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

## Jherdi Khola

## Gulmi District

**CMS Engineering Consult Pvt. Ltd.**

**Full Bright Consultancy Pvt. Ltd. JV**

**July 2017 / Saun 2074**

## Salient Features

| | | | |
|---|---|---|---|
| 1. | Name of Sub-Project | **JherdiKhola Irrigation Subproject** | |
| 2. | Longitude | 280 02’ 17.88”N to 280 02’ 17.74”N | |
| 3. | Latitude | 830 22’ 15.50”E to 830 21’ 59.65”E | |
| 4. | Location (District, VDCs, Wards of Command Area) | | Gulmi/Hunga- 9 |
| 5. | Type of SP (Mountain, Hill and Terai) | | Hill |
| 6. | Feasibility Study Year | | 2011/012 AD. |
| 7. | Name of the Source | | Jherdi and KunniKhola |
| 8. | River Discharge | Max: 20 m3/ sec | Min: 0.150 m3/sec |
| 9. | Gross Command Area | | 30 ha |
| 10. | Net Command Area | | 25 ha |
| 11. | Canal Design Discharge | | 55 lit per sec |
| 12. | Diversion Type | Core wall across Khola and Side intake (sluice type) | |
| 13. | Canal Length | | 2.64 km |
| | 13.1. Main Canal | | 1.26 Km |
| | 13.2. Branch Canal | | 1.38 Km |
| | 13.3. Tertiary Canal | | - |
| 14. | RAC Approval Date | | |
| 15. | PICC Approval Date | | 16th January 2014 |
| 16. | Approved Detailed Design Amount | | NPR 1,06,59,541.41 |
| 17. | Participatory Shares Amount | | |
| | 17.1. DOI Part | | NPR 98,67,046.68 |
| | 17.2. WUA Contribution | | NPR 7,92,494.73 |
| 18. | Contract Amount (NRs) | | NPR 67,47,458.38 |
| | 18.1. NCB Contracted Amount | | NPR 24,69,280.29 |
| | 18.2. WUA Payable Contract Amount | | NPR 42,78,178.09 |
| 19. | Actual Expenditure (NRs) | | NPR 91,26,595.50 |
| | 19.1 Contract Part | | NPR 24,07,501.79 |

| | | | |
|---|---|---|---|
| | 19.2 | WUA payable part | NPR 42,78,178.09 |
| | 19.3 | WUA Contribution | NPR 8,66,633.62 |
| | 19.4 | Other expenditure | NPR 8,68,482.00 |
| 20. | Per Hectare Investment Amount (NPR.) | | NPR 3,65,063.82 |
| 21. | Tiers of WUA | | Single Tier |
| 22. | Date of WUA Registration | | 31st December 2013 |
| 23. | Number of Beneficiary (No. of HHs/ Population) | | 109 nos. and 562 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 | | 158% |
| | Future cropping intensity | | 300% |
| | Current cropping Intensity | | 260% |

## Executive Summary

JherdiKhola Irrigation Sub-project, Gulmi of cultivable command area 25 ha had been rehabilitated fully with active participation of water users' association (WUA) and beneficiaries. Reinforced cement concrete lining (RCC) work of length 950 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.

Besides main water source, there is another water source on right bank of Khola has been managed by inletting the discharge towards intake on left. Intake and core wall are protected by gabion retaining structures. River banks are stable but bed is composed of debris 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 to double than previous flow. It helped in reducing water rotation from 48 hours to 24 hours in winter and is almost nil in summer.

Labour consumption during maintenance at intake and main canal before rehabilitation was 200 m-d in summer season and 75 to 100 m-d in winter. After rehabilitated, it has been reduced to 50 to 60 m-d, in both seasons in regular maintenance. 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 3.11 tonnes/ha to 3.70 tonnes/ha, similarly maize from 2.63 to 2.90, wheat 4.20 to 4.20, potato 14.70 to 20.2 and vegetables 7.0 to 10.7 tonnes/ha

The cropping intensity of project area has been substantially increased to a great extent. The cropping intensity has increased by 102% compared to that of the base year (158%). 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.

