BENCHMARKING THE IMPACT OF MICRO WATERSHED DEVELOPMENT PROJECTS OF SABARKANTHA AND ARAVALLI DISTRICTS OF GUJARAT

A Thesis submitted to Gujarat Technological University for the Award of

Doctor of Philosophy

in

Civil Engineering

By

Vishalkumar Rameshchandra Gor

149997106020

under supervision of

Prof. (Dr.) Vinodkumar Manilal Patel

GUJARAT TECHNOLOGICAL UNIVERSITY

AHMEDABAD

February, 2023

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ABSTRACT

For achieving continuous and sustainable development in a watershed area, it is desirable that natural resources such as soil and water are assessed and used efficiently. In general, water and land resources are assessed as a unit considering the watershed area. In order to achieve sustainability, it is also necessary to consider hydrological, social, economic and environmental aspects of water resources. However, it is difficult to bring all these indicators together on a single platform. An integrated watershed management approach adopted in the recent decade caters to the management of natural resources and the overall economic improvement of the region. There is a large-scale implementation of projects with watersheds as a planning unit in many parts of the country. Several projects are under implementation, and several are completed in Gujarat's Sabarkantha and Aravalli districts. The districts are situated in the northern parts of Gujarat, India, which has an uncertain discrepancy of enduring drought and the consequential crop failure, low irrigation and drinking water, and mass migration of people searching for work, etc.

This research aimed to develop and apply a framework to assess the overall efficiency of the watershed projects on an integrated approach by selecting major affecting indicators and benchmarking their performance on ranking criteria. To evaluate the effectiveness of these projects on different parameters, the changes in hydrological, agricultural, economic, and social parameters before and after implementing watershed projects were studied in this research work. A set of indicator questions for questionnaire survey, was developed to collect the ground-level agricultural and socio-economic data to evaluate the effects of watershed project implementation. RUSLE carried out the soil erosion estimation, and change in groundwater was estimated by well inventory and water table fluctuation method. All evaluated indicator values were used to develop the watershed performance benchmarking index (WPBI) for ranking and indexing watershed projects implemented in the study area for each watershed and regression model for WPBI was obtained by statistical analysis. Based on WPBI, the development status is observed after the implementation of watershed projects under various programmes.

This study also concentrated on the impact of watershed projects on the participation of people through local institutions in watershed management and their resultant impact on the region's society, economy, and environment. This research focuses on the overall

impact of watershed management in the development of Sabarkantha and Aravalli districts based on micro watershed projects under IWDP, DPAP, and IWMP watershed schemes.

This research contributed to the evaluation of watershed projects to identify issues and challenges in watershed implementation and suggestions for policymakers to make necessary changes in guidelines. The evaluation framework will benefit watershed planners and managers by assessing and evaluating watershed impacts in other watersheds.

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Right from the beginning, I cannot find adequate words to express my immense gratitude for the invaluable inspiration I have drawn in this thesis from my esteemed guide, **Dr. Vinodkumar M. Patel**, Professor and Head of Department, Civil Engineering, Shantilal Shah Engineering College, Bhavnagar. As the torchbearer in this work, he left no stone unturned to make my little endeavor a success, and without his sincere dedication it was impossible for this work to see the light of day. I wish to express to my guide my deep and sincere gratitude for the constructive and moral support, constant encouragement, invaluable guidance and challenge to our efforts in the right direction, without which this work would not have come into its present form.

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DEDICATED

TO

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List Of Abbreviation

^{0}C	Degree Centigrade
A.W.	After Watershed
B.W.	Before Watershed
BCR	Benefit Cost Ratio
CCI	Change in Cropping Intensity
DDP	Desert Development Programme
DDP	Desert Development Programme
DoLR	Department of Land Resources
DPAP	Drought Prone Area Programme
DPR	Detailed Project Report
DRDA	District Rural Development Agency
EPA	Entry Point Activities
GCA	Gross Cropped Area
GIS	Geographical Information System
ha	Hectares
IWDP	Integrated Wastelands Development Programme
IWMP	Integrated Watershed Management Programme
IWMP	Integrated Wasteland Management Programme
IGWDP	Indo-German Watershed Development Programme
Kg/ha	Kilograms per hectare
MoRD	Ministry of Rural Development
NABARD	National Bank for Agriculture and Rural Development
NGOs	Non-Governmental Organizations
NGOs	Non-Government organizations
NWDPRA	National Watershed Development Project for Rainfed Areas
NPV	Net Present Value
PIA	Project Implementing Agency

PRIs	Panchayati Raj Institutions
PVC	Present Value of Cost
RUSLE	Revised Universal Soil Loss Equation
WDP	Watershed Development Program
WDPs	Watershed Development Projects

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CHAPTER 1

Introduction

1.1 General

Land, water and vegetation are the most valuable natural resources, and their importance to human civilization needs no further explanation. In fact, life on earth is impossible without land, water and vegetation. However, degradation of natural resources is increasing due to rapid biotic pressure from anthropogenic activities. The needs of agriculture, industry, the home and others often result in water being diverted from one use to another. In rural areas, livelihoods and natural resources such as land, water and vegetation are linked. Therefore, it is essential that natural resources are optimally managed for the maintenance of life and development.

The term watershed has been defined as the highest topographical point from which rainwater is drained. The accurate meaning of watershed is a geohydrological unit drained at a common point by a system of streams. It is an area from which all water drains to a common point. Watersheds allow one to manage water and soil resources to improve agricultural production through water and soil conservation techniques. Watershed management involves the optimal use of soil and water resources between upstream and downstream areas within a watershed to ensure the conservation of natural resources, increased agricultural productivity, and better living standards for its residents. It also ensures the best possible balance in the environment. Thus, watershed management is the process of directing and organizing the use of land, water and other resources in a watershed to meet desired needs and services without compromising land and water resources (Rajora, 2002).

Each watershed management project under the Watershed Management Program is a micro-level effort to achieve the goal of optimal production with minimal threat to the ecology of the area by treating the unproductive land and engaging in related activities for the benefit of the landless. The program employs a collaborative strategy of multi-resource management, involving all stakeholders within the watershed unit, working together as a group to identify the resource issues and concerns of the watershed plan with solutions that

are socially, economically, and environmentally sustainable (Rockstorm et al 2007; Wani et al 2007). The Watershed Management and Development Policy was formulated and became effective on April 1, 1995. Since then, the Drought Prone Areas Program (DPAP), Desert Development Program (DDP) and Integrated Wasteland Development Program (IWDP) have been implemented on a watershed basis.

Participatory watershed development has proven to be an attractive approach to rural development in recent decades. Projects and programs have been implemented across Latin America, Africa and South Asia, but perhaps it is India where the approach is most popular and sustainable (Rajora, 2002).

The Watershed Program is one of the means of addressing the regional resource management program to address the water scarcity and will also solve the temporal and spatial distribution of rainfall in the Indian subcontinent. The Watershed Development Program addresses the problem of rain-fed agriculture in India. Watershed management has emerged as a new paradigm for the planning, development and management of land, water and biomass resources with a focus on social and environmental aspects and a participatory approach. It aims to integrate social resource management with natural resource management. The approach is generally preventive, progressive, corrective and creative. Watershed management involves the prudent use of natural resources with the active participation of institutions organized in harmony with the ecosystem.

The environment has a pervasive impact on the human community living in a micro-watershed region as they depend on it for food, fodder, fuel and water. It is necessary for the people to understand the relationship between their poverty and the devastated environment in which they live. They find a good economic alternative in the Watershed development program and willingly trade short-term environmental demands for possible long-term benefits. The regeneration of the environment is therefore only possible if the local community deems it necessary and if they have full control over the mobilization, management and conservation of resources. To be successful, the watershed development program must ensure the participation of the people concerned and relate to the environment in which they live and on which they depend to meet their needs (Rajora, 2002).

The concept of "integrated watershed development" states that the development and management of the resources in the watershed should be taken up in order to achieve higher production that can be sustained without causing resource base degradation or ecological imbalances. It aims to prevent watershed degradation resulting from the interaction of physiographic features, eliminate unscientific land use through appropriate cultivation patterns, and eliminate soil erosion so as to improve and maintain resource productivity, resulting in higher income and living standards in the watershed (Khanpara et al., 2009)

Every effort should be made to ensure water conservation on site. Runoff use on a watershed basis should be restored to minimize spatter erosion losses. The crop production program should introduce efficient cultivars, both productive and profitable cropping systems, forage crops and their improved production techniques. Live stock is maintained with appropriate management. On land unsuitable for crop production, alternative systems such as pastoralism, agricultural horticulture and alley cropping could be established to meet the different needs of humans and livestock. Trees are an ecologically optimal land use for stabilizing flood catchment areas. There is an acute shortage of firewood in the villages. Firewood (fast-growing species) must now be planted, tended, and marketed as a crop. All these activities in a watershed will also benefit human resource development.

The Watershed Framework offers an excellent option for sustainable agricultural management - for today and for years to come. However, the success of watershed management efforts depends on the participation of the population who understand the issues related to soil and water management, water table fluctuations, current crop systems and intensity, as well as infrastructure, marketing and the socio-economic fabric in which farmers are involved.

Community participation and collective action are critical components of watershed management. Sustainability, equity and participation are three basic elements of participatory watershed management. Therefore, the broader socio-economic concern of any technology package is to affect population size, ethnic or community populations, household composition and structure, and people's basic and secondary needs. There is a close relationship between community and the environment and people that depends on food, water and other resources. These conditions can be further improved with lifestyle changes to improve the condition of the ethnic tribesmen of the affected areas.

The Parthasarathy Committee (2006) felt that community participation was sought by entrusting responsibility for all aspects of the program to the Panchyati Raj Institution. The committee recommends that the Village Watershed Committee (VWC) will be a committee of Gram Panchayat, elected at a meeting of Gramsabha. As watershed development affects all members of the community, Gramsabha is the appropriate authority to decide on priorities for the exploitation of common results and the equitable sharing of benefits between different segments. Functional responsibility for preparing for implementation and management of the Watershed Action Plan rests with V.W.C.

Parthasarathy (2006) suggested that for genuine women's participation in watershed management, Women Watershed Committees (WWC) should be formed and the duty of the Watershed Development Team (WDT) should be to mobilize women to actively participate in meetings of the WWC and should pay due attention to women's perceptions and priorities in the Watershed Action Plan.

Sridevi et al. (2010) stated that the involvement of men and women in soil, water and vegetation conservation is an essential condition for the success of the management of any watershed. Using a gender-sensitive approach to watershed management ensures that the unique needs, priorities and knowledge of women and men are incorporated into the management plan and policies.

The watershed development program is accordingly being communicated as an effective tool to address a significant number of these issues and is perceived as a potential engine for agricultural development and improvement in vulnerable and minimally rain-fed areas (Joshi et al., 2005). Proper stewardship of normal wealth at the tipping point level brings numerous benefits when it comes to expanding food production, improving jobs, securing living conditions, addressing gender and value issues alongside biodiversity (Wani et al., 2003).

1.2 Concept of Watershed Development

1.2.1 Definition of Watershed

A watershed is defined as a topographically defined geographic area in which all runoff through the existing drainage system extends to the common drain of the area for eventual disposal (Corn, 1993; Swallow et al., 2001). One watershed is separated from another by a

natural boundary known as a watershed or ridge line. It is an area of land that captures precipitation and carries overland flow and runoff to an outlet in the main river channel. Watershed is essentially all land and water that contributes water to a common point. A watershed is defined as a geographic area drained by a stream or system of connecting rivers in such a way that all surface runoff arising from precipitation in that area exits the area in a concentrated flow through a single outlet (Singh, 2000). While a simple or a first-order catchment consists of a single stream, a multi-order catchment consists of several such simple-order catchments. The entire drainage basin of a large river system is commonly referred to as a drainage basin, which actually includes a large number of watersheds. Thus, a watershed is an area from which all water drains to a common point, making it an attractive entity for engineering efforts to manage water and conserve soil to improve production and conservation. A watershed in an alpine region would be very different from a dry and dusty watershed in an arid region. Two contiguous watersheds that lie side by side actually differ in detail, even though they may look the same. The watershed over any point of a defined outflow canal can be easily identified. Therefore, the watershed is the area that includes the catchment, command, and delta of a stream. From a hydrological perspective, the shape of the watershed is important because it controls the time it takes for runoff to concentrate at the outlet. Watersheds can also be categorized as hilly or flat watersheds; wet or dry watersheds; Red Earth Watershed or Black Earth Watershed based on criteria such as soil, slope, climate, etc.

1.2.2 Objectives and Need of Watershed Development Programmes

The objectives of watershed development projects are: -

(i) Development of barren/degraded land, drought prone and desert areas on a watershed basis, keeping in mind land capability, site conditions and local needs.

(ii) Promoting macroeconomic development and improving the socio-economic conditions of resource-poor and disadvantaged groups living in the program areas.

(iii) Mitigating the adverse effects of extreme climatic conditions such as drought and desertification on crops, humans and livestock to improve them overall.

(iv) Restoring the ecological balance through the utilization, conservation and development of natural resources, namely land, water, vegetation.

(v) Encouraging the village community to engage in sustainable community action for the operation and maintenance of the assets created and further developing the potential of the natural resources in the watershed. Simple, easy and affordable technological solutions and institutional arrangements that use and build on local technical knowledge and available materials.

(vi) Job creation, poverty alleviation, community empowerment and development of human and other economic resources of the village.

The needs of watershed development projects are: -

The development of rain-fed areas is essential not only for their contribution to overall food production, but also to increase other resources in the drylands such as forage, fruit, timber, etc. The dominant land-use system, accompanied by unabated deforestation, results in rapid soil erosion and depletion of the water table. Uncontrolled grazing of land washes away invaluable soil nutrients, and continued soil erosion is silting up reservoirs at a more alarming rate than the loss of reservoir storage capacity. In the absence of efforts to increase production and productivity, the rainy areas have stagnated. This led to increasing regional disparities between rained and irrigated areas. The productivity of crops in dry areas is very low due to soil erosion, depletion of moisture resources, low soil fertility, denudation of planting, plowing under marginal soil, etc.

Soil erosion is a major problem in arid areas of grass or crops during the pre-monsoon season due to lack of soil cover. This requires the adoption of inflection point development approaches. Unemployment, seasonal unemployment, disguised unemployment, etc. are common in arid regions, leading to poverty, malnutrition and dietary imbalances. This requires the adoption of watershed management approaches. The watershed development program is recognized as the best program to conserve soil and water, increase vegetation and water resources, and improve crop productivity, employment opportunities for the rural population and food intake in terms of nutritional value. Rainfall on undulating terrain combined with unscientific farming practices are causing large-scale erosion of fertile topsoil, adversely affecting agricultural yields. Problems of soil erosion and water conservation therefore required a regional approach. As the weak dryland farmers are unable to take effective measures to conserve the soil and water resources, the government

has introduced a watershed approach using low-cost and locally accessible technologies, suitable for soil and moisture conservation, afforestation, etc.

The broader goal of the program is general economic development and improvement of the socio-economic conditions of the resource poor part of the people inhabiting the program area. Irrigation in India has been practiced since ancient times and irrigation tanks and wells are familiar features of the Indian landscape to supplement and conserve rainfall. The ancient Native American civilization developed primarily in the river valleys, which were well-endowed with irrigation systems that aided in the cultivation of food crops and cotton.

Livestock is another important natural resource in Indian agriculture. In the absence of favorable conditions for agriculture, livestock farming is the only alternative source of income for the majority of the rural population. India had the largest cattle inventory in the world in 2021 followed by Brazil and China. India's cattle's inventory was reported at 305.5 million head in 2021, accounting for roughly 30 percent of the world's inventory (Rob cook, 2022). Cattle numbers vary from state to state due to climate, grazing opportunities, and forage area. Cattle provide the main motive power for almost all agricultural work, such as ploughing, raising water from wells, and transporting produce from the fields to market centers. They provide us with milk and dairy products.

1.2.3 Components of watershed development programmes

The components of the watershed development programme include:

(i) Soil and water conservation

(ii) Water harvesting

(iii) Management of crops

(iv) Afforestation

(v) Pasture development

(vi) Livestock management

(vii) Practicing various land use systems

(viii) Other agricultural and non-agricultural activities

(ix) Development of community resources.

(x) Employment generation and reduction in migration

1.2.4 Watershed Development in India

Watershed Development Programs (WDPs) are very important programs that fall under the purview of the Department of Land Resources (DoLR) and the Ministry of Rural Development (MoRD). Four major schemes namely IWDP, DPAP, DDP, and IWMP are widely implemented by governments with within the project durations. The DoLR is dedicated for updating the programme guidelines for these programs with regular input from research institutions, government and non-government organizations, technical committees, workshops and seminars, etc.

The development of watersheds in India has a long history that started immediately after the planning stage. In the beginning, the process of watershed development started on a small scale with some activities like soil and water conservation, land development, strengthening of land borders, etc. Watershed strategies have been changed from the success and failure of the various activities carried out in different parts of the country and achieved the status of an Integrated Watershed Management Program (IWMP) with voluntary community participation. Not only central and state governments, but also international agencies are stepping up to partner with local institutions to implement watershed development projects.

In India, more than 60 percent of the country falls under the rainfed agriculture category, which is characterized by low productivity, water scarcity, degraded soils and widespread poverty (Rani et al., 2007). Therefore, the implementation of watershed development projects attracts the attention of small and marginal farmers and landless workers, who interestingly involve and support the implementation and management process. It would guarantee more food, fodder, fuel and livelihood security for those at the bottom end of the rural income scale. Watershed development projects aim to harmonize the use of water, soil, forest and pasture resources in order to conserve these resources to increase agricultural productivity (Farrington et al. 1999).

Given the prevailing conditions and the rate of declining soil quality and depletion of water resources, Govt. of India have paid more attention in all their five-year plans in terms of allocating huge budgets and deploying more manpower and institutions for the effective implementation of Watershed Development Programs (WDPs). The WDP approach aims to improve and develop all types of land, i.e., Government, forest, community and private lands lie within the watershed. The programs have focused on wasteland improvement, runoff reduction, water conservation and protective irrigation mechanism in all areas including desert-prone and drought-prone areas. The development programs envisaged in his area of responsibility include almost all activities affecting land, water and biomass production.

1.2.5 Watershed Programme Implemented in Gujarat

In Gujarat, the Ministry of Rural Development (MoRD) initiated DDP, IWDP and DPAP in all districts of the state to consider the impact of watershed programs on various agroclimatic and socio-economic conditions of watershed farmers. The program has placed an emphasis on providing irrigation by eliminating runoff with dams and securing farmers' ability to irrigate. This program has transformed the socio-economic status of people in the watersheds and their quality of livelihood as income from agriculture has increased.

1.2.6 Integrated Wasteland Development Programme (IWDP)

The Integrated Wasteland Development Program (IWDP), was a centrally funded program came in operation since 1989-90 and was transferred to the former Department of Wasteland Development along with the National Wasteland Development Board in 1992. The development of wasteland and degraded land under the program aims to promote job creation in the rural areas and improve people's participation at all stages, leading to sustainable development of the country and fair sharing of benefits. The integrated wasteland development program provides for the development of non-forest wasteland in the country. The basic approach in the implementation of this program was changed from 1995, when the guidelines for the development of watersheds through the watershed approach came into force. Since then, wasteland development projects had been approved on a micro-watershed basis. From 1999-2000, new Integrated Wasteland Development Program projects were prioritized for approval in consultation with the state government. The projects must be completed over a period of five years at a total cost of Rs. 4,000 per

hectare for projects sanctioned up to year 2000 and a total cost of Rs. 6,000 per hectare for projects sanctioned after year 2000.

Objectives of the IWDP:

(i) Development of wasteland or degraded land on the basis of watersheds, taking into account the possibilities of the land, site conditions and local needs.

(ii) Promoting overall economic development and improving the socio-economic situation of the poor and disadvantaged sections of the population in the program areas.

(iii) Restoring the ecological balance through the use, conservation and development of natural resources, e.g., land, water, vegetation.

(iv) Sustainable community action for the operation and maintenance of the created assets and further development of the potential of the natural resources in the catchment area.

(v) Simple, easy and affordable technological solutions and institutional arrangements that use and build on local technical knowledge and available materials.

(vi) Job creation, poverty alleviation, community empowerment and development of human and other economic resources of the village.

IWDP aims to develop all non-forested badlands in the country. When the Watershed Development Guidelines for the development of problem areas through a watershed went into effect in April 1995, the basic approach to implementing this program was changed.

1.2.7 Drought Prone Area Development Programme (DPAP)

The Drought Prone Areas Program (DPAP) was launched by the Government of India in 1973-74 to address the particular problems faced by these vulnerable areas, which are constantly affected. The program has been run on a watershed basis since 1995. Responsibility for the planning, execution and maintenance of the watershed projects will be entrusted to a local people's organization specially established for this purpose. In view of the large problem area to be dealt with and the current budget, the program has to be started continuously over several years. The watershed projects included for this purpose have a project duration of 5 years. The program covered 972 blocks in 183 districts in 16

states. The states covered are Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal.

Objectives of DPAP:

(i) Minimize the adverse effects of drought on crop production, livestock, land productivity, water and human resources.

(ii) Promoting overall economical development and improving the socio-economic conditions of the poor and disadvantaged sections of the population in the program areas.

(iii) Initiate development work by watershed for land development, water resource development, and afforestation or pasture development.

1.2.8 Integrated Watershed Management Programme (IWMP)

Planning Commission and National Rainfed Authority (NRA) had framed common guidelines, 2008 for the implementation of watershed programmes for all ministries and departments based on the recommendations of the Dr. Parthasarathy Committee Report. The Committee have necessitated modifications in the watershed schemes of the Department of Land Resources. Accordingly, Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP) and Integrated Wastelands Development Programme (IWDP) of land Resources have been integrated and consolidated into a single modified programme called Integrated Watershed Management Programme (IWMP), with effect from 2009-10.

The main objective of the IWMP is to restore the ecological balance through the use of conservation and development of degraded natural resources such as soil, vegetation and water. The results are prevention of soil runoff, regeneration of natural vegetation, rainwater harvesting and replenishment of the water table. This allows for multiculturism and the introduction of various agriculture-based activities that help provide people with a sustainable livelihood.

The salient features of IWMP:

(i) Establishment of dedicated institutions with multidisciplinary experts at State, district and projects level like State level Nodal Agency (SLNA), Watershed Cell cum Data Center (WCDC) at district level, Project Implementing Agency (PIA) and Village level Watershed Committee (WC) at project level.

(ii) Cluster approach applied in project selection and preparation.

(iii) Increased cost norms from Rs. 6,000 per ha. to Rs. 12,000/ha. in plain areas and Rs. 15,000/ha in difficult/hilly areas.

(iv) Uniform funding pattern of 90:10 by center and state governments.

(v) Release of central finance in three instalments, i.e., 20 percent, 50 percent and 30 percent instead of five installments.

(vi) Project duration considered is 4 to 7 years.

(vii) Technical planning of the projects using IT, RS techniques, GIS facilities for planning and monitoring & evaluation.

(viii) Earmarking of the project funds for DPR preparation (1 percent), entry-level activities (4 percent), training and capacity building (5 percent), monitoring (1 percent) and evaluation (1 percent).

(ix) Introducing new livelihood component with earmarking of 9 percent of the project funds and production system and micro-enterprises with 10 percent of the project fund.

(x) Delegating power of sanctioning authority for projects to state governments.

1.3 Need of the Study

Since the Watershed Programme has completed two decades of implementation, it has become relevant to examine its impact on the community's livelihood and household level to achieve its objectives. Very few studies have been conducted in this region, which facts the need for more micro-level studies. Sabarkantha and Aravalli districts are drought-prone districts and also are hot arid districts falling under a rain-shadow tone. The districts are covered under the IWDP, DPAP, and IWMP for two decades, from 2000 to 2020. Because

of the above, it is essential to study the impact of the Watershed Development Programme on the social and economical development of the region in both districts.

Further, it is essential to study the impact of the Watershed Development Programme on agriculture and the other living conditions of the rural community in the study area. A detailed study is necessary to know the changes in income and employment generation of households in the watershed areas, examine the groundwater levels after the Watershed Development Programme, and assess the socio-economic transformation of poor rural households. It has been necessary to evaluate watershed development programs considering an integrated approach for various hydrological, agricultural, and socio-economic parameters by ranking and indexing the indicators in one value. Therefore, the watershed performance benchmarking index is essential to understanding the overall impact of watershed programs in the region. Researchers have not much focused on ranking and indexing the watershed performance indicators in an integrated approach.

1.4 Objectives of the Study

The objectives of the study are:

(i) To assess the impacts of the programs on hydrological, agricultural, economical, and social parameters.

(ii) To design the watershed performance benchmarking index from the impacts of the watershed program activities in a given study area.

(iii) To compare the watershed programs for identification of existing issues and deficiencies in the implementation of the programs and suggest remedial measures

1.5 Organization of the Thesis

In this thesis, the author has tried to organize the chapters in a way such that it gives a vision to the benchmarking the impact of watershed management on hydrological, agricultural and socio-economic development of Sabarkantha and Aravalli districts. The author has tried to find out how watershed management under IWDP, DPAP and IWMP implemented and what the effects of these micro watershed management programmes are and how they contributed to the socio-economic upliftment of the rural poor in study area.

The introductory chapter i. e. first chapter deals with the background of the study, concept of watershed development, watershed development in India and Gujarat state, need and objectives of study, limitations of the study, and lastly the chapter schemes.

The second chapter deals with the performance indicators of watershed evaluation, literature review based on impacts of watershed development programmes on various performance indicators and research gaps.

The third chapter briefly discussed about the profile of Gujarat state, Sabarkantha and Aravalli districts, talukas and watershed projects. Statistical details of the study districts, watershed project implementation data of selected watershed projects.

The fourth chapter discussed the methodology of study and data collection and regarding tools and techniques for analysis.

The fifth chapter deals with the impact assessment of watershed projects on hydrological, agricultural, economical and social parameters for the selected performance indicators.

The sixth chapter deals with the development of a new watershed performance benchmarking index (WPBI) by considering the criteria weights through Analytical Hierarchy Process (AHP) tool.

The seventh chapter deals with the statistical analysis of watershed impacts including statistical tests of impact parameters and WPBI.

The eighth chapter deals with the results and discussion.

The ninth chapter deals with the major findings of the study, and issues and deficiencies identified in implementation of watershed projects and suggestions and remedies.

The tenth chapter deals with the Conclusion and limitations of study.

CHAPTER 2

Review of Literature

2.1 Performance Indicators of the Watershed Evaluation

Development of an assessment framework for any watershed development project deals with: (i) developing a framework to identify the impacts to assess, and selecting appropriate indicators to assess the impacts. (ii) development of a framework to jointly maintain the indicators and assess the overall impact of the project.

Evaluation is a periodic assessment of the project's relevance, performance, efficiency and impact in the perspective of its stated objectives. Various types of evaluation were used in different studies. Many researchers have used various kind of performance indicators for the watershed impact studies. The impact and process indicators for watershed evaluation have been reviewed for the study as per Table 2.1.

Table 2.1 Impact and process indicators of impact assessment

Impact indicators	**Process indicators**
Yield of crop	Project proposal submission
Livestock productivity	Sanction by DRDA/nodal agency
Land under irrigation	Release of funds
Vegetation cover	Information sharing with community
Migration rates	Awareness creation
Employment generation	Resolution from village
Soil loss	Entry point activity
Groundwater table	Baseline survey
Height for age	Self-help group, user group formation
Consumer durable	Watershed committee formation
School enrolment	Planning (delineation, PRA, problem defining, site selection, design and estimates, prioritisation, action plan)
Utilization and maintenance	Approval of action plan

Reproduction	Training
Social capital	Execution of works and completion of project
Distribution of benefits	Measurements and payments
	Extraction of implementing agency
Source: Bollom (1998) and Rama Chandrudu (2006), Mishra and Saxena (2009)	

The performance of watershed projects implemented must be evaluated on basis of performance indicators which impact the livelihood through the physical, agricultural and socio-economic parameters. Many researchers have used different performance indicators in their studies based on the agro-climatic and socio-economic conditions of the watershed regions.

The performance indicators for watershed evaluation have been reviewed for the study as per Table 2.2

Table 2.2 Performance indicators of watershed evaluation

Performance Criteria	**Indicators**	**Measures**
Groundwater recharge and water resource potential	Measurement of groundwater levels, climate variation, and pumping volume	Duration of water availability Water table of wells Surface water storage capacity Hydrological index Index of water conservation practices Difference in number of wells Number of wells recharged/defunct Difference in irrigated area Difference in number of seasons irrigated Difference in village-level drinking water adequacy Difference in irrigation intensity

Agricultural productivity/profits	Agricultural productivity and net returns at plot level	Agricultural Productivity Index (API) Crop Yield Index (CYI) Crop Diversification Index (CDI) Cropping System Index (CSI) Index of Agroforestry Practices (IAP) Difference in cropping pattern Difference in cropping intensity Difference in yield of crops Farm profit
Household welfare	Household income and wealth	Difference in per capita income Difference in employment Difference in household income Difference in persons migrated
	Nutritional status	Food security index (FSI) Child nutrition and health
Socio-economic indicators	Development of infrastructure Impact on women (decision-making, health, life style and awareness) People's participation Institutions Ownership rights	Index of Social Affiliation (ISA) Difference in number of institutions Difference in number of agricultural laborers Difference in number of landless laborers Difference in farm households by size groups
Overall impact	Economic returns to investment Extent of green cover	Net present value, benefit-cost ratio, and internal rate of return Forest Eco Index

Source: Wani et. al. (2011)

2.2 Review of Impact of Watershed Development Programmes

Saaty (1980) developed a powerful and useful tool for managing qualitative and quantitative multi-criteria items affecting decision-making behavior. This model is called Analytical Hierarchy Process (AHP) and is based on a hierarchical structure.

Singh et al. (1989) studied the socio-economic impacts of the Kandi Watershed and Area Development Project in Punjab. The study examined the socio-economic impact of the project through evaluation surveys with before-and-after comparisons. The study found that there was a significant shift in land use pattern: from uncultivated to cultivated, uncultivable waste to cultivable (although some further treatment was necessary to bring about this under cultivation) and from unirrigated to irrigated. The stand pattern analysis showed slight shifts in favor of commercial crops. Investment in farm machinery and equipment had increased from 23 percent of total investment in 1979-80 to 44 percent in 1986-87. Investments in dairy cattle and milk yields were significantly higher in 1986-87 than in 1979-80. Crop yields improved by 2.7, 2.8, and 6.2 percent per year between 1979-80 and 1986-87 for maize, wheat, and oilseeds, respectively. The corresponding growth rates for Punjab were 3.3, 1.2 and 3.5 percent per year. During the period, gross margins per farm and per capita from agriculture grew at rates of 6.1 and 5.4 percent per year at constant prices, respectively. The study also found that the gap between rich and poor had widened as Gini ratios were higher post-project than pre-project. The project as a whole, excluding irrigation and fisheries, achieved a benefit-to-cost ratio of 1.7 at a discount rate of 12 percent and an internal rate of return (IRR) of 16.73 percent. The IRRs for the forestry, livestock, soil conservation, and horticulture components were 15.29, 13.16, 12.57, and 28.31, respectively. The irrigation component returned 3.38 percent, primarily due to significant delays in execution and cost increases.

Bhardwaj et al. (1989) studied the socio-economic impact on the Bajra Ganiyarand Sinha watershed and found that the irrigated area doubled within 4 years from 1983 to 1987. The number of electric wells and sprinklers increased fourfold, crop yields rose sharply, and farmers' incomes rose 166 percent.

Hazra (1989) studied the impact of the watershed development project in Tejpura village, Jhansi district and found that the irrigated area in the village increased from 3.8 to 78 percent. The effect of the watershed on the increased water table was evident from an increased number of wells dug and hours of irrigation from those wells. Wheat recorded the highest production. Initial annual land productivity increased fourfold and total annual production increased from 2238 to 7722.

