Government of Nepal

Ministry of Irrigation

Department of Irrigation

Irrigation and Water Resources Management Project (IWRMP)

Irrigation Infrastructures Development & Improvement (AF), Component-A

(Word Bank Project ID: P144474)

PROJECT COMPLETION REPORT

Aguwa Khola

Parbat District

CMS Engineering Consult Pvt. Ltd.

Full Bright Consultancy Pvt. Ltd. JV

November 2017 / Kartik 2074

Salient Features

1. Name of Sub-Project : **AguwaKhola Irrigation Subproject**
2. Longitude : 28^0 04' 17.6" N (Intake site)
3. Latitude : 83^0 39' 43.7" E
4. Location (District, VDCs, Wards of Command Area) : Parbat/Paiyun Rural M'cipality-6 (Saraun Khola- 1, 2 & 3)
5. Type of SP (Mountain, Hill and Terai): Hill
6. Feasibility Study Year : 2011/012 AD.
7. Name of the Source : Aguwa Khola
8. River Discharge: Max: 45 m3/ sec Min: 0. 020 m3/sec (May 2012)
9. Gross Command Area : 37 ha
10. Net Command Area : 35 ha
11. Canal Design Discharge : 75 lit per sec
12. Diversion Type : Side intake
13. Canal Length : 2.88 km
    - 13.1. Main Canal : 2.88 km
    - 13.2. Branch Canal : 3.00 km (10 nos.)
    - 13.3. Tertiary Canal : -
14. RAC Approval Date : _____
15. PICC Approval Date : 16th January 2014
16. Approved Detailed Design Amount : NPR. 1,19,17,335.95
17. Participatory Shares Amount
    - 17.1. DOI Part : NPR. 1,10,89,608.73
    - 17.2. WUA Contribution : NPR. 8,27,727.22
18. Contract Amount : NPR. 79,90,848.13
    - 18.1. NCB Contract Amount : NPR. 32,15,632.00
    - 18.2. WUA Payable Contract Amount : NPR. 47,75,216.13
19. Actual Expenditure : NPR. 90,05,793.67
    - 19.1 NCB Contract Part : NPR. 32,13,463.21

	19.2	WUA payable part	: NPR. 47,75,216.13
	19.3	WUA Contribution	: NPR. 8,40,753.33
	19.4	Other expenditure	: NPR. 1,76,361.00
20.	per Hectare Investment Amount		: NPR. 2,57,308.39
21.	Tiers of WUA		: Single Tier
22.	Date of WUA Registration		: 24th December 2013
23.	Number of Beneficiary (No. of HHs/ Population)		: 145 nos. and 927 nos.
24.	ICWM-program Implemented Year		: _____
25.	Years of ICWM-program Implementation		: _____
26.	Allocated Budget for ICWM-Program		: NPR. _____
	FY-20__/__-Program Budget		: NPR. _____
	FY-20__/__-Program Budget		: NPR. _____
27.	Cropping Intensity		
	Present cropping intensity	168 %	
	Future cropping intensity	-	
	Current cropping Intensity	200 %.	

Executive Summary

AguwaKhola Irrigation Sub-project, Parbat of cultivable command area 35 ha had been rehabilitated fully with active participation of water users' association (WUA) and beneficiaries. Reinforced cement concrete lining (RCC) work of length 1,190 m has been constructed in the main canal, helped farmers in conveying design discharge from the source to agriculture field by preventing water loss through seepage from bed of the canal and regular damage of the earthen canal from uncontrolled water flowing in the canal particularly in rainy season.

Intake which is constructed on left bank of River is protected by gabion structures. River banks are stable bed is composed of boulder and shingles deposited. Water distribution conflicts within the command area were not noticed remarkably; however, with the system improved and developed, water in the command area has been raised significantly (up to the double) than previous flow. It helped in reducing water rotation from 72 hours to 24 hours in winter and is almost nil in summer.

Labour consumption during maintenance at intake and main canal before rehabilitation was 1012 m-d per year. After rehabilitated, it has been reduced to 183 m-d per year in regular maintenance of the system. The WUA would be responsible for the overall operation of the system, repair and maintenance. Decision regarding canal discharges, rotation schedule and conflict management would be under the full responsibility of WUA. Now, the sub-project is under smooth operation.

Yields of crops have increased in the project area. The crop yield of paddy has increased from 2.5 tons/ha to 2.9 tons/ha, similarly maize from 1.1 to 2.9 tons/ha, but wheat from 1.6 to 3.0 tons/ha, potato 7.20 to 14.0 tons/ha and vegetables 6.0 to 12.0 tons/ha.

The cropping intensity of project area has been substantially increased to a great extent. The cropping intensity has increased by 19% compared to that of the base year (168%). The increased cropping intensity is due to timely availability of irrigation water and adoption of short duration improved varieties of the crops grown and demonstrations in different crops including skill development trainings for crop production and management aspects periodically provided by DADO officials.