## Contents

## List of Tables



## List of Annexes

## 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

JherdiKhola irrigation sub- project of command area 25 ha is a farmer managed irrigation system covering 109 nos. of house hold and population 562 nos. This sub project which is farmers' managed irrigation was initiated around 300 years ago by Dynasty named "Naupane". The length of main canal was 1.2 Km located only at ward- 9 of Hunga VDC and irrigated 5-10 ha command area the then time. But with managed irrigation of the system by beneficiaries come on serving command area with extension to 25 ha from local stream named JherdiKhola alone. Total command area is lying at ward- 9 of Hung VDC.

A temporary diversion made of brush wood has been constructed off and on with local technology and resources across JherdiKhola to divert water to their agriculture field. Farmers were operating and maintaining the system on their own resources from long tine back. Frequent wash out of the diversion during flood in summer and shortage of water in winter in JherdiKhola 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 Hunga VDC ward no. – 9, Gulmi District, Lumbini Zone of Western Development Region. The dominant population within the sub project is Brahmins with few Dalit. The sub- project is at 29 km North East from Tamhgas District head quarter of Gulmi with at 8 Km unpaved road North from Bheduwa gate, road head point of Tamghas-Palpa high way.The nearest local markets are Tamghas and Palpa. It is accessible through motor- able road and can be reached to sub- project site within 3 hours from Tamghas.

# 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: 1,343 m

b) Reinforced cement concrete canal lining including covered canal: 950 m

c) RRM lining (Branch Canal): 200 m

d) At head work, simple side intake with gabion protection work: 2 no.

e) Foot bridge: 4 no.

f) Out let/Division Box: 4 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 side intake with controlled gate 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 contract was on 02nd May 2014. Contract completion date was on 15th June 2015. However, SP was completed on 15th June 2015. Farmers are receiving irrigation water continuously since the improvement and development of the SP. |
| 2. | Earthen canal construction canal upgrading/reshaping | m | 1343 | 787 | |
| 3. | RCC lined canal | m | 950 | 950 | |
| 4. | RRM Lining (Branch canal) | m | 200 | 200 | |
| 5. | Road culvert/Foot bridge | nos. | 4 | 2 | |
| 6. | Super passage structures | nos. | - | 3 | |
| 7. | Escape structure | nos. | 1 | 1 | |
| 8. | Out let/Division Box | nos. | 5 | 13 | |
| 9. | Retaining wall (Boulder masonry) | m. | 47 | 16 | |
| 10. | Gabion protection work | cum | 95 | 71 | |

Source: IDD, Gulmi

The approved budget for the works was NPR 1,06,59,541 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 JherdiKhola and KunniKhola, located at Okharkot VDC, ward- 9. Intake and command area are lying on Left bank of the JherdiKhola. The maximum and minimum discharge of the Khola calculated by MIP method obtained to be 20 cumecs and 0.97 cumecs respectively during month

July and September. Total intake water requirement for specific cropping pattern was found as 55 l/s. Intake was designed for discharge 55 lit per s to meet irrigation requirement throughout the season. Intake is simple sluice type controllable and operable by steel gate 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 RCC core wall has been constructed with gabion check downstream to control lowering the bed of Khola and to maintain required pond level for design water level to flow in the main canal. Upstream of Core wall another water source named "KunniKhola" has been managed to inlet the JherdiKhola to augment the discharge during dry period. The Bed and banks are seen stable.

### *2.1.2 Details of Canals & Structures*

Total length of main canal is 1.3 km. Main canal and intake are surrounded by forest. Main canal almost has been lined by RCC to control water seepage. Slope of the canal varies from 1/200 to 1/400. Super passage, foot bridges and covered canal in main canal to protect the debris and dead leaves falling into the canal have been constructed however they have not been mentioned in the scope of the work. Main canal is quite stable except at two locations where toe part of the canal was observed critical but WUA/beneficiaries have started already bio-engineering work planting bamboos bushes to check soil erosion.

RCC lined canal is constructed of length 950 m and branch canal is also strengthened by RRM canal lining of 200 m length. RCC lined canal section is 40*40 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 retaining structures at different locations of length 20 m. There has not been observed any danger of canal by sliding of earth. Whole length of canal is intact and serving well to WUA/beneficiaries for irrigation.

