SFG3896

VOLUME 3: BIODIVERSITY IMPACT ASSESSMENT

DEPARTMENT OF IRRIGATION
RANI JAMARA KULARIYA IRRIGATION PROJECT
DECEMBER 27, 2017

PREFACE

This document is the third of eight volumes, which describes the Biodiversity Impact Assessment (BIA) conducted in relation to the Modernization Rani Jamara Kulariya Irrigation Scheme (MoRJKIS) in Tikapur Kailali Districts, Far West in the Province Seven of Nepal. This study was conducted by project proponent (Department of Irrigation, Rani Jamara Kulariya Irrigation Project) between April to November 2017 and finalized on December 26, 2017. The Report has been prepared in compliance the GoN Law and World Bank Safeguard Policies.

The report of these studies comprises eight volumes, which are arranged as follows:

Volume 1: Executive Summary (combining the finds of EA, BIA, IPM, SA, VCDP & RPF)
Volume 2: Environment Assessment (EA);
Volume 3: Biodiversity Impact Assessment (BIA)-**this document**;
Volume 4: Integrated Pest Management Plan (IPM);
Volume 5: Social Impact Assessment (SIA);
Volume 6: Vulnerable Community Development Plan (VCDP);
Volume 7: Resettlement Planning Framework (RPF);
Volume 8: Stakeholder Consultation Proceeding conducted at Tikapur on December 14, 2017.

The relevant inputs received from the stakeholders during consultation has already been incorporated in respective reports. It is enclosed for reference only.

LIST OF ACRONYMS AND ABBREVIATIONS

Agricultural Component Implementation Unit	ACIU
Area of Influence	AoI
Biodiversity Assessment	BA
Bird Conservation Nepal	BCN
Biodiversity Management plan	BMP
Biodiversity Monitoring Plan	BMoP
Bardiya National Park	BNP
Bank Procedures	BP
Command Area	CA
Command Area Development	CAD
Command Area Protection	CAP
Community Based Organization	CBO
Central Bureau of Statistics	CBS
Community Forests	CFs
Community Forest Users Group	CFUG
Convention on International Trade in Endangered Species	CITES
Dolphin Conservation Committee	DCC
District Forest Office	DFO
Direct Influence Area	DIA
Department of Agriculture	DOA
Department of Irrigation	DOI
District Water Resources Committee	DWRC
Environmental Assessment	EA
Environment, Health and Safety	EHS
Environmental Impact Assessment	EIA
Environmental Management Action Plan	EMAP
Environment Management and Monitoring Committee	LEMC
Environmental and Social Management Plan	ESMP
Environment Protection Act	EPA
Environment Protection Rules	EPR
Farmers Management Irrigation System	FMIS
Government of Nepal	GoN
Grievance Readdress Committee	GRC

High value crops	HVCs
International Development Association	IDA
Karnali River Basin	KRB
Local Environment Monitoring Committee	LEMC
Modernization of Rani Jamara Kulariya Irrigation Scheme	MoRJKIS
Nepali Rupees	NPR
Non-timber Forest Product	NTFP
Operational Policies	OP
Project Implementing Office	PIO
Project Operation Plan	POP
Rani, Jamara and Kulariya Irrigation Project	RJKIP
Rani Jamara Kulariya Irrigation Scheme	RJKIS
Rapid Rural Appraisal	RRA
South Asian Association for Regional Cooperation Secretariat	SAARC
Suklaphanta National Park	SNP
Terai Arc Landscape	TAL
United States Dollar	USD
Village Development Committee	VDC
World Bank	WB
Water User Association	WUA
Water User Groups	WUG
World Wide Fund for Nature	WWF

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1. Introduction, Approach and Methodology

1.1 Introduction

The Rani Jamara Kulariya Irrigation Scheme (RJKIS) Phase-2 (modernization of the lower-order irrigation system such as sub-branches, tertiary canals and water courses) triggers OP/BP 4.04 Natural Habitats. The Karnali and Mohana Rivers are known to have important aquatic species (Gangetic Dolphin, Marsh Mugger, and Gharial crocodile). It has been reported to take place occasional wildlife movement in the adjoining forests. These locations are outside of the project command area and away from project construction sites. Nonetheless it is likely to have indirect impacts from project activities on the natural habitat and biodiversity. Therefore to ascertain the impacts and appropriate mitigation measures on natural habitat and biodiversity, a study on Biodiversity Assessment (BA) and related Biodiversity Management Plan (BMP) has been carried out based on the proposed activities of Modernization of Rani Jamara Kulariya Irrigation Scheme (MoRJKIS) phase 2. The major activities planned in Phase 2 includes Command Area Development (CAD), Command Area Protection (CAP), Rural Agriculture Road Improvement, and Agriculture Extension etc.[1]

1.2 Study Location and Area of Influence (AoI) of Study Area

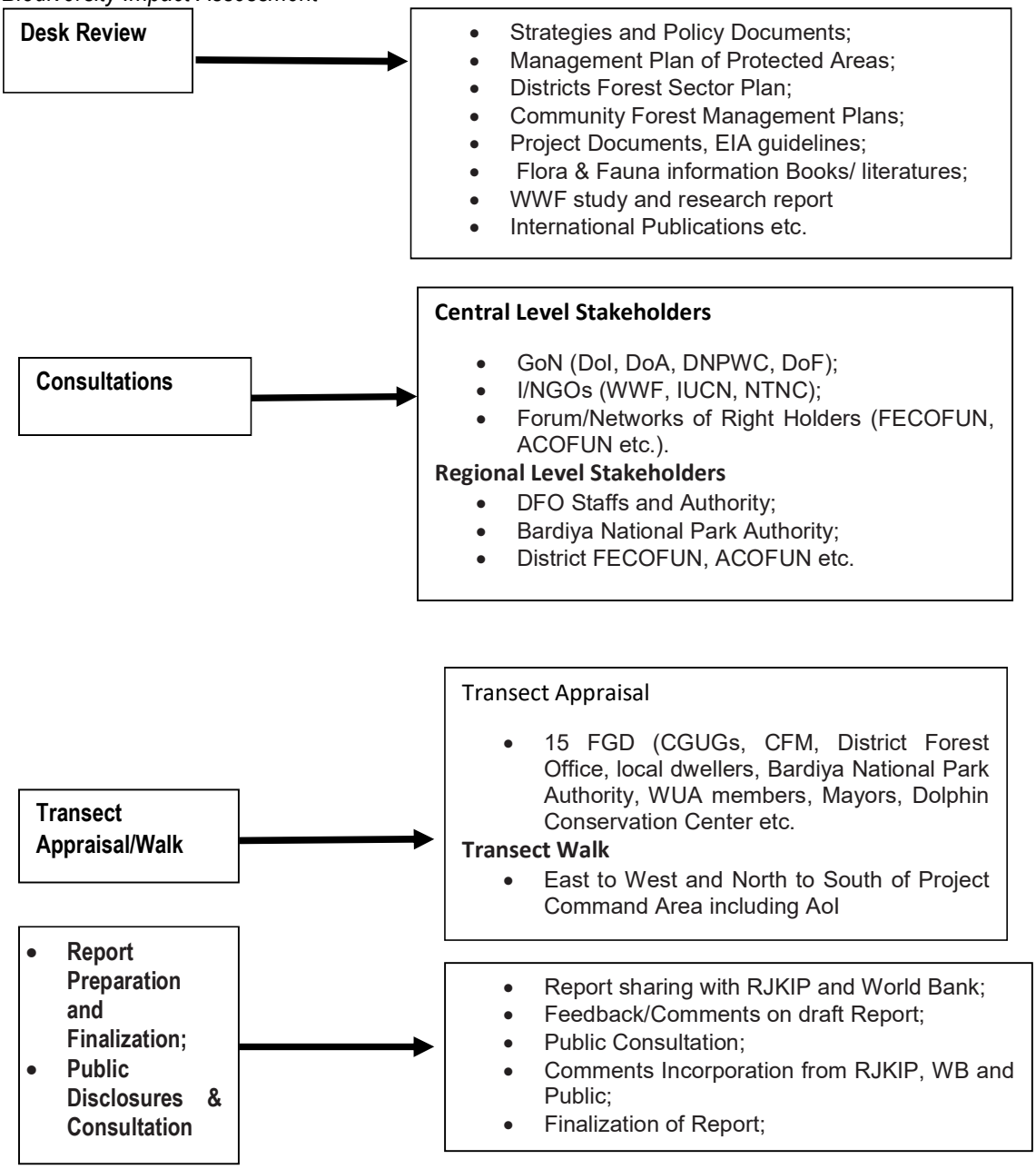
The project spans into Tikapur Municipality, Janaki Rural Municipality and part of Lamki Chuha Municipality. The project site is connected to the East-West Highway at Lamki Bazaar. The regional airports of Dhangadhi and Nepalgunj are within two and two and half hour drive respectively from the project area. The Area of Influence (AoI) for a project is the combination of project footprint or some set distance from the project area. The variables often dependent on the impacting factors (such as direct, indirect, beneficial, induced and adverse) and the affected resources. Therefore, considering these facts, the AoI for the RJKIS system shall be demarcated as:

- East- Karnali River;
- West- Kandra River;
- North- Foothill of Chure;
- South- Mohana River.

1.3 General Approach and Methodology

The overall methodology for the given assignment was based on listing and reviewing of existing information, field observation and exercise, and consultations at multiple levels. A methodological Framework employed during the accomplishment of the assignment and preparation of report is illustrated below:

[1]The World Bank, PROJECT APPRAISAL DOCUMENT- Report No:PAD2489, NP MODERNIZATION OF RANI JAMARA KULARIYA IRRIGATION SCHEME-PHASE2, {RVP/CD CLEARANCE DATE}



1.4 Limitation of this Study

This study in this area is the first of this nature and limited reference materials on similar issue were available. This study mainly focused on:

- Identifying the issues related with biodiversity, provide suggestions on mitigation measures and preparation of BMP to manage the biodiversity conservation in and around RJKIP area.
- Mega wildlife movement mapping, identifying migratory pattern and crossing points in and around RJKIP area.

The results were drawn and based on the analysis of limited secondary data, rapid field observation, consultation and discussion with stakeholders, wildlife experts, key informants rather than relying on scientific evidence and statistical measurements due to time limitation and short natured filed work.

2. Forest and Biodiversity Baseline

2.1 General Characteristics

The District of Kailali currently occupying around 3, 28,552 hectare area in total, out of which 2,05,939 hectare is forest whereas 24,418 hectare is river bed and barren land. The remaining 98,195 hectare is cultivated and agricultural land. The elevation in district ranges from 109 amsl of Terai flood plain to 1950 amsl of Churia range. The Kailali district spreads 74 Km and 51 Km East to West and North to South respectively. It lies N 28°22'-29°5" E 80°30'-81°18" of Far West Nepal. The RJKIP lies in the Terai plain that starts from the intake at West bank of Karnali River near Chisapani. It is a historical irrigation system of Kailali district that dates back to more than century managed by the farmers (Tharu community) led Water User Association (WUA).