Eswarappa and Reddy (1991) found that management efficiency not only brings improvements in watershed development programs and activities, but also benefits beneficiaries in the form of higher income, higher yield, and better job creation.

Shrivastava et al. (1991) examined a watershed development project and found that there was conclusive evidence of changing farming practices, acreage increased by 0.508 hectares per farm and irrigated area increased by 92.43 hectares or 1.49 hectares per farm. Crops such as wheat, gram, urid, spices, and soybeans were first introduced on some farms and covered larger areas on others. The effect of the program on yield levels was positive as crops showed higher yield levels. The increase in yield was greater for Rabi plants than for in kharif plants. The maximum increase in yield was recorded for opium (93.0 percent), followed by grams (84.2 percent), urad (74.4 percent), and wheat (33.81 percent). Among the kharif crops, corn (43.3 percent), peanut (31.9percent) and jowar (25.0 percent) benefited the most. The program also helped create jobs and increase wage income for farming families.

Sandhu et al. (1991) evaluated Makkowal Watershed Project, KatourManhota Watershed Project and Atwerapur Dam for crop productivity and income of beneficiaries in the project area. The study found that the Makkowal and Katour-Manhota Watershed was economically viable and had a positive impact on crop productivity and income for beneficiaries by increasing cultivation intensity. But the Atwarapur Dam did not bring significant benefits to the beneficiaries due to its inappropriate location and high cost.

Singh and Thapaliyal (1991) studied the impact of the National Watershed Development Projects (NWDP) on the rainfed agriculture economy in Jhansi district of Bundelkhand region of Uttar Pradesh, which suggested that watershed projects have contributed significantly to raising the water table in the studied area. The average annual rise in the water table was 3.7 meters and varied from 3 meters in the rainy season to 6.5 meters in the

summer season. After the implementation of the Watershed project, the intensity of cultivation increased significantly. An area shift among legumes from cereals and oilseeds during the kharif season was also observed. However, during the Rabi season, the acreage shifted more towards cereals from legumes and oilseeds. The increase of Rs. 3,109 per hectare in production costs following the implementation of the NWDP clearly shows that farmers have increased the use of inputs in the selected watershed. This resulted in an increase in net income from crops during both the kharif and rabi seasons.

Shah and Memon (1995), in a brief overview of watershed development projects implemented in Gujarat since 1995-96, examined their initial impact at the household level, based on a primary survey covering 120 households in four micro-watersheds spanning Rajkot, Surendranagar, Amreli and Bharuch were selected. Although the project was barely complete four years after its implementation, the irrigated area has almost doubled since the project intervention. Since the increased irrigation was used primarily for cotton cultivation during the kharif season, which extends into the rabi season, there is indeed an increase in cultivation intensity. Increased irrigation has led to a significant increase in the productivity of all crops Yields from all crops increased by 63 percent. As many as 83 percent of households indicated that the project had created a direct benefit in terms of drinking water supply, with this proportion being 100 percent in Surendranagar and Bharuch. The majority of landless households (71percent) reported an increase in job availability, mainly in project activities. even if it has not yet led to a reduction in migration.

Deshpande and Rajashekaran (1997) studied the impact of the National Watershed Development Program in Maharashtra to analyze its impact on resulting variables such as income, employment, women's status, health and education, wealth and household spending, etc. The study showed an increase in gross household income from 17 to 42 percent. However, the income from agriculture of the beneficiaries increased by 34 to 47 percent. It also showed that beneficiaries had better asset generation capacity compared to non-beneficiaries.

Renard et al. (1997), in their study Predicting Soil Erosion by Water: A Guide to Conservation Planning with the RUSLE, provided various empirical equations for estimating the R-factor, K-factor, LS-factor, and the C- and P-factors for the RUSLE equation specified.

Ellis (1998) has explained rural livelihood diversification as intrinsic to the importance and necessity of local contexts and required local attention when assessed in light of demographics, location, income levels, education and vulnerability.

Arunkumar (1998) assessed the impact of watershed development in the Kuthanagere micro watershed in Karnataka. The impacts were analyzed for both private and communal areas. It was reported that among the different farming systems on private land, the cost-benefit ratio was highest in the case of the garden-pasture system, followed by agri-horti, agro-forestry, farming and silvi-pasture systems. The benefit-to-cost ratio for silvi-pasture, silvi-horti-pasture and horti-pasture on common land was 1.92 with an IRR of 25 percent for the project as a whole.

Reddy (2000) had reviewed 22 impact assessment studies conducted across the country between 1967 and 1997 and found that watershed development projects have shown positive effects on crop yields, crop intensity and changes in cropping patterns over the years. He noted that all studies have shown that net incomes have increased significantly and the median BCR has remained stable at 1.75, indicating positive impacts of the turning point development programs in the country.

Bauman et al. (2000) attempted to assess the impacts of watershed development programs under the new guidelines within a broader Sustainable Rural Livelihoods (SRL) framework to examine the impacts in comparison to previous approaches to assessing costs and benefits from many angles and to evaluate.

Hanumantha Rao (2000) based on a qualitative assessment - Impact of the DPAP found that the impact of the program was positive and significant.

Jain et al. (2001) used USLE and Morgan models to estimate soil erosion in the Himalayan watershed. They reported that the erosion was within the limit given by the Morgan model and a slightly higher value of USLE.

Satapathy et al. (2002) concluded that increases in forage production motivated farmers to keep cattle. Milk production increased by 3-4 liters per day. The records were very bad. Details of physical and financial objectives and achievements, list of beneficiaries, appropriate maps, etc. were not available. Interdepartmental collaboration with various line departments was unsatisfactory and the Watershed project was essentially a Department of

Agriculture program. No NGOs or voluntary organizations were involved in the project activities. No special program was set up for the peasant women, who play an important role in the tribal community.

Jaya et al. (2002) issues the operational modality to facilitate people's participation in the Watershed program. It is now widely recognized that active participation by people is critical to the sustainability of development under the Watershed programme. Therefore, a participatory approach is now being used in all phases of the program.

Dhaka and Sharma (2002) found that the watershed projects had contributed significantly to raising the water table in the region and the average productivity of almost all crops was higher in the beneficiaries than in the non-beneficiaries.

Ziller and Phibbs (2003) integrated social impact into the cost-benefit analysis. They followed a participatory method (through stakeholder consultation) and created a matrix that integrates both financial and non-financial costs and benefits incurred or due to individuals and groups. The matrix brought social issues into economical analysis, and the diversity of stakeholders made it a broader exercise.

Mazumdar (2004) studied the effects of soil and water conservation measures under the watershed development program on changes in cropping pattern, cropping intensity, crop productivity and agricultural yields in the Nikhari watershed in Nagaon district of Assam. Analysis of cropping patterns showed that the increase in area under high-yielding varieties of rice and the shift in favor of commercial crops, particularly vegetables, was very noticeable in the case of beneficiary households. The findings of the study would be helpful for agencies, policy makers and administrators in promoting and implementing WDPs. The study also observed that resource consumption like labor and capital were higher among beneficiaries than non-beneficiaries.

Jugale (2004) studied some specific targets such as the impact of rain water harvesting measures in tehsils affected by four droughts in Sangli district of Maharashtra and to identify an effective strategy to improve community participation. The study shows that the percolation tanks or a major irrigation source brought acres of land under the irrigation system, soil quality improved net cropping intensity, and potable water supply improved as well. The study proposes to maintain and resolve conflict resolutions between stakeholders in the upstream-downstream context.

Joshi et al. (2004) assessed erosion loss in the Bhetagad watershed in the central Himalayas. They reported that the soil in terraced farmland was more stable than that in open pine forests, tea gardens, and pastures. The maximum losses of water, soil and nutrients were found on areas covered with open pine trees and the minimum on agricultural areas. The well-managed agricultural land had higher water, soil and nutrient conservation values than the other land use systems in the watershed.

Malaisamy and K. Uma (2004), examined some specific objectives such as assessing and comparing the changes in land use pattern, cropping pattern, employment, income and wealth situation before and after the implementation of the program on watershed and field level. Also, to elaborate the changes in water level and irrigation intensity of the beneficiaries, build a soil erosion model and identify the problem faced by the beneficiaries and propose appropriate policy measures. The study proved to be very beneficial for farmers in terms of increasing crop productivity, employment, groundwater and reducing erosion and ultimately increasing the socio-economic status of farmers. The study suggests that regular evaluation of the WDP is essential to measure progress, make our work more effective, share experiences to assess strengths and weaknesses, and improve activities.

Khalid et al. (2004) recommended in the report that beneficiaries could be improved in terms of livelihood through rural connectivity and the establishment of market links enhanced by watershed development programs. Similarly, it has recommended agricultural and non-agricultural livelihood creation for stakeholders below the watershed.

Agnihotri et al. (2004) conducted an impact analysis of the watershed management project in Relmajra district of Nawansahar (Punjab) based on ‘with and without’ and ‘before and after the project’ approach. A comparison between the watershed (Relmajra) and the control village (Taunja) showed that the control and watershed villages in the situation before the project (1991) had a similar income from milk, firewood and fodder from forests, while the villagers of Tanuja used to earn a higher income than the farmers of Relmajra Agriculture. After the project implementation (2001) there was a quantum leap of about 800 percent in income from agriculture in Relmajra compared to only 50 percent in Tanjua. Milk income in Relmajra and Tansua increased by 104 and 56 percent, respectively. After 10 years of the project, the contribution of agriculture, milk or livestock, firewood and fodder from the forest to the total income of farmers in Relmajra village was 69.4, 28.5, 01 and 2.0 percent, respectively.

Deshingkar (2004) points out that poor people from rural and less affluent areas resort to seasonal, circular and other forms of short-term migration to struggle for a better livelihood. While it is true that people migrate because there is not enough work locally, many poor people see migration as an opportunity to escape the highly exploitative clientele relationship in the village and earn far more than they could ever earn in their own villages.

A study by Sharda, Sumara and Dogra (2005) shows that various mechanical and biological measures significantly reduced runoff and soil loss and increased water storage capacity by more than 45,000 cubic meters per watershed.

Palanisami and Suresh Kumar (2006) observed and found that despite policies, aspects of implementation usually differ due to local demand. Several studies have shown that the watersheds will not be maintained once completed and the benefits may diminish over the years.

Satyendra Prakash Gupta (2006) analyzed 194 watershed respondents in his case study on the impact of national watershed development programs on income and employment generation in Chhattisgarh. The study found that 17.34 lakh was spent on establishing the basic activities in the project area, accounting for 37.76 percent of the total investment. An expense of 14 lakh (30.49 percent) was spent to improve the production system on available and unavailable area, which included cultivation demonstration, agroforestry, dryland horticulture, organic farming system, poultry, pig farming, goat farming, basket and rope manufacturing etc. The The remainder of the approved fund was spent on improving soil and water conservation and livestock management. The watershed was 28.02 percent irrigated, mainly due to relatively higher public investment in that area, while that figure was only 13.33 percent in the non-watershed.

Gurunathan and Eavera (2006) reported from Thanjavur, Coimbatore, Tamil Nadu that the watershed development program has helped improve groundwater recharge, improve water availability for livestock and other non-domestic residents and prevent soil erosion. The water level rose in the wells, which significantly increased the intensity of harvesting. The household income from crops and trees was obtained more from the farmer's area.

According to Bakker et al. (2007), increased soil erosion leads to nutrient losses, leading to a decline in agricultural production, and is also responsible for eutrophication of water bodies.

Palanisami et al. (2009) mentions in 'A Manual on Impact Assessment of Watersheds' that watershed development programs that involve the whole community and natural resources affect (i) crop productivity and production, changes in land use and cultivation patterns, the introduction of modern technologies, the increase in milk production, etc., (ii) community attitudes to project activities and their participation in various stages of the project, (iii) socio-economic conditions of people such as income, employment, wealth, health, education and energy consumption, (iv) environmental impact, (v) use of land, water, human and animal resources, (vi) development of institutions to implement the development activities in the catchment area, and (vii) ensuring the sustainability of the improvement.

Thomas et al. (2009) examined the socio-economic limitations of the watershed development program in Palakad district of Kerala. The results of the study in relation to the socio-economic constraints and the strengths and weaknesses of the program showed that among the constraints faced by the beneficiaries, three constraints, namely: unavailability of irrigation water, lack of technical guidance and awareness of the program played one major role. Analysis of the strengths and weaknesses of the program showed that the greatest strength of the program was farmer collaboration. The problem of the untimely distribution of contributions was identified as a major weakness of the programme.

Joshi et al. (2009) assessed the impacts of watershed programs in India through a thematic analysis of published results and identified the drivers of collective action in watersheds, such as: based entry level activities, good community-based organizations, decentralized decision making, targeted activities for women and vulnerable groups with good capacity building and technical support.

Palanisami et al. (2009) points out that a watershed development project, if implemented successfully, leads to increased availability of water, feed and jobs. These factors would help reduce human and animal migration, particularly people migrating for lack of employment, water and food.

Palanisami et al. (2009) points out that experience shows that watershed development activities have an overall positive impact on the village economy. Therefore, it is important to assess the impact of these river basin development activities using key indicators such as NPV, BCR and IRR. Although these indicators show the overall impact of river basin development activities, very few studies have quantified the benefits and arrived at NPV, BCR and IRR. The reason for this is attributed to many: (i) most rating agencies are unfamiliar with these techniques, (ii) insufficient data availability to quantify benefits and costs, and (iii) unfamiliarity with computer software.

Singh et al. (2010) concludes in their study that there have been changes in land use patterns, livestock farming, forage development, cropping patterns and income generation, with some marked improvements in livelihoods for the people living in the watersheds. However, sustainable employment opportunities in rural areas require further investigation.

Chivate (2010) points out that benchmarking can be defined as a systematic process to ensure continuous improvement through comparison with relevant and achievable internal and/or external norms and standards. It can compare past and present performance, as well as the performance of (otherwise similar) companies and/or compare a performance against a set of relevant 'best practices'. Benchmarking is a very powerful management tool that is widely used around the world to analyze and improve the performance of water resource projects

The Planning Commission (2012) reported that the earlier watershed development programs focused on engineering interventions to develop the soil moisture conservation activities in the drought-affected areas and water harvesting. However, these programs improved crop yields and increased irrigated areas, but the focus was on improving the livelihoods of land-owning and non-land-owning watershed households, which also needed to be considered for future programs.

Rathore et al. (2012) found in their work that during the program implementation the project provided more people with employment opportunities in the activities related to soil and water conservation, while providing the highest level of regular employment in the agricultural production sector.

Vinchurkar (2012) reported that runoff and soil loss remain major problems in Indian agriculture. Various studies have quantified the effects of topography, culture systems,

various soil and culture management techniques, and potential erosion control practices by measuring runoff. A positive correlation between vegetation cover and soil loss has been found in most studies related to the assessment of runoff and soil loss.

Reddy et al. (2012) attempted to assess the impact of WSD programs following the implementation of the 1995 guidelines covering a large sample of watersheds in rain-fed Rajasthan. Specific objectives include: (a) assessing the biophysical, economical, and institutional impacts of WSD, (b) identifying factors affecting watershed performance, and (c) providing policy inputs to improve WSD performance.

Johnson et al. (2013) they found in their work that the availability of water for irrigation and livestock, land productivity and the rehabilitation of degraded and expansion of arable land has increased significantly.

Gray and Srinidhi (2013), in their working paper titled Watershed Development in India: Economic Valuation and Adaptation Considerations, have made it clear that watershed development programs are evolving from a top-down, technical and bureaucratic approach to a participatory, more environmental approach with appropriate technological interventions, including social ones, have developed dimension in its design.

Satishkumar and Tevari (2013) stated that the Watershed Scheme is a land-based scheme that is increasingly water-focused and whose main objective is to increase agricultural productivity through increased on-site moisture conservation and protective irrigation for rural socio-economic development increase people. A major concern in watershed development is the equitable sharing of benefits and cost sharing of land and water resource development and resulting biomass production. The Watershed Development Program is the strategy to promote resource-poor farmers in a sustainable mode.

Dadhich et al. (2014) found in their work that the integrated watershed development program reduced soil erosion and helped conserve moisture, and also raised the water table significantly, which helped increase the country's output and productivity.

Kulshrestha et al. (2014), in their study on the Budhara micro-watershed in the Ambah block of Morena district, Madhya Pradesh, found that due to participation in the watershed management activities, farmers were able to improve their adoption to advance soil and water conservation practices.

Kumar and Bansal (2014) have stated that the impact of the Integrated Watershed Management Program (IWMP) implemented in 2009-10 was in the form of accelerated benefit sharing for the activities related to the creation and increase of Soil moisture in the water catchment areas as well as the increase in drinking water and the availability of water for irrigation purposes were seen as the basis of life.

Dev et al. (2017) worked in Himachal Pradesh on the impact of the watershed development program. The implementation of the watershed development program had a positive impact as evidenced by higher income levels and increased crop production in the watershed. Therefore, the watershed development programs have replicable models for the other areas of the state to make agricultural and other natural resource management practices in the area sustainable.

Zhen et al. (2019) have explained natural capital in terms of households that were primarily engaged in agriculture and earn their living from farming practices. The study also highlights the importance of natural capital in that both the quantity and quality of households with farmland were higher than households with other primary livelihood strategies.

Joji and Jayapal (2020) studied the sub-micro watershed in 42 acres of land owned by Govinda Pai Memorial Govt. College, Manjeshwar Block, Kasaragod District in the lateritic Peninsular India, selected for the demonstrative project on artificial recharge of ground water. The study revealed that the implementation of artificial recharge scheme in the campus of Govinda Pai Memorial Government College, Manjeshwar, Kasaragod district, Kerala had been found to be effective in conserving the monsoon runoff at sub-micro watershed level and also in replenishing the ground water resources in the area. The scheme had also demonstrated the types of recharge structure feasible for undulating terrains of lateritic terrain of Peninsular India for cost-effective recharge augmentation structures.

Khola et al. (2021) evaluated 17 sub-watersheds implemented under River Valley Project in lower Bhavani catchments on hydrology, bio-physical and socio-economic aspects. The study revealed that runoff and soil loss reduction was ranged from 4 to 18% and from 4 to 5 Mg ha-1 yr-1, respectively. The water table had increased in the range of 0.3 to 0.5 m in the influence zone of percolation ponds. The value of net present value was more than Rs.

107 crores with 1.69 BCR and 63.7% internal rate of return. The criteria of economic evaluation indicated that such projects are highly economically sound to be taken on priority for sustainable agricultural growth in the region. The evaluation concluded that such projects should be carried out with more concentration and coordination guided by technological requirement.

Pradyumna et al. (2021) pursued a health impact assessment (HIA) of a watershed development (WSD) project in semi-arid Kolar district, India. The HIA revealed that the WSD project might result in a range of positive (e.g., nutrition, sanitation and water quality) and negative health impacts (e.g., vector-borne diseases, pesticide exposure, drowning and zoonosis). HIA of these projects holds promise to influence health in remote drought-prone areas and build-up HIA capacity through application in non-controversial project environments

2.3 Research Gap

In many studies watershed projects have been evaluated based on `before-after' and `with-without' approaches but they have not covered varieties of watersheds by nature or scheme.

Past studies have undertaken economical benefit-cost analysis by adopting `with-without' comparison but they have not included the environmental impacts integrated with social parameters.

It has been envisaged the absence of adequate base line information on vital parameters like access to irrigation, fertilizer use, seed variety, soil type and topography.

Most of the evaluation studies are carried out either during or almost immediately after the completion of the project implementation which reduces the scope for assessing the impact in the long term.

It has been envisaged the lack of more varieties of watershed development schemes like IWDP, DPAP, DDP, IWMP, IGWDP etc. implemented in an area. Also seen the lack of evaluation by integration of various tools for benchmarking.

Very few studies or none of them have calculated the impact on the basis of indices and ranking through the use of various tools/softwares/methods.

Integration of technical and social evaluation with qualitative and quantitative approach is not adopted in many research studies.

CHAPTER 3

Districts And Area Profile

3.1 Profile of Gujarat State

3.1.1 Location and Boundaries

Gujarat is located on the west coast of India and has the longest coastline of any state in the country at 1,600 km. It borders Pakistan to the north-west, the Indian states of Rajasthan to the north, Madhya Pradesh to the east and Maharashtra to the south-east. The state lies between $20^{o}07'$ N to $24^{o}43'$ N latitude and $68^{o}10'$ E to $74^{o}29'$ E longitude.

3.1.2 Administrative Divisions and Demographic Particulars

The state is administratively divided in to 33 districts (Figure 3.1). For ease of understanding, it has been divided into five geographical units, based on climatic variation, geology, forest types, soil, and drainage patterns. These include (1) South Gujarat: This region is an extension of the northern end of the Western Ghats and can be divided into coastal plains and hilly moist deciduous forest. (2) Central Gujarat: This area is an extension of the western Satpura and Vindhya Ranges (Malwa Plateau) along with some central plains, featuring dry deciduous forest. It receives the drainage water of major rivers, such as the Narmada and Mahi. (3) North Gujarat: This region is an extension of the Aravalli Hills, with a mix of dry deciduous, Prossopis, and thorny scrub arid forest. (4) Saurashtra: This unit has the longest coastline of the five regions, and it includes two coastal gulfs with good mangrove forests. It also comprises large forest blocks of dry deciduous and thorny scrub forests alongside of grasslands. (5) Kutch: This is an area with large undulating hills area with scant rain, as well as dry arid grassland areas.

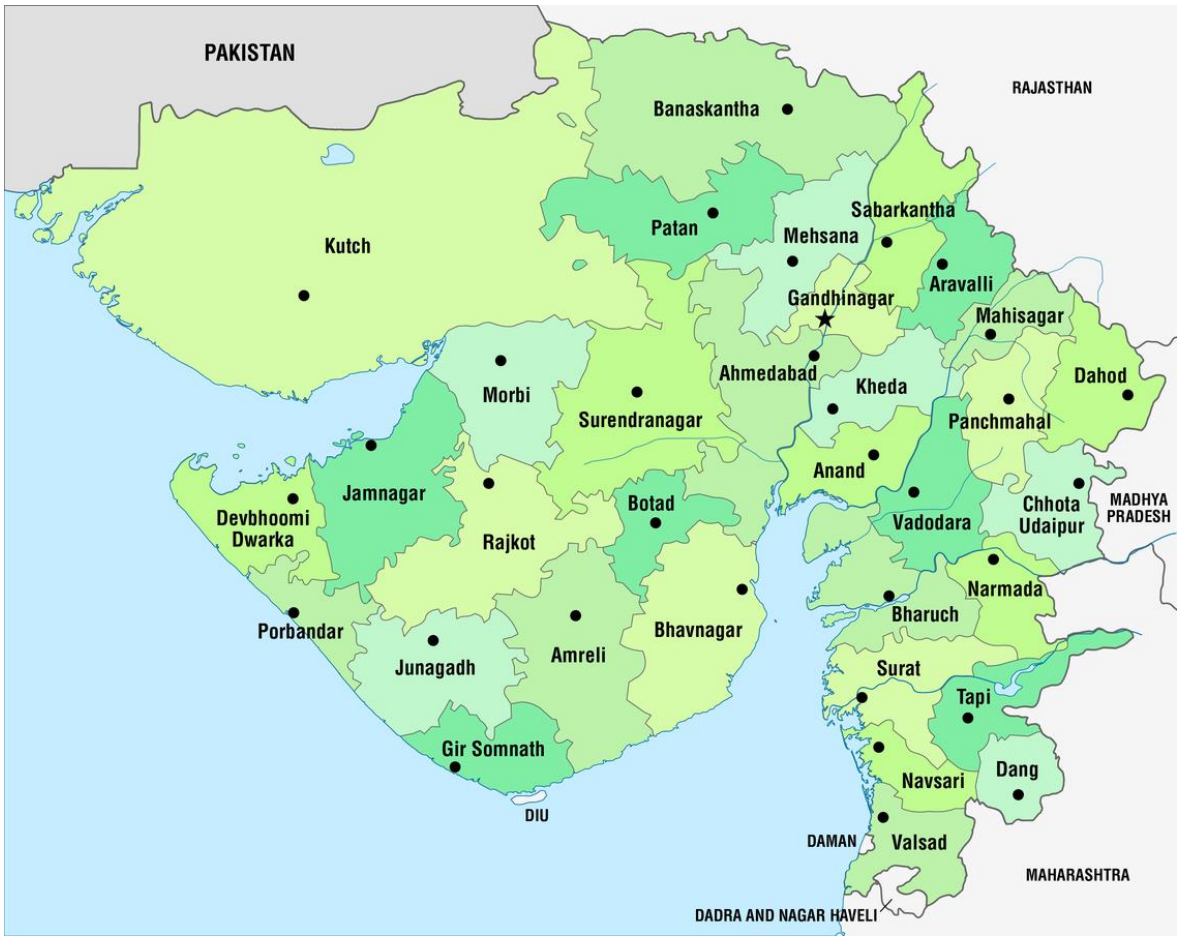

Figure 3.1 Administrative Map of Gujarat State, India.

(Figure is not to scale, Source: Wikipedia, 2019)

Gujarat is one of the progressive states in India with a rich heritage that inspires its people to carve out a bright future with its special geographical location full of diversity like its rivers, hills, valleys, plains, forests and other resources, and the state is well known for its development. Its long history of over 2000 years has left for posterity forts, tanks, temples, mosques and cities of historical importance. These ancient cities have developed into industrial, commercial and educational centers. The state's human resources with racial and religious diversity and professional skills make it a hub of industry. The rapid growth in all sectors is mainly responsible for the development of watershed activities over time. The turning programs like IWDP, DPAP, IGWDP and now the IWMP have been implemented in the state for the improvement of watershed regions which can support the rapid growth of the state.

The capital of Gujarat is Gandhinagar and the largest city is Ahmedabad. According to the 2011 census, the population is 60,439,692. It ranks 9th in India in terms of population. The

state covers an area of 1,96,024 km². It is the fifth largest state in India by area. The literacy rate is 70.031 percent. The language spoken here is Gujarati.

The state's climate is temperate with an average temperature of 25 °C to 28 °C and an average annual rainfall of 800 mm to 1,000 mm. The state has 33 regions, 8 of which are tribal counties. According to the 2011 census, Gujarat has a population of 60.44 million, which is 4.99 percent of India's population. Rural and urban populations account for 42.60 percent and 57.40 percent, respectively. The tribal population accounts for 14.75 percent of the states' population. The state's population density is 308 per square kilometer, which is below the national average. The 2012 19th Livestock Census reported a total livestock population of 27.12 million in the state.

3.1.3 Particulars related to Land, agriculture and social aspects

Gujarat has been lauded for its economic performance, led by the manufacturing and service sectors in the 1980s and 1990s, particularly following the economic reforms. Little attention was paid to the agricultural sector during this period; rather, agricultural growth slowed down during this period (Hirway 2000, Bagchi et al. 2005). In particular, the agricultural growth rate was not low but was accompanied by very high volatility. But the picture changed after 2000, when the high-growth and low-volatility sector rallied dramatically.

Although agriculture has been functioning well in Gujarat since the 2000s, there are many challenges to be addressed in order to facilitate sustainable agricultural development in the state. As highlighted by Pathak and Singh (2007), the main challenges and tasks facing the agricultural sector in Gujarat are: (i) increasing the share of agriculture and related sectors in total government income; (ii) increase public investment in agriculture; (iii) Increasing the irrigated area in rainy areas through the development of micro-scale water resources such as dams, village tanks, farm ponds and well refilling under various water conservation programs; (iv) further increasing irrigation efficiency through increased use of micro-irrigation systems such as drip and sprinkler systems; (v) further development in the dairy sector; (vi) Marketing reforms with alternatives to contract farming; (vii) revitalization of the agricultural advisory system; and (viii) further growth in exports of value-added agricultural products.

Gujarat has varied topographical features, although much of the state has been dominated by arid and arid regions. The average rainfall in the state varies widely from 250 mm to 1500 mm in different zones. Out of 8 agroclimatic zones, five are of arid to semi-arid nature, while the remaining three are of arid sub-humid nature. Dry to medium black soils dominate the soil types in the state.

3.2 Study Area

The districts of Sabarkantha and Aravalli are known for their vulnerability to drought. Water shortages, dry farming and droughts are common. The frequent drought affects agricultural productivity. This phenomenon is totally different from other districts in Gujarat state. Therefore, watershed activities in these districts are of great relevance. The IWMP activities are carried out by the Gujarat State Watershed Management Agency (GSWMA) with financial support from the Ministry of Rural Development, Government of India. The IWDP and DPAP activities were carried out by District Rural Development Agencies (DRDAs) of the respective districts in coordination with Project Implementing Agencies (PIAs) operating in the respective districts. For this study, the IWDP, DPAP and IWMP watersheds from different blocks of the Sabarkantha and Aravalli districts were deliberately chosen as this was the least explored in this part of the country in particular.

3.3 Statistical Details of the Study Districts

3.3.1 Sabarkantha and Aravalli Districts

Sabarkantha District is located in the northeastern part of Gujarat State. The administrative seat of the district is Himatnagar, about 80 km from Ahmedabad. Sabarkantha District is surrounded by the state of Rajasthan on the northeast, Banaskantha and Mehsana districts on the west, Gandhinagar on the south, and Aravalli district on the southeast. On August 15, 2013, Sabarkantha district was split into two separate districts. The newly formed district was named Aravalli. The north-eastern part of Sabarkantha District is covered by the ranges of Aravalli Hills. The Sabarmati River flows on the western border of Sabarkantha District. Sabarmati, Hathmati, Harnav are the main rivers in the district. The location map of Sabarkantha and Aravalli districts is given in Figure 3.2.

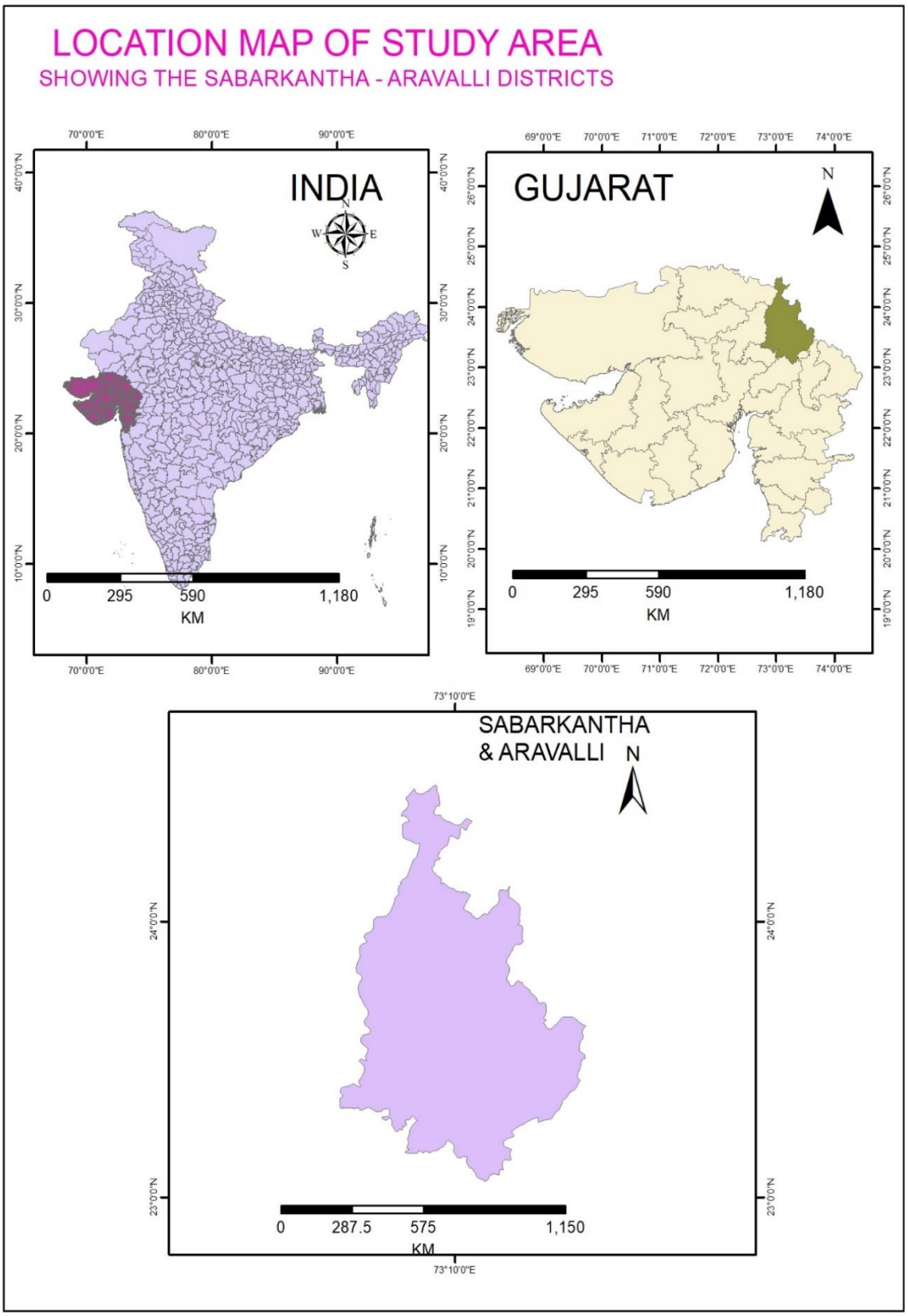

Figure 3.2 Location Map of Sabarkantha and Aravalli Districts

The district is situated between 23.03° N latitude to 24.30° N latitude and 74.43° E longitude to 73.39° E longitude. The "Tropic of Cancer" passes through Sabarkantha district. The total area of the district is 5390 Sq.km. The district is divided in 4 Revenue Sub-Divisions & 8 Talukas. There are 6 Municipalities in the District. Poshina, Khedbrahma & Vijaynagar Talukas are primarily tribal Talukas. These Talukas are hilly and have forest areas. Remaining Talukas are primarily flat areas.