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Abbreviations

AMIS	Agency- Managed Irrigation System
AO	Association Organizer (Social Worker)
CBO	Community Based Organization
cumec	cubic metres per second
DADO	District Agriculture Development Office
DDC	District Development Committee
DDG	Deputy Director General
DG	Director General
DHM	Department of Hydrology and Meteorology
DIO	District Irrigation Office
DoA	Department of Agriculture
DoI	Department of Irrigation
DTL	Deputy Team Leader
DTT	District Technical Team
DTW	Deep Tube Well
DWRC	District Water Resources Committee
EIA	Environmental Impact Assessment
FMIS	Farmers Managed Irrigation System
FY	Fiscal Year
GIS	Geographical Information System
GMIS	Geographical Management Information System
GoN	Government of Nepal
GW	Groundwater
GWID	Groundwater Irrigation Directorate
GWIDD	Groundwater Irrigation Development Division
ha	hectare
ICWMP	Integrated Crop and Water Management Program
IDA	International Development Association
IDD	Irrigation Development Division
IDSD	Irrigation Development Sub Division
IEE	Initial Environmental Examination
ISE	Initial Social Examination
ISEA	Integrated Social and Environment Assessment
ISF	Irrigation Service Fee
IWRMP	Irrigation and Water Resources Management Project
M&E	Monitoring and Evaluation
MIS	Management Information System
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoI	Ministry of Irrigation
MTR	Mid Term Review
MWDR	Mid Western Development Region
NGO	Nongovernmental Organization
NISP	Nepal Irrigation Sector Project

NPC	National Planning Commission
NPR	Nepali Rupee
O&M	Operation and Maintenance
OPD	Office of the Project Director
PAD	Project Appraisal Document
PBME	Project Beneficiary Monitoring & Evaluation
PC	Project Coordinator
PD	Project Director
PICC	Project Implementation and Coordination Committee
PIM	Project Implementation Manual
PIU	Project Implementation Unit
PMU	Project Management Unit
PSC	Project Steering Committee
RAC	Regional Appraisal Committee
RAD	Regional Agriculture Directorate
RD	Regional Director
RfP	Request for Proposal
RID	Regional Irrigation Directorate
RPSU	Regional Project Support Unit
SAC	Sub-project Appraisal Committee
SBD	Standard Bidding Document
SDE	Senior Divisional Engineer
SEA	Social and Environment Assessment
SEMP	Social and Environmental Management Plan
SMU	Sub-project Management Unit
TA	Technical Assistance
ToR	Terms of Reference
WB	World Bank
WUA	Water Users Association
WUG	Water Users Group

1 BACKGROUND

Aguwa Khola irrigation subproject of command area 35 ha is a farmer managed irrigation system covering 145 nos. of house hold and population 927 nos. This subproject which is farmers' managed irrigation was initiated around 109 years ago on leadership of Juwari Lal Tiwari resident of ward-2 of Sarau Khola VDC. The length of existing main canal was 2.88 Km with 10 nos. of branch canal each of length 300 m (on average) located at ward- 1 and 2 of Sarau Khola VDC whereas intake is at ward- 3 of same VDC. But with managed irrigation within the system by beneficiaries come on serving command area with extension to 35 ha from perennial stream named Sarau Khola alone. Total command area is lying at ward- 1, 2 and 3 of Sarau Khola VDC.

A temporary diversion made of brush wood has been constructed off and on with local technology and resources across Sarau Khola to divert water towards intake on left bank to agriculture field. Farmers were operating and maintaining the system on their own resources from long tine back. Frequent wash out of the diversion during summer and shortage of water in winter in Sarau Khola created a problem to the farmers with consumption of intensive labour strength. This frequent washout of diversion, leakage of water through earthen canal bed and temporary cross drainage structures in the system, farmers thereby faced operation problems annually and could not obtain desired quantity of agricultural output because of limited quantity of water at source.

This sub-project lies in the then Sarau Khola VDC ward no. – 1, 2 and 3 Parbat District, Gandaki Zone of Western Development Region. The dominant population within the sub project is Brahmins with Janjati and no Dalit. The subproject is at 110 km West North from Syangja District head quarter with 65 Km paved road Siddhartha Rajmarga South and with 45 Km gravel and earthen road leaving Siddhartha Rajmarga at Waling Bhakunde to West North direction to reach project site. The nearest local markets are Huwas and Waling Bhakunde. It is accessible through motorable road and can be reached to sub-project site within 2 hours from Huwas.

2 INFRASTRUCTURE DEVELOPMENT AND IMPROVEMENT

2.1 Infrastructure Development

Mainly the scopes of the works were as following:

a) Construction of earthen canal, upgrading and reshaping: 2880 m

b) Reinforced cement concrete canal lining including covered canal: 1190 m

c) Drop structures: 24 nos

d) At head work, simple side intake with gabion protection work: 1 no.

e) Foot bridge: 6 no.

f) Out let/Division Box: 10/1 nos.

Table 1 Scope and Completion Status of Works

SN	Name of the structures	Unit	Scopes of works	Completion status	Remarks
1.	Head works- Simple intake structure and gabion guide walls on Left banks and bank protection works	nos.	1	1	SP was accomplished through NCB contract, WUA payable contract and WUA contribution. Agreement date of the NCB contract was on 07th July 2014 and completion date was on 07th April 2015. Overall sub project completed on July 2015 Farmers are receiving irrigation water continuously since the improvement and development of the SP.
2.	Earthen canal construction canal upgrading/reshaping with retaining structures	m	2880	2880	
3.	RCC lined canal with covered	m	1190	1190	
4.	Aqueduct	Nos.	1	1	
5.	Road culvert/Foot bridge	nos.	6	6	
6.	Super passage structures	nos.	4	4	
7.	Escape structure	nos.	1	1	
8.	Out let/Division Box	nos.	10/1	10/1	
9	Boulder masonry retaining structures	Nos.	-	6	
10.	Drops	nos.	24	24	

Source: IDD, Parbat

The approved budget for the works was NPR 1,19,17,335.95 and it was implemented through three contracts: NCB contract, WUA payable contract and WUA contribution. WUA members also shared responsibility for construction supervision after suitable training from the IDD.

2.1.1 Intake Structure

The name of the source is Sarau Khola perennial, located at Sarau Khola VDC, ward- 3. Intake and command area are lying on Left bank of the Khola. The maximum and minimum discharge of the Khola calculated by MIP method obtained to be 45 cumecs and 0.020 cumecs respectively during month July

and May 2012. Total intake water requirement for specific cropping pattern was found as 75 l/s. Intake was designed for discharge 75 l/s to meet irrigation requirement throughout the season. Intake is simple sluice type controllable and operable with trash rack in front of Intake. Intake is associated by escape structure at downstream to spill out excess water during flood.