Road crossing structures mainly foot bridge 2 nos have been provided at appropriate location where local trail crossed over the canal.

Required super passage structures of 3 nos across the main canal have been constructed facilitating the local drain to cross over the main canal without any obstruction of main canal water flow.

2 foot bridges at different suitable location have been constructed facilitating wild and domestic animals across the canal.

Out of 5 nos. of outlets, 13 nos of outlet/division-box have been constructed facilitating farmers easy in water management among beneficiaries to their field.

### *2.1.3 Detail Cost of Development*

Detailed design cost estimate of the sub project after PICC approval is NPRs 1,06,59,541.41 inclusive of SEMP cost as 3,00,000.00, environmental activities cost as 18,530.66, institutional development cost as 18,530.66, insurance cost @ 0.45 %, work charge contingency @ 5 %, Physical contingency @ 10 %, Price escalation @ 10 % and VAT @ 13 %.

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

**Table 2 Detail Completion Cost**

| | |
|---|---|
| Command Area | 25 ha |
| Households (no.) | 109 |

| | |
|---|---|
| **Sanctioned Estimate (NPR.)** | |
| PICC Appraised | 1,06,70,839.00 |
| Detailed Design cost | 1,06,59,541.41 |
| **Cost Sharing (NPR.)** | |
| DOI Part | 98,67,046.68 |
| WUA Contribution | 7,92,494.73 |
| **Contract amount (NPR.)** | |
| WUA Contract (payable) with VAT | 42,78,178.09 |
| NCB contract with VAT | 24,69,280.29 |
| Other Expenses | 22,40,127.54 |
| WUA Contribution | 8,39,169.82 |
| **Expenditure (NPR.)** | |
| WUA Contract (payable) with VAT | 42,78,178.09 |
| NCB Contract with VAT | 24,07,501.79 |
| Other Expenses | 15,74,282.00 |
| WUA Contribution evaluated | 8,66,633.62 |
| **Total** | 91,26,595.50 |
| **Overall Physical Progress w.r.to Physical Scope in %** | 100 |
| **Overall Financial Progress w.r.to Detail Design in %** | 92 |

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 7,92,494.73 that is 7 % of detailed design cost estimate. However, they had contributed labour in sub project development work in terms of cost as NPR 8,66,633.62 that is 8 % of detailed design cost estimate.

### *2.1.5 Physical and Financial Progress*

This subproject has been approved amount as NPR 1,06,59,541.40. By the completion of the project total expenditure in terms of WUA payable, NCB contract and WUA contribution comes out to be NPR 75,52,313.50 against the total contract amount of NPR 75,86,628.20

At the end of sub project, physical progress with respect to physical scope is 100 % and financial progress with respect to detailed design cost comes out to be 92%.

## 2.2 Water Management and Distribution Methods

### *2.2.1 Water Distribution System*

Sufficient outlets 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 when preventing water seepage

through the canal bed. Before rehabilitation sub project was suffered by half of the command area under water shortage but after rehabilitation with water volume increased in main canal this problem is almost nil. 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 the period of water scarce. Before rehabilitation rotation was set to 48 hours, after rehabilitation it is reduced to 24 hours. However, water management is improving as WUA/beneficiaries are active and 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 Naupane Dynasty. 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 JherdiKhola ISP is a single tier system and has main canal level of WUA organization. Fourteen members Jherdikhola WUA was formed from general assembly/mass meeting of the general water users on 2013 (2070 BS) based on their own constitution. The existing WUA is chaired by Mr. Bhim Lal Neupane (Bishnu) and 5 female members, one janajati and other (Brahmin, Chhetri etc.) ethnicity also represent in WUA. It was registered in IDD, Gulmi under the Irrigation Regulation & policy on 31st December 2013.

List of WUA members with landholding area have been prepared by WUA members with 109 households and 562 populations including brahmin, chhetri and dalit communities.