As per 2011 census, the total population of the district is 13,88,671 out of which population of female and male are 6,76,826 and 7,11,845 respectively. The district is primarily rural with around 82.92 percent of the population residing in rural areas. The sex ratio is better in rural areas with 954 females per 1,000 males as against 932 females per 1,000 males in urban area.

The soil texture is generally sandy loam to clayey loam. The agroclimatic conditions provide a range of opportunities for growing crops such as labyrinth, potatoes, legumes and fruits alongside cereals, sorghum and oilseeds. The soils are medium deep and fertile. The soils of Sabarkantha district may be divided into three soil classes. Sandy loamy; Sandy loam, clay loam & clay; and Sandy clay loam, shallow in depth.

For agroclimatic reasons, a number of crops can be grown in the Sabarkantha District, but most of the cultivable land is occupied by cotton, castor, corn, peanuts and pigeon peas, wheat and vegetables. The significant shift in area towards these crops reflects their respective profitability and ease with which the crops can be grown depending on soil suitability.

The district has good water resources in the form of seven rivers viz. Sabarmati, Hathmati and Harnav. The district also has a large number of water reservoirs/dams such as Dharoi, Hathmati, Vanaj, Guhai, Harnav 1 & 2. The prestigious Sujalam Suflam project also benefits the district and has contributed to the improvement of water table and pipe well discharge. The main source of irrigation is wells (76.88 percent), although 28.10 percent of the area has access to canal irrigation. 26 percent of the cultivated area is irrigated.

Located in the heart of the Aravalli range of hills, Aravalli District is famous for its forestry and natural beauty. Besides ancient pilgrims and historical monuments, pilgrims like Tirthatham Shamlaji are located on the banks of the Meshwo River. The outstanding culture, customs, charms and festivals of the Vanvasi tribesmen living in the natural heart

of the district have an outstanding identity. The government has moved towards comprehensive development in the weaker economical, social and educational sectors of tribal and tribal people. The main occupations of the district are agriculture and animal husbandry. Important crops are corn, wheat, chickpea, mustard, millet, cotton etc. A total of 06 talukas belong to the district namely Modasa, Bayad, Dhansura, Bhiloda, Malpur and Meghraj. According to census 2011, the total number of villages is 676 and the total population is 9,08,797. Rivers Vatrak, Meshwo, Mazum, Shedhi, Indrashi, Sakri, etc. flow through the district. The district includes 676 villages and 306 village panchayats. At the time of the 2011 census, the Aravalli district had a population of 1,039,918. Planned Castes and Planned Tribes account for 62,223 and 213,913, accounting for 5.98 percent and 20.57 percent of the population, respectively. The female and male population is 499621 and 524103 respectively. It is the most educated tribal district in Gujarat.

3.4 Profile of Talukas in Study Districts

According to Census of India (2011), below is the list of households, total population and male and female statistics of talukas of sabarkantha district in Table-3.1.

Table 3.1 Demographic details of Sabarkantha district talukas

Talukas	**Population 2011**	**Male**	**Female**	**Households**
Khedbrahma	268,142	135,223	132,919	44,539
Vijaynagar	103,895	51,962	51,933	20,881
Vadali	71,711	36,580	35,131	14,944
Idar	226,728	116,323	110,405	48,486
Himatnagar	244,532	126,665	117,867	50,003
Prantij	137,683	71,473	66,210	27,523
Talod	136,126	70,252	65,874	27,049

(Source: Census of India, 2011)

As on the last 2011 census, Aravalli is divided into 6 Talukas. Below is the list of households, total population and male and female statistics for talukas of Aravalli district in Table 3.2.

Table 3.2 Demographic details of Aravalli district talukas

Talukas	Population 2011	Male	Female	Households
Bhiloda	239,216	121,018	118,198	48,234
Meghraj	167,115	84,987	82,128	31,360
Modasa	154,977	79,660	75,317	31,226
Dhansura	106,733	55,408	51,325	21,278
Malpur	97,838	50,032	47,806	18,950
Bayad	188,505	97,007	91,498	37,960

(Source: Census of India, 2011)

Sabarkantha and Aravalli districts comprises of 13 talukas. As on the last 2011 census, below is the list consisting the details of average sex ratio, average literacy rate, and agricultural labourers for all talukas of districts in Table 3.3.

Table 3.3 Literacy, sex ratio and agricultural labourers in Talukas of Sabarkantha and Aravalli districts

Taluka	Ave. Sex Ratio	Average Literacy Rate (%)		Total Literacy Rate (%)			Agricultural Labourers		
		Urban	Rural	Total	Male	Female	Total	Male	Female
Bayad	940	81.90	76.40	77.06	76.80	56.97	16822	11983	4839
Bhiloda	977	83.50	78.30	78.62	77.02	57.93	18277	10770	7507
Dhansura	926	75.60	64.20	75.61	75.99	54.68	6037	3838	2199
Himatnagar	928	87.00	82.70	84.04	80.38	67.04	18740	14138	4602
Idar	947	83.40	79.60	80.25	78.51	62.24	26091	17395	8696
Khedbrahma	981	80.80	53.20	55.84	50.80	35.53	31921	14751	17170
Malpur	956	83.80	69.10	70.05	70.76	49.12	5800	4330	1470
Meghraj	966	86.00	68.30	69.52	69.35	48.16	5839	2816	3023
Modasa	943	87.20	75.70	79.18	77.62	60.01	14172	8912	5260

Taluka	Ave. Sex Ratio	Average Literacy Rate (%)		Total Literacy Rate (%)			Agricultural Labourers		
Prantij	930	84.10	80.90	81.36	80.27	62.07	16754	11855	4899
Talod	937	82.50	77.50	78.11	77.97	57.69	11371	8243	3128
Vadali	958	77.70	73.90	74.77	74.61	54.76	11396	5739	5657
Vijaynagar	999	82.70	75.90	76.32	74.90	53.80	5069	3064	2005

(Source: Census of India, 2011)

3.5 Selection of Watershed Projects in Study Area

3.5.1 The Sampling Framework and Selection of Watershed Projects

In the study, a stratified random sampling method was used for the selection of watershed projects to cover all blocks where watershed projects were implemented under IWDP, DPAP, and IWMP watershed programs. A total of 143 IWDP watersheds, 25 DPAP watersheds and 16 IWMP watersheds were implemented in the study area. Therefore, almost 10percent of the watershed projects in each category were covered by all watershed projects undertaken. The total sample thus results in 19 watershed projects. The details of the number of projects and the sample size by geographical area are given in Table 3.4. The details of IWDP, DPAP and IWMP watershed projects selected for study are given in Table 3.5, 3.6 and 3.7 respectively.

Table 3.4 The details of number of projects and sample size having geographical area

Projects	Sample Size	Approx. Area (Ha.)
No. of IWDP projects = 143	10% of IWDP projects = 14	7617
No. of DPAP projects = 25	10% of DPAP projects = 3	1584
No. of IWMP projects = 16	10% of IWMP projects = 2	9955
Total no. of projects = 180	Total study watersheds = 14+3+2 = 19	Total area = 19156 ha (approx.)

Table 3.5 The details of IWDP watershed projects selected for study

Sr.No.	Taluka	Project Scheme	Name of PIA	Name of Project	Villages covered	Area (Ha.)
1	Meghraj	IWDP-1	Manav Kalyan Trust	Rellavada	Rellavada	650
2	Meghraj	IWDP-1	Forest Dept. (Sabarkantha South)	Kadvadi	Kadvadi	500
3	Meghraj	IWDP-1	DSC	Valuna	Valuna	503
4	Modasa	IWDP-1	DSC	Modersumba	Modersumba	464
5	Dhansura	IWDP-2	GSRDC	Shika kampa	Malekpur, shika kampa	570
6	Bayad	IWDP-2	GSLDC	Dahegamda	Dahegamda	430
7	Khedbrahma	IWDP-3	Taluka Panchayat, Khedbrahma	Unchi Dhanal	Unchi Dhanal	500
8	Vijaynagar	IWDP-4	Taluka Panchayat, Vijaynagar	Limda	Limda	500
9	Bhiloda	IWDP-5	Taluka Panchayat, Bhiloda	Dhansor	Dhansor	500
10	Bhiloda	IWDP-5	Taluka Panchayat, Bhiloda	Sunsar	Sunsar	500
11	Vadali	IWDP-6	Taluka Panchayat, Vadali	Raheda	Raheda	700
12	Idar	IWDP-7	Taluka Panchayat, Idar	Ravol	Ravol	800
13	Khedbrahma	IWDP-8	Taluka Panchayat, Khedbrahma	Dotad	Dotad	500
14	Idar	IWDP-9	Taluka Panchayat, Idar	Finchod	Finchod	500
Total						7617
Source: DRDA, Sabarkantha (2015)						

Table 3.6 The details of DPAP watershed projects selected for study

Sr. No.	Taluka	Project Scheme	Name of PIA	Name of Project	Villages covered	Area (Ha.)
1	Malpur	DPAP-10	Taluka Panchayat, Malpur	Molli	Molli	500
2	Malpur	DPAP-11	Taluka Panchayat, Malpur	Parsoda	Parsoda	584
3	Malpur	DPAP-12	Taluka Panchayat, Malpur	Vankaneda	Vankaneda	500
Total						**1584**
Source: DRDA, Sabarkantha (2015)						

Table 3.7 The details of IWMP watershed projects selected for study

Sr. No.	Taluka	Project Name	PIA	Cluster	Villages Covered	Area in Ha.
1	Khedbrahma	IWMP-1	Forest Department (Normal) Sabarkantha	Ajavas	Anjani, Kalikankar, Mamapipala, Bedi, Chhatrang, Ajawas and Paliyabiya	5168.58
2	Meghraj	IWMP-12	DWDU Sabarkantha	Dhemada	Adapur, Bharman Kotada, Bhuval, Damor Dhudha, Dhemada, Lalpur, Libhoi, Limbodara Dhudha, Moti Moyadi, Munsivada, Nani Moydi, Palla Dhudha, Sisodara(A), Undava and Vadathali	4787.00
Total						9955.58
Source: DRDA, Sabarkantha (2015)						

3.5.2 Profile of Selected Watershed Projects

The watersheds selected for the study include one or more villages in each watershed as a geographic area. IWDP and DPAP watersheds were not decided by the ridge boundary

delineation approach in the Implementation Guidelines. Therefore, the geographical area covers 500 hectares of land, which approximately takes into account one or more villages. According to the 2011 Census of India, total population and gender population, families, literacy rate, gender literacy rate, gender ratio, farmers and farmworkers, etc. were covered under the profiles of selected watersheds.

Rellavada is a village in Meghraj Taluka in Aravalli district of Gujarat with a total of 507 families. The total population of 2,757, of which 1,446 males and 1,311 females, gives an average sex ratio of 907 in Rellavada. Rellavada's literacy rate is 73.3percent. The male literacy rate in Rellavada village is 86.3percent and the female literacy rate is 59.35percent.

Kadvadi is a village in Meghraj Taluka in Aravalli district of Gujarat with a total of 345 families. The total population of 1,936, of which 979 males and 957 females, thus the average gender ratio of Kadvadi is 978. The literacy rate of Kadvadi is 73.3percent. The male literacy rate in Kadvadi Village is 84.98percent and the female literacy rate is 61.38percent.

Valuna is a village in Meghraj Taluka in Sabarkantha district of Gujarat with a total of 225 families. The total population of 1,176, of which 595 males and 581 females, thus the average sex ratio of Valuna is 976. The literacy rate of Valuna is 81.1 percent. The male literacy rate in Valuna village is 90.6 percent and the female literacy rate is 71.03 percent. In the village of Valuna, 608 of the total population were engaged in work activities. 100 percent of employees describe their work as main work (employment or earnings of more than 6 months), while 0 percent had less than 6 months in a secondary job that ensured their livelihood. Out of 608 workers employed in the main labor, 574 were farmers (owner or co-owner), while 3 were agricultural workers.

Modarsumba is a village in Modasa Taluka in Aravalli district of Gujarat with a total of 188 families. The total population of 1,074, of which 542 males and 532 females, the average sex ratio of Modarsumba is 982. The literacy rate of Modarsumba is 75.4 percent. The male literacy rate in Modarsumba village is 87.9 percent and the female literacy rate is 62.53 percent. Out of the total population, 441 workers were employed in Modarsumba village. 95.5 percent of those in employment describe their work as their main job (employment or gainful employment of more than 6 months), while 4.5 percent had less

than 6 months in a secondary job that ensured their livelihood. Of 441 laborers employed in the main labor, 226 were farmers (owner or co-owner), while 187 were farm workers.

Malekpur (Shika kampa) is a village in Dhansura Taluka in Aravalli district of Gujarat with a total of 273 families. The total population of 1,385, of which 727 males and 658 females, thus the average gender ratio of Malekpur is 905. The literacy rate of Malekpur is 59 percent. Male literacy rate in Malekpur village is 72.44 percent and female literacy rate is 43.93 percent. In the village of Malekpur, out of the total population, 750 were engaged in work. 71.1 percent of those in employment describe their job as their main job (employment or gainful employment of more than 6 months), while 28.9 percent were employed for less than 6 months in a secondary job that secured their livelihood. Of 750 workers employed at the main plant, 297 were farmers (owners or co-owners) while 181 were agricultural workers.

Dahegamda is a village in Bayad Taluka in Aravalli district of Gujarat with a total of 231 families. The total population of 1,163, of which 604 males and 559 females, the average sex ratio of Dahegamda is 925. The literacy rate of Dahegamda is 67.9 percent. Therefore, the male literacy rate is 78.42 percent and the female literacy rate is 57 percent in Dahegamda village. In Dahegamda village, 391 of the total population were employed. 100 percent of employees describe their job as their main job (employment or earnings of more than 6 months), while 0 percent had less than 6 months in a secondary job that ensured their livelihood. Of 391 workers employed in the main work, 215 were farmers (owner or co-owner) and 131 were farmhands.

Unchi Dhanal is a village in Khedbrahma Taluka in Sabarkantha district of Gujarat with a total of 450 families. The total population of Unchi Dhanal is 2,099, of which 1,068 are males and 1,031 are females, thus the average gender ratio of Unchi Dhanal is 965. The literacy rate of Unchi Dhanal is 75.1 percent. The male literacy rate is 87.54 percent and the female literacy rate is 62.31 percent in Unchi Dhanal Village. In Unchi Dhanal Village, 1,061 of the total population were employed. 74.3 percent of those in employment describe their work as their main job (employment or gainful employment of more than 6 months), while 25.7 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,061 laborers employed in the main labor, 299 were farmers (owners or co-owners), while 248 were agricultural workers.

Limda is a village in Vijaynagar Taluka in Sabarkantha district of Gujarat with a total of 534 families. The total population of Limda is 2,671, of which 1,300 males and 1,371 females, thus the average sex ratio of Limda is 1,055. According to the 2011 census, Limda's literacy rate is 83.7 percent. The male literacy rate in Limda Village is 95.66 percent and the female literacy rate is 72.43 percent. In Limda village, 1,221 of the total population were employed. 42.7 percent of those in employment describe their work as their main activity (employment or gainful employment of more than 6 months), while 57.3 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,221 laborers employed in the main labor, 240 were farmers (owners or co-owners), while 197 were farm workers.

Dhansor is a village in Bhiloda Taluka in Aravalli district of Gujarat with a total of 473 families. The total population of Dhansor is 2,356, of which 1,188 are males and 1,168 are females, thus the average gender ratio of Dhansor is 983. The literacy rate of Dhansor is 84.2 percent. The male literacy rate in Dhansor village is 92.13 percent and the female literacy rate is 76.35 percent. In the village of Dhansor, 1,285 workers were employed out of the total population. 38.3 percent of those in employment describe their work as their main activity (employment or gainful employment of more than 6 months), while 61.7 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,285 workers employed in the main work, 373 were peasants (owners or co-owners) and 29 agricultural workers.

Sunsar is a village in Bhiloda Taluka in Aravalli district of Gujarat with a total of 393 families. The total population of Sunsar is 1,844, of which 948 are males and 896 are females, so the average sex ratio of Sunsar is 945. The literacy rate of Sunsar is 76.4 percent. The male literacy rate is 88.72 percent and the female literacy rate is 63.73 percent in Sunsar village. In the village of Sunsar, 942 of the total population were employed. 88.6 percent of those in

employment describe their work as their main activity (employment or gainful employment of more than 6 months), while 11.4 percent have had less than 6 months in a secondary activity that ensured their livelihood. Of 942 laborers employed in the main work, 460 were peasants (owners or co-owners), while 269 were agricultural workers.

Raheda is a village in Vadali Taluka in Sabarkantha district of Gujarat with a total of 359 families. The total population of Raheda is 1,770, of which 899 are males and 871 are females, making the average sex ratio of Raheda 969. Raheda's literacy rate is 75.6 percent. The male literacy rate in Raheda Village is 85.66 percent and the female literacy rate is 65.47 percent. In the village of Raheda, 1,083 of the total population were employed. 98.2 percent of employees describe their job as their main job (employment or gainful employment of more than 6 months), while 1.8 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,083 laborers employed in the main labor, 364 were peasants (owners or co-owners), while 487 were agricultural workers.

Ravol is a village in Idar Taluka in Sabarkantha district of Gujarat with a total of 285 families. The total population of Ravol is 1,227, of which 672 males and 555 females, making the average Ravol sex ratio 826. Ravol's literacy rate is 69.4 percent. The male literacy rate in the village of Ravol is 85.05 percent and the female literacy rate is 51.1 percent. In the village of Ravol, 781 of the total population were employed. 66.5 percent of employees describe their work as their main activity (employment or gainful employment of more than 6 months), while 33.5 percent had less than 6 months of secondary employment that ensured their livelihood. Of 781 laborers employed in the main labor, 44 were peasants (owners or co-owners), while 384 were agricultural workers.

Dotad is a village in Khedbrahma Taluka in Sabarkantha district of Gujarat with a total of 767 families. The total population of Dotad is 4,962, of which 2,461 are males and 2,501 are females, making the average sex ratio of Dotad 1,016. Dotad's literacy rate is 38.1 percent. The male literacy rate in Dotad village is 45.99 percent and the female literacy rate is 30.19 percent. In Dotad Village, 2,713 of the total population were employed. 51.3 percent of those in employment describe their work as their main activity (employment or gainful employment of more than 6 months), while 48.7 percent had less than 6 months in a secondary job that ensured their livelihood. Of 2,713 laborers employed in the main labor, 1,072 were farmers (owners or co-owners), while 282 were agricultural workers.

Finchod is a village in Idar Taluka in Sabarkantha district of Gujarat with a total of 619 families. The total population of Finchod is 2,747, of which 1,401 are males and 1,346 are females, thus the average sex ratio of Finchod is 961. The literacy rate of Finchod is 78.9 percent. The male literacy rate is 88.31 percent and the female literacy rate is 69.3 percent in Finchod village. In the village of Finchod, 1,484 of the total population were employed.

75.3 percent of those in employment describe their job as their main job (employment or gainful employment of more than 6 months), while 24.7 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,484 laborers employed in the main labor, 241 were peasants (owners or co-owners), while 585 were agricultural workers.

Molli is a village in Malpur Taluka in Sabarkantha district of Gujarat with a total of 295 families. The total population of Molli is 1,594, of which 825 are males and 769 are females, so the average sex ratio of Molli is 932. The literacy rate of Molli is 69.6 percent. The male literacy rate in the village of Molli is 83.71 percent and the female literacy rate is 54.56 percent. In the village of Molli, 677 of the total population were engaged in work activities. 88.6 percent of employees describe their work as main work (employment or gainful employment of more than 6 months), while 11.4 percent had less than 6 months in a secondary job that ensured their livelihood. Of 677 laborers employed in the main labor, 342 were farmers (owner or co-owner), while 104 were farm workers.

Parsoda is a village in Malpur Taluka in Sabarkantha district of Gujarat with a total of 367 families. The total population is 1,952, of which 979 are males and 973 are females, thus the average gender ratio is 994. The literacy rate of Parsoda is 70.3 percent. The male literacy rate is 85.97 percent and the female literacy rate is 54.59 percent. In the village of Parsoda, 1,402 of the total population were engaged in labor activities. 61.1 percent of employees describe their work as main work (employment or gainful employment of more than 6 months), while 38.9 percent had less than 6 months in a secondary job that ensured their livelihood. Of 1,402 laborers employed in the main labor, 437 were farmers (owners or co-owners), while 125 were agricultural workers.

Vankaneda is a village in Malpur Taluka in Sabarkantha district of Gujarat with a total of 342 families. The total population of Vankaneda is 1,843, of which 956 are males and 887 are females, so the average gender ratio of Vankaneda is 928. The literacy rate of Vankaneda is 58.6 percent. The male literacy rate in Vankaneda Village is 72.83 percent and the female literacy rate is 42.96 percent. In Vankaneda village of the total population 868 were engaged in labor activities. 68.9 percent of employees describe their work as main work (employment or gainful employment of more than 6 months), while 31.1 percent had less than 6 months in a secondary job that ensured their livelihood of 868 laborers employed in the main labor, 329 were farmers (owner or co-owner), while 78 were farm workers.

Ajwas Project (IWMP-1) is located at Khedbrahma Taluka, Sabarkantha District, Gujarat State. The project is a cluster of seven micro watersheds with respective codes 5F1B662e, 5f1B6b1, 5f1B6, 5f1B6b1, 5f1B6b2, 5F1B662e, 5f1B6b1. The total project area of the watershed is approximately 6418.13 ha, of which 5168.58 ha. are planned to be treated under the Integrated Watershed Management Program (IWMP). The nearest town is Khedbrahma which is about 45 km from all villages but well connected via the Pucca road. The watershed includes seven villages of Khedbrahma taluka namely Anjani, Kalikankar, Mamapipala, Bedi, Chhatrang, Ajawas and Paliyabiya. Schedule tribe communities are the main residents of the village. The livelihood of these people is mainly based on rain-fed agriculture and wage labour. The watershed falls under the government designated hilly area. It is a very poor and inner village of Khedbrahma block. The net geographical area of the Ajwas watershed is approximately 6418.13 ha, of which 81.37 percent is forest area. That is about 5222.80 ha. The majority of the forest area is covered by the village area. Approximately 92.56 percent of the area is agriculture, which is entirely rain-fed, mainly taking a kharif crop. Approximately 807.52 of all land is classified as watershed, of which 92.56 percent is cultivable and 28.27 percent is uncultivable and hilly. The watershed consists of ubiquitous, scrubby shrubs; some spices are in canyons with toll broad leaf species (DPR, IWMP-1, Sabarkantha).

Dhemada Project (IWMP-12) is located in Meghraj Taluka, Sabarkantha District, Gujarat State. The project is a cluster of nine micro-watersheds with respective codes 5F2C3d3d, 5F2C3d3c, 5F2C3d3b, 5F2C3d1b, 5F2C3d3a, 5F2C3d3c, 5F2C3d3e, 5F2C3d2a, 5F2C3d2b. The total project area of the watershed is approximately 5190 ha, of which 4787 ha are planned to be treated under the Integrated Watershed Management Program (IWMP) from 2010-11. The nearest town is Meghraj, which is about 16 km from Dhemada village and well connected by pucca road. The project area lies on the edges of the wider district of Dungarpur in the state of Rajasthan. The watershed of the Dhemada project included the 16 villages. In the coverage, the communities like OBC, SC and ST are the main residents of the villages. The livelihood of these people is mainly based on rain-fed agriculture, animal husbandry, hired labor, goat and camel herding. The watershed falls under the government designated hilly area. It is a very poor and abandoned village on the border of Sabarkantha district. The total number of families under BPL is 1043 (44.23 percent), which is less than 55.77 percent of all households in the village. The tribal people in the villages make up about 65 percent of the total population; Rain farming is the main

occupation of the village as the groundwater is saline and therefore unusable. More than 60 percent of farmers are inherently small and insignificant in this region. Drinking water availability is only 7-9 months, which becomes much less in the summer months. The soil is very permeable and the production of the land can be greatly enriched by the availability of timely irrigation. The Dhemada watershed falls in continuity with other watersheds namely Adapur, Bharman Kotada, Bhuval, DamorDhudha, Adhodiya, Lalpur, Libhoi, Limbodara Dhudha, Moti Moyadi, Munsivada, Nani Moydi, Palla Dhudha, Sisodara (A), Undava and Vadathali with cluster consideration of 15 watershed villages having a total area of 4787 ha (DPR, IWMP-12, Arvalli).

The location of selected watershed projects of study area is shown below in Figure 3.3.

Sabarkantha and Aravalli districts fall in the catchment of Sabarmati River basin as a part and they are having different sub watersheds with the watershed identification codes covering various blocks of districts. The sub watersheds along with the watershed codes are shown in Figure 3.4 as per the watershed atlas of Gujarat.

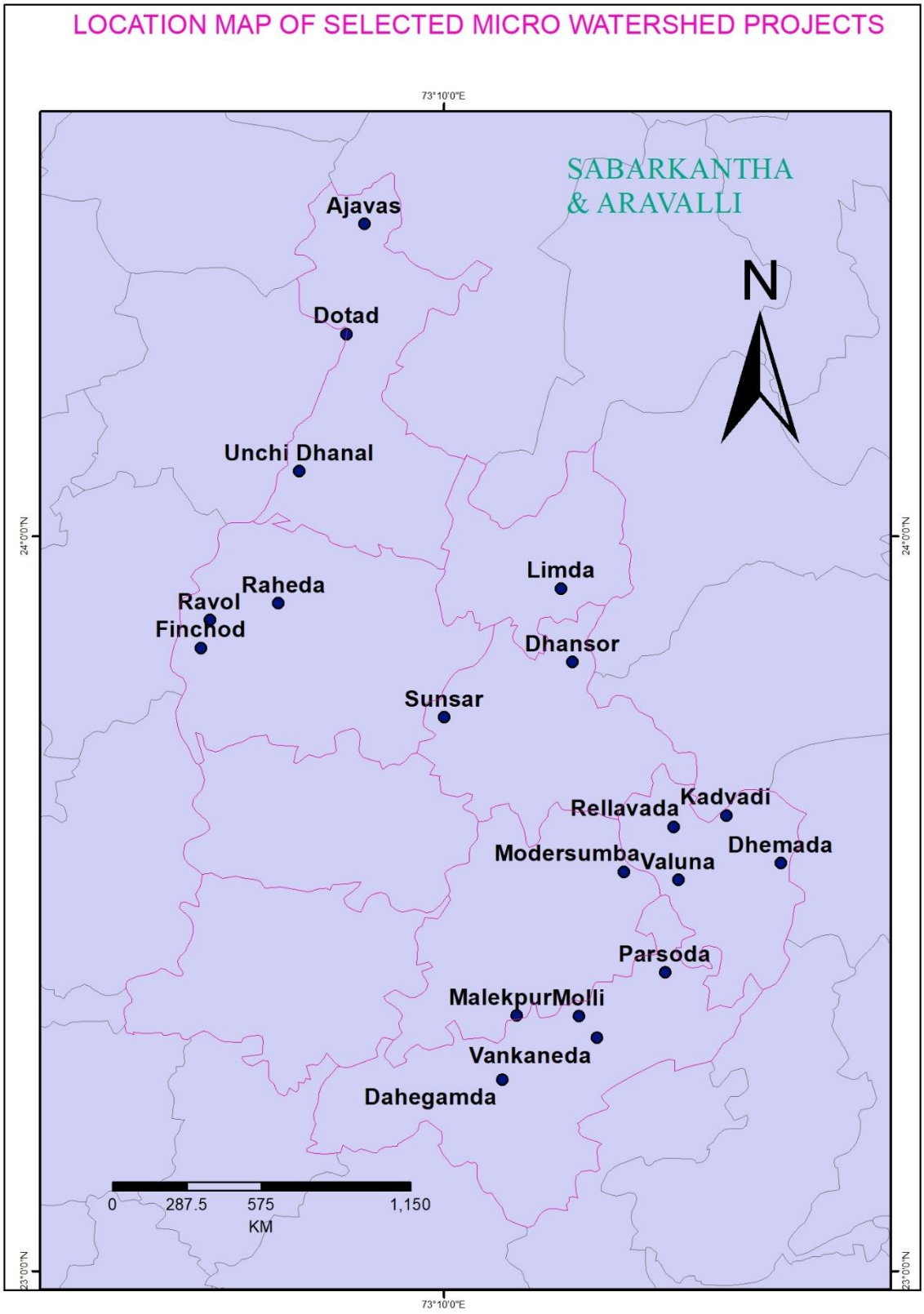

Figure 3.3 Location map of selected Watershed Projects in study area

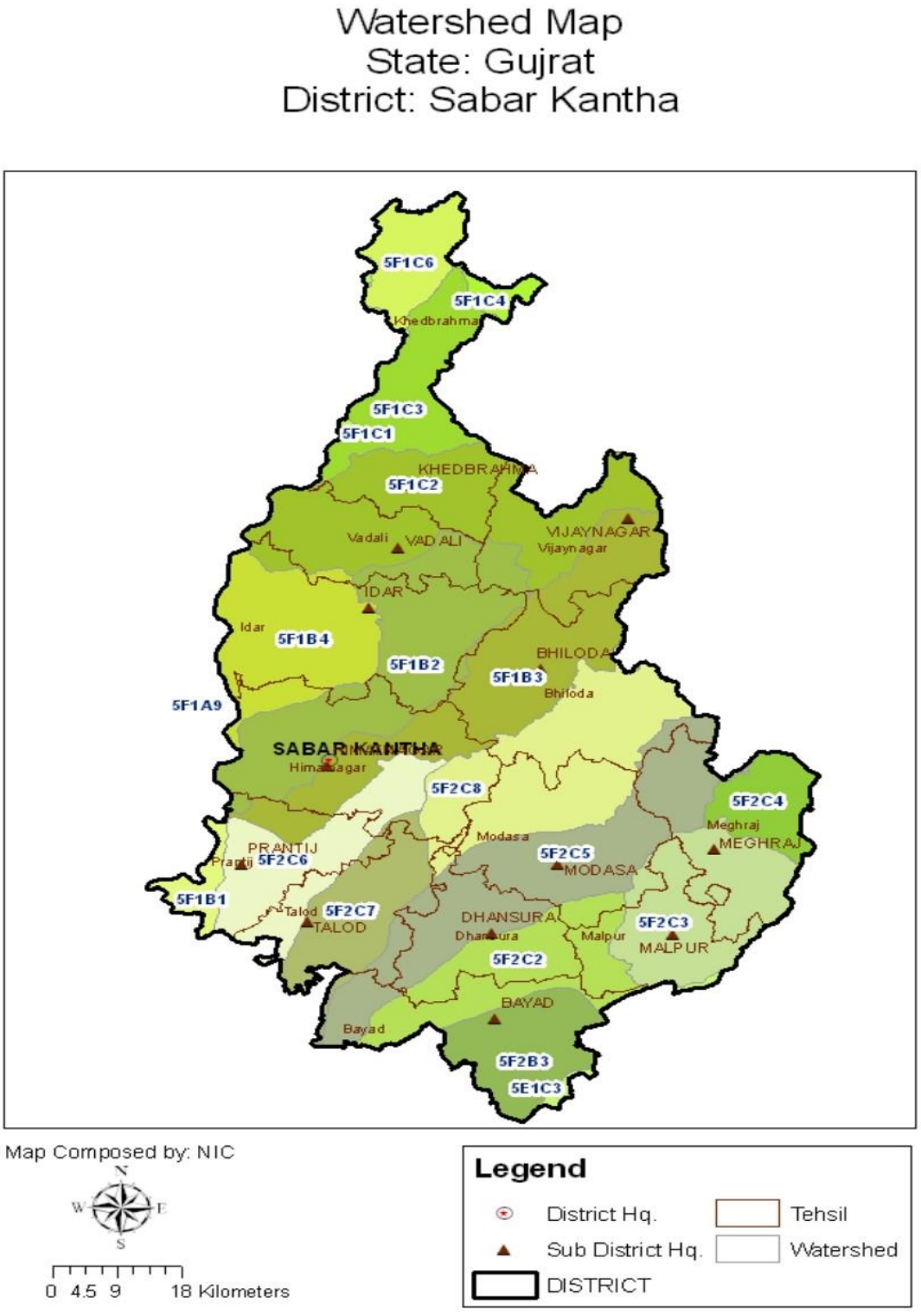

Figure 3.4 Watershed Atlas of Sabarkantha District

CHAPTER 4

Methodology And Data Collection

4.1 Methodology

This study aimed to develop and apply a framework to assess the overall efficiency of the watershed on an integrated method by selecting major affecting indicators and benchmarking their performance on ranking criteria. A set of indicator questions for questionnaire survey, was developed to collect the ground-level agricultural and socio-economic data to evaluate the impacts of watershed project implementation. RUSLE carried out the soil erosion estimation, and change in groundwater was estimated by well inventory and water table fluctuation method. All evaluated indicator values were applied to develop the watershed performance benchmarking index (WPBI) for ranking and indexing watershed projects implemented in the study area. This research contributed to the assessment of watershed projects to identify issues and difficulties in watershed implementation and recommendations for policymakers to make necessary variations in guidelines. The evaluation framework will benefit watershed planners and managers assess and evaluating watershed impacts in other watersheds.