Across the Khola temporary boulder diversion structure has been constructed with gabion bank protection. Bed of the Khola is stable composed of boulders and shingles and danger of lowering the bed of Khola is minimal and to maintain required pond level for design water level to flow in the main canal can be achieved easily.

2.1.2 Details of Canals & Structures

Total length of main canal is 2.88 km. Main canal and intake is surrounded by forest. Main canal has been lined by RCC to control water seepage. Slope of the canal varies from 1/100 to 1/400. Steep slope has been controlled by construction drop structures. Aqueduct, super passage, foot bridges, escape and covered canal in main canal to protect the debris and dead leaves falling into the canal have been constructed. Main canal is stable by construction boulder masonry check structures at required locations.

RCC lined canal is constructed of length 1190 m and branch canal is maintained by WUA/beneficiaries with off take provided by sub project. RCC lined canal section is varying 50*50 to 35*35 cm with wall thickness as 10 cm. Quality of the work is satisfactory, supervised by WUA/construction supervision committee. Farmers have felt that by lining the volume of water has been doubled comparing with previous unlined main canal.

Toe of the main canal has been protected by RRM boulder masonry and gabion retaining structures at different locations. There has been observed no any danger of canal obstruction by sliding of earth. Whole length of canal is intact and serving well to WUA/beneficiaries for irrigation.

Road crossing structures mainly foot bridges 6 nos for local and domestic animal to cross over and cloth washing provision at appropriate location for locals have been provided.

Required super passage structures of 4 nos across the main canal have been constructed facilitating the local drain to flow over the main canal without obstructing the main canal water flow.

Outlets, 10 nos. and division-box, 1 no. have been constructed facilitating farmers easy water management among beneficiaries into their field.

2.1.3 Detail Cost of Development

Detailed design cost estimate of the sub project after PICC approval is NPR 1,19,17,335.95 inclusive of SEMP cost as 3,50,000.00, environmental activities cost as 20,693.19, institutional development cost as 20,693.19, insurance cost @ 0.45 %, work charge contingency @ 5 %, Physical contingency @ 10 %, Price escalation @ 10 % and VAT @ 13 %.

Overview of completion cost of Aguwa Khola irrigation sub-project after improvement and development has been depicted in Table 2.

Table 2 Detail Completion Cost

Command Area	35 ha
Households (no.)	145
Sanctioned Estimate (NPR.)	
PICC Appraised amount	1,22,89,000.00
Detailed Design cost	1,19,17,335.95

Cost Sharing (NPR.)	
DOI Part	1,10,89,608.73
WUA Contribution	8,27,727.22
Contract amount (NPR.)	
WUA Contract (payable) with VAT	47,75,216.13
NCB contract with VAT	32,15,632.00
Other Expenses	30,98,761.60
WUA Contribution	8,27,727.22
Expenditure (NPR.)	
WUA Contract (payable) with VAT	47,75,216.13
NCB Contract with VAT	32,13,463.21
Other Expenses	1,76,361.00
WUA Contribution evaluated	8,40,753.33
Total	90,05,793.67
Overall Physical Progress w.r.to Physical Scope %	94
Overall Financial Progress w.r.to Detail Design %	78

Other expenses cover environmental activities cost, insurance cost, contingencies cost, physical contingencies and price adjustment cost.

2.1.4 Cost Sharing by WUA in Project Development

As per approved cost estimate, the cost to be shared by WUA in sub project development was NPR 8,27,753.55, that is 6.9 % of detailed design cost estimate. However, they had contributed labour in subproject development work in terms of cost as NPR 8,40,753.33 that is 7% of detailed design cost estimate. This is 101.57% WUA contribution achieved with respect to WUA agreed contribution.

2.1.5 Physical and Financial Progress

This subproject has been approved amount as NPR 1,19,17,335.95. By the completion of the project total expenditure in terms of WUA payable, NCB contract and WUA contribution comes out to be NPR 88, 29,432.67 against the total contract amount of NPR 88,18,601.68

At the end of sub project, overall physical progress with respect to physical scope is 94 % and overall financial progress with respect to detailed design cost comes out to be 78%.

2.2 Water Management and Distribution Methods

2.2.1 Water Distribution System

Off takes in each branch canal (total 10 nos. branch canal) have been constructed for the farmers to operate the system during winter period where total area was not possible to bring under command at once. Farmers have established mutual cooperation among themselves. Water distribution conflicts within the command area were not found remarkably. WUA/beneficiaries felt that water in the command area have been raised significantly to double than previous flow by the construction of RCC lined canal and preventing water seepage through the canal. Before rehabilitation subproject canal tail part command area was suffered by water shortage with 72 hrs rotation of branch canals but after rehabilitation with water volume increased in main canal this problem is reduced to 24 hrs within the branches in winter whereas in summer it is almost zero. Farmers are traditionally managing the system.

Hence, the customary laws prevail for problem solving if water distribution conflicts arise within the system.

2.2.2 Water Distribution Method

Farmers are adopting rotational water distribution method during winter. Before rehabilitation rotation was set to 72 hours, after rehabilitation it is reduced to 24 hours. However, water management is improving as WUA/beneficiaries are active in water management after improvement and development of the sub project. Water distribution practices are customary, traditional and the WUA committee penalizes the defaulters accordingly.

3 INSTITUTIONALISATION OF WUA

3.1 Formation and Registration of WUA

Initiation and evolution of this irrigation system has portrayed that the water users are self-motivated and dynamic from Juwari Lala Tiwari resident of ward-2. At the initiation of the system, they were working in an informal way. Their unity and the participation were bonded by a sort of common need, interest and goal.