2.2 Status of Forests and Biodiversity in Project Area

The Terai (southern plain area) parts of Kailali district consists of categorically good forest 36% (71,180 ha) and degraded forest 7% (13,230 ha) which is around 40.98% of total forest area of the district. Similarly, the district consists of grassland 1%, fallow land 8% and wetland 1% (DFO Kailali).

The Terai area of Kailali District occupies Shorea robusta (Saal in Nepali) hardwood forest around 31.39%, while Acacia catechu-Dalbergia sissoo, Khayar forest covers 4.9%. There is no forest area along the irrigation canal constructed at initial parts, while forest patches are observed upstream of canal system in the Churia range crossing East west highway along North-West part of project. It falls under the subtropical and partially belongs to Bhavar area at the foot hills of Churia range. Common trees are Sal, Khayar, Terminalia elliptica (Saaj in Nepali), Syzygium cumini (Jamun in Nepali), Albizia lebbeck (Sirish in Nepali), Sissoo etc. The area is dominated by Khayar-Sissoo forest with scattered Bombax (Simal in Nepali) trees.

2.2.1 Vegetation

The yearly flooding and change of river course has depleted most of the forest area and no patches of forests are observed around the intake area. However, forest patches start with the canal proceeding to westward near Katashe forest. The canal is constructed South along the Saal forest area some scattered Simal and Khayar species. The Katashe forest (N 28°35"11.1"E 81°11'52.3"; 167amsl) has Saal, Khair and Simal trees near diversion.

There are 15 Community Forests (CF)2 in the project AoI. The scattered CFs have middle sized Khayar trees mixed with Saal, Haldina Cordifolia (Haldu in Nepali), Saaj and Simal trees. The presence of some medicinal plants and NTFP was observed and Pipari, Amala, Sikakai, Jamun, Gurjo, Aakasbeli, Pahelopate, Harro, Barro, Sindure are the major medicinal plants that has become scarce due to their exhaustive use.

The forest status seems to be declining and large trees are not observed as the anthropogenic activities along with movement of domestic and feral cattle have already degraded these forests. Uncontrolled utilization, haphazard cutting and logging, and fragmentation of forests due to various infrastructure related development activities3 have already depleted the forest cover of the project area.

The Katashe Bazar (N 28°35"32.2"E 81°12'00.0"; 173 amsl) has some forest patches that is connected to Karnali River in the East. The Khairi Phanta (N 28°35"05.1"E 81°11'07.4"; 177 amsl) of Janaki Village consists of Amarawati Community Forest which is along the Karnali River corridor. The forest is mixed forest with natural and plantation species and has low canopy cover.

[2] Community forest are: ShivashaktiPatabhar, Kailasheswor, Amarawati, Chetana, Kalika, Ranijamara, Mahunyal, Radhakrishna, Bandevi, Pashupati, Nilkantha, NyuSagarmatha, Laukaha Bhaukaha, Amarboli Kopila and Janaki.

[3] Based on discussion with Community Forest User Groups

The RJKIP Phase 1 has initiated plantation (75000 sapling planted till date) along the irrigation canal system to augment the loss of vegetation from project activities. However, due to the absence of proper protection mechanism and excessive thoroughfare of cattle and human activities, the growth of planted sapling is poor. The survival rate, as reported by the Project officials and local key informants, is around 30 to 35% only. In addition to RJKIP intervention, the District Forest Office (DFO) is also carrying out reforestation activities. In Fiscal Year 2070/71 BS (2014-15), a total of 10,000 seedlings of different tree species were planted on 6.36 ha of Kalika CF and Chetana CF. However, the survival rate of DFO plantation is also poor.

The RJKIP has mostly planted exotic species such as Eucalyptuses sps, Leucaena leucocephala (Ipil-Ipil in Nepali), Tectona grandis (Saagaun in Nepali) etc. The beneficiaries during discussion opined and suggested to plant indigenous species like Sal, Sissoo, Khayar and fodder plants to avoid further forest degradation and to meet supply of beneficiaries need. In project area there are 15 CFs and these can be encouraged to establish their own nurseries to grow native species by providing technical inputs on plant species selection, nursery establishment and sapling plantation from the project to make the plantation initiative successful and meaningful.

For compensating impacts by MoRJKIS Phase 2, an extensive afforestation program to control the sheet erosion and flash flooding in the project area will be implemented. The CF areas near irrigation escape points are the ideal areas for reforestation that were identified during transact walk survey. However, these areas need to be further assessed for seedling selection, suitability of selected species and number of plantings. The table below provides potential sites for compensatory plantation.

Table- 2-1 Potential plantation sites in RJKIP Area

S.N.	Potential Plantation Sites	GPS Coordinates	Area (Ha)	Remarks
1	Khotena Bhurakhani CF	28.51249°N; 81.13789°E	0.60	Tikapur Municipality -8
2	Bhagraiya CF	28.48757°N; 81.12197°E	0.50	Daulatpur Ghat
3	Kopila CF	28.59916° N; 81.16232° E	2.00	Lamki Chuwa 3
4	Sahipur CF	28.46504°N; 81.10601°E	0.65	Sahipur
5	BP Nikunj CF	28.48244°N; 81.04995°E	1.30	Bandarpur
6	Satti Karnali CF	28.45477° N; 81.08341° E	0.50	Satti

2.2.2 Wildlife

The Kailali district has records of 34 species of wild animals. Some frequently recorded animals in and around the district are tiger, elephant, bear, leopard, spotted deer, barking deer, blue bull, wild pigs, marten, leopard cat, field rat, hare, mongoose, langur monkey and rhesus monkeys. Dolphins are also the main attraction of this district at least in high water season along the Karnali, Mohana, Kadha, Kandra and Paththariya tributaries. However, the project's AOI is not the habitat for these animals, but they are frequently sighted because the Bardiya National Park in the East and Dudhwa National Park of India in the south border the district. These two National Parks are the main habitats for these large mammals and other animals.

There are two known wildlife movement corridors in the region: the Khata corridor in the East and the Basanta corridor in the West of the Rani Jamara Kulariya Irrigation Scheme. However, no wildlife movement corridors has been identified in the DIA of MoRJKIS Phase 2 and these wildlife movement corridors are about 7 km away from the project sites. The Basanta Corridor, which is used by large mammals for occasional movement between Bardia NP and Dudhwa NP, is located about 9 km west of project command area. The project has constructed canal crossings at adequate spacing along the feeder canal (Figure 2-1).

Figure 2-1: Canal crossing in the feeder canal constructed under MoRJKIS Phase I

Similarly, it was informed by the local residents that a herd of 10-12 Elephant used to roam around for 2-3 months in this area but now it has not been sighted for last two years. The migratory route for elephant seems along the Karnali River to the base of Churia hills. A feeder canal downstream of the hydropower location which is not part of MoRJKIS Phase 2 falls in this elephant route (Figure 2-2) and the project has proposed to construct an animal guide to facilitate the elephant movement

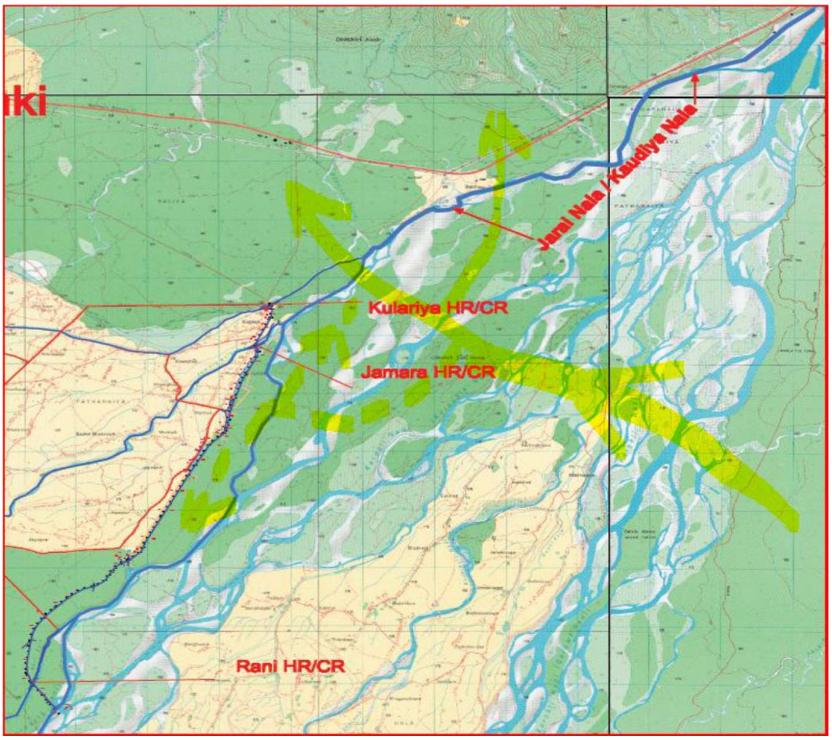


Figure 2-2: Occasional elephant movement corridor

The Tigers are also seen in the area. The tigers are mostly from the adjoining Bardiya as well as Indian National Park and travel to Badka Banuwa and reach up to Churia forest. These wild beasts are just wandering alone. A study on biodiversity survey along with adjoining district of Kailali is given in Table 2-2.

Table 2-2: List of wildlife in the district

Species	Kanchanpur	Kailali	RJKIP 2	Bardia	Status/GoN
Asian palm civet		1		1	
Asiatic elephant				1	Protected
Barking deer	1	1	Yes	1	
Blue bull	1	1	Yes	1	
Common leopard	1	1		1	
Hog deer				1	
Honey badger				1	
Hyena		1	Yes	1	Protected
Indian crested porcupine	1	1	Yes	1	
Indian grey mongoose		1	Yes	1	
Indian hare	1	1	Yes	1	
Jackal	1	1	Yes	1	
Jungle cat	1	1	Yes	1	
Langur	1	1		1	
Large Indian civet		1		1	
Leopard cat	1	1		1	Protected
Masked palm civet	1	1	Yes		
One horned rhino				1	Protected
Rhesus macaque	1	1	Yes	1	
Sambar	1			1	
Small Indian civet	1	1	Yes	1	
Spotted deer	1	1		1	
Striped squirrel	1	1	Yes		
Tiger	1	1		1	Protected
Wild boar		1	Yes	1	
Yellow throated marten	1	1			
Total	15	19		22	

In the project command area, human and wildlife conflict is a common phenomenon. The community people during discussion reported occasional disturbances by wild animals. The loss of livestock due to straying carnivores; raiding of crops by wild pig, deer; and occasional disturbances by elephant herds were their common concern.