The WUA meeting is held regularly by every month. Besides this they hold emergency meetings. 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 established their own office with signboard in a small hut at the village. One steel rack and trunk box were given by IDD Gulmi and one chair with table is being assured to provide by IDD, Gulmi for WUA office management. They have WUA letter pad, seal, minute register of meeting, users list, 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 60,000.00 to fulfill Up-front cash (0.5% of total project cost) as retention in account of IDD Gulmi.

Enrollment 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 labor contribution while regular maintenance of Canal & structures/Intake would perform. There is NPR 8,00,000.00 in the hand of WUA collected from different

sources. It was also suggested to WUA for membership distribution to the water users and 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, 66, 633.62, mobilizing all beneficiary farmers as people's contribution (8% of total project cost) during sub project improvement and development

### 3.6 WUA Training and Further Requirements

As per IDD, Gulmi 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 | 07/12/2070 | 12 | 6 | 18 | 13 | 3 |
| WUA Management | 08/07/2070 | 18 | 7 | 25 | 0 | 0 |
| Agriculture Management | 05/09/2071 | 25 | 10 | 35 | 3 | 0 |
| O&M | 30/12/2071 | 21 | 9 | 30 | 1 | 0 |
| WUA Management | 12/03/2072 | 18 | 7 | 25 | 0 | 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. For this WUA have at hand profit money NRP 8, 00, 000.00 from WUA payable contract and NPR 60, 000.00 retention money would get back from IDD Gulmi later as seed money for O & M. WUA is planning to invest it among them at good interest rate and interest amount to be used in repair and maintenance of the system. 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 joint field visit of IDD and TA and meeting with WUA on 9 April, 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 Gulmi district. Selected few ICWM-activities were launched in the sub-project in the FY: 2072/73 and FY: 2073/74. The DADO Official/Focal Person distributes the activities to each ISP as per need of Sub-project and some activities are conducted in close guidance and support of the DADO Office, Tamghas 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 Johang Agriculture Service Centre (ASC),of the DADO office, Tamghas and district level training participants were represented from other different ISPs as well.

## 4.2 Cropping Patterns, Yields and Intensity

The cropping intensity in the command area has gradually increased. The soil of command area is sandy loam to loam and in some patches clay loam. Cultivation of 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 260 % compared to base year (130 %). The increased cropping intensity is mainly due to availability of timely irrigation water and sufficiency of water 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 Tamghas and PainchoCooperstives of Jherdi locality 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

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 NWRP, Bhairahawa and RARS, Lumle are supporting to solve any type technical field problems in the crops. They also, are proving source seed of varieties in demand of rice, wheat and maize. But the Seasonal Crop Planning Workshop is organized in the site by DADO officials and/or ASC officials at Johang as when needed

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

iv Agro-vet for Fertilizer, Cereal Seeds and Vegetable Seeds and Paincho Cooperative for seasonal credit facility

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

b) Private dealers are supporting by providing fertilizers.

c) Paincho Cooperative is 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 2072/73 after rehabilitation of sub-project. Farmers are enthusiastic and happy to cultivate their lands after rehabilitation of scheme. Now farmers are confident to grow summer, winter crops and some area in spring crops.

### *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<br>2. Few farmers 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: 2071/72.Farmers of sub-project 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: 2072/73 and 2073/74) 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:

**Table 5 Introduced Improved Varieties of Crops**

| Crops | Adopted Crop Varieties |
|---|---|
| Paddy | Khumal 4, Ram Dhan |
| Maize | Manakamana-3 & Arun-2. |
| Wheat | Gautam and NL-197 |
| Oil Crop | Unnati |
| Potato | Janakdev and Cardinal |
| Summer Vegetables | Hybrid seeds of cucumber, bitter guard, sponge guard |
| Cauliflower | Snow crown, Snowmistric, Kathmandu Local |
| Cabbage | Green Coronet |

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 community 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)-Paddy and Potato*

Two Farmers' Field Schools have been conducted in the sub-project area. The FFS were on vegetables (cauliflower and potato) in each FFS about 25 participants have participated and they were taught about crop farming from land preparation to harvesting time and all farm operations have to be done by their self-involvement. 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 control measures of the pests.