The Aguwa Khola ISP is a single tier system and has main canal level of WUA organization. Eleven members Aguwa Khola WUA was formed from general assembly/mass meeting of the general water users based on their own constitution. The existing WUA is chaired by Mr. Parasuram Tiwari and 3 female members (suggested to WUA to involve minimum 33 % female representatives), 5 janajati and other (Brahmin, Chhetri etc.) ethnicity also represent in WUA. It was registered in DWRC, Gulmi on 24th December 2013. There are dalit community in the village but they are not water users according to WUA.

It has been suggested to WUA to prepare list of WUA members with landholding with 145 households and 927 populations including Brahmin, Chhetri and Janajati communities.

The WUA meeting is not regular and suggested to adopt monthly regular meeting. Decisions made in meeting are found maintained in minute book. Major decisions are often made by the executive committee unanimously.

WUA organize Annual General Assembly Meeting (AGM) once in a year. In the AGM, WUA presents all the records and information, progress of concern activities, income and expenditure, account keeping of WUA for transparently inform to the beneficiary participants.

WUA has been suggested to establish their own office with signboard at the village. They have WUA letter pad, seal, minute register of meeting, filing of letters, and feedback register in the office.

3.2 Rules and Regulations

It has its traditional rules and regulation for operation and maintenance of the system, resources collection and mobilization for regular repair and maintenance and emergency maintenance of canal system. Formulation of WUA rules and regulation has not been made yet and WUA is suggested to step ahead.

3.3 Conflict Resolution

As per executive members, incident of stealing water is very less. However minor conflict are happened during irrigating for seed planting which are normally settled by farmers themselves in mutual understanding. There is no land issue during sub-project construction.

3.4 Resources/ Fund Mobilization

WUA have deposited NPR 63,000.00 to fulfil Up-front cash (0.5% of total project cost) as retention in account of IDSD Parbat.

Enrolment of Membership and membership fee have been fixed and suggested to act on it followed by Rules and regulation.

Irrigation Service Fee has not been fixed and suggested to act on it after finding reasonable ISF rate to meet operation and maintenance of the system. ISF applicable to the sub project exercised in the participation of WUA/beneficiaries is attached in Annex.

There is penalty system in absence of labour contribution while regular maintenance of Canal & structures/Intake would perform. It was also suggested to WUA for membership distribution to the water users and to keep the money in the commercial Bank of WUA account.

3.5 WUA Contribution

Financial sustainability of the ISP mostly depends on resource/fund generation and collection and mobilization for O&M fund. WUA contributed the labour resources equivalent to NPR 8,40,753.33, mobilizing all beneficiary farmers as people's contribution (7% of total project cost) during subproject improvement and development

3.6 WUA Training and Further Requirements

As per IDSD, Parbat trainings on construction management, quality control and institution development have been provided to Institution (WUAs' executive committee and key farmers). Details of Capacity Development (Training/Exposure visit/workshop) of WUAs conducted by WRID/IDD are as follows:

Table 3 WUA's Capacity Build-up Training Provided by WRID/IDD

Topics of Trainings	Date	Participants (no.)			Ethnicity (no.)	
		Male	Female	Total	Janajati	Dalit
Pre-construction	NA	9	2	11	4	0
Planning and design	NA	2	3	5	2	0
O&M	NA	14	36	50	25	0
IPM	NA	9	16	25	1	0
Institutional development training at Lumle (3 days)	16-18th June 2015	1	5	6	2	0
Exposure visit (5 days)	4-8th May 2016	0	5	5	2	0

3.7 Operation, Maintenance and Management

There is traditional customary for operation and maintenance of the canal. The canal has been operated by water users/farmers themselves in the leadership of WUA.

The maintenance works of canal system is done regularly two times in winter (January/December) as well as in summer (June/July) of every year. Contribution is mostly in the form of labour in removing obstacles and cleaning the silt deposited in the canal and Chaukidar/Dhalpa. Main canal and structures are made of RCC work after improvement and development of the sub project. As time passes on they need repair and maintenance using cement, steel bar and skilled manpower to keep them up to date in operable condition requiring contribution in the form of cash. WUA would get back NPR 63, 000.00 as retention money from IDSD Parbat later as seed money for O & M. Besides this WUA is suggested to find out reasonable ISF rate with respect to O & M expenditure to apply to all irrigators would act good resource/fund generation for system operation and maintenance.

3.8 Arrangement of Water Guard (Dhalpa, Heralu, Sardaruwa, Mahato)

Previously they had managed the system under guidance of WUA without any specific rule. WUA is at to keep water guard (Chaukidar/Dhalpa) on regular basis from beneficiaries to look after the system. The water guard has not been appointed yet and it was suggested during field visit of TA and meeting with WUA on 2 June, 2017.

4 AGRICULTURE DEVELOPMENT ACTIVITIES

4.1 Agricultural Activities in the Sub-project

The ICWM-program and program budget is collectively sent to DADO Office from ICWM/DOA for all ISPs that have to be implemented under Parbat district. Selected few ICWM-activities were launched in the subproject in 2015/16 and 2016/17. The DADO Official/Focal Person distributes the activities to each ISP as per need of subproject and some activities are conducted in close guidance and support of the DADO Office, Kusma. All proposed ICWM-activities are not enough to conduct in each ISP so selected ICWM-activities are assigned as per project location and farmers' demand. The distribution of ICWM-activities to each ISP is assigned or allocated as per discussion of WUA Chairperson or WUA representative and DADO Officials (Focal Person). In general, number of trainings are not enough to conduct in each ISP site so training was conducted under Triveni Agriculture Service Centre (ASC) of the DADO office, Kusma and district level training participants were represented from other different ISPs as well.