2.2.3 Birds

Far West Nepal hosts several bird habitats ranging from forest and wetlands in the Tarai and up to the mountainous region. In total 500 bird species are recorded in this region and out of which more than 140 species of birds are recorded in the district. Suklaphanta Wildlife Reserve, Ghodaghodi Lake and Mohana River Corridor are the popular avian habitats in this region. In addition, a Vulture restaurant on the bank of the Khutiya River (located between Bardia National Park and Suklaphanta Wildlife Reserve around 13 km from Dhangadhi along the Eastern direction of the East -West highway near Attariya) is also located in this region. However, MoRJKIS Phase 2 will not have direct impacts on the birds of this region and their habitat.

2.2.4 Aquatic life

The Gangetic Dolphin (Platanista gangetica) are the main attraction of this district at least in high water season along the Karnali, Mohana, Kadha, Kandra and Patharaiya rivers. It is an endangered species of IUCN Red dada book and protected mammal by National Park and Wildlife Conservation Act 1973 of Government of Nepal. The

RJKIP area is also known for the freshwater Dolphins that are found in the Mohana River confluence with tributaries such as Kandha, Kandra, Pathariya, even in Gahirinala during monsoon when water levels are high enough and fish diversity is plentiful. The fish species common in this area are Sedhari, Dira, Charangi, Rawa, Darahi, Kurasa, Rohu, Saunri, Singhi, Dongi, Khesati, Tengra, Bam, Parani, Dhori, Harat and Mailawa.

The Dolphin sampling of July 2016 carried out by Dolphin Conservation Centre members on 16 locations along the 18 km stretch of Mohana River (Figure 2-3) reported a total of 63 dolphins. The highest concentration was reported from Mohana-Rapti and Patthariya-Mohana confluence with 8-8 individuals each. This suggests that the dolphins prefer the confluence of tributary with gentle flow of water with large volume, less noise and undisturbed areas.

During MoRJKIS Phase 2 field visit in September 2017, sampling was carried out following the procedure and man power of 2016 that revealed only 20 adults and 2 infants. The decrease of population compared to July 2016 might be because of the migration of Dolphin to the lower stretches of Karnali River Basin due to the low water level of dry season in the Mohana River.

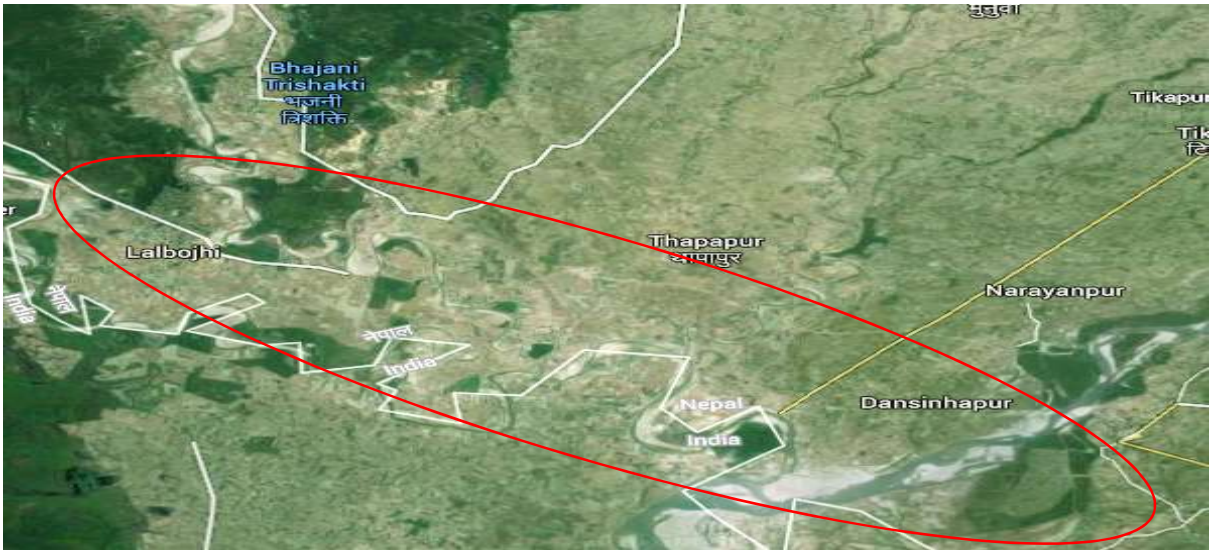


Figure 2-3: Dolphin population sampling (July 2016 and September 2017)

The Mohana river system with its tributaries (Pathariya, Kandra, and Gahirinala) is the preferred location for Dolphins and need to be managed for Dolphin rearing in future. These areas need water level maintained by controlling silt and sand entering into these river sections and adopting appropriate river training works. Efforts shall be made to prohibit haphazard fishing and rampant sand mining activities in these areas. With the help of the concerned agencies, the fishing licensing will be restricted to area with no Dolphin4 stretch of the rivers. The fish licensing by the district authority need to be scientifically validated to control the fish harvest. In addition, the sand and gravel extraction and trans-boundary fishing and poaching has also been observed and need to be controlled and monitored involving community as well as local authorities in the districts, Tikapur Municipality and WUA from project area.

The Dolphin Conservation Committee (DCC) which has more than 15 sub-branch committees in villages of each river confluence appeared to be proactive in the conservation of Dolphins and other wildlife despite of resource constraints. The DCC periodically involves local volunteers especially youth of that area to aware community on the importance of conserving wild animals and aquatic life. These volunteers also monitor the poaching, illegal

[4] The adverse situation of river system forced the dolphins in existing status of river and flow pattern seems migrating from high water level of lower Karnali basin of Nepal during low water season. Generally dolphins start their upward migration with the rise of monsoon flood by June and stay till August in those rivers and lowering of rain water causes them to swim back in higher water level around Nepal India border

hunting and fishing activities.

2.3 Safety and Canal Bank Protection

The safety concerns for human population and falling of wild animals and cattle into the feeder canal constructed under Phase 1 was reported during site visit. The cattle were observed grazing along the canal banks that has a detrimental effect on grass growth which further leads to soil erosion and bank failure as shown in Figure 2-5.

Figure 2-5: Cattle grazing along the canal bank

The canals system has a provision of steps constructed at an interval of 500 m near the bridge as shown in Figure 2.6. However, the effectiveness and use of these steps for human and animal survival after falling into the canal need to be established.

Figure 2-6: Steps for animal and human rescue from the canal

2.4 Feral Cattle

A large number of isolated large heard of feral cattle are found around the project area. These animal raid huge quantity of crops every year in the command area and have become a major threat to the beneficiaries of the project area. However, the actual population of these animal yet to be established in the project AoI and will need further assessment.

2.5 Bio-diversity Hotspots and important features in the AoI

The main forest area lies in the North and Eastern parts of RJKIP command area and some productive forests expand to the west of project area. The MoRJKIS Phase 2 does not have direct impacts to these forest patches. However, there will be induced impacts will affect these forest patches to an extent.

The main forests patches are Laljhadi, Basanta (Badka Banuwa), Bhajani, Dundejhadi, Baghamara, Bandarkhal Chure, Sattighat and East of Tikapur. These forest patches, that connect Tarai to Churia range are fragmented and degraded by cattle and human use. Tarai Arc Landscape (TAL) has initiated restoring some of these forest patches by barbed wire fencing considering their potential for biodiversity hotspot.

There are evidences of tiger occurrence in Basanta and Laljhadi in the past. Prey depletion coupled with human disturbances has affected the tiger movement through these forest patches and possible actions shall be taken to improve the habitat conditions and reduce the human induced pressures in these areas. The corridors of Basanta and Laljhadi are also the main focus of NGOs related to biodiversity and animal movement. TAL and other wild life related institutions are currently involved to enrich the habitat and to increase the natural movement of tigers. The grassland created with removal of invasive species in Basanta, Bardia and Khata area to support the prey base is aimed to attract the large carnivores as their migratory habitats in the long run.

Churia habitat in the north, which is used by large mammals was documented during the assessment done by TAL program, is connected with the lowland Tarai forest of the RJKIP area that spreads up to Suklaphanta National Park (SNP) in the west. The SNP is popular for deer population that supports large carnivores. The Southern part of SNP is connected to the Reserve Forest of Pilibhit Forest Division and Kishanpur Wildlife Sanctuary in Uttar Pradesh, India. The corridor from Churia to SNP, if improved and preserved properly can become the migratory routes for mega-herbivores and carnivores to Bardia National Park (BNP) that lies in the left bank of the Karnali River and Eastern boundary of RJKIP.

3. Biodiversity Impact Assessment and Proposed Mitigations

The Tables-3-2 and 3-3 below summarize the potential impacts of the project during construction and operating stages along with the prudent mitigation measures to address respective impacts to minimize the adverse impacts as well as to augment the beneficial impacts to the Biodiversity of RJKIP area.

The Tables 3-2 & 3-3 also identify the locations of each impact, its potential significance and duration based on the baseline status and identify the agencies that will be responsible for implementing each mitigation measure.

3.1 Beneficial Impacts

The impact of RJKIP development has two fold impacts on the existing biodiversity. The presence of increased water level in the canal system have positive impacts on the micro-climate within the project area such as increase in the moisture content in the air that relieves plants from "Moisture Stress"5 which otherwise occurs when the water in a plant's cells is reduced to less than normal levels.

The regular irrigation water supply in the project command area will also have a positive effect on the biodiversity. It will enhance the productivity of natural system to support the balancing of predator–prey relation. The enhanced floral and faunal diversity will further contribute to local economy to uplift the livelihood in and around project area. The Table-3-1 summarizes indirect beneficial impacts from the biodiversity conservation.