Sabarkantha and Aravalli districts of Gujarat were two selected districts for implementing IWDP, DPAP, and IWMP watershed projects by the Department of land Records, Ministry of Rural Development, Government of India. There were around 200 watershed projects implemented in these districts under IWDP, DPAP, and IWMP. Amongst them, 19 watershed projects were selected for study by random sampling covering all three schemes. The hydrological, agricultural, social, and economical parameters were considered to evaluate watershed projects in the study area. The different selected indicators for these parameters with their denotations were as per following: (i) Reduction in soil erosion – RSE, (ii) Increase in groundwater table – IGWT, (iii) Change in crop productivity – CCP, (iv) Change in cropping intensity – CCI, (v) Increase in livestock – ILS, (vi) Increase in employment – IEM, (vii) Increase in saving and expenditure capacity – IEX, (viii) Reduction in migration – RMI, (ix) Increase in income - IIN and (x) Benefit-cost ratio – BCR

The methodology chart showing all details is given in Figure 4.1

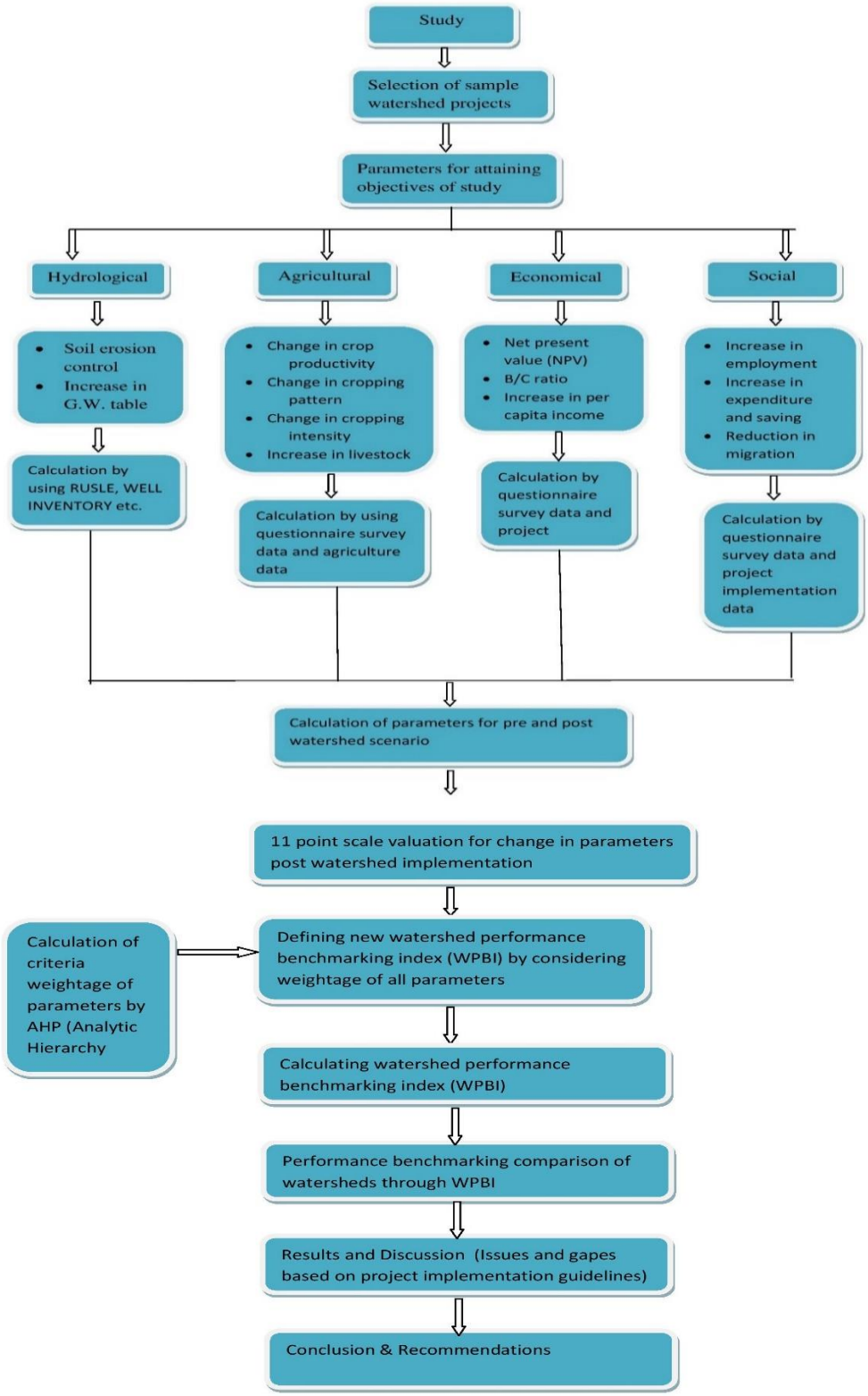

Figure 4.1 Methodology chart of research study

4.1.1 Estimation of Hydrological Parameters

The measurement and calculation of the reduction in soil erosion were carried out through the Revised Universal Soil Loss Equation (RUSLE) (Admankar and Patil, 2019) as per the following equation (1).

$$A = R \times K \times LS \times C \times P \text{ ----------(1)}$$

Where, A is the computed average soil loss over a period selected for R, usually yearly (t/ha/y); R is the rainfall-runoff erosivity factor (MJ mm/ha/hr/yr); K is the soil erodibility factor (t/MJ/hrmm); LS is the slope length (L) and slope gradient (S) factor (dimensionless); C is the cropping management factor (dimensionless, ranging between 0 and 0.5); P is the supporting conservation practice factor (dimensionless, ranging between 0 and 1).

R- factor is the rainfall erosivity factor based on rainfall data. Babu et al. (1992) developed the relationship between average annual erosion index (R factor) and annual rainfall India based on their analysis of data from 44 stations spread across various rainfall zones of the country. The relationship is mentioned in equation (2):

$$R = 79 + 0.363P \text{ ----------(2)}$$

Where R-Factor is rainfall erosivity factor and P is Average annual rainfall in mm. In present study, annual rainfall data (in mm) for the 25 years period 1995-2018 for 8 meteorological stations of Sabarkantha and Aravalli Districts were used to compute the R factor. The required missing rainfall data were obtained from local government agencies.

The erodibility of a soil is an expression of its inherent resistance properties to particle detachment and transport by rainfall. The K-factor was calculated by using the formula by Wang et al. (2016) given below in equation (3),

$$100K = 2.1 \times 10^{-4} \times (12 - \%OM) \times M^{1.14} + 3.25 \times (SI - 2) + 2.5 \times (PI - 3) \text{ -----(3)}$$

Where, K is soil erodibility (tons/MJ-hrmm), OM is percent organic matter, PI is permeability index, SI is the soil structure index and M is a function of the primary particle size function given by M= (%silt+%very fine sand) × (100-%clay).

In present study, 45 soil samples were collected out of which 27 were from cultivated fields and 18 from uncultivated wastelands. For calculation of K factor by above formula, textural analysis of 45 soil samples was carried out.

Accordingly, the samples were heated at 120 ^{o}C in an oven for 2 days to dry out the moisture content. These were passed through sieves of 2 mm, 0.25 mm and 0.062 mm diameter. To estimate the amount of organic matter present in a soil sample, the weight lost by an oven-dried (120 °C) soil sample when it is heated to 400 °C was measured by method “loss of ignition”. As the soil sampling for B.W. scenario is not possible as the implementation of most of the watersheds was started in previous years (i.e. before 2009) so for all the projects, the data for soil texture, slope steepness, organic matter content, etc. was collected by joint field visits and questionnaire with the beneficiaries and cross checked by the records of district agricultural department.

The L and S factor (topographic factor) represents the effect of topography on erosion in USLE method. The slope length factor (L) represents the effect of slope length on erosion, and the slope steepness factor (S) represents the influence of slope gradient on erosion. The topographic factor in the present study was therefore computed by using the equation (4) stated by Admankar and Patil (2019).

$$LS = (0.065 + 0.045S + 0.0065S^2) \times (\lambda/22.1)^{0.5} \text{ ----------(4)}$$

Where S is the slope steepness in %, λ is slope length in m. Topographic Abney level Clinometer was used to measure field slopes in degrees. Slope length was measured using meter tape. Thereafter, degree slope was converted to percent slope.

C - Factor is the cropping management factor, dimensionless and ranging between 0 and 1 based on different LULC classes. Panagos et. al. (2015) suggested the C-factor values assigned for different crop types as per Table 4.1.

Table 4.1. C-Factor per Crop Type Based on Literature Review

Crop type	**C Factor**	**Crop type**	**C Factor**
wheat	0.20	Oilseeds	0.28
Barley	0.21	Rape and turnip rape	0.30
maize (corn)	0.38	Sunflower seed	0.32
Paddy	0.15	Linseed	0.25

Crop type	C Factor	Crop type	C Factor
Dried pulses (legumes)	0.32	Soya	0.28
Potatoes	0.34	Cotton seed	0.50
Sugar beet	0.34	Tobacco	0.49
		Fallow land	0.50

Source: Panagos et al. (2015)

Considering land use land cover and major crops grown in project, the corresponding values of C-factor based on crop type were finalized through joint field visits and questionnaire data.

The P-factor is a supporting conservation practice factor which represents the ratio of soil loss by a support practice to that of straight-row farming up and down the slope. The P-factor was assumed by using the conservation practice of the study area. Values of P factor compiled at ICAR Dehradun Centre for Indian conditions have been used for calculating P-factor as shown in Table 4.2.

Table 4.2. Values of P factor compiled at ICAR Dehradun Centre for Indian conditions

Support Practice	P-factor
Up and Down cultivation	1.00
Contour farming	0.68
Channel terraces with contour	0.38
Channel terraces with graded furrows	0.36
Strip cropping (3:1)	0.51
Strip cropping (1:1)	0.62

(Source: G. Singh et al. 1992)

The values for P-factor were considered based on the treatments provided in watershed projects for A.W and B.W scenarios. The same for B.W. scenario were considered for the traditional up and down cultivation as there was no treatment before the implementation of projects.

The measurement and calculation of the increase in groundwater table were carried out by the water table fluctuation method through the well inventory. Total 131 wells were observed for ground water table in study area for different watershed projects in After watershed (A.W.) scenario. Data of ground water table for same wells were collected through questionnaire from beneficiaries in study area for different watershed projects in Before watershed (B.W.) scenario.

4.1.2 Estimation of Agricultural, Social and Economical Parameters

The agricultural and socio-economic indicators were calculated from the data obtained through the questionnaire survey, joint field visits of the watershed area and beneficiaries, and focused group discussions with village communities. The questionnaire survey was carried out for the various groups of beneficiaries from entire watershed villages. The beneficiary households were selected faliya wise of the respective watershed villages.

4.1.3 Estimation of Watershed Performance Benchmarking Index (WPBI)

The abovementioned indicator values were converted into percentage changes and then brought up at percentage level and thus prepared on an 11-point scale. The Analytic Hierarchy Process (AHP) tool was used to obtain different criteria weights for each indicator, and Watershed Performance Benchmarking Index (WPBI) was then calculated based on the criteria weights. The equation developed for WPBI was then validated by statistical analysis and regression to check the significance of the regression model. Finally, the WPBI was calculated based on regression coefficients. Based on the values obtained for each indicator and WPBI, the watershed projects were compared, and identified the issues and challenges in implementing watershed projects.

4.2 Data Collection

The initial data related to the study area's physical environment and the socio-economic condition is collected from the watershed from 2000 to 2018 from the project implementing agency, and DRDA, Sabarkantha. Data related to the climatic conditions like rainfall, temperature, humidity, etc. total area, population, soil data, and status of the local community were collected from the respective government departments and various agencies. The questionnaire included various data related to water availability and resources, crop productivity, cropping intensity, livestock, migration, socio-economic status etc. were included in the questionnaire while surveying.

4.2.1 Rainfall data

The rainfall data were collected from state water data center, Gandhinagar and weather stations of taluka panchayats of respective taluka block. The average annual rainfall (mm) was recorded for considering base years for before-after implementation approach. The

average annual rainfall data was used to calculate the rainfall-runoff erosivity factor in RUSLE calculation. The average annual rainfall data for weather stations of study area are given in Table 4.3.

Table 4.3 Average annual rainfall data for weather stations of study area

Sr. No.	Station	Base Year	Average Annual Rainfall (mm) (B.W.)	Base Year	Average Annual Rainfall (mm) (A.W.)
1	Meghraj	1999	450.00	2007	852.30
2	Meghraj	1999	450.00	2008	809.49
3	Meghraj	1999	450.00	2008	809.49
4	Meghraj	1999	450.00	2008	809.49
5	Kabola	2000	385.50	2008	798.09
6	Ambaliyara	2000	210.00	2008	799.39
7	Khedbrahma	2004	499.50	2013	855.95
8	Khedbrahma	2004	499.50	2013	855.95
9	Khedbrahma	2006	787.51	2014	844.13
10	Khedbrahma	2006	787.51	2014	844.13
11	Khedbrahma	2006	787.51	2010	877.00
12	Khedbrahma	2006	787.51	2014	844.13
13	Khedbrahma	2007	810.18	2012	833.94
14	Khedbrahma	2007	810.18	2012	833.94
15	Bhempoda	1999	748.70	2008	834.22
16	Bhempoda	1999	748.70	2008	834.22
17	Bhempoda	1999	748.70	2008	834.22
18	Meghraj	2009	710.00	2018	895.56
19	Meghraj	2009	710.00	2018	895.56

(Source: State Water Data Centre, Gandhinagar, Gujarat)

4.2.2 Soil Properties data

The soil samples from study area were analyzed by textural analysis of samples in laboratory and the organic matter, structure and permeability properties were identified along with the proportions of silt, very fine sand and clay for after watershed scenario. The proportions of silt, very fine sand and clay were obtained through the field visits and questionnaire survey with the beneficiaries and the obtained data were reconciled with the data from agriculture department of districts for before watershed scenario. The soil

properties data are given in the Tables 4.4 and 4.5 for B.W and A.W scenarios respectively.

Table 4.4 Soil properties of samples before watershed implementation

Sr. No.	Name of Watershed	% Organic Matter (%OM)	Structural Code (SI)	Permeability Code (PI)	%Silt	% Very fine Sand	%Clay
1	Rellavada	2.48	3.00	5.00	63.24	7.10	2.99
2	Kadvadi	1.12	4.00	5.00	66.91	2.39	0.11
3	Valuna	0.64	3.00	5.00	66.95	9.51	2.86
4	Modersumba	0.85	3.00	4.00	88.69	4.51	1.12
5	Shika kampa	0.19	3.00	5.00	88.30	4.49	0.53
6	Dahegamda	0.22	4.00	5.00	83.67	2.89	0.29
7	Unchi Dhanal	0.22	3.00	5.00	82.67	2.16	0.15
8	Limda	0.57	3.00	5.00	84.01	1.55	0.17
9	Dhansor	1.28	3.00	5.00	67.23	6.78	0.92
10	Sunsar	0.26	3.00	5.00	88.39	2.62	0.27
11	Raheda	0.81	3.00	5.00	84.05	4.42	1.80
12	Ravol	0.67	3.00	5.00	82.91	4.23	1.06
13	Dotad	0.05	3.00	5.00	82.88	1.89	0.13
14	Finchod	0.07	3.00	5.00	93.04	4.00	0.55
15	Molli	0.26	4.00	5.00	90.79	1.35	0.00
16	Parsoda	0.33	4.00	5.00	87.02	4.38	0.73
17	Vankaneda	0.35	4.00	4.00	84.34	5.51	1.42
18	Ajavas	0.68	4.00	4.00	74.92	9.06	1.84
19	Dhemada	1.00	4.00	4.00	87.02	4.38	0.73

Source: questionnaire survey (2017) & District agriculture office, sabarkantha (2017)

Table 4.5 Soil properties of samples after watershed implementation

Sr. No.	Name of Watershed	% Organic Matter (%OM)	Structural Code (SI)	Permeability Code (PI)	%Silt	% Very fine Sand	%Clay
1	Rellavada	3.15	2.00	4.00	63.09	7.05	3.14
2	Kadvadi	1.67	3.00	4.00	66.76	2.34	0.26
3	Valuna	1.08	2.00	3.00	64.80	9.46	3.25
4	Modersumba	1.20	2.00	4.00	86.54	4.46	2.67
5	Shika kampa	0.85	2.00	4.00	88.15	4.44	0.68

Sr. No.	Name of Watershed	% Organic Matter (%OM)	Structural Code (SI)	Permeability Code (PI)	%Silt	% Very fine Sand	%Clay
6	Dahegamda	0.95	3.00	4.00	83.52	2.84	0.44
7	Unchi Dhanal	1.06	2.00	4.00	82.52	2.11	0.30
8	Limda	1.35	2.00	4.00	83.86	1.50	0.32
9	Dhansor	1.75	2.00	4.00	67.08	6.73	1.07
10	Sunsar	0.93	2.00	4.00	88.24	2.57	0.42
11	Raheda	1.26	2.00	4.00	83.90	4.37	1.95
12	Ravol	1.38	2.00	4.00	82.76	4.18	1.21
13	Dotad	1.00	2.00	4.00	82.73	1.84	0.28
14	Finchod	0.86	2.00	4.00	92.89	3.95	0.70
15	Molli	0.98	3.00	4.00	90.64	1.30	0.15
16	Parsoda	1.28	3.00	4.00	86.87	4.33	0.88
17	Vankaneda	1.12	3.00	4.00	84.19	5.46	1.57
18	Ajavas	1.65	2.00	3.00	74.77	9.01	1.99
19	Dhemada	1.85	2.00	3.00	86.87	4.33	0.88

Source: Laboratory work by author (2017)

4.2.3 Slope and Gradient data

Clinometer was used to measure field slopes in degrees. Slope length was measured using meter tape. Thereafter, degree slope was converted to percent slope and the formula applied. The angle of the slope, slope steepness and slope length obtained for watersheds in study area are given in Tables 4.6 and 4.7 for B.W and A.W scenarios respectively.

Table 4.6 Angle of slope, slope steepness and slope length of watersheds (B.W.)

Sr. No.	Name of Watershed	Angle of the slope (a)	Slope Steepness (Sp %)	Slope length (m)
1	Rellavada	5.00	8.75	53.40
2	Kadvadi	4.00	6.99	48.90
3	Valuna	5.00	8.75	11.70
4	Modersumba	6.00	10.51	35.50
5	Shika kampa	3.00	5.24	68.00
6	Dahegamda	6.00	10.51	69.15
7	Unchi Dhanal	4.00	6.99	74.00
8	Limda	4.00	6.99	69.60
9	Dhansor	4.00	6.99	56.00
10	Sunsar	4.00	6.99	59.00
11	Raheda	3.00	5.24	53.00

Sr. No.	Name of Watershed	Angle of the slope (a)	Slope Steepness (Sp %)	Slope length (m)
12	Ravol	4.00	6.99	58.00
13	Dotad	4.00	6.99	63.00
14	Finchod	5.00	8.75	52.00
15	Molli	5.00	8.75	48.00
16	Parsoda	5.00	8.75	50.00
17	Vankaneda	5.00	8.75	35.00
18	Ajavas	6.00	10.51	18.00
19	Dhemada	6.00	10.51	28.00

Source: questionnaire survey (2017)

Table 4.7 Angle of slope, slope steepness and slope length of watersheds (A.W.)

Sr. No.	Name of Watershed	Angle of the slope (a)	Slope Steepness (Sp %)	Slope length (m)
1	Rellavada	1.49	4.00	6.99
2	Kadvadi	1.04	3.00	5.24
3	Valuna	0.70	3.00	5.24
4	Modersumba	1.59	4.00	6.99
5	Shika kampa	0.84	3.00	5.24
6	Dahegamda	2.22	5.00	8.75
7	Unchi Dhanal	1.28	3.00	5.24
8	Limda	1.24	3.00	5.24
9	Dhansor	1.11	3.00	5.24
10	Sunsar	1.14	3.00	5.24
11	Raheda	0.74	2.00	3.49
12	Ravol	1.13	4.00	6.99
13	Dotad	1.18	3.00	5.24
14	Finchod	1.47	4.00	6.99
15	Molli	1.41	6.00	10.51
16	Parsoda	1.44	6.00	10.51
17	Vankaneda	1.20	5.00	8.75
18	Ajavas	1.13	6.00	10.51
19	Dhemada	1.41	6.00	10.51

Source: Field work by author (2017)

4.2.4 Ground Water Table Data

Total 131 wells were observed for ground water table in selected watershed projects of study area in After watershed (A.W.) scenario. Data of ground water table for same wells

were collected through questionnaire from beneficiaries and joint field visits of observation wells in study area for different watershed projects in Before watershed (B.W.) scenario. The measurement of groundwater table was carried out by the water table fluctuation method through the well inventory. The ground water table data from observed wells are given in Table 4.8.

Table 4.8 Ground Water table data from observed wells in study area

Sr. No.	Name of Watershed	No. of Observation wells	Base year of Observation (B. W.)	Average WT in Mtr. (B.W.)	Base year of Observation (A.W.)	Average WT in Mtr. (A.W.)
1	Rellavada	6	1998	8.90	2007	10.10
2	Kadvadi	5	1998	15.70	2008	16.10
3	Valuna	5	1998	18.00	2008	23.30
4	Modersumba	5	1998	12.50	2008	15.40
5	Shika kampa	5	1999	16.90	2008	19.80
6	Dahegamda	4	1999	13.30	2008	15.00
7	Unchi Dhanal	5	2003	19.80	2013	22.58
8	Limda	5	2004	15.90	2013	18.65
9	Dhansor	5	2005	13.90	2014	16.62
10	Sunsar	5	2005	12.20	2014	15.00
11	Raheda	7	2005	18.10	2010	23.35
12	Ravol	8	2005	15.10	2014	18.20
13	Dotad	5	2006	10.50	2012	13.20
14	Finchod	5	2006	11.87	2012	14.00
15	Molli	5	2004	13.80	2010	15.00
16	Parsoda	6	2005	15.40	2011	17.00
17	Vankaneda	5	2006	9.58	2012	11.43
18	Ajavas	20	2009	15.00	2018	19.20
19	Dhemada	20	2009	13.60	2018	16.10

Source: Well inventory data from field observations (in base years)

4.2.5 Agricultural, Social and Economical data

A format for questionnaire survey was developed to collect the ground-level agricultural and socio-economic data to evaluate the impacts of watershed project implementation. The questionnaire survey format included the household survey in one part and village level amenities survey in another part to cover the details of infrastructure, facilities, amenities, status of implementation, demography etc.

The questionnaire survey format is given here in Appendix – I and Appendix – II.

The data were collected on different agricultural and socio-economic aspects for B.W and A.W scenarios for 19 selected watershed projects by selected individual household survey and village watershed survey. The data collected through the questionnaire is arranged in tabular form for ease of further calculation as per Appendix – III.

CHAPTER 5

Impact Assessment of Watershed Projects on Hydrological, Agricultural, Economical and Social parameters

5.1 Changes in Soil erosion

The soil loss from the agricultural fields was calculated by applying the RUSLE. This involved the multiplication of the factor values of R, K, LS, C and P for each of the watershed projects. The resulting soil loss values are in t ha^{-1} yr^{-1} directly as all factor values had been converted to metric units.

5.1.1 Rainfall-Runoff Erosivity Factor (R-factor)

The annual rainfall is a prime indicator of change in the rate of soil erosion to illustrate the seasonal distribution of sediment yield. Therefore, in the present study, the average annual rainfall was used for calculation of R factor. The estimated R factor value for B.W ranges from 155.23 to 373.10 and for A.W ranges from 369.18 to 404.09. It is detected that rainfall is high in Dotad and Finchod watersheds for B.W and in Ajwas and Dhemada for A.W as indicated from the results shown in Table 5.1. The comparative values of R-factor for B.W and A.W have been shown Figure 5.1.

Table 5.1 Calculation of R-factor (B.W. and A.W.)

Sr. No.	Station	Name of Watershed	Rainfall-runoff erosivity factor (R) (B.W.)	Rainfall-runoff erosivity factor (R) (A.W.)
1	Meghraj	Rellavada	242.35	388.38
2	Meghraj	Kadvadi	242.35	372.84
3	Meghraj	Valuna	242.35	372.84
4	Meghraj	Modersumba	242.35	372.84
5	Kabola	Shika kampa	218.94	368.71

Sr. No.	Station	Name of Watershed	Rainfall-runoff erosivity factor (R) (B.W.)	Rainfall-runoff erosivity factor (R) (A.W.)
6	Ambaliyara	Dahegamda	155.23	369.18
7	Khedbrahma	Unchi Dhanal	260.32	389.71
8	Khedbrahma	Limda	260.32	389.71
9	Khedbrahma	Dhansor	364.87	385.42
10	Khedbrahma	Sunsar	364.87	385.42
11	Khedbrahma	Raheda	364.87	397.35
12	Khedbrahma	Ravol	364.87	385.42
13	Khedbrahma	Dotad	373.10	381.72
14	Khedbrahma	Finchod	373.10	381.72
15	Bhempoda	Molli	350.78	381.82
16	Bhempoda	Parsoda	350.78	381.82
17	Bhempoda	Vankaneda	350.78	381.82
18	Meghraj	Ajavas	336.73	404.09
19	Meghraj	Dhemada	336.73	404.09

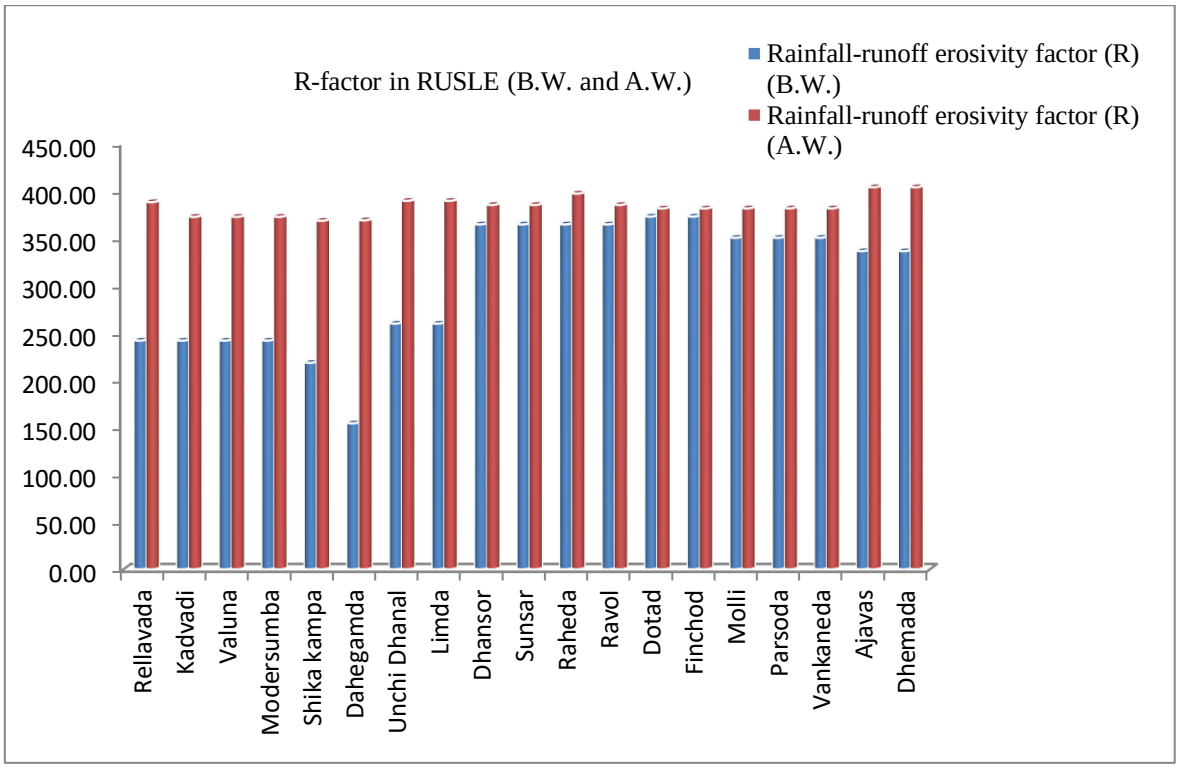

Figure 5.1 Calculation of R-factor (B.W. and A.W.)