4.2 Cropping Patterns, Yields and Intensity

The cropping intensity as well as crop diversification in the command area has gradually increased. The soil of command area is loamy to clay loam. Cultivation of diversified crops is increasing such as paddy, wheat crops, pulses, oil crops, potato and vegetables are the main crops of project area but coverage of potato and vegetables is extensively increasing. The cropping intensity has increased by 19% compared to base year (168 %). The increased cropping intensity is mainly due to availability of timely irrigation water and management practices for crop production. The cropping area and cropping intensity before and after rehabilitation of the sub-project is given below.

4.3 Linkage Establishment with Service providers

Linkage initiation has been made between/among DADO, IDD/IDSD, Agriculture Research Centre and WUA for infrastructure improvement and technical support. DADO Office is providing agriculture training to WUA members to educate agriculture technical knowledge and IDD providing training for institutional development and project construction work for supervision during project construction. Besides Local Agrovets of Huwas and local financial institutions in Parbat district. Also, Agrovets and other local suppliers from Walling in Syanja district are providing support services to WUA farmers by sales of seeds, fertilizers and other inputs and seasonal credit facilities as well.

i ASC/DADO Offices for Technical Services through ICWM Program

a) DADO and ASC is implementing ICWM-program and providing technical services to the farmers as program needs.

b) DADO, ASC and RAD is providing intra-district visit to the farmers of command area for expose.

c) FM-broadcast was on air for awareness of farmer on knowledge of ICWM-program under IWRMP and technical information Concerned extension specialists from Regional agriculture Directorate are broadcasting technical message from FM Radio channels.

d) Regular District Technical Team (DTT) Meeting organized by DADO is providing or updating the knowledge of ICWM-program activities and smoothing the coordination among DTT members

e) IDD Officials are coordinating in training to DADO Office as when needed for training especially for water management aspects.

ii IDD/IDSD Offices for Technical Services for Infrastructure and On-farm Structure Development

a) Participation of IDD in District Technical Team (DTT) Meeting is providing or updating the knowledge of ICWM-program activities and smoothing the coordination among DTT members

iii Agriculture Research Centre for Technical Service and Source Seed

a) Agriculture Research Centers such as Regional Agriculture Research Station, Lumle, National Wheat, Research Program, Bhairahawa, Rupandehi, National Maize Research Program, Rampur, Chitawan and Horticulture Research Farm, Malepatan, Pokhara are supporting to solve any type technical field problems in the crops. They also, are proving source seeds of varieties in demand of rice, wheat and maize.

b) Research Centres are supplying source seed as Foundation Seed for seed production programs in the subproject sites through DADO, Kusma. All technical supports in source production activities are monitored and supervised by DADO officials.

iv Agro-vets and Local Cooperatives and Private Dealers for Fertilizer, Cereal Seeds and Vegetable Seeds for seasonal credit facility

a) Agro-vets are providing seeds of vegetable seeds and agro-chemicals

b) Private dealers are supporting by providing cereal source seeds and fertilizers.

c) Local Cooperative are providing seasonal credit facility for WUA farmers

4.4 Water Distribution and Water Sufficiency in the Sub-project

4.4.1 Water Distribution in the Command Area after Rehabilitation

Water distribution has started in the scheme from summer season (Ashadh) of Fiscal Year 2016/17 after rehabilitation of subproject. Farmers are enthusiastic and happy to cultivate their lands after rehabilitation of scheme. Now, farmers are managing to grow summer, winter crops and some area in spring crops with judicial water management practices by rotational schemes.

4.4.2 Water Sufficiency in the Command Area

Irrigation water is running in the system. Irrigation water is sufficient from the source for summer crops but it is sufficient for only 80-90% area of command area in the winter season and about 25-30% area for spring crops. Sufficiency of irrigation water in each canal reach (Head, Middle and Tail) for the command area is presented below:

Table 4 Water Sufficiency in the Command Area

<table>
<tr><th rowspan="2">Water Management in the scheme</th><th rowspan="2">Crop Season</th><th colspan="3">Distribution of Water (Satisfactory=S)</th><th rowspan="2">Effect of Demonstration for Replication</th><th rowspan="2">Remarks</th></tr>
<tr><th>Head</th><th>Middle</th><th>Tail</th></tr>
<tr><td rowspan="3">Water Delivery</td><td>Summer</td><td>S</td><td>S</td><td>S</td><td rowspan="3">1. Farmers are adopting improved technology and improved varieties
2. Some of them are switching to vegetable and potato cultivation</td><td rowspan="3"></td></tr>
<tr><td>Winter</td><td colspan="3">Sufficient for 80-90% Area by rotation basis</td></tr>
<tr><td>Spring</td><td colspan="3">Sufficient for about 25-30% Area by rotation basis</td></tr>
</table>

4.5 Successful Activities in the Subproject

Construction of scheme is completed and water is running in the canal from summer season of FY: 2014/15. Farmers of subproject are progressive and innovative and farmers are practicing to adopt improved technologies and improved crop varieties in their farm. Farmers are benefited by the project by

increasing crop productivity and producing high value crop as vegetables to some extent. The ICWM-program has launched since last two Years (FY: 2015/16 and 2016/17) in the project area.

4.5.1 Adoption of Improved Varieties

The main objective of ICWM program is to demonstrate the proficiency of variety and to motivate the use of improved variety in the project area. Adoption of Improved varieties alone can increase the productivity of crop by 25-35% depending on crops and crop variety. The adopted crop varieties are listed below:

About 65% of paddy area is covered by improved varieties like Khumal 8 and Hardinath 2, more than 95.0% wheat area is covered by Gautam and 60% maize is covered by Arun 2 and Mankamana 3 varieties, improved potato varieties adopted by the farmers is Janakdev with its adoption of around 40%. and vegetables are mostly cultivated with improved hybrid varieties in tomato, bitter gourd, cabbage, cauliflower, cucumber, bottle gourd and sponge gourd in most cases. However, open pollinated varieties of vegetables are also prevalent and source seeds are supplied by local Agro-vets and Agri-input suppliers of Huwas bazaar in the locality and Walling bazaar in adjacent Suangja district.