### *4.5.4 Motivation of Farmers to Vegetable Cultivation*

Farmers are cultivating vegetables and 3 sets of Plastic Houses were distributed to three farmers for encouraging them for vegetable cultivation and off-season vegetable cultivation. Tanghas bazaar and Tansen bazaar (Palpa) are not so far and there is regular bus transportation. There is an office of Agriculture Service Centre (ASC) at Johang that is implementing ICWM program activities in the project area. ASC is promoting command area farmers for product sale in the locality.

### *4.5.5 Vegetable and Agriculture Produce Collection Center*

A vegetable and Agriculture Produce Collection Center to construct by the WUA farmers at middle area of command area is planned in the near future. The WUA has capacity to build it which will help them for training hall, production collection as well as for regular official purpose.

### *4.5.6 Recruitment of Social Mobilizer (SM)*

There is a Social Mobilizer, who is looking over the activities of project. She coordinates all activities related to construction, agriculture and institutional development in the project area.

## 4.6 Impact of Agricultural Activities in Agriculture Development in ISP

### *4.6.1 Adoption of Improved Crop Variety*

About 70% of paddy area is covered by improved varieties like Khumal-4, Ram Dhan, 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 bitter gourd, cabbage and cauliflower in most cases. However, open pollinated varieties of vegetables are also prevalent and source seeds are supplied by Agro-vets and agri-input suppliers of Tamghas. . .

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 4 and Ram Dhan

Wheat - Gautam and NL-297

Maize - Manakamana-3 and Arun 2

Oil Crop - Unnati

Potato - Janakdev and Cardinal

Cabbage/Cauliflower - Improved or Hybrid

### *4.6.2 Crop Area and Cropping Intensity*

The cropping intensity of project area has been substantially increased to a great extent. The cropping intensity has increased by 260% compared to that of the base year (130 %). 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) | | Latest FY: 2014/15 | | Remarks |
|---|---|---|---|---|---|---|---|
| | Area (ha) | Yield (t/ha) | Proposed Area (ha) | Yield (t/ha) | Area (ha) | Yield (t/ha) | |
| Paddy | 9 | 2.30 | 20 | 3.40 | 15 | 3.70 | |
| Wheat | 6 | 1.60 | 18 | 2.40 | 15 | 4.20 | |
| Maize | 20 | 1.70 | 25 | 2.40 | 22 | 2.90 | |
| Potato | 2 | 8.00 | 7 | 12.00 | 6 | 2 0.20 | |
| Vegetables | | 7.00 | | 10.00 | 1 | 10.70 | |
| Total | 37 | | 70 | | 59 | | |

| Crops | Baseline-FSR (Nov. 2013) | | Target-FSR (Nov. 2015) | | Latest FY: 2014/15 | | Remarks |
|---|---|---|---|---|---|---|---|
| | Area (ha) | Yield (t/ha) | Proposed Area (ha) | Yield (t/ha) | Area (ha) | Yield (t/ha) | |
| Cropping Intensity (%) | 130% | | 300% | | 260% | | |
| % 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 2.30 tones/ha to 3.70 tones/ha, similarly maize from 1.70 to 2.90, wheat 1.60 to 4.20, potato 8.00 to 20.2 and vegetables 7.0 to 10.7 tones/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 rice, maize and wheat. Production demonstration, Farmers' Field School (FFS) in different vegetables such as in bitter gourd and potato, Seed Multiplication of rice, wheat and maize 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 1-Power Tiller to WUA. The tiller will help farmers to operate farm operation that will reduce operation time and costs.

*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 three farmers and initiated vegetable cultivation in Plastic Houses each having 60 sq. m. area. Generally, Plastic House is used for seedling development in off-season and off-season vegetable cultivation especially in tomato and cucumber.