5.1.2 Soil Erodibility Factor (K-factor)

From the results presented in Table 5.2, the values of K factor are found ranging between 0.55 and 0.96 for B.W and 0.46 and 0.84 for A.W. The lower value of K factor is associated with the soils having lesser permeability, lesser moisture content, etc. The comparative values of K-factor for B.W and A.W have been shown in Figure 5.2.

Table 5.2 Calculation of K-factor (B.W. and A.W.)

Name of Watershed	Soil Erodibility Factor (K) (B.W.)	Soil Erodibility Factor (K) (A.W.)
Rellavada	0.55	0.46
Kadvadi	0.66	0.57
Valuna	0.70	0.57
Modersumba	0.83	0.74
Shika kampa	0.90	0.80
Dahegamda	0.87	0.77
Unchi Dhanal	0.83	0.71
Limda	0.81	0.70
Dhansor	0.66	0.57
Sunsar	0.88	0.78
Raheda	0.81	0.72
Ravol	0.81	0.71
Dotad	0.84	0.72
Finchod	0.96	0.84
Molli	0.93	0.82
Parsoda	0.91	0.79
Vankaneda	0.86	0.78
Ajavas	0.78	0.63
Dhemada	0.84	0.69

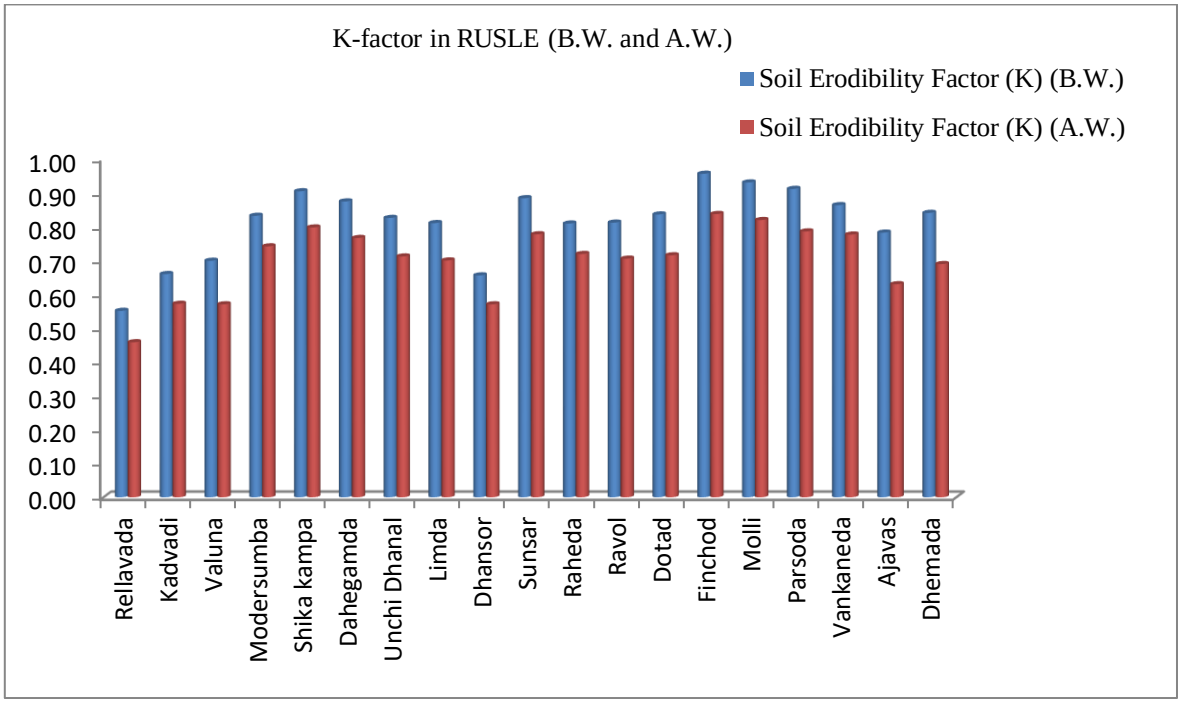

Figure 5.2 Calculation of K-factor (B.W. and A.W.)

5.1.3 Length-Slope Factor (LS-factor)

Length-slope factor represents the topographical influence of slope length and slope steepness on erosion process. LS factor was calculated by considering the land gradient and slope steepness. From the analysis and results presented in Table 5.3, it is observed that the value of LS factor increases in a range of 0.7 to 2.22 for B.W and 0.36 to 2.37 for A.W as the flow accumulation and slope changes over time. The comparative values of LS-factor for B.W and A.W have been shown in Figure 5.3.

Table 5.3 Calculation of LS-factor (B.W. and A.W.)

Name of Watershed	**Length-Slope factor (LS) (B.W.)**	**Length-Slope factor (LS) (A.W.)**
Rellavada	1.49	1.09
Kadvadi	1.04	0.72
Valuna	0.70	0.36
Modersumba	1.59	0.94
Shika kampa	0.84	0.84
Dahegamda	2.22	1.70
Unchi Dhanal	1.28	0.88
Limda	1.24	0.85
Dhansor	1.11	0.77

Name of Watershed	Length-Slope factor (LS) (B.W.)	Length-Slope factor (LS) (A.W.)
Sunsar	1.14	0.79
Raheda	0.74	0.47
Ravol	1.13	1.12
Dotad	1.18	0.81
Finchod	1.47	1.24
Molli	1.41	2.36
Parsoda	1.44	2.37
Vankaneda	1.20	1.37
Ajavas	1.13	1.38
Dhemada	1.41	1.66

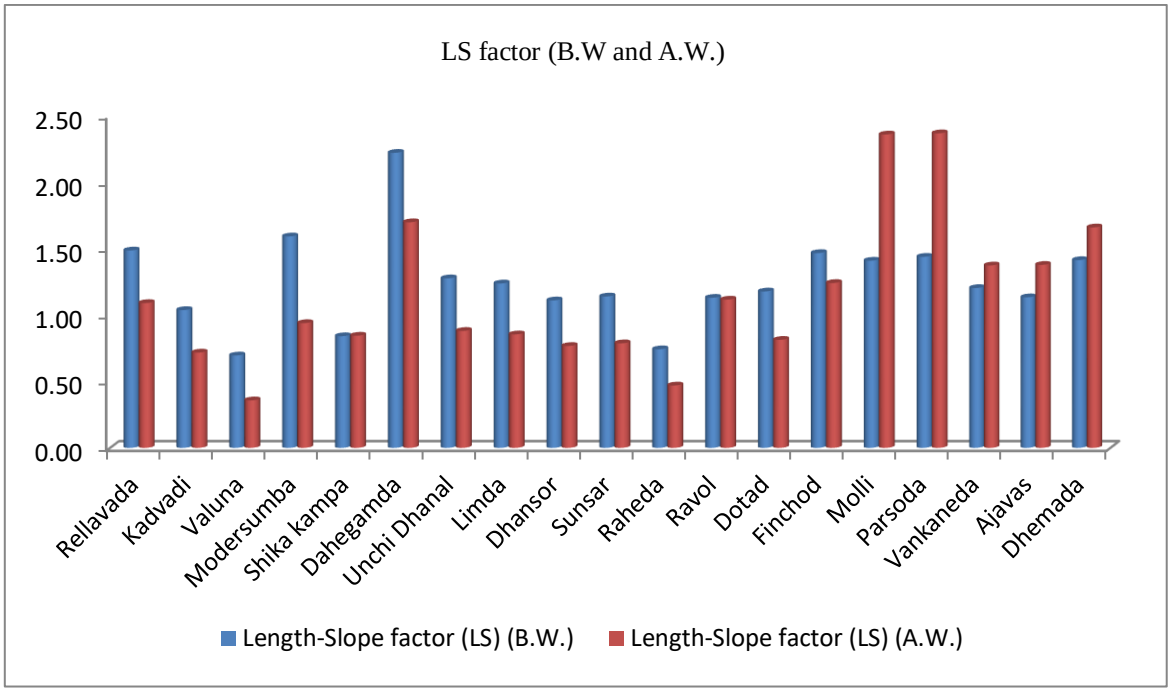

Figure 5.3 Calculation of LS-factor (B.W. and A.W.)

5.1.4 Cropping Management Factor (C-Factor)

The C-factor values in this study are considered as per the cropping pattern based on LULC classes according to the Table 4.1. The values are assigned for different cropping patterns and varying from 0.32 to 0.50 as presented in Table 5.4. The comparative values of C-factor for B.W and A.W have been shown in Figure 5.4.

Table 5.4 Calculation of C-factor (B.W. and A.W.)

Name of Watershed	Cropping Management factor (C) (B.W.)	Cropping Management factor (C) (A.W.)
Rellavada	0.38	0.20
Kadvadi	0.38	0.38
Valuna	0.38	0.28
Modersumba	0.50	0.28
Shika kampa	0.34	0.34
Dahegamda	0.32	0.25
Unchi Dhanal	0.32	0.25
Limda	0.50	0.38
Dhansor	0.34	0.20
Sunsar	0.34	0.34
Raheda	0.32	0.28
Ravol	0.50	0.25
Dotad	0.32	0.28
Finchod	0.32	0.28
Molli	0.50	0.38
Parsoda	0.50	0.38
Vankaneda	0.50	0.38
Ajavas	0.50	0.38
Dhemada	0.50	0.38

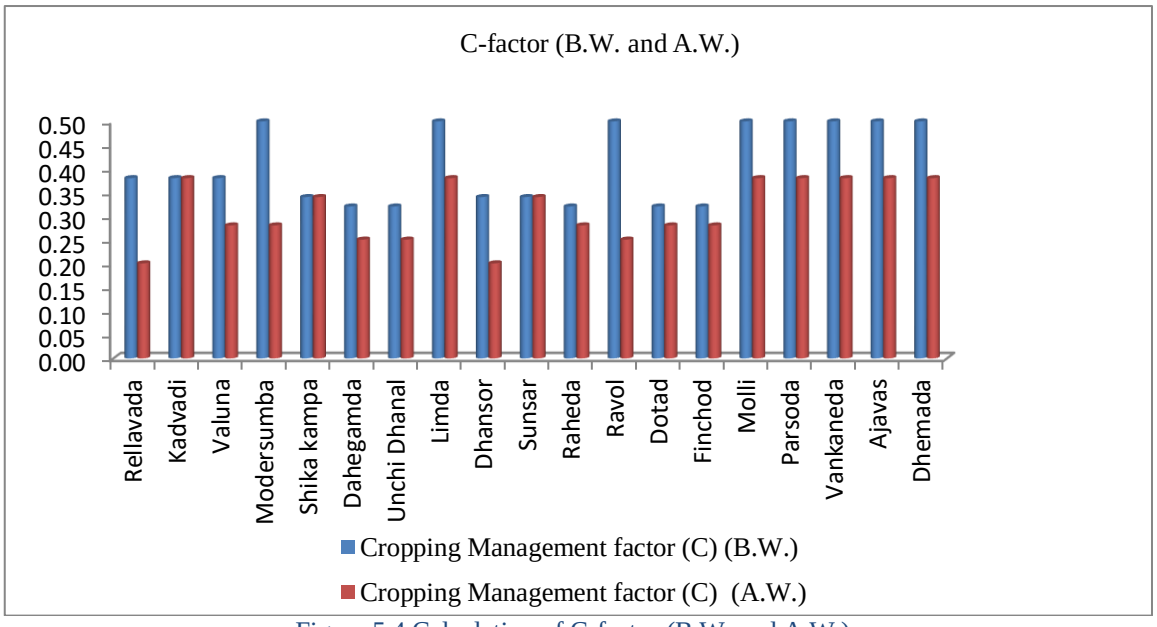

Figure 5.4 Calculation of C-factor (B.W. and A.W.)

5.1.5 Supporting Conservation Practice Factor (P-Factor)

The P factor values representing the effect of various soil and water conservation and support practices implemented in watershed areas are assigned for different classes of LULC in the study area. As it is presumed that there are negligible practices in the watershed area for B.W, the P factor value is assigned as 1 and as per the LULC class for A.W, different values ranging from 0.36 to 1.00 have been assigned as represented in Table 5.5. The comparative values of P-factor for B.W and A.W have been shown in Figure 5.5.

Table 5.5 Calculation of P-factor (B.W. and A.W.)

Name of Watershed	Supporting Conservation Practice Factor (P) (B.W.)	Supporting Conservation Practice Factor (P) (A.W.)
Rellavada	1.00	0.38
Kadvadi	1.00	0.62
Valuna	1.00	0.68
Modersumba	1.00	0.68
Shika kampa	1.00	0.36
Dahegamda	1.00	0.36
Unchi Dhanal	1.00	1.00
Limda	1.00	0.38
Dhansor	1.00	0.38
Sunsar	1.00	1.00
Raheda	1.00	0.38
Ravol	1.00	1.00
Dotad	1.00	0.38
Finchod	1.00	0.68
Molli	1.00	0.51
Parsoda	1.00	0.51
Vankaneda	1.00	0.68
Ajavas	1.00	0.68
Dhemada	1.00	0.68

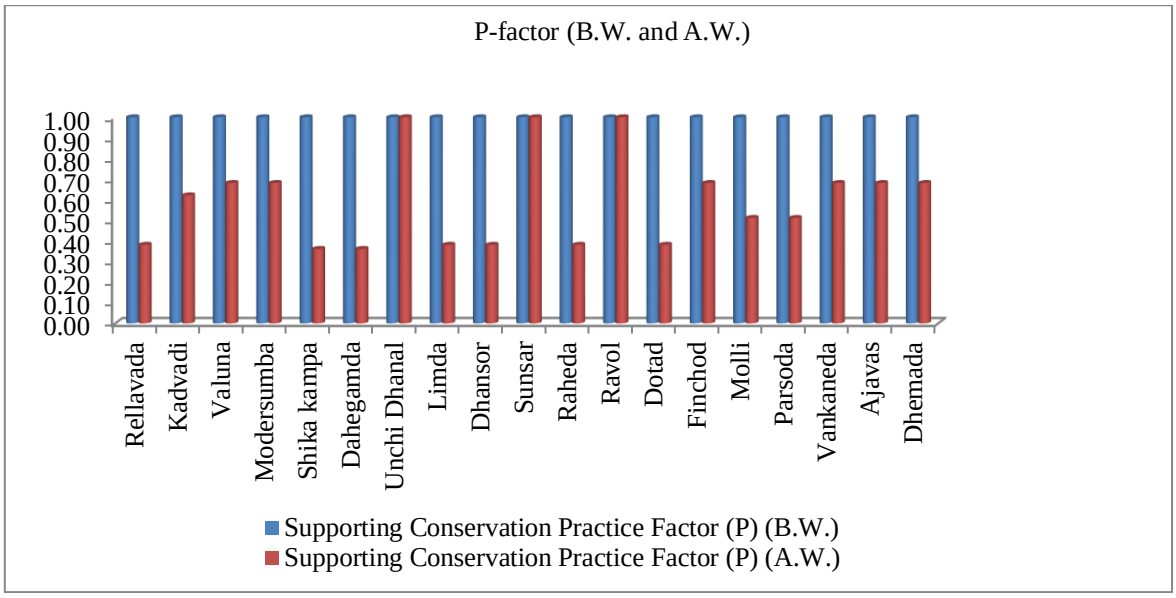

Figure 5.5 Calculation of P-factor (B.W. and A.W.)

5.1.6 Soil Erosion Rate

The average annual soil loss for B.W and A.W in the study area was computed using RUSLE and represented in Table 5.6. The average annual soil loss values for B.W vary from 45 to 230 t/ha/year whereas for A.W vary from 13 to 143 t/ha/year. The comparative values of soil erosion rate and changes in B.W and A.W have been shown in Figure 5.6.

Table 5.6 Calculation of soil erosion rate and changes (B.W & A.W)

Name of Watershed	Soil loss (t/ha/year) (B.W.)	Soil loss (t/ha/year) (A.W.)	Increase (+)/Decrease (-) in soil erosion (t/ha/year)
Rellavada	75.56	14.78	-60.78
Kadvadi	63.10	36.10	-27.01
Valuna	44.83	14.50	-30.33
Modersumba	160.50	49.49	-111.01
Shika kampa	56.60	30.40	-26.20
Dahegamda	96.50	43.28	-53.22
Unchi Dhanal	87.80	61.12	-26.68
Limda	130.60	33.68	-96.93
Dhansor	90.41	12.83	-77.58
Sunsar	124.98	80.21	-44.77
Raheda	70.14	14.28	-55.86
Ravol	167.39	75.91	-91.47

Name of Watershed	Soil loss (t/ha/year) (B.W.)	Soil loss (t/ha/year) (A.W.)	Increase (+)/Decrease (-) in soil erosion (t/ha/year)
Dotad	117.56	23.64	-93.92
Finchod	167.41	75.54	-91.87
Molli	229.96	143.12	-86.84
Parsoda	229.92	137.77	-92.15
Vankaneda	182.25	105.27	-76.98
Ajavas	149.34	90.70	-58.64
Dhemada	200.11	119.55	-80.56

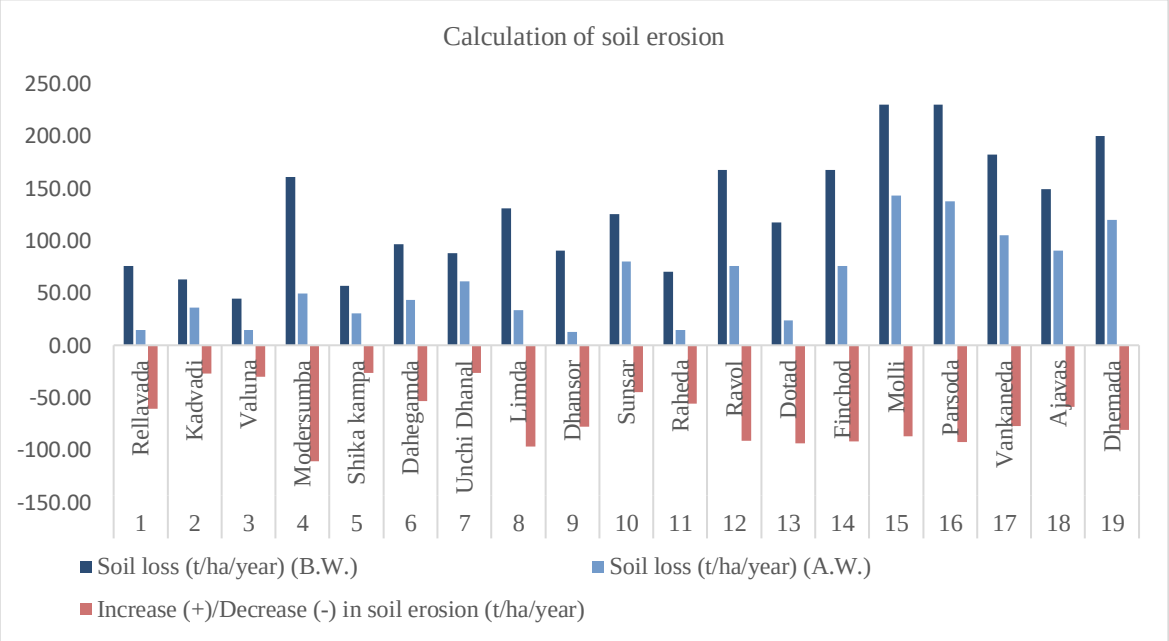

Figure 5.6 Calculation of soil erosion rate and changes (B.W. and A.W.)

5.1.7 Change in Soil Loss (Erosion Risk Category wise)

The quantitative results of changes in soil loss were divided into five categories as shown in Table 5.7. Major study area falls within the severe (77.28 percent) and high erosion category (10.86 percent) for B.W, where the hilly topography, high land slopes and poor cultivation practices result in severe and high soil erosion. These severe and high erosion category area for A.W scenario reduces to 33.26 percent (severe) and 36.38 percent (high), which justifies that various watershed interventions have made the impact in watershed projects implemented in study area. About 9.24 percent of the study area is under moderate and 2.63 percent under slight categories for B.W. So, for A.W scenario, the severe area under extreme erosion risk is distributed into low, slight, and moderately high category

areas. So, management practices adopted in the areas of the high to extreme risk erosion in order to reduce soil loss have impacted over the years and have become the successful project components to reduce the soil erosion rate.

Table 5.7 Change in soil erosion rate (Erosion Risk Category wise) (B.W & A.W)

Erosion Risk	**Ha (B.W.)**	**% Area under erosion risk**	**Ha (A.W.)**	**% Area under erosion risk**
Low	0	0	2853	14.89
Slight	503	2.63	2464	12.86
Moderate	1770	9.24	500	2.61
High	2080	10.86	6968.6	36.38
Severe	14803.6	77.28	6371	33.26

5.2 Changes in Ground Water Table

From the data collection of groundwater level from selected observation wells of the study area through the inventory of the wells, the fluctuations in the groundwater level of the wells before and after the implementation of watershed projects were analyzed and the differences in the groundwater levels were identified. The rise in groundwater levels has been estimated at 2.55 percent to 29.44 percent in different watersheds. The maximum groundwater level rise was in Valuna with 29.44 percent and the minimum groundwater level rise was in the Kadvadi watershed with 2.55 percent. The groundwater level rise for selected watersheds in the study area is given in Table 5.8. The comparative values of groundwater level rise for selected watersheds in the study area are represented in Figure 5.7.

Table 5.8 Rise in ground water table for selected watershed projects

Sr.No.	**Name of Watershed**	**Average WT in Mtr. (B.W.)**	**Average WT in Mtr. (A.W.)**	**Difference in WT (Mtr)**	**Increase (+)/decrease (-) in GWT (%)**
1	Rellavada	8.90	10.10	1.20	13.48
2	Kadvadi	15.70	16.10	0.40	2.55

Sr.No.	Name of Watershed	Average WT in Mtr. (B.W.)	Average WT in Mtr. (A.W.)	Difference in WT (Mtr)	Increase (+)/decrease (-) in GWT (%)
3	Valuna	18.00	23.30	5.30	29.44
4	Modarsumba	12.50	15.40	2.90	23.20
5	Shika Kampa	16.90	19.80	2.90	17.16
6	Dahegamda	13.30	15.00	1.70	12.78
7	Unchi Dhanal	19.80	22.58	2.78	14.04
8	Limda	15.90	18.65	2.75	17.30
9	Dhansor	13.90	16.62	2.72	19.57
10	Sunsar	12.20	15.00	2.80	22.95
11	Raheda	18.10	23.35	5.25	29.01
12	Ravol	15.10	18.20	3.10	20.53
13	Dotad	10.50	13.20	2.70	25.71
14	Finchod	11.87	14.00	2.13	17.94
15	Molli	13.80	15.00	1.20	8.70
16	Parsoda	15.40	17.00	1.60	10.39
17	Vankaneda	9.58	11.43	1.85	19.31
18	Ajwas	15.00	19.20	4.20	28.00
19	Dhemada	13.60	16.10	2.50	18.38

WT – Water table

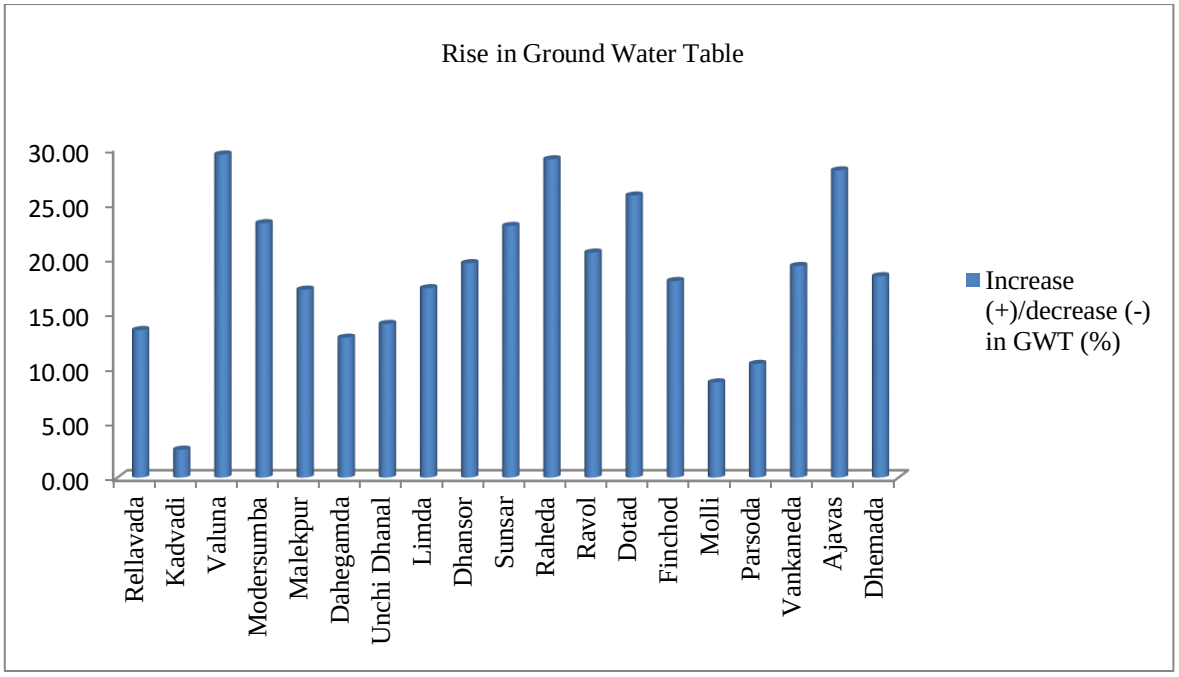

Figure 5.7 Rise in ground water table for selected watershed projects

5.3 Changes in Crop Productivity and Cropping Intensity

The maximum and minimum increase in crop productivity was found in the Dhansor project with 151.49 percent and the Rellavada project with 119.05 percent, respectively, in the rainfed season under IWDP. The maximum and minimum increase in crop productivity was found in the Dahegamda project with 161.89 percent and the Rellavada project with 108.44 percent, respectively, in an irrigated season under IWDP. The maximum and minimum increase in crop productivity was found in the Parsoda project with 130.95 percent and the Molli project with 104.93 percent, respectively, in the rainfed season under DPAP. The maximum and minimum increase in crop productivity was found in the Molli project with 174.43 percent and the Paroda project with 142.57 percent, respectively, in an irrigated season under DPAP. The maximum and minimum increase in crop productivity was found in the Ajavas project with 141.39 percent and the Dhemada project with 135.10 percent, respectively, in the rainfed season. The maximum and minimum increase in crop productivity was found in the Ajavas project with 127.83 percent and the Dhemada project with 104.93 percent, respectively, in the irrigated season under IWMP. The change in crop productivity for selected watershed projects is given in Table 5.9. The compared values of change in crop productivity for watersheds are given in Figure 5.8.

Table 5.9 Change in crop productivity for selected watershed projects (B.W. & A.W.)

Name of Watershed	Change in Crop Productivity (Kg/ha.)							
	Rainfed				Irrigated			
	B.W	A.W	Change	Change (%)	B.W	A.W	Change	Change (%)
Rellavada	1531.25	3354.17	1822.92	119.05	2331.82	4860.36	2528.54	108.44
Kadvadi	1370.83	3431.94	2061.11	150.35	1459.57	3406.32	1946.75	133.38
Valuna	1400.00	3300.00	1900.00	135.71	1420.27	3130.23	1709.96	120.40
Modarsumba	1409.72	3295.83	1886.11	133.79	1416.93	3276.87	1859.94	131.27
Shika Kampa	1454.69	3204.69	1750.00	120.30	1464.36	3472.45	2008.09	137.13
Dahegamda	1312.50	3266.67	1954.17	148.89	1276.11	3342.00	2065.89	161.89
Unchi Dhanal	1412.50	3287.50	1875.00	132.74	1420.35	3421.60	2001.25	140.90
Limda	1385.42	3314.17	1928.75	139.22	1365.07	3450.24	2085.17	152.75
Dhansor	1302.78	3276.39	1973.61	151.49	1285.98	2858.21	1572.23	122.26
Sunsar	1300.00	3262.50	1962.50	150.96	1288.10	3213.04	1924.94	149.44
Raheda	1325.00	3262.50	1937.50	146.23	1289.44	3234.04	1944.60	150.81
Ravol	1350.00	3215.00	1865.00	138.15	1368.84	3341.94	1973.10	144.14
Dotad	1312.50	3237.50	1925.00	146.67	1332.25	3219.34	1887.09	141.65
Finchod	1414.58	3470.83	2056.25	145.36	1415.80	3354.74	1938.94	136.95
Molli	1775.00	3637.50	1862.50	104.93	1316.83	3613.83	2297.00	174.43
Parsoda	1575.00	3637.50	2062.50	130.95	1386.41	3363.04	1976.62	142.57
Vankaneda	1575.00	3550.00	1975.00	125.40	1318.27	3500.03	2181.76	165.50
Ajwas	1379.17	3329.17	1950.00	141.39	1163.51	2650.79	1487.28	127.83
Dhemada	1402.19	3296.56	1894.38	135.10	3118.27	6390.37	3272.11	104.93

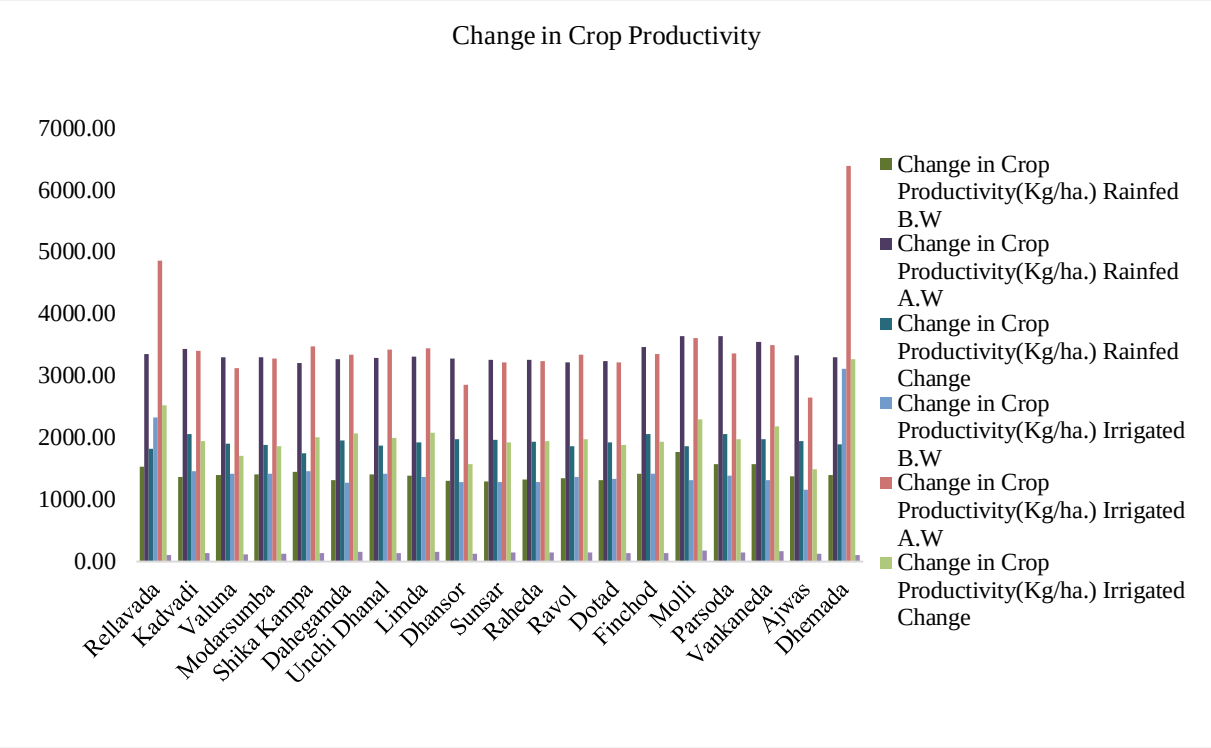

Figure 5.8 Change in crop productivity for selected watershed projects (B.W & A.W.)