Table 5 Adoption Introduced Improved Varieties of Crops

Crops	Adopted Crop Varieties
Paddy	Khumal 8 and Hardinath 2
Maize	Manakamana-3 & Arun-2.
Wheat	Gautam
Oil Crop	Lumle 1
Potato	Janakdev
Vegetables Potato	Hybrid seeds of tomato, cauli flower, cabbage, cucumber, bitter guard, sponge guard Janakdev
Cauliflower	Snow Mistik (hybrid)

Note: Based on field observation and seed distribution

4.5.2 Seed Production and Distribution

Seed multiplication program were launched in the project area for two Fiscal Years. Farmers are aware of improved varieties and potentials of improved varieties. The seed multiplication was done on paddy, wheat and maize but farmers are not able to store them in common community storage basis. Each household are storing seed as per their requirement and few farmers have collected seeds from seed growers.

4.5.3 Farmers' Field School (FFS) in Potato and Cauliflower

Two Farmers' Field Schools have been conducted in the subproject area. The FFS were on vegetables (in potato with Janakdev variety during F. Y. 2015/16 and in cauliflower with Snow Mistik variety during F. Y. 2016/17). There were 25 participant farmers each year they were taught about vegetable crop farming from land preparation to harvesting time and all farm operations have to be done by their self-involvement that included all crop management practices especially planting methods, weed control, compost/fertilizer management, water management, pests management and management of post-harvest handling of cabbage and potato crops Participation of the farmers in each growth stage of the crop has helped him/her to identify friendly and harmful insect-pests in the crop. This has technically helped them in observation and in adopting environmentally sustainable measures to manage infestation of the insect-pests and diseases.

4.5.4 Motivation of Farmers to Vegetable Cultivation

Farmers are cultivating vegetables and a total of 15 sets of Plastic Houses were distributed to WUA farmers during FY 2015/16 (seven) and FY 2016/17 (eight) for encouraging them for vegetable cultivation and off-season vegetable cultivation. Huwas bazaar about 16 km. down from Aguwa Khola ISP command areas and further down of 25 km is Walling bazaar (Syangja) on Sunauli-Pokhara highway with more scope of selling all agriculture products. There is an office of Agriculture Service Centre (ASC) at Triveni that is implementing ICWM program activities in the project area. ASC is promoting command area farmers for product sale in the locality with information flow.

4.5.5 Vegetable and Agriculture Produce Collection Centre

So far, They have no such infrastructure development. However, a vegetable and agriculture produce collection centre is suggested to WUA members to it construct by WUA in future when they felt its need together with their capacity development. This will help them for their produce collection and collective market promotion as well as for regular official purpose.

4.5.6 Recruitment of Social Mobilizer (SM)

There was a Social Mobilizer, who is looking over the activities of project during FY 2016/17 and FY 2017/18. She is coordinating ongoing activities related to construction, agriculture and institutional development in the project area. However, DADO/ASC, Triveni are providing technical backstopping to SM and mostly they make joint venture in guiding the farmers for crop scheduling and monitoring of site specific agricultural activities.

4.6 Impact of Agricultural Activities in Agriculture Development in ISP

4.6.1 Adoption of Improved Crop Variety

About 65% of paddy area is covered by improved varieties like Khumal 8 and Hardinath 2, more than 95.0% wheat area is covered by Gautam and 60% maize is covered by Arun 2 and Mankamana 3 varieties, improved potato varieties adopted by the farmers is Janakdev and vegetables are mostly cultivated with improved hybrid varieties in tomato, bitter gourd, cabbage, cauliflower,cucumber,bottle gourd and sponge gourd in most cases. However, open pollinated varieties of vegetables are also prevalent and source seeds are supplied by local Agro-vets and agri-input suppliers of Huwas bazaar in the locality and Walling bazaar in adjacent Suangja district.

Farmers have adopted improved varieties of paddy, wheat, maize, potato and vegetables. Farmers have started cultivation hybrid seeds of paddy and obviously hybrid variety of vegetables since two or three years.

Crop varieties adopted in main crops in the project area:

Paddy - Khumal 8 and Hardinath 2.

Wheat - Gautam

Maize - Manakamana-3 and Arun 2

Oil Crop - Lumle 1

Potato - Janakdev

Cauliflower - Hybrid variety i.e. Snow Mistik

4.6.2 Crop Area and Cropping Intensity

The cropping intensity of project area has been increased to some extent. The cropping intensity has increased by 19% compared to that of the base year (168 %). The increased cropping intensity is due to

timely availability of irrigation water and adoption of short duration improved varieties of the crops grown and demonstrations in different crops including skill development trainings for crop production and management aspects periodically provided by DADO officials.

4.6.3 Crop Yields of Major Crops

Table 6 Cropping Area and Cropping Intensity

Crops	Baseline-FSR (Nov. 2013)		Target-FSR (Nov. 2015)		Current FY: 2016/17		Remarks
	Area (ha)	Yield (t/ha)	Proposed Area (ha)	Yield (t/ha)	Area (ha)	Yield (t/ha)	
Paddy	15	2.5			16	2.9	
Wheat	15	1.6			14	3.0	
Maize	25	1.1			30	2.9	
Potato	2	7.2			5	14.0	
Vegetables	2	6.0			5	12.0	
Total	59				70		
Cropping Intensity (%)	168%				200%		
% of Farmers Adopting Improved Techniques	<20		>80		>70		

Note: 1. * = Baseline Data as per "Feasibility Study Report", Nov., 2013
2. ** = Present Situation in given year as reported by Focal Person or DADO Official of respective District and observation of TA-Agriculturist (FY: 2073/74)

Yields of crops have increased in the project area. The crop yield of paddy has increased from 2.5 tons/ha to 2.9 tons/ha, similarly maize from 1.1 to 2.9, wheat 1.6 to 3.0, potato 7.20 to 14.0 and vegetables 6.0 to 12.0 tons/ha.