# 5 SOCIAL AND ENVIRONMENTAL SAFEGUARDS

## 5.1 Participation of Beneficiaries in SEMP Preparation

IDD Gulmi invited through letter dated November 1, 2013 to all district offices (project affected line agencies and people) for the mass meeting to be held in Hunga VDC-9, Gulmi district on date November 8, 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 participation in 10 nos. Like wise in group discussion participated from affected line agencies were Chief of district administration office, Chief of local development office, Chief of soil conservation office, Chief of Drinking water supply office, Chief of district forest office with other members of district offices. WUA and farmers of head, middle and tail of both banks of canal (38 nos) and Dalit of 10 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 economically backward people of command area and modern agriculture practices emphasising on organic manure preparation with minimising the use of rampant pesticides. Finally minutes of meeting highlighted major issues andpossible 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 of Movement of domestic Animals/People | Low cost Foot Bridge/crossing at different/convenient location. | √ | |
| | Covered canal | √ | |
| Use of Chemical fertilizer and pesticide | Organic farming training & promotion | √ | |
| | Awareness training on controlled use of CF & Pesticide | √ | |
| Management of Stone Quarry along the canal alignment | Provision of required hauling distance | √ | |
| | WUA will strictly prohibit extracting river material within 300m u/s and 300m d/s of purposed intake point and other permanent structures | √ | |
| | IDD will expedite an alternative quarry site | √ | |
| Breaching of canal due to overflow in rainy season and canal losses due to holes created by insects. | Provision of flow control structures | √ | |
| | Provision of RCC lining | √ | |
| Aggravate Land slide problem | Provision of lining, covered canal and retaining structures. | √ | |
| | Vegetation and plantation | √ | |
| Gender Issue | Assess the training needs as regards to skill development and income generation like organic farming etc. | √ | |
| | Field and exposure visit | √ | |
| | Provision of special clause regarding equal wages among male and female workers on same kind of work | √ | |
| Employment Opportunity to economically Backward people. | Priority for Recruitment of backward people in the construction activities. | √ | |
| | Priority for Recruiting them for Canal operation | √ | |
| Establishment of labor camp | For health and safety of construction workers | √ | |

### 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 planting | | | | | | |
| Farmers field School training | 4* | 13 | 12 | 25 | 2 | 2 |

* School days run 4 times from planting, intercultural operation, plant protection and harvesting in an interval of one month in potato crop.

### 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 women groups, they were confident to prepare organic manure and about fifty percent of farmers had adopted modern farming techniques. 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.

The Planting of Bamboos on right bank of canal controlled soil erosion thereby making canal as stable. Farmers were suggested to increase bamboo planting along the bank of 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. There were water deficiency at the tail end farms 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

JherdiKhola Irrigation sub-project 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 JherdiKhola sub-project are active and would keep system intact and sustainable by following the resources/fund generation activities such as by growing cash crop, livestock and poultry farm 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 delivered 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 transported 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 keeping 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 and finding the access reaching to them for sustainability. Technical know- how by pursuing through specific, practical and substantial numbers of training programs needs to be provided to WUA and farmers of JherdiKhola sub project in order to make system sustainable. Irrigation development division (IDD), Gulmi 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 good management in compare to other SPs of Mustang, Manang, Lamjung and Parbat districts but some more trainings are required on financial management and cooperative development including IFS 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 a great extent. The cropping intensity has increased by 260 % compared to that of the base year (130 %). 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.

Yields of crops have increased in the project area. The crop yield of paddy has increased from 2.30 tones/ha to 3.70 tones/ha, similarly maize from 1.70 to 2.90, wheat 1.60 to 4.20, potato 8.00 to 20.2 and vegetables 7.0 to 10.7 tones/ha.

Farmers are cultivating vegetables and 3 sets of Plastic Houses were distributed to three farmers for encouraging them to vegetable cultivation and off-season vegetable cultivation. Farmers have no problem of selling farm products. In Tamghas bazaar and Tansen bazaar (Palpa) is not so far from project area and there is regular bus transportation despite of the rough road going on there.. Around 5 ton of fresh winter vegetables (cauliflower, cabbage, radish, broccoli and carrot) is sold locally and/or to the Tamghas and Palpa markets.

About 70% of paddy area is covered by improved varieties like Khumal-4, Ram Dhan, 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 bitter gourd, cabbage and cauliflower in most cases. However, open pollinated varieties of vegetables are also prevalent and source seeds are supplied by Agro-vets and agri-input suppliers of Tamghas.

Farmers are rearing different types of livestock commodities which help promote the use of farmyard manures 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. Technology diffusion is happening gradually from the project site to other neighboring Village Palika s as well.