Table 3-1: Indirect benefit of biodiversity conservation

Environmental	Economic	Social
Flood control and availability of water Optimum utilization of barren land for productive use Improvement of existing biodiversity Soil fertility enhancement Availability of year round fresh water in the canals will be an important source for wildlife	Leisure and tourism activities Employment generation Land value improvement Development of market and commercial centers Tourism enhancement	community wellbeing and poverty reduction Improvement of health and education system Enhanced social harmony Improved access to and from the project area and nearest commercial centers Women development

[5] **https://en.wikipedia.org/wiki/Moisture_stress**

Table 3-2: Potential Impacts of the Project during Construction Stage and Potential Mitigation Measures

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
1.Forest Resource	• Excess soil erosion causing siltation in canal system • Increase in sheet flow and flash flood • Change in micro climate in project area • Reduction in Fodder and NTFP resources/products	RJKIP Project Command Area	M	L	P	• Formulation of compensatory plantation strategy and plan by the project before the start of the construction activity involving WUA and CFUGs • Establishment of nurseries involving CFUG • Compensatory plantation at the ratio of 1:25 under the compensatory plantation program of the project • Restrict free vehicular movement without permission to control illegal NTFP collection and logging.	RJKIP, WUA, CFUGs
2. Wildlife	• Habitat loss & defragmentation • Disturbance to Migratory routes • Increase in human and animal conflict • Threat of poaching and illegal hunting • Behavioral changes in Animals	RJKIP Project Area	M	L	T	• Preparation of Site Specific Environment Management Plan (SS_EMP) by the Contractor and duly approved by the Project before beginning of the construction activities in sensitive areas • The illegal wildlife trade by construction work force will be prohibited. Any encounter of wildlife during the construction will be reported to the concerned authority. • Install CCTV at locations where required to monitor wildlife movements in the project area during construction • Community will be encouraged to adopt the alternative crops and cropping pattern that are disliked by the animals • Maintain the connectivity between the forest • Avoid migratory routes to the possible extent • Realign the canal alignment or minimize the disturbance to the traditional migratory routes • Regular communication and consultation with WUA, CFUGs, Wardens and District Forest Authorities • Prohibition to enter into the forest • Restriction on construction activities during peak migration period • Construction activities during night discouraged • Labor camps will be constructed away from forest boundary • Leftover food and items will be disposed properly in pits or designated places • Night movements of labor forces will be strictly controlled;	RJKIP, WUA, CFUGs, CC

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
						• Labors will kept in group in the camp • Labors will be prohibited to keep dogs and chickens with them during their stay in the camps that are near to the forest • Labor's children below 10 years will not be left unattended in the camp; • Awareness Campaign to the Labors, stakeholders and local communities	
3. Birds	• Habitat loss and disturbance to migratory patterns • Illegal hunting and Poaching	RJKIP Project Command Area	M	L	T	• Prohibition of illegal hunting & poaching; • Avoid or minimize felling large canopy trees • Practice judicious use of pesticides through IPM • Conduction of awareness program on regular basis • Plantation of tall (Simal) and large canopy trees (Bar, Pipal, Sami etc)	RJKIP, WUA, CFUGs, CC
4. Aquatic life	The Mohana River and its tributaries are enriched with Dolphins, Crocodile and other fish population and aquatic fauna. The following key impacts during construction envisaged such as: • Fishing with illegal means affects the Dolphin prey; • Excessive noise and vibration from heavy construction machinery have adverse impacts on Dolphin movements • Spillage of toxins, oils and lubricants into water bodies kill infant and young dolphins and other aquatic faunas • Excessive use of sand mining smother the breeding/spawning grounds for fish and crocodiles	Mohana River and its tributaries	M	L	T	• Effluent shall be passed through series of settling ponds before disposing into the main water bodies • Heavy machine works during migration or presence of Dolphins shall be avoided • Sand mining will be strictly avoided from the spawning areas • Water levels at Dolphin movement areas will be maintained • Spillage of toxins and other lubricants will be strictly controlled and prohibited • Facilitate to implement controlled fishing with license • Facilitate for heavy penalty or imprisonment for illegal fishing taking support from the GoN and local administration • Regularly monitor fishing activity and dismiss any laborer caught fishing by any method • Regular monitoring of DO, temperature, PH, turbidity, Total Suspended Solid (TSS) etc. to maintain the river water quality suitable for aquatic fauna • Disposal of effluent from Tikapur Municipality will be discouraged in coordination with the Tikapur Municipality; • Effluent treatment lagoon will be constructed for treating the sewerage before disposing it to main water bodies maintaining the Effluent Standard prescribed by the GoN. • The ecosystem of lower Karnali River will be considered as a	RJKIP, Local Administration; Dolphin Conservation NGO, CC

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
						single conservation unit and priority will be given to preserving all of its components including fishes that provide food for the Dolphins as well as the indigenous people. Efforts will be made to establish the entire area as conservation area and its management shall be given to local bodies[6] • The Dolphins usually feed upon smaller fishes and shrimps, the mesh size of fishing nets can be regulated so that the fishermen catch only larger fishes and allow smaller fishes to escape. It was observed that the use of gill net is destructive to the fishing population as it entangles fishes of all size that ultimately hampers breeding fish population though instances of dolphin entanglement have not been reported[7]; • Unless the local people recognize the significance of wildlife values of their immediate surrounding and the river dolphins as a whole, implementing many of the recommendations that involve local participation would not yield desirable success. Both local and national media, print (newspaper and magazines) and electronic (radio and TV), will extensively be made use of, in highlighting the issues on the existing dolphin population[8]; • The study has found that the local communities have religious and cultural belief regarding dolphin as a holy animal, conservation effort will be built on their existing belief rather than trying to impose a scientific basis for conservation at the very beginning[9].	

Legend:

Significance H-High; M-Medium and L-Low;

Impact Duration L-Long; M-Medium and S-Short;

Impact Type P-Permanent (Irreversible) and T- Temporary (Reversible);

[6]WWF Nepal May 2006, Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal
[7]WWF Nepal May 2006, Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal
[8]WWF Nepal May 2006, Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal
[9]WWF Nepal May 2006, Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal

RJKIP Rani Jamara Kulariya Irrigation Project;
CC Construction Contractor
CFUG Community Forest User Group
CBO Community Based Organization
WUA Water User Association
NGO Nongovernment Organization
DFO District Forest Office
BCN Bird Conservation Nepal

Table 3-3: Potential Impacts of the Project during Operation Stage and Potential Mitigation Measures

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
1.ForestResource	• Conservation of plantation and natural forests around project command area	RJKIP Project Command Area	M	M	T	• Encourage regular pruning and trimming of trees in the CF to allow healthy forest growth. • Encourage agro forestry to minimize the pressure on community forests;	RJKIP, WUA, CFUGs
2. Wildlife	• Human and animal conflict • Increment in wildlife population • Poaching and illegal hunting	RJKIP Project Area	M	L	T	• Facilitate for increment of Buffer Zone area and aware locals on potential area of conflicts with the wild animals • Install CCTV where ever required and necessary to monitor the wild life movement with the help of TAL project to reduce human animal conflict and poaching. • Involve CFUG members especially youth to monitor the illegal poaching and identify the root causes for the incidents	RJKIP, WUA, CFUGs, DFO
3. Birds	• Impacts of use of pesticide on bird population.	RJKIP Project Command Area	L	S	T	• Implement of Integrated Pest Management program • Encourage to establish Bird Watching Centers in project area; • Improve wetlands around the project area; • Conduction of awareness program on regular basis	RJKIP, WUA, CFUGs, BCN, NGOs, CBOs

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
4. Aquatic life	The Mohana River and its tributaries are enriched with Dolphins and other fish population and aquatic fauna. The following key impacts during operation envisaged such as: • Surface runoff with high concentration of pesticide from the agriculture field or canal escape • Fishing with illegal means affects the Dolphin prey • Sand mining by the communities in areas sensitive to Dolphin • Reduction in water level may impact Dolphin population	Mohana River and its tributaries	H	L	P	• Facilitate to construct the effluent treatment for treating the sewerage before disposing it to main water bodies maintaining the Effluent Standard prescribed by the GoN • Coordination with Lamki Cluster of President Chure-Terai Madesh Conservation Development Board to organize joint conservation activities as it supplies conserve and recharge ground water that discharges into Mohana river and its tributaries to increase the water level in these river system to ensure the survival of Dolphins in this area • Coordinate with GoN and local administration to impose heavy penalty or imprisonment for illegal fishing and thoroughfare in the Dolphin habitat areas. Controlled fishing with licensing will be encouraged and regularly monitored. • Facilitate to control sand mining from the spawning areas in coordination with local bodies and the government. The local GoN and administration will be encouraged to issue license only for already disturbed river segments and rotate such activities in a sustainable manner and ban remaining areas for mining activities[10] • Maintaining the water levels at Dolphin movement areas • Regular monitoring of DO, temperature, pH, turbidity, Total suspended Solid (TSS) etc. to maintain the river water quality suitable for aquatic fauna • Coordinate with authorities for prohibition on the use of gill net during fishing as it entangles fishes of all size that ultimately hampers breeding fish population. • Both local and national media, print (newspaper and magazines) and electronic (radio and TV will used to highlight the issues on the existing Dolphin population	RJKIP, Local Administration; Dolphin Conservation NGO.

[10]WWF Nepal May 2006, Status, Distribution and Conservation Threats of Ganges River Dolphin in Karnali River, Nepal

Sector	Potential Impacts/Activity	Location	Significance	Impact Duration	Impact Type	Proposed Mitigation	Responsibility
3. Feral Cattle	• Raiding of agricultural crops every year • Cattle falling in to canal system; • Canal bank failures due to excessive grazing along the bank	RJKIP Project Area	H	L	P	• Encourage development of controlled community managed raring centers; • Encourage castration to control the reproduction • Fencing along both side of canal to control grazing as well to control cattle falling into the canal system; • Awareness program on income generation from feral cattle	RJKIP, WUA, NGOs, CBOs, Local Bodies

4. Biodiversity Monitoring Plan (BMoP)

The Biodiversity Monitoring Plan (BMoP) is employed during project implementation to provide support to the biodiversity protection measures identified during Biodiversity Assessment (BA) exercise.

The BMoP is built on and expands the mitigation measures outlined in the BA and provides the mechanism through which the measures are physically executed and their performance are checked to ensure that:

- All of the actions required and related mitigations measures are addressed as set out in the BMP
- The actions mitigate the impacts and protect the environment as intended
- The residual impacts due to unexpected activities or any other reasons occurring during project execution are recorded and addressed by applying additional mitigation measures

The environmental compliance during the project implementation will be ensured by adhering joint regular monitoring by Project Environment Management Office (PEMO) and contractor's representatives. Monitoring activities include:

1. Carryout project level monitoring activities jointly by PEMO officials and the Contractor representative
2. Carryout Baseline, Impact and Compliance monitoring on monthly basis to ensure effective implementation of mitigation measures prescribed by BA
3. Carryout and facilitate the Contractors to execute various SS-EMPs during implementation of the works as specified in the documents

The RJKIP will keep provision for three comprehensive monitoring by an external independent consultant to assess the performance of safeguard implementation in the project. The schedule of such monitoring shall be as follows:

a. first monitoring- one year from the project start date
b. second monitoring- middle of the project execution
c. third monitoring- after the completion of the project

The Table 4-1 below shows the EMoP for Construction and Operation phase of RJKIP. However, it is envisaged that during operation of the project, there will not be major environmental impacts; hence there is no need for extensive environmental monitoring.