4.6.4 Production Demonstration

Few numbers of demonstrations were conducted in project area to impart technologies to the farmers on crop production of maize (Arun 2) and wheat (Gautam) production demonstration, Farmers' Field School (FFS) in potato during winter seson of FY 2015/16 and in cauliflower during FY 2016/17. Seed Multiplication of wheat (Gautam variety), maize (Arun 2 variety) and Tori (Lumle 1 variety) are the main tools to transfer improved farming technology and familiarization and promotion to adoption of new crop varieties and increased crop production.

4.6.5 Farm Machinery and Farm Tools

DADO Office handed over two Threshers and one Corn Sheller collectively to WUA members run farmers' groups viz., Sunaulo Taja Tarakari Samuha and Pragatishil Krishak Samuha both at Sadhane, Parbat. The equipments supplied by DADO office to help farmers to enhance post-harvest farm operations that will reduce operation costs, time, and human labour drudgery.

4.6.6 Plastic House for Vegetable Cultivation

Farmers of the project area are trained in vegetable cultivation as in open fields and plastic houses. Farmers were provided resources for Plastic House construction to altogether to 15 farmers during FY 2015/16 (seven) and 2016/17 (eight). Vegetables cultivated in Plastic Houses each having 60 sq m area. Generally, Plastic House was used for seedling nursery development during off-season and off-season vegetable cultivation especially in tomato, cucumber, bottle gourd and sponge gourd.

5 SOCIAL AND ENVIRONMENTAL SAFEGUARDS

5.1 Participation of Beneficiaries in SEMP Preparation

IDSD Parbat invited through public notice to all district offices (project affected line agencies and people) for the mass meeting to be held in Sarau Khola- 1, Sadhane, Parbat district on date June 25, 2013 to have knowledge on the problem and issues and possible mitigation measures to protect adverse impact on environment during construction of the subproject in the contest of preparing SEMP. Focus group discussion was conducted with women participating 11 nos. as well as Janajati participating 10 nos. Like wise group discussion participated from concerned line agencies were Chief of local development office, Chief of soil conservation office, Chief of district forest office and Chief of women development office with other members of district offices. WUA and farmers of head, middle and tail of both banks of canal on left (42 nos) and on right (39 nos) from command area were also facilitated in group discussion. Subject discussed in the meeting were on health and sanitation, employment opportunity to dalit and disadvantage community of the village, shortage of agro inputs & fertilizer, modern agriculture practices and economically backward people of command area emphasising on modern agriculture practice, organic manure preparation with minimising the use of rampant pesticides. Finally minutes of meeting highlighted major issues and implication with possible mitigation measures have been drawn out among the participants for SEMP preparation and implementation during sub project construction.

5.2 Identified Issues and Agreed Mitigation Measures

Table 7 Social and Environmental Management Plan

Major environmental issues/impacts	Proposed mitigation measures	Compliance	
		Yes	No
Impediment to movement of wildlife and people;	Provision of low cost foot bridge/local crossings will be incorporated in estimate;	√	
Forest management-likely damage to trees and bushes by labour;	Small ditches will be constructed for drinking water to wildlife and domestic cattle;		√
Seepage and damping problem to house at Ch 2+150;	The Contractor will orient labour on collection of only dried wood for firewood, ban to illegal poaching of wildlife, not to throw cigarette butts in forest area including compensatory plantation if trees will be felled;	√	
Canal passing along the road side at ward no.2 of Saraun VDC;	Lined and covered canal along vulnerable zone will be incorporated in the design estimate;	√	
Protection of local spring sources and place of worship;	WUA will maintain canal properly and also practice regulated distribution of water and follow irrigation schedule `by turns`-branch and canal scheduling;	√	
Hard rock excavation at Ch 2+550 to 2+630;	IDSD will convince Road Users to protect slope of the road by suitable conservation techniques;	√	
Occupational health, sanitation and safety;	Provision of canal lining at weak and porous zones will be incorporated in design estimate;	√	
	Local spring sources and places of worship protection measures will be incorporated in estimate;	√	
	The Contractor will not use blasting materials, instead will cut hard rock through chiselling using local labour;	√	
	The Contractor will arrange all Personal Protective Equipment (PEP) for workers including First-aid facilities at construction sites;	√	
	Safety measures such as Helmets, Gumboots, Masks, Goggles etc., need to be made available for construction workers;	√	
	Health and sanitation awareness program to raise awareness and maintain its worthiness be organized annually or half yearly supported by interaction visits.		√

5.3 Involvement of Farmers in Mitigation Activities

Table 8 Number of Training Courses with Gender

Topics of Trainings	Number of days	Av. Participants per day				
		Male	Female	Total	Janajati	Dalit
Study tour (SEMP)						
Awareness training for Women (SEMP)						
Construction management						
Capability building training						
Seasonal planning	3	56	16	72	8	3
Farmers field School training	8*	4	46	50	28	0

*School days run 4 times each in potato and cauliflower during FY 2015/16 and 2016/17 from planting, intercultural operation, plant protection and harvesting in an interval of one month.

