imp: Farmers	Use of chemical fertilizer in the crops	Mon: DADO
Realization of Enhancement Potentials								
	Employment to the local people	Provide employment to local people in priority	Within Sub project area	Hire local labour to the extent possible	No cost	Imp: Contractor	Payroll of contractor	Mon: WUA
	Livelihood programs for landless households	Provide Livelihood enhancement Program (LEP) training to the targeted people	Within sub project area	Training I	include in LEP cost	Imp: SMU	Training on LEP	Mon: WUA
F	feasibility of cooperatives	Provide institutional development training	Within sub project area	Training I	include in Institutional development plan cost.	Imp: SMU	Training on Institutional development training	Mon: WUA

IX. PUBLIC CONSULTATION AND DISCLOSURE

59. 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 27th to 29th 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. On 29th December 2008 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.

60. A list of the WUA members is presented here below:

	Name	Position
1.	Mr. Lokendra Bahadur Tigela	Chairman
2.	Mr. Guru Prasad Adhikari	Vice – Chairman
3.	Mr. Bhakta Bahadur Limbu	Secretary
4.	Mr. Shiva Kumar Tigela	Joint – Secretary
5.	Mr. Gyan Bahadur Tumba	Treasurer
6.	Mr. Nar Bahadur Karki	Member
7.	Miss Rita Darji Nepali	Member
8.	Miss Pee Kumari Ghale	Member
9.	Miss Sarita Ghale	Member
10.	Mr. Prem Rana Magar	Member
11.	Mrs. Mina Kumari Limbu	Member

61. The participants during the Walkthrough Survey from WUA were Mr. Lokendra Bahadur Tigela, Shiva Kumar Tigela and Prem Rana Magar.

X. FINDINGS AND RECOMMENDATIONS

62. 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.

63. 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

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

65. 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

Item No	WayPoints		Chainage		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To	From	To					
1	015		0+000		Intake			Intake site	
2	016	018	0+047	0+065	Lining	Leakage	Leakage from canal Section	Lining	
3	017		0+027		Drop			Drop Structure	
5	019		0+081		Drop			Drop Structure	
6	020		0+094		FB	Track Crossing	Damage by crossing	Footbridge	
8	022		0+110		SP	Drain Crossing	Damage by crossing	Superpassage	
9	023 025		0+122	0+160	Lining	Leakage	Leakage from canal Section	Lining	
12	026		0+202		Lining	Leakage	Leakage from canal Section	Lining with d/s protection	
14	028		0+277		FB	Track Crossing	Damage by crossing	Foot bridge	
15	029 030		0+304	0+350	Lining	Leakage	Leakage from canal Section	Canal Lining	
17	031		0+361		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	Outlet	
18	032 033		0+381	0+399	Lining	Leakage	Leakage from canal Section	One side canal lining	
20	034	035	0+420	0+473	Lining	Leakage	Leakage from canal Section	Two side canal lining	
22	036		0+487		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	Outlet	

Item No	WayPoints		Chainage		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To	From	To					
23	037		0+503					Escape	
24	038	039	0+513	0+531				L/R retaining structures	
26	040	041	0+541	0+548	Lining	Leakage	Leakage from canal Section	Lining	
28	042	043	0+554	0+565				Chute	
29	043	044	0+565	0+570	Lining	Leakage	Leakage from canal Section	Canal lining	
31	045		0+607		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	outlet	
32	046	047	0+616	0+627	Drop			Chute drop	
34	048	049	0+655	0+660				D/s protection	
36	050	053	0+676	0+711	Lining	Leakage	Leakage from canal Section	lining	
37	051		0+683		SP	Drain Crossing	Damage by crossing	Superpassage	
40	054	055	0+809	0+814	Lining	Leakage	Leakage from canal Section	Canal lining	
42	056	057	0+833	0+846	Lining	Leakage	Leakage from canal Section	Canal lining	
46	060		0+962		FB	Track Crossing	Damage by crossing	Foot bridge	
47	061	062	0+982	0+990	Lining	Leakage	Leakage from canal Section	Canal lining	
49	063		0+991		FB			Foot bridge	

Item No	WayPoints		Chainage		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To	From	To					
50	064	066	1+069	1+100	Lining	Leakage	Leakage from canal Section	Canal lining	
53	067		1+215		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	outlet	
54	068		1+217		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	outlet	
55	069	070	1+312	1+369	Lining	Leakage	Leakage from canal Section	canal lining	
57	071		1+435		SP	Drain Crossing	Damage by crossing	Superpassage with Escape	
58	072		1+441					Division Box for branch :1	
61	075		1+460					offtaken from vertically drop stream	
62	076	078	1+465	1+569	Lining	Leakage	Leakage from canal Section	Start of canal lining	
65	079		1+626		Division Box			Division Box	
67	081	083	1+650	1+772	Lining	Leakage	Leakage from canal Section	Lining with d/s protection	

Item No	WayPoints		Chainage		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To	From	To					
70	084		1+835		SP	Drain Crossing	Damage by crossing	Superpassage in Be te kholsi	
71	085		1+841		FB	Track Crossing	Damage by crossing	Foot Bridge	
73	087	088	1+934	1+956	Lining	Leakage	Leakage from canal Section	lining	
76	090		1+985		SP	Drain Crossing	Damage by crossing	Superpassage	
77	091		1+990		SP	Drain Crossing	Damage by crossing	Superpassage	
78	092		2+003		FB	Track Crossing	Damage by crossing	Footbridge	
79	093		2+033		Drop			Drop structure	
80	094		2+065		FB	Track Crossing	Damage by crossing	Foot Bridge	
82	096		2+228		FB	Track Crossing	Damage by crossing	Foot Bridge	
83	097	099	2+294	2+306	Lining	Leakage	Leakage from canal Section	canal lining	
87	101		2+469		Outlet Impro	per Outlet	No controlled outlet causing bank erosions	Outlet	
88	02		2+507		FB	Track Crossing	Damage by crossing	Footbridge	
89	03		2+676		Lining	Leakage	Leakage from canal Section	covered canal lining	
91	05		2+693		FB	Track Crossing	Damage by crossing	Foot Bridge	

Item No	WayPoints		Chainage		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To	From	To					
92	06		2+716					End of Existing Main canal	
93	106	107	2+716	2+788	Lining	Leakage	Leakage from canal Section	canal lining	
98	12		3+009					End of Main canal(Tail structures)	