Table 4-1: EMoP for Construction and Operation Phase of RJKIP

Impact/Activity	Mitigation	Monitoring Parameters	Method	Res.	Frequency	Location	Project Phase	
							Const.	Opr.
Forest Resources	Compensatory plantation, formulation of plan for compensatory plantation; Nursery establishment and plantation @ 1:25 in already determined areas involving CFUGs Fencing of forest for regeneration and restoration	Formulation of compensatory plan, SS-EMP of plantation sites, Sapling survival rates , indications and presence of pests and disease, invasive species, human encroachment, and other unauthorised activities meeting minutes with CFUGs and WUA	Walkover surveys, discussion with CFUGs, WUAs, Project officials and Document verification	RJKIP, CC	For the first year of project , every three months and after that every six months	Nursery, Plantation sites and forest	√	
Illegal felling of trees and Biodiversity improvement	Nursery establishment, controlled movement using canal feeder road, agro forestry to minimize pressure on CFs	Seeding status at respective nursery sites, agro forestry plans and mechanism for access control, sapling selection suitable for local climatic condition as well as meeting demand and expectation of beneficiaries	Walkover surveys, discussion with CFs and WUA	RJKIP, WUA, CFUGs	Every six months up to five years from project completion date	Nursery and Plantation sites		√
Wildlife Habitat loss, defragmentation, threat to illegal poaching and hunting	SS-EMP preparation by the Contractor, avoid working during peak migration period, change in cropping pattern, thoroughfare inside forest restricted area; realignment of canal and its ancillary structures where ever possible and applicable	SS-EMP documents review, walk over in sensitive areas, visit to labour camps, inspection of housekeeping in and around labour camp; check about awareness programs for labours	informal discussion, visual inspection of labour camps and surrounding area	RJKIP, WUA, CC	At least once in a week	Construction site in sensitive areas, labour camps, forest areas	√	

Impact/Activity	Mitigation	Monitoring Parameters	Method	Res.	Frequency	Location	Project Phase	
							Const.	Oprn.
Frequency of human and wild life conflicts recorded, frequency illegal hunting and poaching.	Increase buffer zone, monitoring through CFUG involving youths and installation of CCTV cameras.	Conflict evidences between human and animal and illegal hunting; animal movement footage.	Documentation, CCTV footage	RJKIP, WUA, CFUG, DFO	Every six months on regular basis or as per the situation up to five years from the date of project completion	Respective sites		√
<u>Birds</u> Habitat loss, disturbance in migratory routes, decline in population, illegal hunting and poaching.	Protect large canopy trees; awareness, judicious use of pesticide.	Presence of large canopy trees, birds population census, evidence of poaching and hunting; observation on migratory birds or new species	Walk over survey, bird watching, group discussion, visual observation	RJKIP, WUA, CFUG, DFO	Twice in a year, one during migratory season	Project area and nearby CFUGs and forest and wet land	√	
Increase/decline in bird population; IPM impact on birds; illegal hunting and poaching	Large canopy tree plantation; awareness, judicious use of pesticide.	Observation of migratory birds flocks, reviving of wetlands in and around project area	Walk over survey, bird watching, group discussion, visual observation, Bird census.	RJKIP, WUA, CFUG, DFO, NGO	Migratory season up to five years from the date of project completion	Project area and nearby CFUGs and forest and wet land		√
<u>Aquatic life</u> Direct discharge of effluent in to the river, excessive fishing and sand mining, excessive noise and vibration, release of toxins and pesticides into water bodies, human encroachment and thoroughfare.	Refer table-3-2 and 3-3 above	Incidences of sand mining and illegal means of fishing, establishment of settling ponds before disposing the toxins or waste water from construction equipment; effluent management from labour camp		RJKIP, WUA, DFO, NGO	Twice in a year before and after rainy season		√	
Direct discharge of municipality effluent in to the river, excessive	Refer Table-3-2 and 3-3	Dolphin population census, incidences of discharge of	Dolphin population census; walkover	RJKIP, WUA,	Twice in a year before and after	Sensitive areas of Karnali,		√

Impact/Activity	Mitigation	Monitoring Parameters	Method	Res.	Frequency	Location	Project Phase	
							Const.	Opr.
fishing and sand mining, excessive, release of pesticides into water bodies, human encroachment and thoroughfare.		effluent in the Karnali and Mohana river, incidences of sand mining and fishing	survey; discussion with municipality and visual observation and verifying licenses of sand miners and fisher men.	DFO, NGO	rainy season up to five years from the date of project completion	Mohana river and its tributaries.		
Feral Cattle Crop raiding, rampant grazing; falling into canal	Refer Table-3-3	Census to determine the exact population, castration of animals, establishment of community managed feral cattle raring centres	Visual observation, walk over surveys, document verification.	RJKIP, WUA, DLSO	Twice in a year	Each rearing centres in project command area	√	
Crop raiding, cattle falling into canal, canal bank failure	Refer Table-3-3	Cattle population inside the raring centres; numbers of cattle fall into the canal, status of pasture lands; establishment of fencing along the canal bank, grass growth status along the canal bank	Visual observation and census	RJKIP, WUA, DLSO	Once in a year up to five years from the date of project completion	Each rearing centres in project command area		√

5. Institutional Arrangements of RJKIP and Water User Association (WUA)

The Organization Chart of RJKIP is presented below. At present, Environmental and Social Safeguard Section is managed only by the Senior Sociologist taking support from Project Implementation Office (PIO). However, during construction of RJKIP, it will be strengthened with following provisions as mentioned below:

- The Project Director of RJKIP will have direct administrate control on the Section
- The Senior Sociologist, who has been working in RJKIP for substantial period of time, has good rapport among the stakeholders of the project command area. He will be made responsible to manage day to day activities of the Section;
- Considering the sensitivity and requirements to cover and monitor the large command area of the project, each command area will have one environment and one social safeguard officer for construction period
- To implement the provisions of BMP during execution of project, one Environmentalist having experience in floral and faunal biodiversity will be recruited.

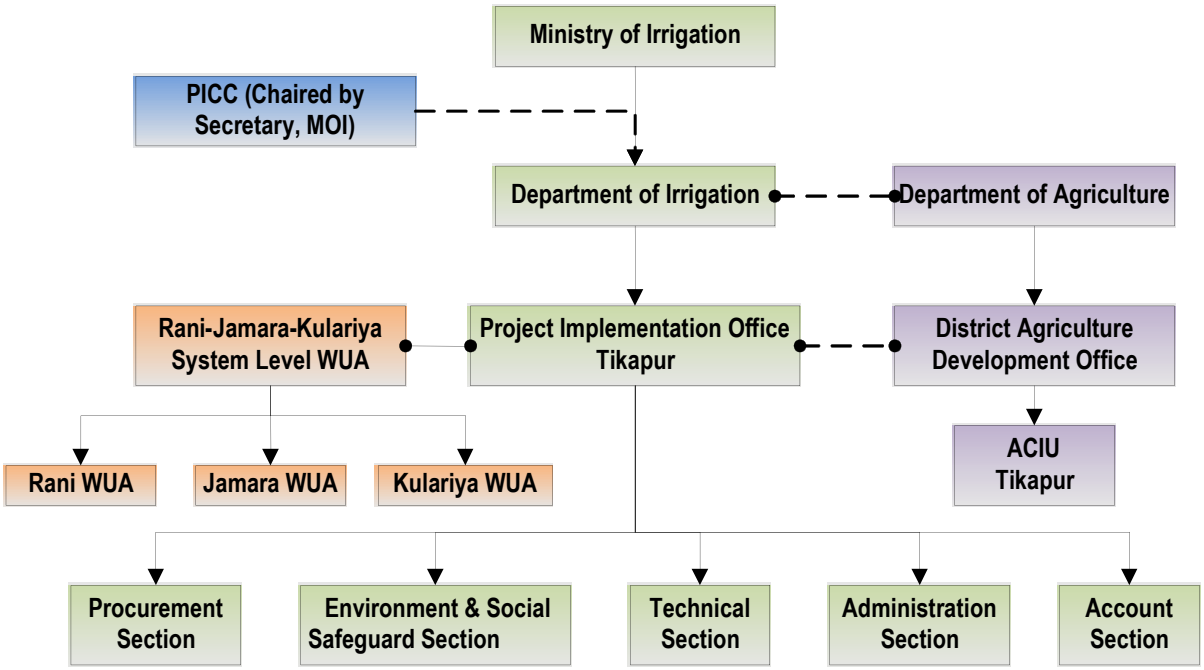


Figure 5-1: Organization Chart of RJKIP

The Organization Chart of WUA, RJKIP will be as presented below:

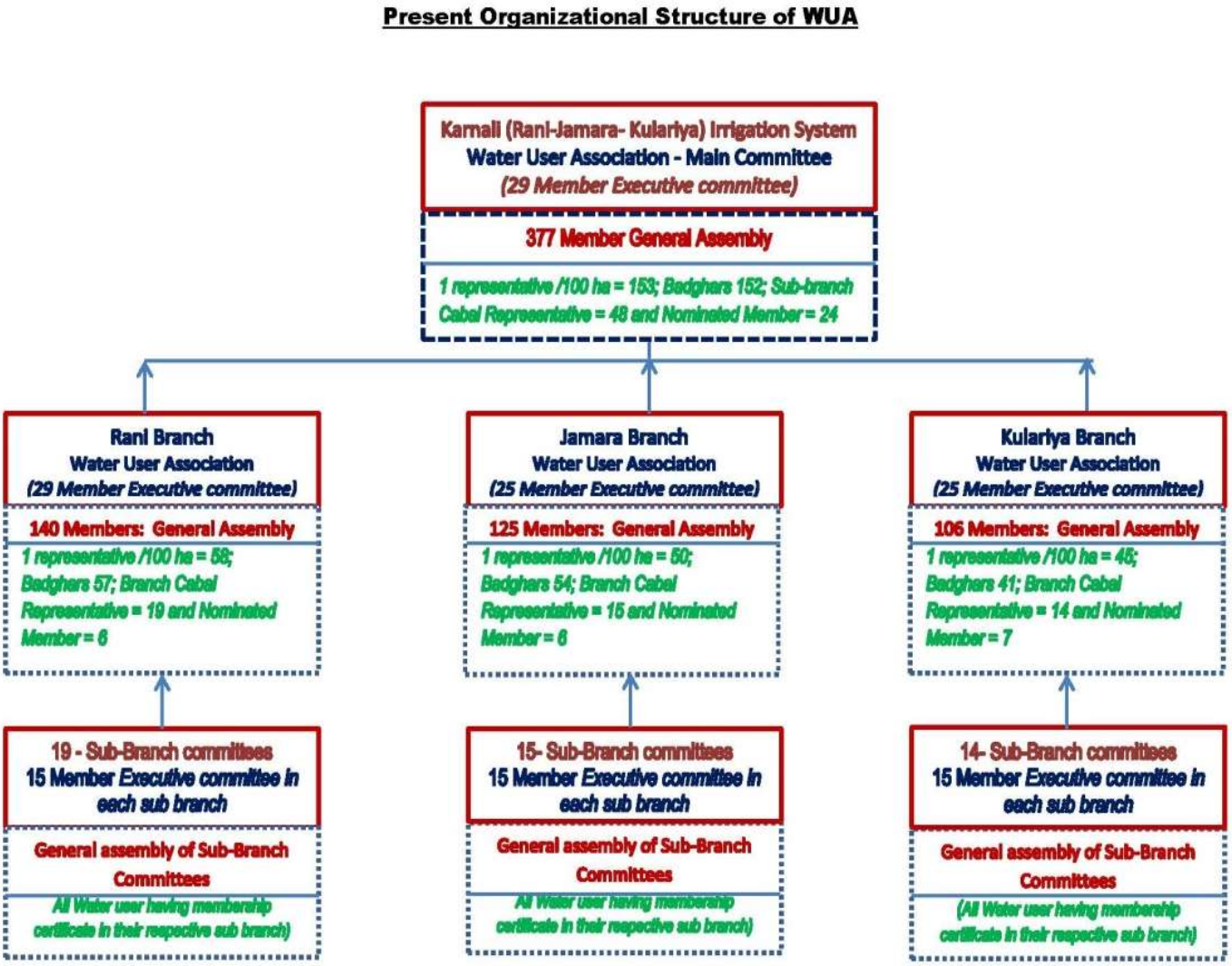


Figure 5-2: Organization Chart of RJKIP

6. Biodiversity Management Plan (BMP)

6.1 Introduction

In Nepal, biodiversity is closely linked to the livelihoods and economic wellbeing of millions of rural people who directly depend on natural resources for meeting their daily subsistence needs and cash income. Therefore, Biodiversity is important in a number of ways:

1. species have utilitarian (subsistence and commercial) value to human;
2. biodiversity represents the natural balance within an ecosystem that provides a number of ecological services, including nutrient cycling and pollination of plants; and
3. Species have intrinsic value.