The maximum and minimum increase in cropping intensity was found in the Valuna project at 41.76 percent and the Ravol project with 0.18 percent, respectively, under IWDP. The maximum and minimum increase in cropping intensity was found in the Molli project at 9.83 percent and the Parsoda project at 2.56 percent under DPAP. The maximum and minimum increase in cropping intensity was found in the Ajavas project at 10.84 percent and the Dhemada project at 3.10 percent under IWMP. The change in cropping intensity for selected watershed projects is given in Table 5.10.

Table 5.10 Change in cropping intensity for selected watershed projects

Name of Watershed	Cropping Intensity (%)			
	B.W	A.W	Change	Change (%)
Rellavada	108.25	111.52	3.27	3.02
Kadvadi	112.38	115.47	3.10	2.76
Valuna	110.88	157.19	46.31	41.76
Modarsumba	126.24	148.66	22.42	17.76
Shika Kampa	175.94	178.44	2.50	1.42
Dahegamda	144.94	174.83	29.89	20.62

Name of Watershed	Cropping Intensity (%)			
	B.W	A.W	Change	Change (%)
Unchi Dhanal	159.89	165.40	5.51	3.44
Limda	149.00	153.92	4.91	3.30
Dhansor	126.65	141.85	15.20	12.00
Sunsar	173.53	178.08	4.55	2.62
Raheda	178.76	181.02	2.26	1.26
Ravol	150.79	151.05	0.27	0.18
Dotad	158.03	162.90	4.87	3.08
Finchod	140.64	144.14	3.49	2.48
Molli	127.05	139.54	12.49	9.83
Parsoda	162.91	167.08	4.17	2.56
Vankaneda	150.55	157.96	7.42	4.93
Ajwas	114.80	127.24	12.44	10.84
Dhemada	153.25	158.00	4.75	3.10

The change in cropping intensity for selected watershed projects is given in Figure 5.9.

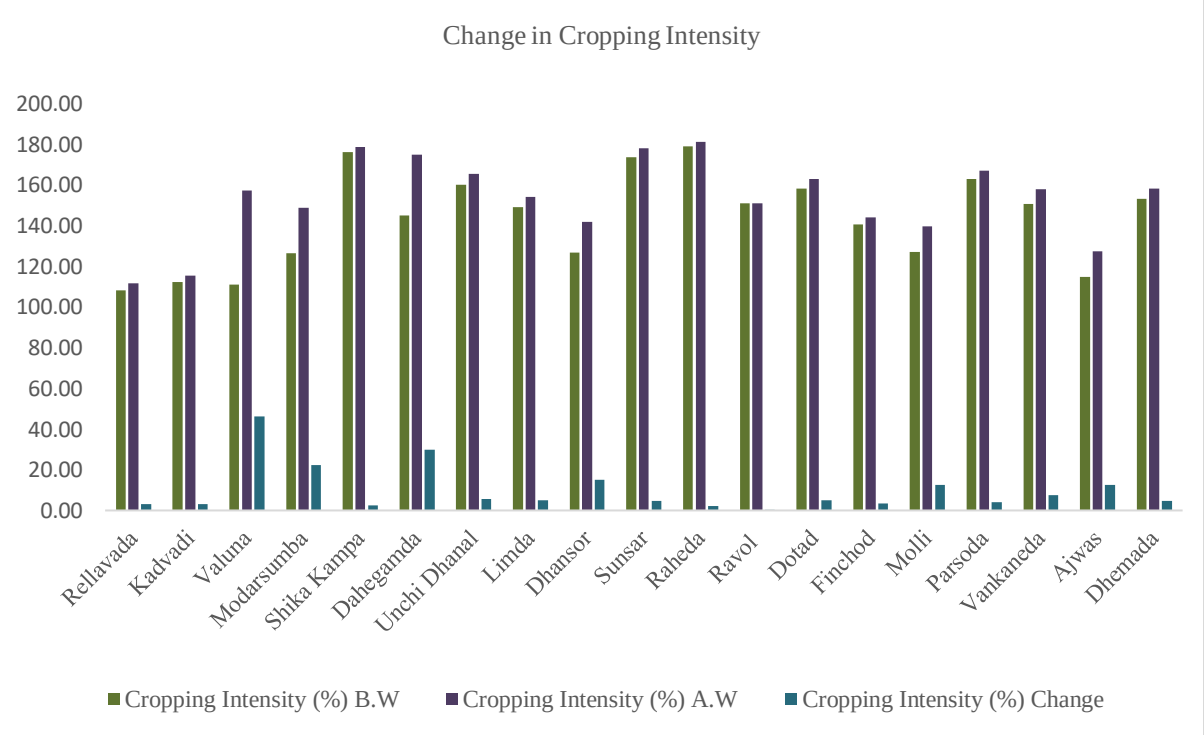

Figure 5.9 Change in cropping intensity for selected watershed projects (B.W. & A.W.)

5.4 Changes in Livestock

The maximum and minimum increase in the number of livestock was found in the Raheda project with 154.55 percent and the Kadwadi project at 40 percent, respectively under IWDP. The maximum and minimum increase in the number of livestock was found in the Parsoda project with 81.82 percent and in the Molli project at 54.55 percent, respectively, under DPAP. The maximum and minimum increase in milk production was found in the Raheda project at 154.55 percent and the Kadwadi project at 40 percent, respectively, under IWDP. The maximum and minimum increase in milk production was found in the Parsoda project at 81.82 and the Molli project at 54.55 percent, respectively, under DPAP.

The maximum and minimum increase in income due to milk production was found in the Raheda project at 225.29 percent and the Kadwadi project at 78.91 percent under IWDP. The maximum and minimum increase in income due to milk production was found in the Parsoda project with 132.35 percent and the Molli project at 97.50 percent, respectively, under DPAP.

The change in livestock numbers, milk production, and income due to milk production after watershed implementation are given in Table 5.11.

The comparisons of livestock numbers, milk production, and income due to milk production before and after watershed implementation are given in Figure 5.10, 5.11 and 5.12 respectively.

Table 5.11 Change in Livestock, milk production and income due to milk production for selected watershed projects

Name of Watershed	Livestock No.				Milk Production (Lit. per day)				Annual Income due to Milk Production (Rs.)			
	B.W	A.W	Absolute Change	Change (%)	B.W	A.W	Absolute Change	Change (%)	B.W	A.W	Absolute Change	Change (%)
Rellavada	2.00	4.66	2.66	133.35	11.00	25.67	14.67	133.32	126768.00	378000.00	251232.00	198.18
Kadvadi	2.22	3.11	0.89	40.00	13.33	18.67	5.33	40.00	140853.33	252000.00	111146.67	78.91
Valuna	1.71	4.29	2.57	150.00	10.29	25.71	15.43	150.00	108658.29	347142.86	238484.57	219.48
Modarsumba	2.00	4.56	2.56	127.78	12.00	27.33	15.33	127.78	126768.00	369000.00	242232.00	191.08
Shika Kampa	2.38	5.63	3.25	136.84	14.25	33.75	19.50	136.84	150537.00	455625.00	305088.00	202.67
Dahegamda	1.67	3.50	1.83	110.00	10.00	21.00	11.00	110.00	105640.00	283500.00	177860.00	168.36
Unchi Dhanal	2.00	5.00	3.00	150.00	12.00	30.00	18.00	150.00	126768.00	405000.00	278232.00	219.48
Limda	2.33	3.83	1.50	64.29	14.00	23.00	9.00	64.29	147896.00	310500.00	162604.00	109.94
Dhansor	1.78	3.22	1.44	81.25	10.67	19.33	8.67	81.25	112682.67	261000.00	148317.33	131.62
Sunsar	1.43	3.00	1.57	110.00	8.57	18.00	9.43	110.00	90548.57	243000.00	152451.43	168.36
Raheda	1.57	4.00	2.43	154.55	9.43	24.00	14.57	154.55	99603.43	324000.00	224396.57	225.29
Ravol	2.00	3.71	1.71	85.71	12.00	22.29	10.29	85.71	126768.00	300857.14	174089.14	137.33
Dotad	1.57	3.57	2.00	127.27	9.43	21.43	12.00	127.27	99603.43	289285.71	189682.29	190.44
Finchod	1.50	3.17	1.67	111.11	9.00	19.00	10.00	111.11	95076.00	256500.00	161424.00	169.78
Molli	1.57	2.43	0.86	54.55	9.43	14.57	5.14	54.55	99603.43	196714.29	97110.86	97.50
Parsoda	1.57	2.86	1.29	81.82	9.43	17.14	7.71	81.82	99603.43	231428.57	131825.14	132.35
Vankaneda	1.86	3.00	1.14	61.54	11.14	18.00	6.86	61.54	117713.14	243000.00	125286.86	106.43
Ajwas	2.05	4.00	1.95	95.35	12.29	24.00	11.71	95.35	129786.29	324000.00	194213.71	149.64
Dhemada	1.98	4.28	2.30	116.46	11.85	25.65	13.80	116.46	125183.40	346275.00	221091.60	176.61

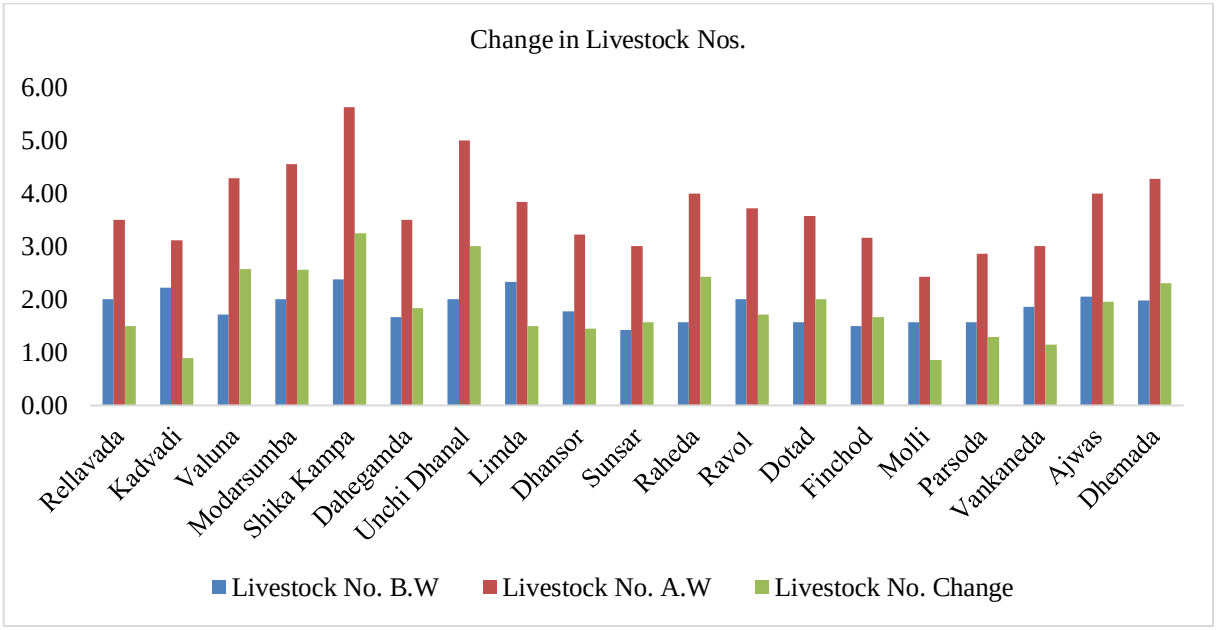

Figure 5.10 Change in number of livestocks in watershed projects (B.W. & A.W.)

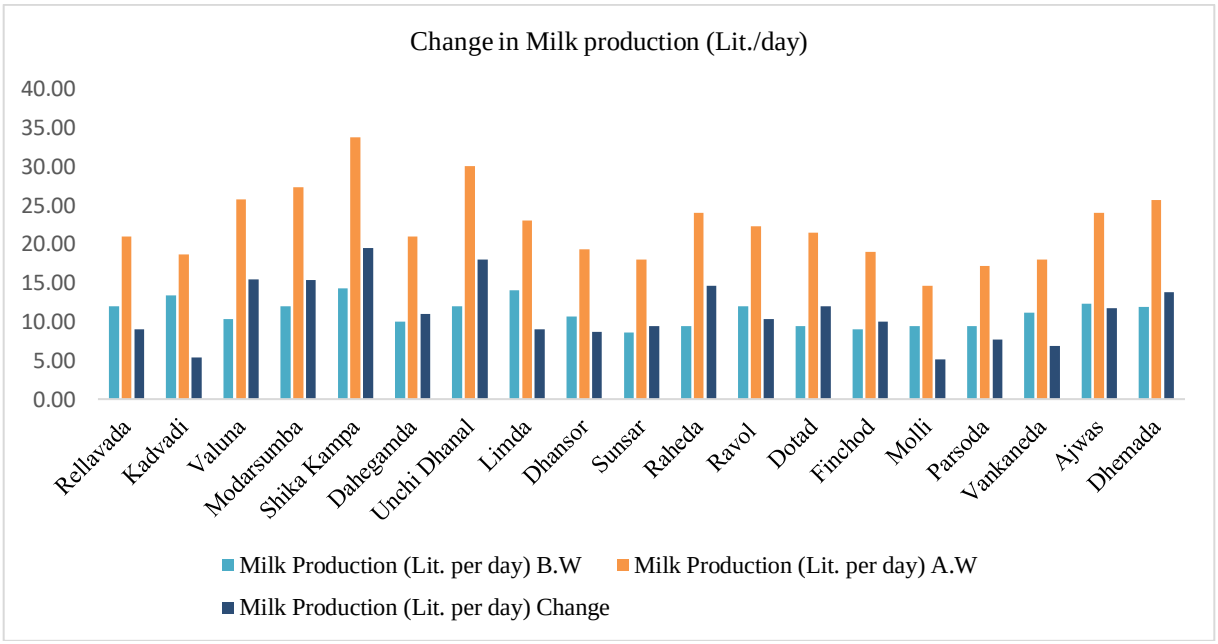

Figure 5.11 Change in milk production in watershed projects (B.W. & A.W.)

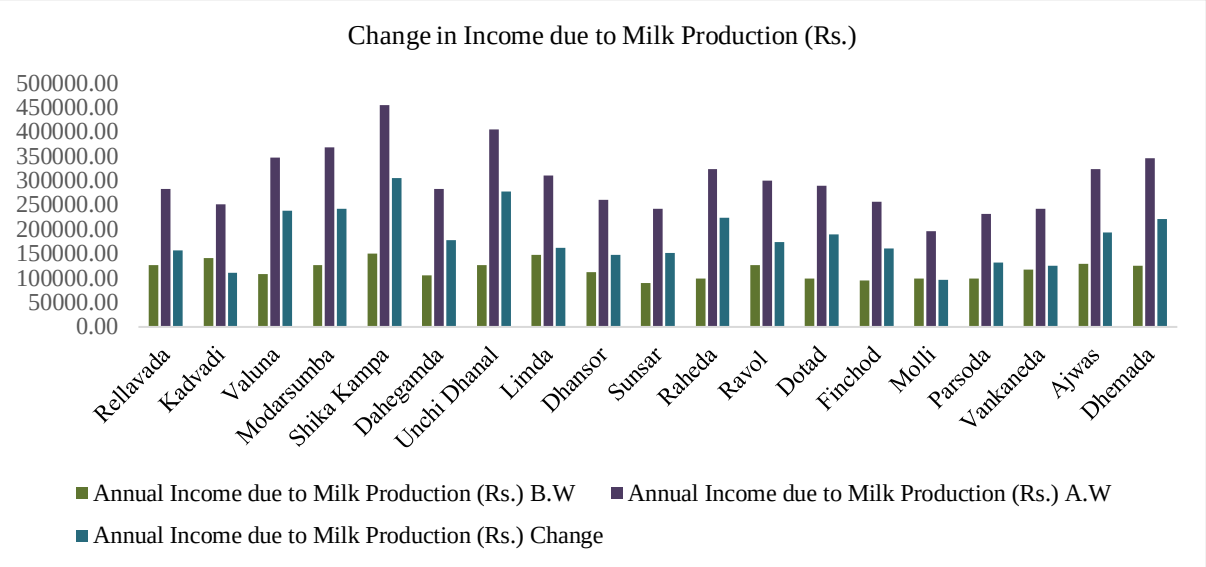

Figure 5.12 Change in income due to milk production in watershed projects (B.W. & A.W.)

5.5 Changes in Total income

The total income of beneficiaries was derived from three different income criteria (1) the income through livestock, (2) income from agriculture, and (3) savings in migratory expenses. Due to the reduction in a migration after implementing watersheds, the expenses incurred for migration activities were considered and converted into monetary terms as saving and a further addition to the household's overall income.

Considering all income criteria, the increase in total average annual income per HH was estimated to be 293.28 percent in IWDP watersheds. The maximum and minimum increase in income was found in the Unchi Dhanal project at 365.29 percent and in the Kadwadi project at 214.38 percent, respectively, under IWDP. The maximum and minimum increase in income was found in the Parsoda project with 256.64 percent and the Vankaneda project at 224.33 percent, respectively under DPAP. The increase in total average annual income per HH was found at 268.42 percent in the Ajavas watershed project and 291.21 percent in the Dhemada watershed under IWMP. The change in income from agriculture, livestock, migratory expenses and total income is given in Table 5.12, 5.13, 5.14 and 5.15 respectively. The comparative values for change in income from agriculture, livestock, migratory expenses and total income is given in Figure 5.13, 5.14, 5.15 and 5.16 respectively.

Table 5.12 Change in income from agriculture (B.W. & A.W.)

Name of Watershed	Change in Income from Agriculture (Rs. /year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Rellavada	89910.00	377282.50	287372.50	319.62
Kadvadi	71601.11	341613.89	270012.78	377.11
Valuna	25133.93	113610.71	88476.79	352.02
Modarsumba	27451.39	128480.56	101029.17	368.03
Shika Kampa	177521.88	664911.25	487389.38	274.55
Dahegamda	31243.75	160387.50	129143.75	413.34
Unchi Dhanal	123473.21	632317.86	508844.64	412.11
Limda	56793.75	264295.00	207501.25	365.36
Dhansor	58211.67	273037.22	214825.56	369.04
Sunsar	58325.00	291635.71	233310.71	400.02
Raheda	94419.64	458457.14	364037.50	385.55
Ravol	31541.07	151553.57	120012.50	380.50
Dotad	30367.86	149125.00	118757.14	391.06
Finchod	36520.83	184095.83	147575.00	404.08
Molli	45205.36	211789.29	166583.93	368.50
Parsoda	38305.36	179953.57	141648.21	369.79
Vankaneda	51503.57	247678.57	196175.00	380.90
Ajwas	53179.29	251112.14	197932.86	372.20
Dhemada	66143.25	304038.50	237895.25	359.67

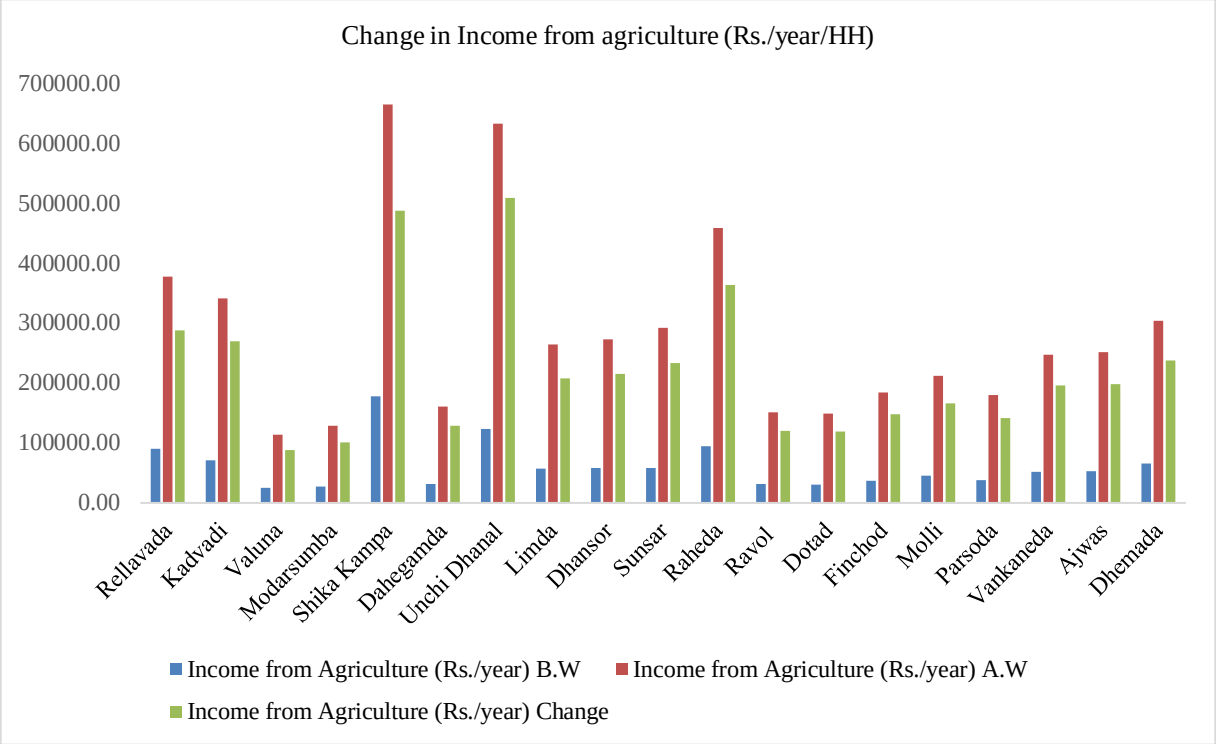

Figure 5.13 Change in income from agriculture (B.W. & A.W.)

Table 5.13 Change in income from livestock (B.W. & A. W.)

Name of Watershed	Income from Livestock (Rs. /year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Rellavada	126768.00	283500.00	156732.00	123.64
Kadvadi	140853.33	252000.00	111146.67	78.91
Valuna	108658.29	347142.86	238484.57	219.48
Modarsumba	126768.00	369000.00	242232.00	191.08
Shika Kampa	150537.00	455625.00	305088.00	202.67
Dahegamda	105640.00	283500.00	177860.00	168.36
Unchi Dhanal	126768.00	405000.00	278232.00	219.48
Limda	147896.00	310500.00	162604.00	109.94
Dhansor	112682.67	261000.00	148317.33	131.62
Sunsar	90548.57	243000.00	152451.43	168.36
Raheda	99603.43	324000.00	224396.57	225.29
Ravol	126768.00	300857.14	174089.14	137.33
Dotad	99603.43	289285.71	189682.29	190.44

Name of Watershed	Income from Livestock (Rs. /year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Finchod	95076.00	256500.00	161424.00	169.78
Molli	99603.43	196714.29	97110.86	97.50
Parsoda	99603.43	231428.57	131825.14	132.35
Vankaneda	117713.14	243000.00	125286.86	106.43
Ajwas	129786.29	324000.00	194213.71	149.64
Dhemada	125183.40	346275.00	221091.60	176.61

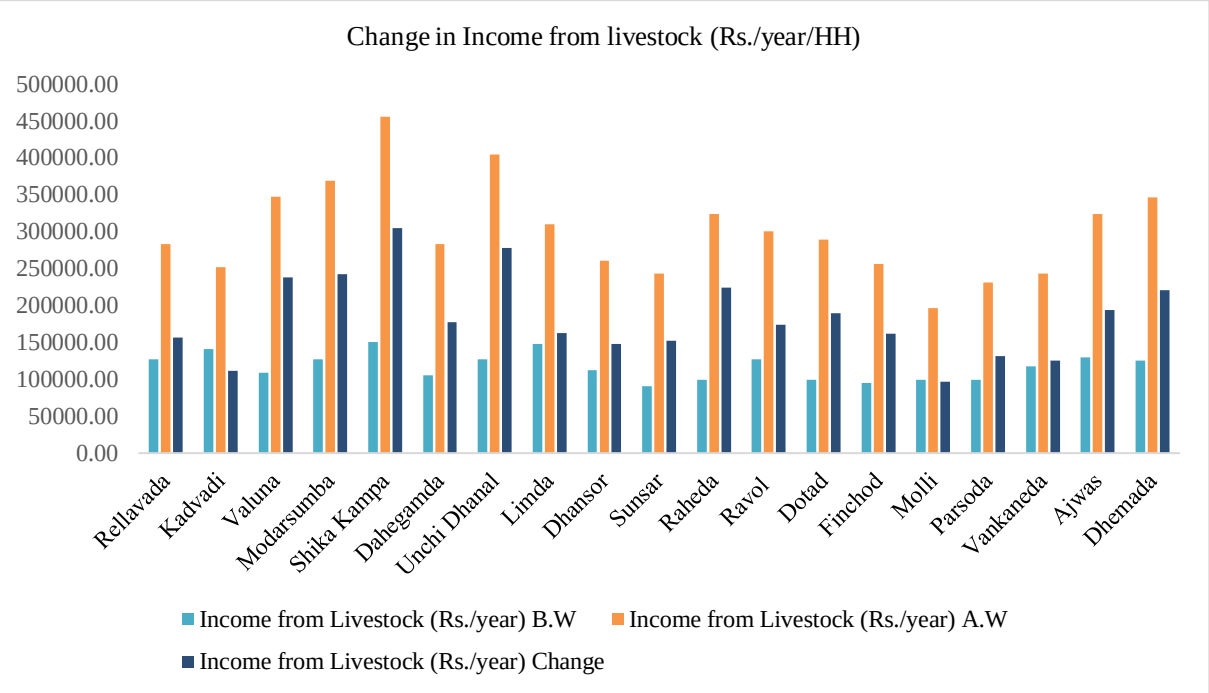

Figure 5.14 Change in income from livestock (B.W. & A. W.)

Table 5.14 Change in income from migratory expenses (B.W. & A. W.)

Name of Watershed	Migratory expenses (Rs. /year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Rellavada	54687.55	39162.55	15525.00	28.39
Kadvadi	24654.39	3198.83	21455.56	87.03
Valuna	26995.67	3288.53	23707.14	87.82
Modarsumba	30044.29	4194.29	25850.00	86.04

Name of Watershed	Migratory expenses (Rs. /year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Shika Kampa	19314.40	826.90	18487.50	95.72
Dahegamda	31366.27	5366.27	26000.00	82.89
Unchi Dhanal	28503.44	5596.29	22907.14	80.37
Limda	29053.28	4928.28	24125.00	83.04
Dhansor	27291.39	5391.39	21900.00	80.25
Sunsar	23481.97	4667.68	18814.29	80.12
Raheda	26973.31	4737.59	22235.71	82.44
Ravol	28445.91	4453.05	23992.86	84.35
Dotad	26876.47	4533.61	22342.86	83.13
Finchod	29067.92	8067.92	21000.00	72.24
Molli	27736.90	8915.47	18821.43	67.86
Parsoda	23493.44	3336.30	20157.14	85.80
Vankaneda	19679.90	5679.90	14000.00	71.14
Ajwas	27963.83	4047.17	23916.67	85.53
Dhemada	25976.34	3442.59	22533.75	86.75

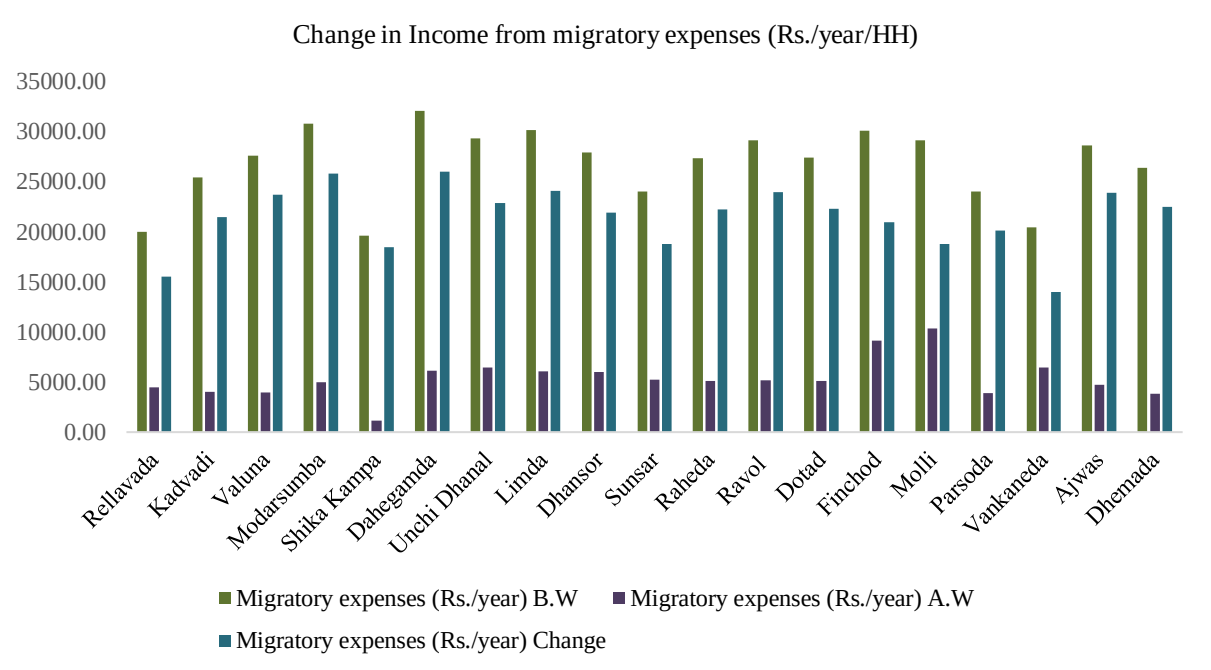

Figure 5.15 Change in income from migratory expenses (B.W. & A. W.)

Table 5.15 Change in total income (B.W. & A. W.)

Name of Watershed	Change in Total Income (Rs. /Year/HH)			
	B.W	A.W	Absolute Change	Change (%)
Rellavada	161990.45	621619.95	459629.50	283.74
Kadvadi	187800.06	590415.06	402615.00	214.38
Valuna	106796.54	457465.04	350668.50	328.35
Modarsumba	124175.09	493286.26	369111.17	297.25
Shika Kampa	308744.48	1119709.35	810964.88	262.67
Dahegamda	105517.48	438521.23	333003.75	315.59
Unchi Dhanal	221737.78	1031721.56	809983.79	365.29
Limda	175636.47	569866.72	394230.25	224.46
Dhansor	143602.95	528645.84	385042.89	268.13
Sunsar	125391.60	529968.03	404576.43	322.65
Raheda	167049.77	777719.55	610669.79	365.56
Ravol	129863.16	447957.66	318094.50	244.95
Dotad	103094.82	433877.10	330782.29	320.85
Finchod	102528.91	432527.91	329999.00	321.86
Molli	117071.89	399588.10	282516.21	241.32
Parsoda	114415.34	408045.84	293630.50	256.64
Vankaneda	149536.81	484998.67	335461.86	224.33
Ajwas	155001.74	571064.98	416063.24	268.42
Dhemada	165350.31	646870.91	481520.60	291.21

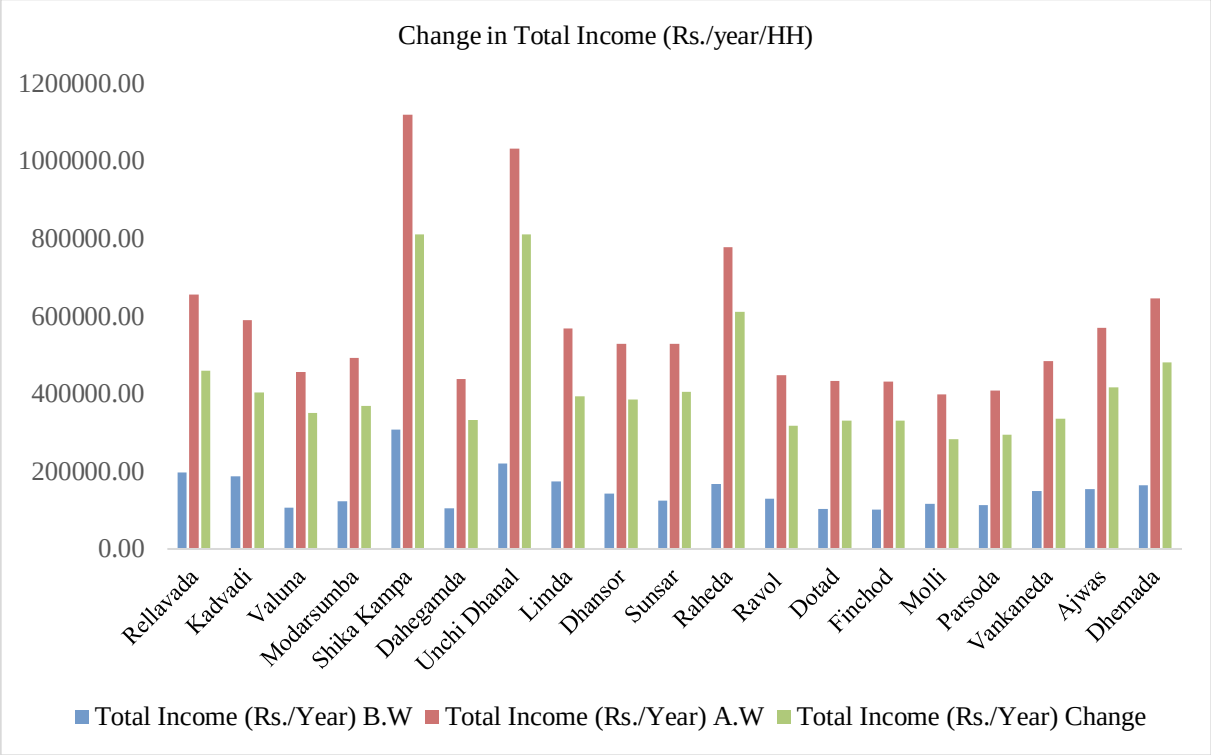

Figure 5.16 Change in total income (B.W. & A. W.)