5.4 Other Social and Environmental Impacts (Gender, Resettlement and Indigenous)

As far as concern to its implementation and impacts, training on preparing organic manure and organic farming techniques were provided through IPM and farmers to farmers training under ICWMP. During the field observation and interaction with WUA farmers group with majority of women farmer, they were confident to prepare organic manure and about sixty percent of farmers had adopted modern farming techniques in off season vegetables. Farmers of this subproject were growing vegetables and other high value crops that had changed their income level.

5.5 Environment Conservation

The project activities were environment friendly; as precautionary measures for environmental conservation the project emphasized on either avoid or controlled use of chemical fertilizers/ hazardous chemical/pesticides which are blamed for negative impact on environment. It has promoted widely used environment friendly organic- fertilizers, and micro-nutrients. The overall agricultural activities carried out under the project have significant contribution on soil/water conservation.

Some plantation on the bank of canal has been done with view of controlling soil erosion thereby making canal as stable. Farmers were suggested to increase environment friendly planting activities along the bank as much as up to length of main canal. It was noted that vegetation and plantation was listed as mitigation measures to resolve the landslide problem. RRM masonry walls were constructed to maintain natural ground slope of the hill along the main canal. There was water deficiency at the tail end farmers due to the seepage from the bottom and sides of earthen canal that resulted huge water loss along with breaching of the canal banks. The project improved efficiency of the canal system and increased the discharge in the canal.

6 KEY ISSUES FOR FUTURE SUSTAINABILITY

6.1 Infrastructure Development and Improvement

Aguwa Khola Irrigation subproject has been developed and improved on the demand basis of the farmers. A problem that was frequently observed in irrigation schemes was the inefficient way in which farmers would repair and maintain their canal network without time line planning. Irrigation Infrastructures developed within the system are very simple enough reachable to farmers for operation of the structures, considering aspect of minimizing negative impact on environment. The system is within in operation and maintenance at the capacity of users' community. Regular maintenance and operation of the system are being established by WUA and farmers of Aguwa Khola sub-project are active and would keep system intact and sustainable by following the resources/fund generation activities such as by growing cash crop and livestock through agriculture group. Irrigation network is not much complicated, so farmers could manage water distribution by making use of traditional and modern practices. Training programs on operation and maintenance of the system has been conducted but this would not sufficient for them to understand technical know-how to operate and maintain the newly built structures. Comprehensive knowledge on quantity of water being supplied into the canal and the water conservation at the source would become vital for management of water in the system for the farmers. Training on discharge measurement and regular recording discharge data in the system would be pertinent to WUA/beneficiaries for water management within the system. Other essential aspects to be considered for the farmers are mobilizing internal and external resources to attain sustainability. Technical know-how by pursuing through specific, practical and substantial numbers of training programs needs to be provided to WUA and farmers of Aguwa Khola sub project in order to attain system sustainable. Irrigation development sub division (IDSD), Parbat could play a vital role in assistantship to farmers of the sub project by helping them through various trainings and technical knowledge follow-up to make more durable and better use of the irrigation canal system.

6.2 Institutional Development

This WUA has average good management with the rooms of improvement but some more training are required on financial management and cooperative development including ISF collection, rules formulation, exposure visit and office management to enhance the WUA performance.

6.3 Agriculture Development

The cropping intensity of project area has been substantially increased to some extent. The cropping intensity has increased by 19 % compared to that of the base year (168 %). The increased cropping intensity is due to timely availability of irrigation water and adoption of short duration improved varieties of the crops grown and demonstration effects in different crops including skill development trainings for crop production and management aspects periodically provided by DADO officials.

Yields of crops have increased in the project area. The crop yield of paddy has increased from 2.5 tons/ha to 2.9 tons/ha, similarly maize from 1.1 to 2.9, wheat 1.6 to 3.0, potato 7.20 to 14.0 and vegetables 6.0 to 12.0 tons/ha.

Farmers of the project area are trained in vegetable cultivation as in open fields and plastic houses. Farmers were provided resources for Plastic House construction to altogether to 15 farmers during FY 2015/16 (seven) and 2016/17 (eight). Vegetables cultivated in Plastic Houses each having 60 sq m area. Generally, Plastic House was used for seedling nursery development during off-season and off-season vegetable cultivation especially in tomato, cucumber, bottle gourd and sponge gourd. There is sustained impact of such plastic house vegetable cultivation in the locality by adopting the technology provided to WUA farmers.

Farmers have real problem of selling farm products locally. Huwas bazaar in nearby roadside area and Walling bazaar (Syangja) is the market centre of command areas of Aguwa Khola command area farmers. There is a problem of transportation despite of the rough road going on there with sparse bus service for the public being managed by private agencies. However, around 5 ton of fresh winter vegetables (cauliflower, cabbage, radish, broccoli and carrot) are sold in the local markets.

About 65% of paddy area is covered by improved varieties like Khumal 8 and Hardinath 2, more than 95.0% wheat area is covered by Gautam and 60% maize is covered by Arun 2 and Mankamana 3 varieties, improved potato varieties adopted by the farmers is Janakdev and vegetables are mostly cultivated with improved hybrid varieties in cauliflower, cabbage, bitter gourd, cucumber, bottle gourd and sponge gourd in most cases. However, open pollinated varieties of vegetables are also prevalent and source seeds are supplied by local Agro-vets and agri-input suppliers of Huwas bazaar in the locality and Walling bazaar in adjacent Syangja district.

Similar to other hilly districts, farmers are rearing different types of livestock commodities which help promote the use of farmyard compost manure in vegetable cultivation and in turn livestock cattle, buffalos and goats are getting dried hay and green fodder by-products from crops grown. Besides, crops livestock commodity is an integral part of the farming system in the mid-hills of Nepal to sustain their economy and improve the livelihoods of the people. Also, technology diffusion is gradually happening from the project command areas to other neighbouring villages.