Therefore, conserving biodiversity is an essential part of safeguarding the biological life support systems on the Earth11. The fundamental goal of Biodiversity Conservation and Management plan (BMP) is to check the anthropogenic pressures on the natural resources. It needs a sustainable use and management of resources and habitats and community participation in the conservation12. The BMP for the RJKIP area has been formulated considering the wildlife (fauna and flora) profile of the region, customs and cultures of the indigenous Tharu community in particular and the beneficiaries of command area at large.

6.2 Initiatives on Biodiversity Conservation and Management

6.2.1 Dolphin Conservation

Dolphins are aquatic cetacean mammals comprising marine dwellers and fresh water river dwellers. Among seven fresh water cetacean species (WWF Species factsheet 2007), Ganges river Dolphin (Platanista gangetica, Roxburgh 1801) is found in South Asian river throughout India, Nepal, Bangladesh whereas the other closely related Ganges dolphin (Platanista gangetica minor) is found in Indus river in Pakistan.

This fresh water charismatic mammal had once thrived throughout the “Ganges, Brahmaputra, Meghna” and “Karnaphuli, Sangu” river systems of Nepal, India, and Bangladesh, from the Himalayan foothills to the Bay of Bengal (WWF Species factsheet 2007, Chalise 2008, 2015). The IUCN has listed as "Endangered", all the species of river dolphin such as Amazon River dolphin, Indus river dolphin and Ganges river dolphins.

The GoN, National Park and Wildlife Conservation Act 1973 has categorized the Gangetic Dolphin (IUCN Red List) as endangered and protected mammal species. The report indicated that, a few years ago, populations of the Ganges River Dolphin were about 4,000 to 5,000 and recent censuses found only about 1,200 to 1,800 Ganges River Dolphin in the entire distribution range (Smith et al. 2004). According to (Mohan et al. 1998) rampant sand mining is one of the greatest threats to the Gangetic Dolphin species. The BA baseline reported The Mohana river system with its tributaries (Paththraiya, Rapti, Kandha, Kandra, and Gahurinala) is the preferred location for Dolphins. Therefore habitat restoration and conservation initiatives will be initiated in these areas. The activities recommend are:

1. **River bank correction and protection-**The river banks of Mohana river system are very fragile and

[11]NEPAL NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN 2014-2020
[12]BIODIVERSITY MANAGEMENT & CONSERVATION PLAN of Lower Siang H.E. project (2700 MW), Arunachal Pradesh

prone to erosion and some of its areas are even flattened due to flooding as shown in photograph below. It is planned to train the river for about 1500 m at the confluence of Kandra, Paththraiya with Mohana initially with RCC vertical retaining structures with smooth surface facing water to maintain regular water flow. The gabion retaining structures as practiced in Nepal for river training works will be avoided (It might pierce the skin of Dolphins after rusting) However, detail assessment will be carried out to ascertain the correction and protection works involving specialist who have extensive working experience in this field.

Figure 6-1: River banks siltation and massive bank cutting by flood water

2. **Cleaning of River bed-** Annual bank cutting and eroded silt and soil from the Churia range accumulates bed load in the Mohana River. These activities have resulted in raising the Mohana River bed level and have reduced the depth of the river required for Dolphin movement. Dolphins prefers at least 3-4 m of water depth for free movement and RJKIP will have a plan to clean twice in a year before and immediately after rainy season, however the cleaning frequency and time of cleaning will be finalized based on the assessment and the recommendations by the specialist.

3. **Garbage and Effluent Management**- The throwing and dumping of garbage directly into the river system or its banks need to be strictly prohibited. The effluent and other waste from Tikapur Municipality need to be treated before discharging into the river. The Tikapur Municipality will be encouraged to manage the household waste and discharge effectively to protect the river ecology. The project will organize consultation with the Mayor, WUA and other stakeholders and take decision on the basis of consultation outcome.

4. **Habitat improvement along the River Bank-**Habitat improvement (such as river training, restoration of wet land, awareness) along the riverbank of Mohana and Karnali will help in controlling the riverbank erosion**.** River banks areas of Mohana and Karnali are also used as the wetlands by the avian fauna of the region. The wetlands are dependent on rich and diverse vegetation and robust river embankments as they provide good source of natural humus required for the enhancement of the aquatic flora and fauna population. The parts of Karnali and Mohana River banks require habitat improvement to augment the wetlands that are currently degraded. The local bodies, WUA and stakeholders will be encouraged to participate in this activity to make the activity successful. .

5. **Dolphin observatory-** Dolphins in large number are observed on the confluence of the Mohana River tributaries and along the Mohana River system. Dolphin observatory, apart from promoting tourism, can also become a source of income to the area and Dolphin Conservation Society. The Dolphin Conservation Committee (DCC) has already constructed an observatory in Dhungana Tole (Figure 6-2)

with the financial support from Department of Tourism and WATLC. Pattharaiya-Mohana and Rapti-Mohana confluence are the potential sites for Dolphin observation based on 2016 survey and RJKIP will work with DCC to promote home stay and Dolphin Observatory in these areas.

6. **Augmentation of Karnali water to Pathariya River during Winter-** There is a possibility to increase the water depth of Pathariya River during winter by augmenting Karnali water through canal system modification and its proper operation. The surplus water during winter (8 m^3/sec) which is not in use of irrigation will be passed through Basanta, Mahuriniya and Beluwa sub branch canal to Pathraiya River to increase water depth. This will help the Dolphin population during winter by increasing water level of Pathariya.

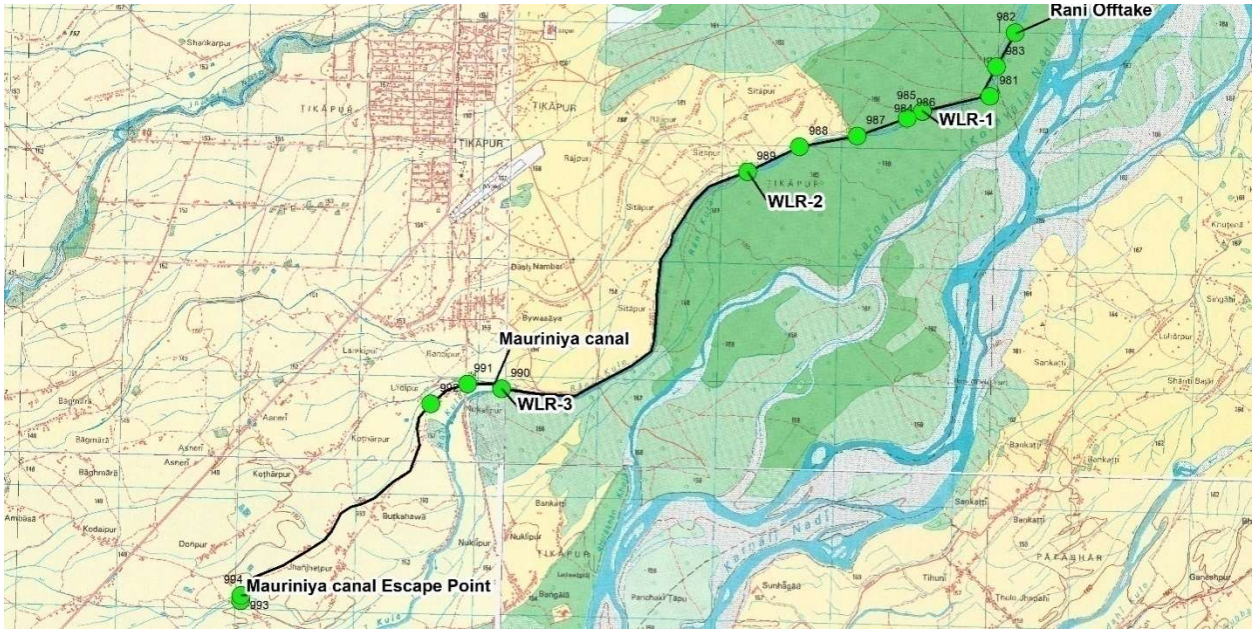


Figure 6.2: Rani System canal alignment used to augment water in Pathariya River during winter

Fig 6-3: Dolphin Observatory supported by DCC in Dhungana Tole

7. **Biodiversity conservation support to local Dolphin Conservation Committee (DCC) -**
In Kailali district, Dolphin Conservation Committee (DCC) has been dedicately working in the field of biodiveristy conservation since 1995. Currently, it is active in biodiversity conservation in RJKIP

command area with its 15 sub-centers spread at different locations. The orgnization is currently led by Mr Bhoj Raj Shrestha (Guleli Baje) senior citizen of the society and further backstopped by Secretary Mr Bijay Raj Shrestha. The RJKIP will partially support DDC for office operation, Dolphin resaerch and data collection and awareness programs for Dolphin conservation and promotion. The RJKIP willl also sponser DCC an education and exposure to Turtle Breeding Center, Wildlife Park and Wetland areas in Jhapa and Morang districts (Kalikoshi Saatkanya Wetland, Betana Taal and Shinghiya complex to explore possibilities of revenues from conserving natural resources.