5.6 Net Present Value (NPV) and Benefit-Cost Ratio (BCR)

The yearly income has been calculated per household in the selected watershed projects. The total cost of the project incurred for the implementation of watershed programs for various expense heads like physical structures, entry point activities, training and capacity building, administrative expenses, etc. for selected watershed projects. Total annual income of watershed has been calculated by the product of the annual income per household and number of households in watershed. Net present value and the present value of cost have been calculated with a 10 percent discount rate. The cost, total income and benefits of the selected watershed projects have been calculated as per Table 5.16.

The Net present value of IWDP watersheds ranged from 3416.93 lacs to 8764.12 lacs, whereas the present cost value ranged from 570.78 lacs to 3416.93 lacs. The NPV was 8764.12 lacs, and PVC was found to be 951.30 lacs in the Unchi Dhanal watershed with a maximum BCR of 9.21. The NPV was found to be 3416.93 lacs, and PVC was found to be 1418.76 lacs in the Ravol watershed with a minimum BCR of 2.41. Therefore, the BCR ranged from 2.41 to 9.21

in IWDP watersheds. The Net present value of DPAP watersheds ranged from 2570.34 lacs to 3524.27 lacs, whereas the present cost value ranged from 577.92 lacs to 742.56 lacs. The NPV was 3524.27 lacs, and PVC was 577.92 lacs in the Vankaneda watershed with a maximum BCR of 6.10. The NPV was 2570.34 lacs, and PVC was found to be 742.56 lacs in the Molli watershed with a minimum BCR of 3.46. Therefore, the BCR ranged from 3.46 to 6.10 in DPAP watersheds. The NPV was 17128.65 lacs, and PVC was found to be 3055.50 lacs in the Ajavas watershed with a maximum BCR of 5.61. The NPV was 15834.05 lacs, and PVC was found to be 2890.86 lacs in the Dhemada watershed with a minimum BCR of 5.48.

The sample calculation of cost-benefit analysis for Rellavada watershed is given here in Table 5.17. The cost-benefit analysis for other watershed projects is given in Annexure – IV. The net present value and benefit cost ratio of watershed projects have been calculated and given in Table 5.18.

Table 5.16 Cost, total income and benefits of the selected watershed projects

Sr. No.	Project	Cost (Rs. in lakhs)	Total HHs	Income in Rs.	Income in lakhs	Benefits (Rs. in lakhs)
1	Rellavada	18.580	255	459629.500	4.596	1172.055
2	Kadwadi	15.680	240	402615.000	4.026	966.276
3	Valuna	19.420	198	350668.500	3.507	694.324
4	Modersumba	16.590	180	369111.167	3.691	664.400
5	Shika Kampa	21.760	156	810964.875	8.110	1265.105
6	Dahegamda	14.740	187	333003.750	3.330	622.717
7	Unchi Dhanal	22.650	180	809983.786	8.100	1457.971
8	Limda	24.900	201	394230.250	3.942	792.403
9	Dhansor	19.210	200	385042.889	3.850	770.086
10	Sunsar	16.180	170	404576.429	4.046	687.780
11	Raheda	27.020	185	610669.786	6.107	1129.739
12	Ravol	33.780	180	318094.500	3.181	572.570
13	Dotad	13.590	194	330782.286	3.308	641.718
14	Finchod	14.160	201	329999.000	3.300	663.298
15	Molli	17.680	152	282516.214	2.825	429.425
16	Parsoda	16.890	168	293630.500	2.936	493.299
17	Vankaneda	13.760	175	335461.857	3.355	587.058
18	Ajwas	72.750	686	416063.238	4.161	2854.194

Sr. No.	Project	Cost (Rs. in lakhs)	Total HHs	Income in Rs.	Income in lakhs	Benefits (Rs. in lakhs)
19	Dhemada	68.830	548	481520.600	4.815	2638.733

Table 5.17 Sample calculation of cost-benefit analysis for Rellavada watershed

Year	Costs (in lakhs)	Benefits (in lakhs)	Net Benefits (in lakhs)	Discount Factor for benefit	Present Value of benefit (in lakhs)	Discount Factor for cost	Present Value of Cost (in lakhs)
0	18.580	0.000	-18.580	1.000	-18.580	1.00	18.580
1		0.000	0.000	0.909	0.000	1.10	20.438
2		0.000	0.000	0.826	0.000	1.20	22.296
3		0.000	0.000	0.751	0.000	1.30	24.154
4		1172.055	1172.055	0.683	800.529	1.40	26.012
5		1172.055	1172.055	0.621	727.754	1.50	27.870
6		1172.055	1172.055	0.564	661.595	1.60	29.728
7		1172.055	1172.055	0.513	601.450	1.70	31.586
8		1172.055	1172.055	0.467	546.772	1.80	33.444
9		1172.055	1172.055	0.424	497.066	1.90	35.302
10		1172.055	1172.055	0.386	451.878	2.00	37.160
11		1172.055	1172.055	0.350	410.798	2.10	39.018
12		1172.055	1172.055	0.319	373.453	2.20	40.876
13		1172.055	1172.055	0.290	339.503	2.30	42.734
14		1172.055	1172.055	0.263	308.639	2.40	44.592
15		1172.055	1172.055	0.239	280.581	2.50	46.450
16		1172.055	1172.055	0.218	255.073	2.60	48.308
17		1172.055	1172.055	0.198	231.885	2.70	50.166
18		1172.055	1172.055	0.180	210.804	2.80	52.024
19		1172.055	1172.055	0.164	191.640	2.90	53.882
20		1172.055	1172.055	0.149	174.219	3.00	55.740
				NPV=	7045.059	PVC=	780.360
				B/C=	9.03		

Table 5.18 Net present value and benefit-cost ratio of watershed projects

Name of Project	Total HH	Income per HH per year	Project Cost	Total Income per year	Net Present Value	Present Value of Cost	B/C Ratio
Rellavada	255	6.22	18.580	1585.13	7045.06	780.36	9.03
Kadwadi	240	5.90	15.680	1417.00	5807.79	658.56	8.82
Valuna	198	4.57	19.420	905.78	4165.07	815.64	5.11
Modersumba	180	4.93	16.590	887.92	3987.56	696.78	5.72
Shika Kampa	156	11.20	21.760	1746.75	7602.66	913.92	8.32
Dahegamda	187	4.39	14.740	820.03	3738.20	619.08	6.04
Unchi Dhanal	180	10.32	22.650	1857.10	8764.12	951.30	9.21
Limda	201	5.70	24.900	1145.43	4750.68	1045.80	4.54
Dhansor	200	5.29	19.210	1057.29	4621.87	806.82	5.73
Sunsar	170	5.30	16.180	900.95	4128.87	679.56	6.08
Raheda	185	7.78	27.020	1438.78	6781.59	1134.84	5.98
Ravol	180	4.48	33.780	806.32	3416.93	1418.76	2.41
Dotad	194	4.34	13.590	841.72	3853.86	570.78	6.75
Finchod	201	4.33	14.160	869.38	3983.35	594.72	6.70
Molli	152	4.00	17.680	607.37	2570.34	742.56	3.46
Parsoda	168	4.08	16.890	685.52	2956.08	709.38	4.17
Vankaneda	175	4.85	13.760	848.75	3524.27	577.92	6.10
Ajwas	686	5.71	72.750	3917.51	17128.65	3055.50	5.61
Dhemada	548	6.47	68.830	3544.85	15834.05	2890.86	5.48

5.7 Changes in Employment

From the data obtained through questionnaire survey in the study area, it was observed that the people were getting the employment before watershed implementation for average 98 days whereas after watershed implementation, the employment has increased to 109 days for a household. For all selected watersheds in study area the benchmark values of 98 man-days and 109 man-days before and after watershed implementation have been taken for calculation of change in employment. After implementing watershed projects under IWDP, DPAP, and IWMP, the increase in man-days was found almost in all projects. Still, a maximum increase in man-days were observed in the Modersumba project with 44.90 percent and a minimum increase in man-days in the Rellavada project with 11.22 percent under IWDP. It was also

reported that, due to the convergence of different programs with IWDP, the opportunity to get labour work in governmental programs slightly increased. The maximum and minimum increase in man-days were observed in the Vankaneda project with 12.24 percent and the Parsoda project with 8.16 percent, respectively, under DPAP. The maximum and minimum increase in man-days were observed in the Dhemada project with 40.82 percent and the Ajavas project with 35.71 percent, respectively, under IWMP. The change in employment in watershed projects is given in Table 5.19 and comparative values of change in employment are shown in Figure 5.17.

Table 5.19 Change in employment in selected watershed projects (B.W. & A. W.)

Name of Watershed	Total HH	Employment (Mandays)			
		B.W	A.W	Absolute Change	Change (%)
Rellavada	255	24990.00	27795.00	2805.00	11.22
Kadvadi	240	23520.00	26880.00	3360.00	14.29
Valuna	198	19404.00	27126.00	7722.00	39.80
Modarsumba	180	17640.00	25560.00	7920.00	44.90
Shika Kampa	156	15288.00	21840.00	6552.00	42.86
Dahegamda	187	18326.00	20944.00	2618.00	14.29
Unchi Dhanal	180	17640.00	20880.00	3240.00	18.37
Limda	201	19698.00	23718.00	4020.00	20.41
Dhansor	200	19600.00	22200.00	2600.00	13.27
Sunsar	170	16660.00	19890.00	3230.00	19.39
Raheda	185	18130.00	21460.00	3330.00	18.37
Ravol	180	17640.00	20700.00	3060.00	17.35
Dotad	194	19012.00	22892.00	3880.00	20.41
Finchod	201	19698.00	23517.00	3819.00	19.39
Molli	152	14896.00	16264.00	1368.00	9.18
Parsoda	168	16464.00	17808.00	1344.00	8.16
Vankaneda	175	17150.00	19250.00	2100.00	12.24
Ajwas	686	67228.00	91238.00	24010.00	35.71
Dhemada	548	53704.00	75624.00	21920.00	40.82

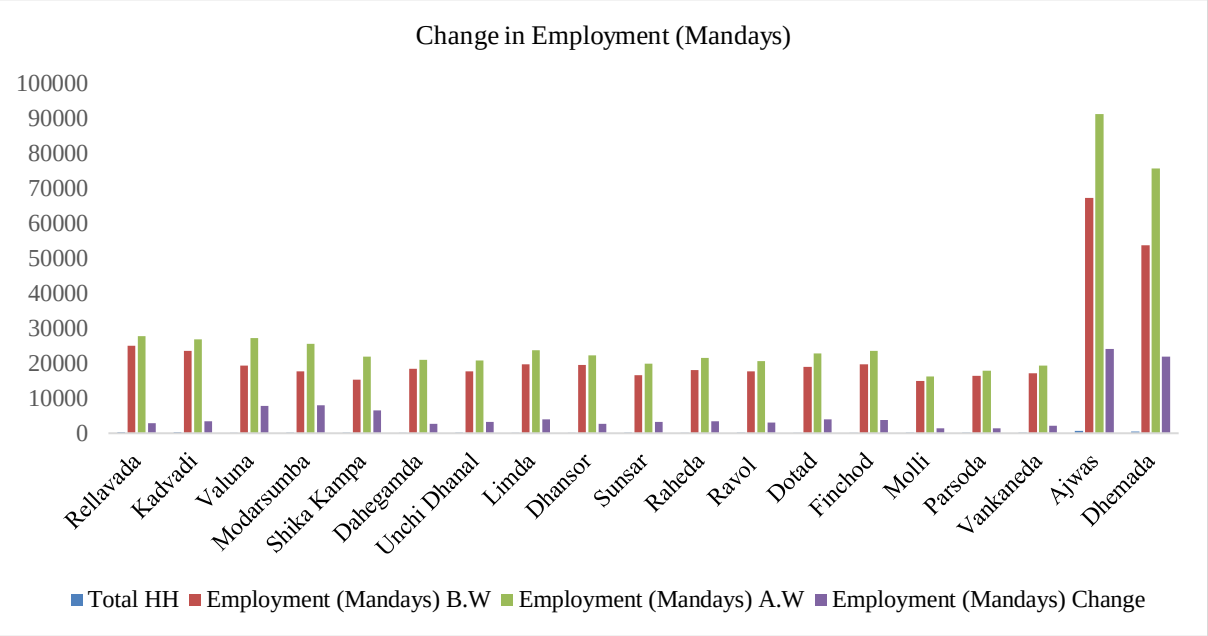

Figure 5.17 Change in employment in selected watershed projects (B.W. & A. W.)

5.8 Changes in Saving and expenditure capacity

The average value for saving capacity and expenditure capacity was considered for a single value as an indicator of saving and expenditure capacity. Therefore, the change in the average capacity of saving and expenditure was 98.33 percent for the Dhansor watershed, the maximum, and 26.67 percent as the minimum in the Kadwadi watershed.

The change in the average capacity of saving and expenditure was calculated to be 57 percent for the Vankaneda watershed, the maximum, and 42 percent as the minimum in the Molli watershed. The average capacity of saving and expenditure change was calculated to be 109.67 percent for the Dhemada watershed, the maximum, and 98.33 percent as the minimum in the Ajavas watershed.

The change in expenditure capacity (Rs. /year) and saving capacity (Rs. /year) for watershed projects is given in Table 5.20. The comparative values of change in expenditure capacity are shown in Figure 5.18 and the comparative values of change in saving capacity are shown in Figure 5.19.

Table 5.20 Change in saving and expenditure capacity in watershed projects (B.W. & A. W.)

Name of Watershed	Total HH	Expenditure (Rs. /year)				Saving (Rs. /year)				Average Change (%)
		B.W	A.W	Absolute Change	Change (%)	B.W	A.W	Absolute Change	Change (%)	
Rellavada	255	4653750	7446000	2792250	60.00	2792250	4653750	1861500	66.67	63.33
Kadvadi	240	4380000	5256000	876000	20.00	2628000	3504000	876000	33.33	26.67
Valuna	198	3613500	5781600	2168100	60.00	2168100	4697550	2529450	116.67	88.33
Modarsumba	180	3285000	5256000	1971000	60.00	1971000	4599000	2628000	133.33	96.67
Shika Kampa	156	2847000	4270500	1423500	50.00	1708200	3871920	2163720	126.67	88.33
Dahegamda	187	3412750	5460400	2047650	60.00	2047650	3071475	1023825	50.00	55.00
Unchi Dhanal	180	3285000	5124600	1839600	56.00	1971000	3547800	1576800	80.00	68.00
Limda	201	3668250	6602850	2934600	80.00	2200950	4035075	1834125	83.33	81.67
Dhansor	200	3650000	6570000	2920000	80.00	2190000	4745000	2555000	116.67	98.33
Sunsar	170	3102500	4964000	1861500	60.00	1861500	3847100	1985600	106.67	83.33
Raheda	185	3376250	5064375	1688125	50.00	2025750	4051500	2025750	100.00	75.00
Ravol	180	3285000	5387400	2102400	64.00	1971000	3613500	1642500	83.33	73.67
Dotad	194	3540500	6514520	2974020	84.00	2124300	4602650	2478350	116.67	100.33
Finchod	201	3668250	5869200	2200950	60.00	2200950	4108440	1907490	86.67	73.33
Molli	152	2774000	3994560	1220560	44.00	1664400	2330160	665760	40.00	42.00
Parsoda	168	3066000	4660320	1594320	52.00	1839600	2820720	981120	53.33	52.67
Vankaneda	175	3193750	4918375	1724625	54.00	1916250	3066000	1149750	60.00	57.00
Ajwas	686	12519500	23787050	11267550	90.00	7511700	15524180	8012480	106.67	98.33
Dhemada	548	10001000	20602060	10601060	106.00	6000600	12801280	6800680	113.33	109.67

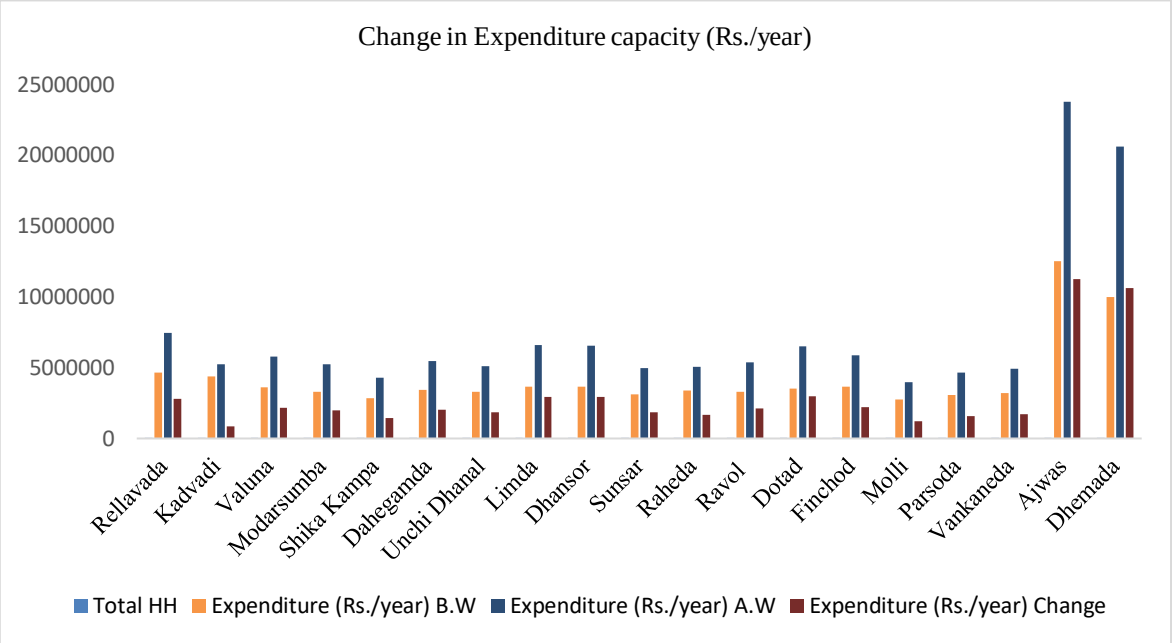

Figure 5.18 Change in expenditure capacity in watershed projects (B.W. & A. W.)

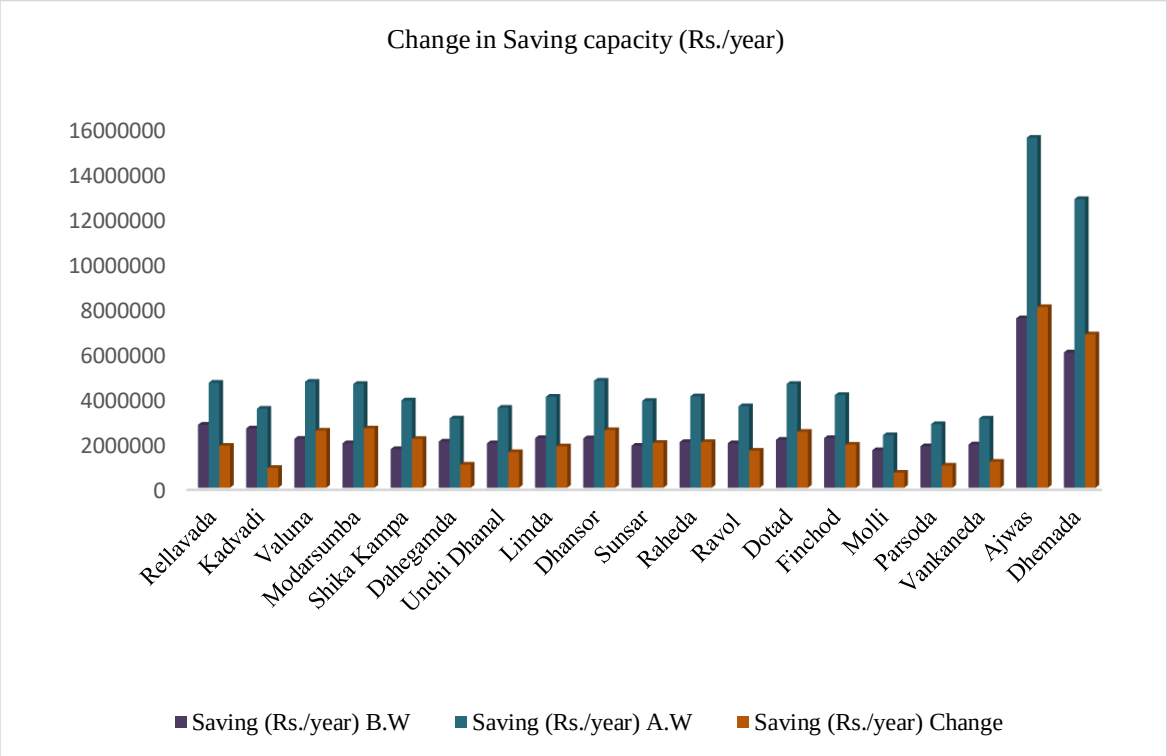

Figure 5.19 Change in saving capacity in watershed projects (B.W. & A. W.)

The change in average of both the saving and expenditure capacity for watershed projects is given in Table 5.21 and Figure 5.20

Table 5.21 Change in average saving and expenditure capacity

Name of Watershed	Average saving and expenditure capacity (%)
Rellavada	63.33
Kadvadi	26.67
Valuna	88.33
Modarsumba	96.67
Shika Kampa	88.33
Dahegamda	55.00
Unchi Dhanal	68.00
Limda	81.67
Dhansor	98.33
Sunsar	83.33
Raheda	75.00
Ravol	73.67
Dotad	100.33
Finchod	73.33
Molli	42.00
Parsoda	52.67
Vankaneda	57.00
Ajwas	98.33
Dhemada	109.67

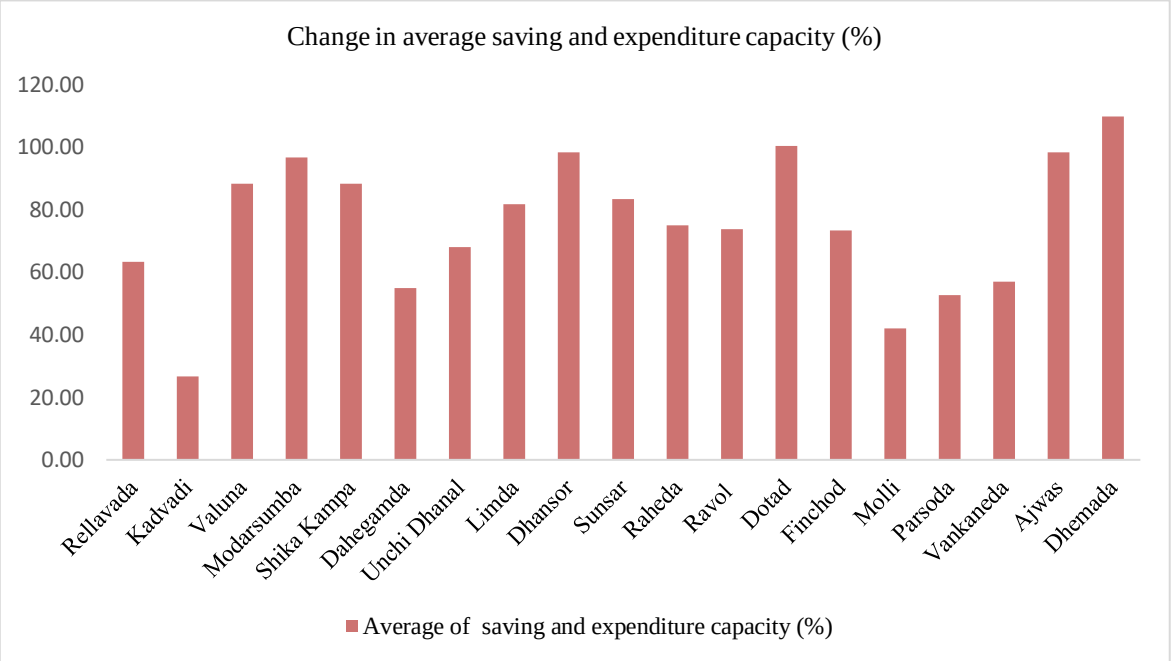

Figure 5.20 Change in average saving and expenditure capacity

5.9 Reduction in Migration

The average number of migrating persons per HH was found maximum in the Malekpur (Shikakampa) watershed, with a change in migration of 92.31 percent. The average number of migrating persons per HH was found at a minimum in the Rellavada watershed, with a change in migration of 70.00, under IWDP. The average number of migrating persons per HH was maximum in the Parsoda watershed, with a change in migration of 78.57 percent. The average number of migrating persons per HH was minimum in the Molli watershed, with a change in migration of 52.94 percent, under DPAP. The average number of migrating persons per HH was found maximum in the Ajavas watershed, with a change in migration of 78.00 percent. The average number of migrating persons per HH was found to be minimum in the Dhemada watershed, with a change in migration of 80.68 percent under IWMP. The change in average number of persons migrating in watershed projects is given in Table 5.21. The comparative values for change in average number of persons migrating in watershed projects is given in Figure 5.20.

Table 5.22 Change in average number of persons migrating in watershed projects (B.W. & A. W.)

Name of Watershed	Average No. of Persons Migrating per HH			
	B.W	A.W	Absolute Change	Change (%)

Name of Watershed	Average No. of Persons Migrating per HH			
	B.W	A.W	Absolute Change	Change (%)
Rellavada	1.67	0.50	-1.17	-70.00
Kadvadi	2.11	0.44	-1.67	-78.95
Valuna	2.29	0.43	-1.86	-81.25
Modarsumba	2.56	0.56	-2.00	-78.26
Shika Kampa	1.63	0.13	-1.50	-92.31
Dahegamda	2.67	0.67	-2.00	-75.00
Unchi Dhanal	2.43	0.71	-1.71	-70.59
Limda	2.50	0.67	-1.83	-73.33
Dhansor	2.33	0.67	-1.67	-71.43
Sunsar	2.00	0.57	-1.43	-71.43
Raheda	2.29	0.57	-1.71	-75.00
Ravol	2.43	0.57	-1.86	-76.47
Dotad	2.29	0.57	-1.71	-75.00
Finchod	2.50	1.00	-1.50	-60.00
Molli	2.43	1.14	-1.29	-52.94
Parsoda	2.00	0.43	-1.57	-78.57
Vankaneda	1.71	0.71	-1.00	-58.33
Ajwas	2.38	0.52	-1.86	-78.00
Dhemada	2.20	0.43	-1.78	-80.68

* Negative values indicate reduction in migration

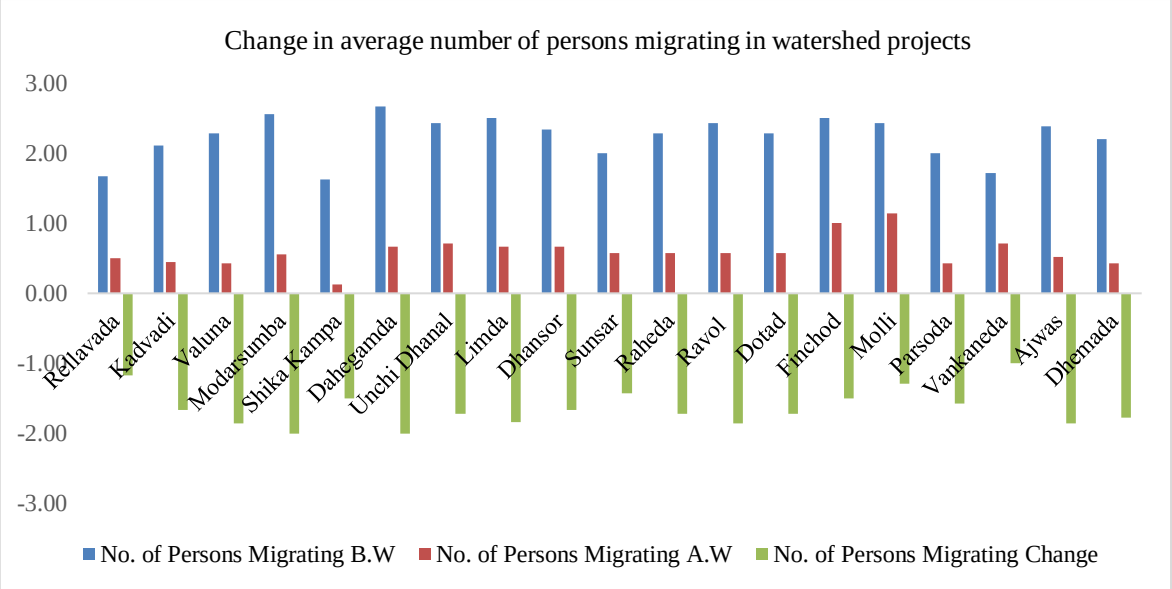

Figure 5.21 Change in average number of persons migrating in watershed projects (B.W. & A. W.)

CHAPTER 6

Estimation of Watershed Performance Benchmarking Index (WPBI)

6.1 Summary of calculated parameters of watershed impact assessment

The values obtained for 10 selected indicators were having different measurement units. It is necessary to bring them on common platform basis. The changes in each indicator before and after watershed implementation have been brought to common measuring platform by converting them into percentage changes. The indicators have been denoted for ease of calculation and representation in tabular form as per Table 6.1. All the indicator values give the scenario of watershed projects implementation and outcomes after implementation. Each indicator has a significance on development of watershed area in rainfed regions. For the selected indicators of watershed projects, the percentage changes in a watershed impact indicator were calculated for selected watershed projects after implementation of the watershed programs as per table 6.2.