6.2.2 Linking Chure with Fragmented Forest Patches and Conservation- The Chure range (also called 'Shivalik' is the youngest mountain formed by the deposition of river materials around 40 millions year ago) extended from Indus river of Pakistan in the West and Bharamaputra of India in the East. The Chure range has covered around 12.78% of the total land area of Nepal. The range has become fragile due to increased anthropogenic activities. In addition, the rivers and rivulets from Mahabharat range flow through Chure to the Tarai of Nepal and they further erode the fluvial weak and unstable sedimentary rocks that has aggravated soil erosion and soil mass deposition in the Terai river flood plains. The biodiversity and productivity of Chure range north of RJKIP is also decreasing gradually because of deforestation, over exploitation of forest products, open grazing and unscientific use of the land. The thick and intact Chure range is a good corridor for the wildlife movements and will support mega herbivore and carnivore of the area. In addition, the fragmented forest patches around the RJKIP command area need to be linked with chure area for effective movement of wildlife from Bardia NP and Suklaphanta Reserve. RJKIP will work with Chure-Terai Madesh Conservation Development Board, CFUGs, WUA and other stakeholders of the project area to support the biodiversity conservation and resolve human-wildlife conflict In the project area.

6.2.3 Afforestation and Compensatory Plantation works- It is reported that RJKIP phase 1 has cleared 10,432 trees from the project area for their construction. Therefore to compensate the loss, RJKIP has already initiated compensatory plantation at 1:25 ratio. To make the ongoing plantation more effective, RJKIP will establish 15 nurseries in each CF covering command area for all three irrigation schemes in consultation with beneficiaries, CFUG members and WUA. The Project will promote production of native tree seedling to support and meet local needs and demands for future plantation. The fragmented Saal forest will be protected to enhance regeneration as well as to control the thoroughfare and open grazing. Similarly, suitable NTFP plantation will be carried out on the canal banks and open areas to promote income generation activities. The adjacent community or beneficiary groups that are responsible to take NTFP harvest will be made responsible for the protection and conservation of the NTFP plantation sites.

6.2.4 Management of Feral Cattle- The census on feral cattle will be started with the start of phase 2 project activities. The beneficiaries, community members, WUAs, local bodies, official from project affected municiplities, representative from Department of Livestock Office (DLSO), District Forest Office (DFO) will be consulted for the establishment of Community Managed Feral Cattle Sheds and its impacts and benefits. There shall be at least one such shed in each respective command area of RJKIP. The project affected municipalities in association with DLSO, RJKIP and WUA will be encouraged to initiate program on microchip implant[13] on domestic and feral cattle as widely practiced in Africa and has following benefits:

a. Control communities in project command area from sending their cattle in forest or open area after drying lactation or becoming old and effective;

[13]https://en.wikipedia.org/wiki/Microchip_implant_(animal)

b. Identify and recover lost and stolen cattle;
c. Breed Registry database[14];
d. Cheap, easy and safe on animal and humans.

6.2.5 People Biodiversity Register (PBR)[15]- Peoples Biodiversity Register (PBR) will be maintained with the help of local people. People have traditional knowledge on medicinal plant species and other economical uses of plants but they do not exchange their knowledge due to various reasons. The RJKIP area is well known for ancient farmer managed irrigation and agricultural practices and folk varieties. The PBR will be helpful in recording such types of knowledge that contains comprehensive information on the medicinal plant species, NTFPs, cultivar species, critical habitat folk varieties and land race species (local). Preparation of PBR will require various researches and bio-surveys and the universities or local research institutions will be mobilized for bio research through Local Environment Management Committee (LEMC). The RJKIP Will support the PBR activities in consultation with LEMC.

6.2.6 Joint Forest Protection and Management Plan/Program- Joint Forest Management in collaboration with District Forest Office (DFO), CFUGs and local bodies, WUAs in RJKIP AoI will be carried out for forest conservation. The RJKIP in association with DFO, WUAs and CFUGs will constitute Forest Conservation Committees (FCC) in different villages in AoI and provide the necessary facilities and equipment viz. gloves, helmets, aprons, shovels, pick axes, beaters, extinguishers, chain saw to protect adjoining forest from fire, grazing, overexploitation, illegal logging, hunting and poachingby the FCC. These committees will be paid incentives for a period of five years on annual basis.

6.2.7 Quiz Context and other Conservation related Program for Schools-These initiatives will be carried out on regular basis to generate sense of responsibility in school children and broaden their knowledge on environment, biodiversity and wild life conservation and their importance for the sustainability of ecosystem in the universe. A week long environmental program will be conducted every year during construction period on June-5 (Environment Day) every year to celebrate environment week followed by plantation, garbage collection and disposing at designated place and program in radio/local FM on biodiversity conservation.

6.2.8 Canal Safety and Turfing with grass patches along the banks-The fencing along canal bank will be carried out to avoid falling and trapping of cattle, children and human into the canal. The black spots (risky areas) will be identified and fenced with chain link or metal fence and rest of the areas will be fenced with live fence using bushy plants. The unlined portion of bank above the concrete lining will be covered with grass turf to protect it from erosion and open grazing along the turfed canal bank will be discouraged.

6.2.9 Occupational Health and Safety Programs for Safe Implementation of BMP- The World Bank/IFCEHS guideline will be followed for the provisions during the execution of works[16].

6.2.10 LEMC re-formation and activation considering Phase-2 works of RJKIP-The proposed LEMC will act also as Biodiversity Management Committee (BMC). The LEMC will be an advisory body within the RJKIP to advice on the biodiversity and related conservation initiatives under the direct administrative control

[14]https://en.wikipedia.org/wiki/Breed_registry

[15]Biodiversity Management Plan of Lower Siang H.E. Project (2700 MW) in Arunanchal Pradesh, India

[16]http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies standards/EHS-guidelines

of the Project Director of RJKIP. The proposed LEMC to contribute as BMC as well will be comprised of following members:

1. Chairman of District Coordination committee- Chairman
2. Mayor of Tikapur, Janaki and Lamki Chuha Municipality-Member
3. Chief District Officer-Member
4. District Forest Officer- Member
5. Agriculture Extension and Soil Conservation Officer- -Member
6. Warden of Bardiya National Park-Member
7. Coordinator, Terai Arc Landscape Programme (TAL)-Member
8. Local NGOs working on Conservation and Environment-Member
9. WUA Chairman—Member
10. Representative, FECOFUN-Member
11. Community Forest User Groups in the project area-Member
12. E&S Safeguard Section Chief of RJKIP- Member Secretary

6.3 Impact of Climate Change on Pest Management in RJKIP

The geographical distribution and population dynamics of insect pests, insect-host plant interactions, abundance of natural enemies and efficacy of crop protection technologies are triggered by climate change and global warming[17].

Pest outbreaks occurred more frequently, particularly during extended periods of drought, followed by erratic rainfall and flooding. Some of the components of pest management such as host-plant resistance, bio-pesticides, natural enemies and synthetic chemicals will be less effective due to sudden rise in temperatures, UV radiation and reduction in precipitation. It has also been reported that the rate of insect pests multiply with the increase in CO^2 and variation in temperature[18].

According to Nepal's Central Bureau of Statistic (CBS), about 30-35% of crop production has been damaged by insect pest, diseases and weeds. The reduced winter crop production due to lower post-monsoon precipitation and high proportion crop damage by different types of pests has become serious threat that causes food insecurities and malnutrition (about 60% of child deaths are due to malnutrition) among the children in rural Nepal. The statistic also estimated that about 518,000 children under five year's age are suffering from acute under-nutrition or wasting and have a heightened risk of morbidity and mortality19. Therefore, RJKIP will conduct the research to assess the impact of climate variability and extreme weather events on pest management in the RJKIP command area using quantitative and qualitative techniques.

6.4 Communication and Outreach Program[20]

The Information dissemination and consultation strategy for BMP and PMP will be categorized into two broader divisions that are: awareness creation and showcasing successful case studies.

17 Sharma, H C (2014) Climate Change Effects on Insects: Implications for Crop Protection and Food Security. Journal of Crop Improvement, 28. pp. 229-259.
[18]Reddy PP (2014) Impact of climate change on insect pests, pathogen and nemotodes. Pest Management and Horticulture Ecosystem; 9(2): 225-253.
[19]Pandey S (2017) Climate change and Nepal's food insecurity. Kathmandu Tribune: Exclusive News from Nepal & the World.
[20]Project for Agriculture Commercialization and Trade (PACT), supported by the World Bank under IDA.

The first phase will be concentrated on developing and disseminating strategies and creation of awareness programs. It will include development of information, education and communication material, behavior change communication tools, workshops, tours, public displays, mass media messages, broadcast and multimedia modes.

The second phase will be focused on the showcasing the project interventions carried out in the project and it's AoI for the sustainability of RJKIP. The tools applied for this initiatives will be print media, mass media outlets, production of visual inventories with fact sheets, personal experiences of WUAs, CFUG members, project officials, documentary production on successful cases and broadcasting them in mass media.

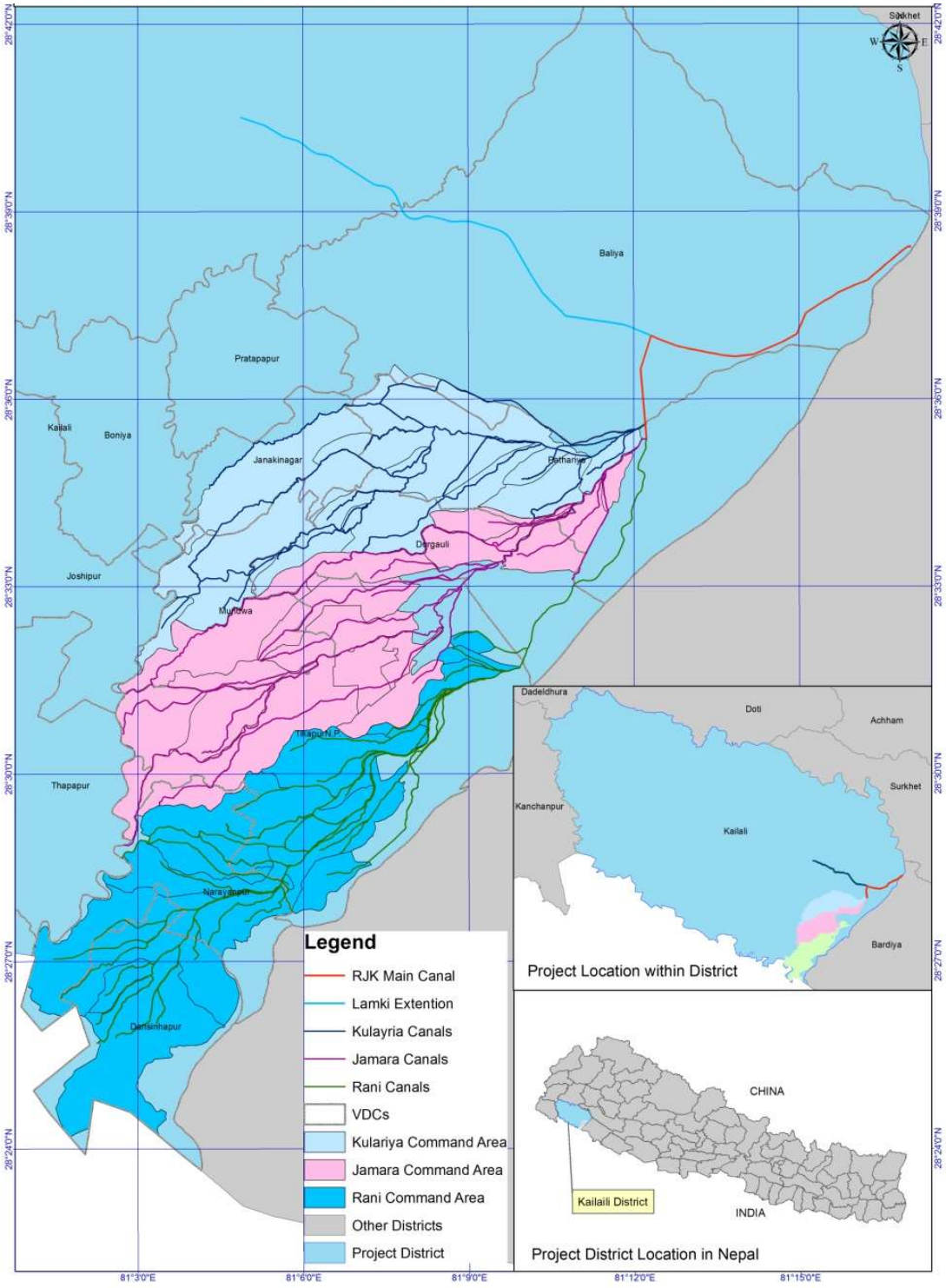
6.5 Cost Estimate for Biodiversity Management Plan (BMP)

The summary of cost estimates for Biodiversity Management & Conservation Plan for the RJKIP project as tabulated below:

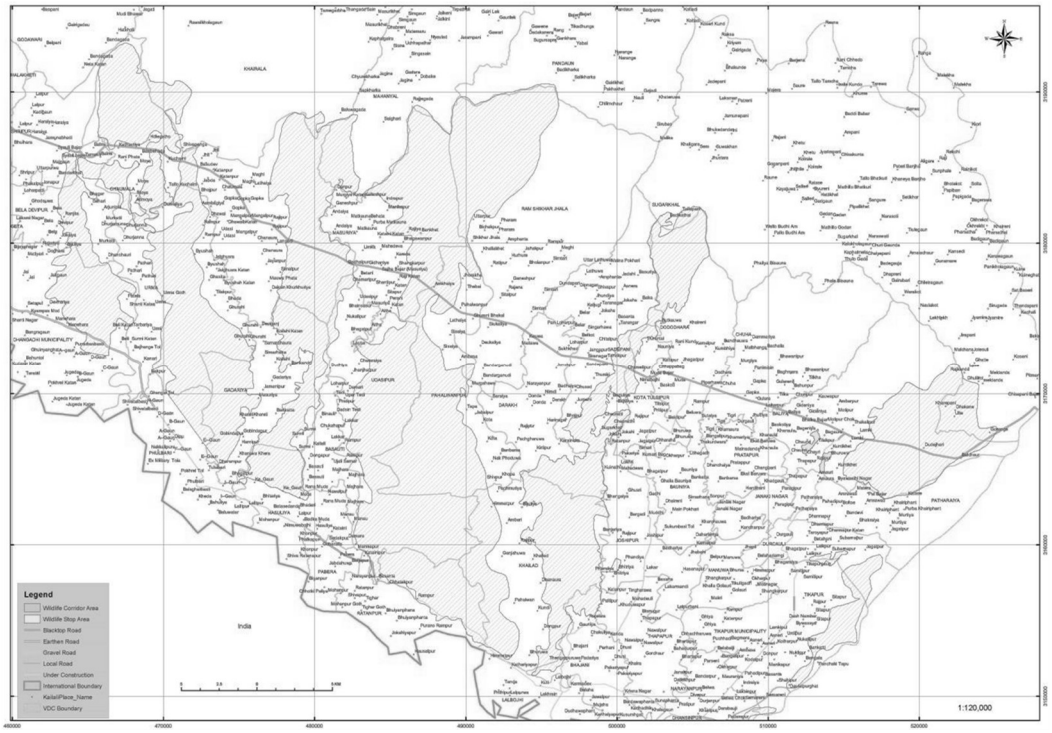
S.N	Activities	Cost Estimate		Remarks
		NRS	US$[21]	
1	Dolphin Conservation	100,000,000.00	1,000,000.00	
2	Linking Chure with Fragmented Forest Patches and Conservation	20,000,000.00	200,000.00	
3	Afforestation and Compensatory Plantation works including joint forest Management	50,000,000.00	500,000.00	
4	Management of Feral Cattle	2,000,000.00	20,000.00	
5	People Biodiversity Register (PBR)	500,000.00	5,000.00	
6	Awareness raising, Quiz Context and other Conservation related Program for Schools	500,000.00	5,000.00	
7	Canal Safety and Turfing with grass patches along the banks	30,000,000.00	300,000.00	
8	Occupational Health and Safety Programs for Safe Implementation of BMP	500,000.00	5,000.00	
9	LEMC re-formation and activation considering Phase-2 works of RJKIP	2,000,000.00	20,000.00	
10	Communication and Outreach Program	500,000.00	5,000.00	
11	Grand Total	206,000,000.00	20,600,00.00	

[21]For easy calculation the exchange rate assumed shall be 1US$-100 NRS

Appendix A: Location map of RJK irrigation system



Appendix B: Main Forest Patches at Southern boundary of RJKIP Command Area



Appendix C: Community Member involved during Interaction in RJKIP

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BD + Dolphin Group Date :

Place :

S.N.	Name	Signature	Phone number
१	लालवीर चौधरी	[illegible]	९८४८६९३२२९
२	विजय राज श्रेष्ठ	[illegible]	९८२२६२६३६५
३	बालकृष्ण चौधरी (कैलालेखा CF)	[illegible]	९८४८६१५३६२
४	शुक्र राम चौधरी	[illegible]	
५	[illegible] राम भट्ट	[illegible]	९८४८५७१९४१
६	राम प्रसाद भाट	[illegible]	९८४८६५०६६३
७	हितेन्द्र थापा	[illegible]	राम प्रसाद
८	खेम राज भाट	[illegible]	९८६६८०९३८३
९	ल पूर्ण राज शर्मा	[illegible]	९८४८५०२२६४
			९८०८७८२८४०
१०	केवल चौधरी	[illegible]	९८४८५५३४५०
११	प्रदेश चौधरी	[illegible]	९८००६४८९८३
१२	अम्बिका चौधरी	[illegible]	″
१३	सुमादेवी चौधरी	[illegible]	९८६५९०४०८५
१४	टेके प्रसाद आचार्य	[illegible]	९८४८५१६६३४
१५	श्याम प्रसाद चौधरी	[illegible]	९८४८५९४५७०
१६	अनुज रमाय	[illegible]	९८२४६२४०७२
१७	चेत राम भाट	[illegible]	९८६१४२४६९०
१८	लक्ष्मी राम भाट		९८४१७४४९११
१९	निर्मल थापा		९८४८६१६४८
२०	कमल विष्ट		
२१	श्री इन्द्रराज उपाध्याय		९८६५८०६१७५
२२	अमृत सापकोटा		९८४८०६८९४४
२३	मोती राम देवकोटा	मोतीराम	९८६५७०६०६२
२४	कृष्णा व चौधरी		९८६५८३०५४८
२५	रक्षित रावत		९८११६२९९४४
२६	अमृ सावद		
२७	पूर्ण व मलासी		९८४८६२९८५८
२८	छत्र व विष्ट	[illegible]	९८५८४९००७४
२९	उमा सावद		
३०	श्री भोज राज श्रेष्ठ	[illegible]	९८४८८०५०६३
३१	कोपिला विष्ट	[illegible]	

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BD group

Date :
Place :

S.N.	Name	Signature	Phone number
1.	Bal Krishna Chaudhari		9848615962
	Kailaseshwor C.F, Secrety		
३२	श्री मनोज राज श्रेष्ठ		९८४८८०३०६३
३३	डिला न्यौपाने	Dila.	9809670421
३४	भिमराज शर्मा	भिमराज	
३५	नरेन्द्र प्रसाद रेग्मी		9848492281
३६	धिरेन्द्र प्रसाद ढुंगाना	धिरेन्द्र	9804619055
३७	भोजराज ढुंगाना		9848440035
३८	नवराज रेग्मी	नवराज	9825684108
३९	मन्जु पाण्डेय	मन्जु	
४०	जानकी रेग्मी		
४१	धनिराम रेग्मी	धनिराम	
४२	नेत्र राज रेग्मी	नेत्र	
४३	ललित बहादुर भण्डारी	ललित	
४४	शारदा रेग्मी	शारदा	
४५	पदमराज ढुंगाना	पदम	
४६	सिद्ध प्रसाद ढुंगाना	सिद्ध	
४७	नरेन्द्र ढुंगाना	नरेन्द्र	9804692603
४८	मनोज भण्डारी	मनोज	
४९	शारदा भण्डारी	शारदा	
५०	कल्पना जैसी	कल्पना	

DFO, Officers.

Date :
Place :

S.N.	Name	Signature	Phone number
1.	Dr. Rajendra K.C.		9851149420
2.	Amar Bdr Bulan		9848044914
3.	Rabi Kumar Nidhi		9846134049
4.	Abinash Chaudhary		9848955780
5	Shyam Mohan Lal Das		[illegible]
6	Dr. Sindu Dhungana (REED)		
7	Radha Wagle		
8	Bhim Dhakal ADFO		9845148044

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Dolphin Count 2074

Date : 2074-5-24

Place : ~~बर्दिया~~-7

S.N.	Name	Signature	Phone number
1.	नारायण ढकाँपाने		9825624O3
2.	मनोज्ञ भण्डारी		9825684026
3.	नवराज रेजमी		9865967548
4.	सिलाना भण्डारी	सीलना	9800688243
5.	नरेन्द्र डुंगाना		9809692603
6.	सिद्ध प्रसाद डुंगाना		9815693080
7.	पदमराज डुंगाना		9814651983
8.	धिरेन्द्र प्र डुंगाना		9814619055
9.	शारदा भण्डारी		9813463819
10.	शोभराज डुंगाना		9848440035
11.	नृप बुढा		
12.	देवु राजी		
13.	शिवराज शर्मा		
14.	राजेन्द्र डुंगाना		
15.	राम बहादुर चौधरी		
16	भुमर बुढा		
17	नरेन्द्र प्रसाद रेजमी		9848492281
18	दिला ढकाँपाने		9809674042!
19	मन्चु पाण्डेय		
20	आशा रेजमी		

Appendix D: Glimpses of Site Visit and Focus Group Discussion (FGD) in RJKIP area.