Table 6.1 Impact indicators and denotations

Impact Indicator	Denotation
Reduction in soil erosion	RSE
Increase in Ground water table	IGWT
Change in crop productivity	CCP
Change in cropping intensity	CCI
Increase in Livestock	ILS
Benefit Cost ratio	BCR
Increase in income	IIN
Increase in employment	IEM
Increase in saving and expenditure capacity	IEX
Reduction in migration	RMI

Table 6.2 Summary of impact indicators for selected watershed projects

Name of Scheme	Name of Project	RSE	IGWT	CCP	CCI	ILS	BCR	IIN	IEM	IEX	RMI
IWDP	Rellavada	60.78	13.48	115.28	3.02	133.33	9.03	283.74	11.22	63.33	70.00
	Kadvadi	27.01	2.55	141.87	2.76	40.00	8.82	214.38	14.29	26.67	78.95
	Valuna	30.33	29.44	128.06	41.76	150.00	5.11	328.35	39.80	88.33	81.25
	Modarsumba	111.01	23.20	132.53	17.76	127.78	5.72	297.25	44.90	96.67	78.26
	Shika Kampa	26.20	17.16	128.72	1.42	136.84	8.32	262.67	42.86	88.33	92.31
	Dahegamda	53.22	12.78	155.39	20.62	110.00	6.04	315.59	14.29	55.00	75.00
	Unchi Dhanal	26.68	14.04	136.82	3.44	150.00	9.21	365.29	18.37	68.00	70.59
	Limda	96.93	17.30	145.98	3.30	64.29	4.54	224.46	20.41	81.67	73.33
	Dhansor	77.58	19.57	136.88	12.00	81.25	5.73	268.13	13.27	98.33	71.43
	Sunsar	44.77	22.95	150.20	2.62	110.00	6.08	322.65	19.39	83.33	71.43
	Raheda	55.86	29.01	148.52	1.26	154.55	5.98	365.56	18.37	75.00	75.00
	Ravol	91.47	20.53	141.15	0.18	85.71	2.41	244.95	17.35	73.67	76.47
	Dotad	93.92	25.71	144.16	3.08	127.27	6.75	320.85	20.41	100.33	75.00
	Finchod	91.87	17.94	141.16	2.48	111.11	6.70	321.86	19.39	73.33	60.00
DPAP	Molli	86.84	8.70	139.68	9.83	54.55	3.46	241.32	9.18	42.00	52.94
	Parsoda	92.15	10.39	136.76	2.56	81.82	4.17	256.64	8.16	52.67	78.57
	Vankaneda	76.98	19.31	145.45	4.93	61.54	6.10	224.33	12.24	57.00	58.33
IWMP	Ajwas	58.64	28.00	134.61	10.84	95.35	5.61	268.42	35.71	98.33	78.00
	Dhemada	80.56	18.38	120.02	3.10	116.46	5.48	291.21	40.82	109.67	80.68

Note: All values except BCR are in percentage (%)

6.2 Development of WPBI

Watershed performance benchmarking index (WPBI) is designed based on the linear relationship between the impact indicators calculated for selected watershed projects as per following equation (5).

$$Y = \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + \beta 10X10 \quad \text{----------(5)}$$

where,

Y – WPBI, X1 – (RSE) Reduction in soil erosion, X2 – (IGWT) Increase in Ground water table, X3 – (CCP) Change in crop productivity, X4 – (CCI) Change in cropping intensity, X5 – (ILS) Increase in Livestock, X6 – (BCR) BC ratio, X7 – (IIN) Increase in income, X8 – (IEM) Increase in employment, X9 – (IEX) Increase in saving and expenditure capacity, X10 – (RMI) Reduction in migration, β1 to β10 – co-efficient for respective indicators.

6.2.1 Conversion of Impact Indicator to 11-point Scale

To develop WPBI, the values of different impact indicators were converted into an 11-point scale by considering the criteria based on the range of impact indicator values.

The calculated values of RSE range from 26.20 to 111.01, IGWT from 2.55 to 29.44, CCP 115.28 to 155.39, CCI 0.18 to 41.76, ILS 40 to 154.55, BCR 2.41 to 9.21, IIN 214.38 to 365.56, IEM 8.16 to 44.90, IEX 26.67 to 109.67, RMI 52.94 to 92.31.

Therefore, the indicator score has been assigned for value of indicators for converting the indicator values in 11-point scale. For each indicator the score is according to the value of indicator.

The criteria for score and values of impact indicators for each indicator are given in Table 6.3.

The 11-point scale values for all impact indicators have been calculated for selected watershed projects in study area for calculation of WPBI. The 11-point scale values for impact indicators are given in Table 6.4

Table 6.3 Criteria for impact indicator value and score

RSE		IGWT		CCP		CCI		ILS		BCR		IIN		IEM		IEX		RMI	
Value	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**
0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
10	2	3	2	15	2	5	2	15	2	1	2	40	2	5	2	10	2	10	2
20	3	6	3	30	3	10	3	30	3	2	3	80	3	10	3	20	3	20	3
30	4	9	4	45	4	15	4	45	4	3	4	120	4	15	4	30	4	30	4
40	5	12	5	60	5	20	5	60	5	4	5	160	5	20	5	40	5	40	5
50	6	15	6	75	6	25	6	75	6	5	6	200	6	25	6	50	6	50	6
60	7	18	7	90	7	30	7	90	7	6	7	240	7	30	7	60	7	60	7
70	8	21	8	105	8	35	8	105	8	7	8	280	8	35	8	70	8	70	8
80	9	24	9	120	9	40	9	120	9	8	9	320	9	40	9	80	9	80	9
90	10	27	10	135	10	45	10	135	10	9	10	360	10	45	10	90	10	90	10
100	11	30	11	150	11	50	11	150	11	10	11	400	11	50	11	100	11	100	11

Table 6.4 The 11-point scale values for impact indicators

Watershed Project	(RSE) 11-point scale	(IGWT) 11-point scale	(CCP) 11-point scale	(CCI) 11-point scale	(ILS) 11-point scale	(BCR) 11-point scale	(IIN) 11-point scale	(IEM) 11-point scale	(IEX) 11-point scale	(RMI) 11-point scale
Rellavada	7.00	5.00	8.00	1.00	9.00	10.00	8.00	3.00	7.00	8.00
Kadvadi	3.00	1.00	10.00	1.00	3.00	9.00	6.00	3.00	3.00	8.00
Valuna	4.00	10.00	9.00	9.00	11.00	6.00	9.00	8.00	9.00	9.00
Modarsumba	11.00	8.00	9.00	4.00	9.00	6.00	8.00	9.00	10.00	8.00
Shika Kampa	3.00	6.00	9.00	1.00	10.00	9.00	7.00	9.00	9.00	10.00
Dahegamda	6.00	5.00	11.00	5.00	8.00	7.00	8.00	3.00	6.00	8.00
Unchi Dhanal	3.00	5.00	10.00	1.00	11.00	10.00	10.00	4.00	7.00	8.00
Limda	10.00	6.00	10.00	1.00	5.00	5.00	6.00	5.00	9.00	8.00
Dhansor	8.00	7.00	10.00	3.00	6.00	6.00	7.00	3.00	10.00	8.00
Sunsar	5.00	8.00	11.00	1.00	8.00	7.00	9.00	4.00	9.00	8.00
Raheda	6.00	10.00	10.00	1.00	11.00	6.00	10.00	4.00	8.00	8.00
Ravol	10.00	7.00	10.00	1.00	6.00	3.00	7.00	4.00	8.00	8.00
Dotad	10.00	9.00	10.00	1.00	9.00	7.00	9.00	5.00	11.00	8.00
Finchod	10.00	6.00	10.00	1.00	8.00	7.00	9.00	4.00	8.00	7.00
Molli	9.00	3.00	10.00	2.00	4.00	4.00	7.00	2.00	5.00	6.00
Parsoda	10.00	4.00	10.00	1.00	6.00	5.00	7.00	2.00	6.00	8.00
Vankaneda	8.00	7.00	10.00	1.00	5.00	7.00	6.00	3.00	6.00	6.00
Ajwas	6.00	10.00	9.00	3.00	7.00	6.00	7.00	8.00	10.00	8.00
Dhemada	9.00	7.00	9.00	1.00	8.00	6.00	8.00	9.00	11.00	9.00

6.2.2 Weights of Impact Indicator by Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a method for organizing and analyzing complex decisions using mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been refined ever since. It contains three parts: the ultimate goal or problem you are trying to solve, all possible solutions called alternatives, and the criteria by which you judge the alternatives. AHP provides a rational framework for a necessary decision by quantifying its criteria and alternative options, and relating these elements to the overall goal. Stakeholders compare the importance of criteria, two at a time, through pairwise comparisons. AHP converts these scores into numbers that can be compared against any number of criteria. This ability to quantify distinguishes AHP from other decision-making techniques. The fundamental scale for pairwise comparison is given by Saaty (1980) as per Figure 6.1. The responses from stakeholders and experts in the field were recorded for deciding importance of criteria indicators over one another using the AHP questionnaire survey format as per Appendix-V.

The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

Source: Saaty (2005)

Figure 6.1 Fundamental Scale for Pairwise Comparisons

The pairwise matrix for importance of impact indicators was prepared based on the questionnaire survey and focused group discussion with the beneficiaries and also with experts working in the field of watershed development and management. The pairwise matrix for importance of impact indicators in fractions and decimal values are given in

Table 6.5 and 6.6 respectively. The matrix represents the importance of indicator over others as per the intensity of importance given by Saaty.

Table 6.5 Pairwise matrix for importance of impact indicators (fractions)

	RSE	IGWT	CCP	CCI	ILS	BCR	IIN	IEM	IEX	RMI
RSE	1	3	3	3	6	5	5	7	5	8
IGWT	1/3	1	1	3	3	3	3	5	5	7
CCP	1/3	1	1	1	3	3	4	4	4	5
CCI	1/3	1/3	1	1	2	2	3	3	3	3
ILS	1/6	1/3	1/3	1/2	1	1/3	1	1	3	1
BCR	1/5	1/3	1/3	1/2	3	1	8	7	5	5
IIN	1/5	1/3	1/4	1/3	1	1/8	1	3	3	5
IEM	1/7	1/5	1/4	1/3	1	1/7	1/3	1	1	5
IEX	1/5	1/5	1/4	1/3	1/3	1/5	1/3	1	1	3
RMI	1/8	1/7	1/5	1/3	1	1/5	1/5	1/5	1/3	1

Table 6.6 Pairwise matrix for importance of impact indicators (decimals)

	RSE	IGWT	CCP	CCI	ILS	BCR	IIN	IEM	IEX	RMI
RSE	1.00	3.00	3.00	3.00	6.00	5.00	5.00	7.00	5.00	8.00
IGWT	0.33	1.00	1.00	3.00	3.00	3.00	3.00	5.00	5.00	7.00
CCP	0.33	1.00	1.00	1.00	3.00	3.00	4.00	4.00	4.00	5.00
CCI	0.33	0.33	1.00	1.00	2.00	2.00	3.00	3.00	3.00	3.00
ILS	0.17	0.33	0.33	0.50	1.00	0.33	1.00	1.00	3.00	1.00
BCR	0.20	0.33	0.33	0.50	3.00	1.00	8.00	7.00	5.00	5.00
IIN	0.20	0.33	0.25	0.33	1.00	0.13	1.00	3.00	3.00	5.00
IEM	0.14	0.20	0.25	0.33	1.00	0.14	0.33	1.00	1.00	5.00
IEX	0.20	0.20	0.25	0.33	0.33	0.20	0.33	1.00	1.00	3.00
RMI	0.13	0.14	0.20	0.33	1.00	0.20	0.20	0.20	0.33	1.00
Sum	3.03	6.88	7.62	10.33	21.33	15.00	25.87	32.20	30.33	43.00

The normalized pairwise matrix is prepared by dividing the matrix value by the sum of all values and the average value of the normalized pairwise matrix values are taken as the criteria weight. Normalized pairwise matrix with criteria weights is given in Table 6.7.

Table 6.7 Normalized pairwise matrix with Criteria weights

	RSE	IGWT	CCP	CCI	ILS	BCR	IIN	IEM	IEX	RMI	Criteria Weights
RSE	0.3295	0.4363	0.3939	0.2903	0.2813	0.3333	0.1933	0.2174	0.1648	0.1860	0.2826
IGWT	0.1098	0.1454	0.1313	0.2903	0.1406	0.2000	0.1160	0.1553	0.1648	0.1628	0.1616
CCP	0.1098	0.1454	0.1313	0.0968	0.1406	0.2000	0.1546	0.1242	0.1319	0.1163	0.1351
CCI	0.1098	0.0485	0.1313	0.0968	0.0938	0.1333	0.1160	0.0932	0.0989	0.0698	0.0991
ILS	0.0549	0.0485	0.0438	0.0484	0.0469	0.0222	0.0387	0.0311	0.0989	0.0233	0.0457
BCR	0.0659	0.0485	0.0438	0.0484	0.1406	0.0667	0.3093	0.2174	0.1648	0.1163	0.1222
IIN	0.0659	0.0485	0.0328	0.0323	0.0469	0.0083	0.0387	0.0932	0.0989	0.1163	0.0582
IEM	0.0471	0.0291	0.0328	0.0323	0.0469	0.0095	0.0129	0.0311	0.0330	0.1163	0.0391
IEX	0.0659	0.0291	0.0328	0.0323	0.0156	0.0133	0.0129	0.0311	0.0330	0.0698	0.0336
RMI	0.0412	0.0208	0.0263	0.0323	0.0469	0.0133	0.0077	0.0062	0.0110	0.0233	0.0229
SUM	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

For calculation of consistency, the values of normalized pairwise matrix are multiplied with criteria weight of respective impact indicator and weighted sum values have been calculated. Also, the ratio of weighted sum value and criteria weight of respective impact indicators have been calculated as per Table 6.8.

As per AHP concept, the consistency index can be calculated as per following.

The Sum of (weighted sum value/Criteria weights)/(No. of criteria) is considered as λmax. Therefore,

λmax = 11.2863

Consistency index (C.I.) = (λmax-n)/(n-1) = 0.143

Random index (R.I.) based on no. of criteria is given by Saaty as per below

Table 6.8 Random Index (R.I.) based on no. of criteria

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14
R.I.	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57

We have 10 criteria, therefore R.I. = 1.49

Consistency Ratio (C.R.) = Consistency index (C.I.)/Random index (R.I.)

Consistency Ratio (C.R.) = 0.096 which is less than 0.1

Saaty, therefore only considers a matrix to be consistent if and only if C.R. < 0.1

6.3 Calculation of WPBI for integrated impact assessment of watershed projects

The WPBI has been calculated based on the equation (1), by considering the criteria weights.

The sample calculation for Rellavada watershed project is as follows

WPBI = 0.2826 × 7.00 + 0.1616 × 5.00 + 0.1351 × 8.00 + 0.0991 × 1.00 + 0.0457 × 9.00 + 0.1222 × 10.00 + 0.0582 × 8.00 + 0.0391 × 3.00 + 0.0336 × 7.00 + 0.0229 × 8.00. = 6.60.

Based on the criteria decided for category of development as per Table 6.9, the development category for each watershed project and values of WPBI have been discussed and given in Table 6.10.

Table 6.9 Weighted sum values and ratio

Criteria weights	0.2826	0.1616	0.1351	0.0991	0.0457	0.1222	0.0582	0.0391	0.0336	0.0229			
	RSE	**IGWT**	**CCP**	**CCI**	**ILS**	**BCR**	**IIN**	**IEM**	**IEX**	**RMI**	**Weighted Sum value**	**Criteria weights**	**Ratio**
RSE	0.2826	0.4849	0.4053	0.2974	0.2739	0.6108	0.2908	0.2736	0.1679	0.1831	3.2703	0.2826	11.57148
IGWT	0.0942	0.1616	0.1351	0.2974	0.1370	0.3665	0.1745	0.1954	0.1679	0.1602	1.8897	0.1616	11.69118
CCP	0.0942	0.1616	0.1351	0.0991	0.1370	0.3665	0.2327	0.1563	0.1343	0.1144	1.6312	0.1351	12.07459
CCI	0.0942	0.0539	0.1351	0.0991	0.0913	0.2443	0.1745	0.1173	0.1007	0.0687	1.1790	0.0991	11.89438
ILS	0.0471	0.0539	0.0450	0.0496	0.0457	0.0407	0.0582	0.0391	0.1007	0.0229	0.5028	0.0457	11.01366
BCR	0.0565	0.0539	0.0450	0.0496	0.1370	0.1222	0.4653	0.2736	0.1679	0.1144	1.4853	0.1222	12.15889
IIN	0.0565	0.0539	0.0338	0.0330	0.0457	0.0153	0.0582	0.1173	0.1007	0.1144	0.6287	0.0582	10.80855
IEM	0.0404	0.0323	0.0338	0.0330	0.0457	0.0175	0.0194	0.0391	0.0336	0.1144	0.4091	0.0391	10.46755
IEX	0.0565	0.0323	0.0338	0.0330	0.0152	0.0244	0.0194	0.0391	0.0336	0.0687	0.3560	0.0336	10.60511
RMI	0.0353	0.0231	0.0270	0.0330	0.0457	0.0244	0.0116	0.0078	0.0112	0.0229	0.2421	0.0229	10.57724

Table 6.10 Criteria for development category based on WPBI

WPBI	Category
0	Poor
3	Average
5	Good
7	Very Good
9	Excellent

Table 6.11 WPBI and development category of watershed projects

Watershed Project	WPBI	Development Category
Rellavada	6.60	Good
Kadvadi	4.45	Average
Valuna	7.43	Very Good
Modarsumba	8.49	Very Good
Shika Kampa	5.98	Good
Dahegamda	6.67	Good
Unchi Dhanal	5.99	Good
Limda	7.11	Very Good
Dhansor	7.09	Very Good
Sunsar	6.68	Good
Raheda	7.19	Very Good
Ravol	7.06	Very Good
Dotad	8.27	Very Good
Finchod	7.58	Very Good
Molli	6.04	Good
Parsoda	6.68	Good
Vankaneda	6.73	Good
Ajwas	7.12	Very Good
Dhemada	7.48	Very Good

Development category gives the status of execution in a general view from good to excellent based on the development criteria. It shows poor development when WPBI is achieved 0 (zero), average development when WPBI is achieved between 0 and 3, good development when WPBI is achieved between 3 and 5, very good development when WPBI is achieved between 5 and 7, and excellent development when WPBI is achieved above 7.

CHAPTER 7

Statistical Analysis of Watershed Impacts

7.1 Statistical Tests of Impact Parameters and WPBI

WPBI was calculated using the criteria weights obtained by AHP tool for selected watershed projects in the study area. The regression analysis was carried out to develop the relationship of WPBI with the impact indicators.

The quantitative relationship between the WPBI and the determinants is studied by fitting a linear WPBI function with WPBI as the dependent variable and all other indicators as independent variables.

The function applied to a watershed development project is to examine the factors influencing the WPBI of the respondent model is mentioned below in equation (6)

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X$$

$$+ \beta 9X9 + \beta 10X10 \text{ ----------} (6)$$

where, Y – WPBI, α – Constant (Intercept), X1 – (RSE) Reduction in soil erosion, X2 – (IGWT) Increase in Groundwater table, X3 – (CCP) Change in crop productivity, X4 – (CCI) Change in cropping intensity, X5 – (ILS) Increase in Livestock, X6 – (BCR) BC ratio, X7 – (IIN) Increase in income, X8 – (IEM) Increase in employment, X9 – (IEX) Increase in saving and expenditure capacity, X10 – (RMI) Reduction in migration, β1 to β10 – co-efficient for respective indicators

The estimated linear WPBI function is furnished below. Table 7.1 describes model variables.

Table 7.1 Model variables

Model	Variables Entered	Variables Removed	Method
1	RMI, IIN, CCI, CCP, RSE, IGWT, BCR, IEM, IEX, ILS[b]		Enter
a. Dependent Variable: WPBI, b. All requested variables entered.			

Table 7.2 Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.993[a]	0.9867	0.9700	0.1549
a. Predictors: (Constant), RMI, IIN, CCI, CCP, RSE, IGWT, BCR, IEM, IEX, ILS				

Table 7.3 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.2050	10.0000	1.4205	59.1790	.000[b]
	Residual	0.1920	8.0000	0.0240		
	Total	14.3971	18.0000			
a. Dependent Variable: WPBI						
b. Predictors: (Constant), RMI, IIN, CCI, CCP, RSE, IGWT, BCR, IEM, IEX, ILS						

Table 7.4 Co-efficient of regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.33060	0.89671		1.48386	0.17614
	RSE	0.02553	0.00223	0.77720	11.42575	0.00000
	IGWT	0.04080	0.01182	0.32575	3.45262	0.00866
	CCP	0.00450	0.00622	0.05067	0.72284	0.49037
	CCI	0.01989	0.00464	0.22315	4.29025	0.00265
	ILS	0.00542	0.00412	0.20924	1.31515	0.22490
	BCR	0.06495	0.03245	0.13258	2.00123	0.08036
	IIN	0.00175	0.00264	0.08976	0.66519	0.52464
	IEM	-0.00151	0.00563	-0.02052	-0.26871	0.79495
	IEX	0.00772	0.00405	0.18975	1.90366	0.09344
	RMI	0.00386	0.00702	0.03861	0.54889	0.59806

As shown in Table 7.2, the coefficient of multiple determination (R^2) is significant with a value of 0.986, indicating the explanatory variables included in the WPBI function that explain 98.6 percent of the variation in the WPBI of the watershed in the sample.

As shown in Table 7.3, the F-value of regression is 59.179 and significant value is nearer to 0 (zero) which indicates the regression model to be significant.

As per Table 7.4, the intercept is positive and significant. The standardized beta co-efficient of RSE of the project is positive and statistically significant with a value of 0.777, indicating that adding one percent more RSE from the existing mean level of projects will increase the WPBI of the watershed project by 0.777 percent.

Similarly, the standardized beta coefficients of all other indicators are statistically significant, which indicates that adding one percent more of each indicator from the existing mean level of projects will increase the WPBI of the watershed project by standardized beta coefficient value in percent.

Based on regression, the following relationship is derived as mentioned in equation (7).

$$WPBI = 1.33060 + 0.02553\,(RSE) + 0.04080\,(IGWT) + 0.00450\,(CCP) + 0.01989\,(CCI) + 0.00542\,(ILS) + 0.06495\,(BCR) + 0.00175\,(IIN) - 0.00151\,(IEM) + 0.00772\,(IEX) + 0.00386\,(RMI)\text{----------(7)}$$

Based on this relationship, the WPBI values were calculated and compared with the WPBI values obtained by criteria weights through AHP method to find the similarity of WPBI values for model validation. As per table 7.5, the difference values of both WPBI values range from -0.13 to 0.17 which come to nearby 0 (zero) so the regression model is validated and the regression equation seems to be the best fittest for calculation of WPBI from the values of impact indicators considered in this study.

Table 7.5 Comparison of WPBI (regression) and WPBI (AHP)

Name of Watershed	WPBI (Regression)	WPBI (AHP)	Difference
Rellavada	6.56	6.60	-0.04
Kadvadi	4.47	4.45	0.03
Valuna	7.37	7.43	-0.07
Modarsumba	8.63	8.49	0.13
Shika Kampa	6.02	5.98	0.04
Dahegamda	6.55	6.67	-0.12
Unchi Dhanal	6.09	5.99	0.10
Limda	7.15	7.11	0.04
Dhansor	7.26	7.09	0.17
Sunsar	6.58	6.68	-0.09
Raheda	7.34	7.19	0.15
Ravol	7.03	7.06	-0.03
Dotad	8.21	8.27	-0.06
Finchod	7.46	7.58	-0.11
Molli	6.18	6.04	0.14
Parsoda	6.63	6.68	-0.04
Vankaneda	6.61	6.73	-0.13

Name of Watershed	WPBI (Regression)	WPBI (AHP)	Difference
Ajwas	7.15	7.12	0.03
Dhemada	7.33	7.48	-0.15
Average	**6.88**	**6.88**	**0.00**

CHAPTER 8

Results And Discussion

8.1 Impact of IWDP watershed projects on Soil erosion and Groundwater recharge

14 IWDP projects carried out in the study area were selected to analyze the impact of watershed interventions on two hydrological parameters, i.e., reducing soil erosion and increasing groundwater recharge. In the Modersumba project, the soil erosion rate was estimated at 160.50 t/ha/year before the watershed and reduced to 49.49 t/ha/year after implementation of the watershed under IWDP. The maximum reduction in soil erosion was found at the Modersumba project at 111.01 percent. In the Shikakampa project, the pre-watershed soil erosion rate was estimated at 56.60 t/ha/year, which was then reduced to 30.40 t/ha/year after implementation of the watershed under IWDP. The minimum reduction in soil erosion was found at the Shikakampa project to be 26.20 percent. Soil erosion change has been estimated to range from 26.20 percent to 111.01 percent for IWDP projects.

In the Valuna project, the rise in groundwater level after catchment area interventions was estimated at 29.44 percent, which is the maximum of all IWDP projects. In the Kadwadi project, the rise in groundwater level after catchment intervention was calculated at 2.55 percent, which was the lowest of any IWDP project. The change in groundwater recharge has been estimated at 2.55 percent to 29.44 percent for IWDP projects.

8.2 Impact of IWDP watershed projects on Agriculture and Livestock

8.2.1 Change in Crop Productivity and Cropping Intensity

In the Dhansor project, pre-watershed crop productivity was estimated at 1302.78 kg/ha and then increased to 3276.39 kg/ha. after implementing the watershed under IWDP for the rainy season. The maximum increase in crop productivity was found in the Dhansor project at 151.49 percent in the rainy season. In other words, crop productivity has increased 1.51 times in the Dhansor watershed. At the Rellavada project, pre-watershed crop productivity was estimated at 1531.25 kg/ha and then increased to 3354.17 kg/ha. After implementing a

watershed under IWDP for the rainy season. The minimum increase in crop productivity was observed at the Rellavada project at 119.05 percent in the rainy season. In other words, crop productivity has increased 1.19 times in the Rellavada watershed.

Similarly, in the Dahegamda project, pre-watershed crop productivity was estimated at 1276.11 kg/ha and then increased to 3342 kg/ha. After implementing the watershed under IWDP for the irrigation season. The maximum increase in crop productivity was found in the Dahegamda project at 161.89 percent in the irrigation season. In other words, crop productivity has increased 1.62 times in the Dahegamda watershed. At the Rellavada project, pre-watershed crop productivity was estimated at 2331.82 kg/ha and then increased to 4860.36 kg/ha. After implementing the watershed under IWDP for the irrigation season. The minimum increase in crop productivity was found in the Rellavada project at 108.44 percent in the irrigation season. In other words, crop productivity increased 1.08 times in the Rellavada watershed.

The change in cropping intensity is one of the main indicators for evaluating the impact of watershed development programs. At the Valuna project, the pre-watershed crop intensity was estimated at 110.88 and then increased to 157.19. after implementation of the watershed under IWDP. The maximum increase in cropping intensity was found in the Valuna project at 41.76 percent. In other words, cultivation intensity has increased by 0.42 times in the Valuna watershed. In the Ravol project, the cropping intensity before the watershed was estimated at 150.79, which increased to 151.05 after the implementation of the watershed under IWDP. The minimum increase in cropping intensity was found in the Ravol project at 0.18 percent. In other words, cropping intensity has increased by 0.018 times in the Ravol watershed, which is almost negligible.

8.2.2 Change in Livestock

In the Raheda project, the pre-watershed livestock population was estimated at 1.57 per household, which increased to 4.00 per household after implementation of the watershed under the IWDP. The maximum livestock increase recorded at the Raheda project was 154.55 percent. In other words, livestock has increased 1.54 times in the Raheda watershed. In the Kadwadi project, the pre-watershed livestock population was estimated at 2.22 per household, which increased to 3.11 after the implementation of the watershed

under IWDP. The minimum increase in livestock was found in the Kadwadi project at 40 percent.

At the Raheda project, milk production was estimated at 9.43 liters/day/HH before the watershed and increased to 24 liters/day/HH after implementation of the watershed under IWDP. The maximum increase in milk production was found in the Raheda project at 154.55 percent. In other words, milk production has increased 1.55 times in the Raheda catchment area. In the Kadwadi project, pre-watershed milk production was estimated at 13.33 liters/day/HH, which increased to 18.67 liters/day/HH after implementation of the watershed under IWDP. The minimum increase in milk production was found at 40 percent in the Kadwadi project.

In the Raheda project, the annual income from pre-watershed milk production was increased to Rs. 99,603.43 per HH, then increased to Rs. 324,000 per HH each after watershed implementation under IWDP. The maximum increase in milk production was found in the Raheda project at 225.29 percent. In other words, the annual income from milk production has increased 2.25 times in the Raheda catchment area. At Kadwadi Project, the annual income from milk production was increased to Rs. 140,853.33 per HH before the watershed, then increased to Rs. 252,000 per HH after implementation of the watershed under IWDP. The minimal increase in milk production was found in the Kadwadi project at 78.91 percent.

8.3 Impact of IWDP watershed projects on Social and Economical indicators

8.3.1 Changes in Rural Employment, Saving, and Expenditure capacity and Migration

After the implementation of watershed projects within the framework of the IWDP, the increase in man-days was noted in all IWDP projects. However, a maximum increase in man-days of 44.90 percent was observed at the Modersumba project and a minimal increase in man-days at 11.22 percent at the Relavada project. It was also reported that due to the convergence of various programs with IWDP, the opportunity to get work in state programs has increased slightly. The maximum change in expenditure capacity was observed in the Dotad watershed with 84 percent and the minimum change in expenditure

capacity in the Kadwadi watershed with 20 percent. Similarly, the maximum change in saving capacity was observed in the Modersumba watershed at 133.33 percent and the minimum change in saving capacity in the Kadwadi watershed at 33 percent. As an indicator of the ability to save and expend, the average value for the ability to save and expend was considered as a single value. Therefore, the change in average saving and expenditure capacity was 98.33 percent for the Dhansor watershed, the maximum, and 26.67 percent, as the minimum, in the Kadwadi watershed.

The average number of migrating persons per HH was found to be 1.63 before the watershed and 0.13 after the watershed in the Shikakampa watershed, with a change in migration of 92.31 percent, which is the maximum of all IWDP watersheds is. In comparison, the average number of migrating persons per HH was 1.67 before the watershed and 0.50 after the watershed in the Rellavada watershed, with a migratory change of 70.00, which is the minimum among all IWDP watersheds.

8.3.2 Increase in Total Income and Benefit-Cost Ratio

The total income of the beneficiaries was derived from three different income criteria (1) income from livestock, (2) income from agriculture and (3) savings in migration costs. Due to the reduction of a migration after the implementation of watersheds, the expenses incurred for migration activities were taken into account as savings and as a further addition to the total income of the household and converted in monetary terms. The average annual income per HH from agriculture was Rs. 31,243.75 before watershed and Rs. 160,387.50 after watershed at Dahegamda project. The maximum income increase from agriculture was found in the Dahegamda project with 413.34 percent. The average annual income per HH from agriculture was Rs. 177521.88 before watershed and Rs. 664911.25 after watershed at Shikakampa project. The minimum increase in income from agriculture was found in the Shikakampa project at 274.55 percent.

Due to the increase in livestock, milk production and thus income from milk production increased, resulting in the average annual income from livestock being almost 1.6 times the post-watershed scenario. The average annual income per HH from livestock was Rs. 99,603.43 before the watershed and Rs. 324,000 after the watershed at the Raheda project. The maximum increase in livestock income was found at the Raheda project to be 225.29 percent. The average annual income per HH from livestock was Rs. 140,853.33 before

watershed and Rs. 252,000 after watershed in Kadwadi project. The minimum increase in livestock income was found in the Kadwadi project at 78.91 percent.

After the implementation of the project, it was found that the changes or reductions in migration costs in the IWDP watersheds average 81.14 percent. These reduced migration costs due to the reduction in migration were considered savings, so they were included as income for the economical analysis of income. The migration cost per HH was Rs. 19625 before watershed and Rs. 1137.50 after watershed at Shikakampa project. The maximum increase in income through the reduction of migration costs was found in the Shikakampa project at 94.20 percent. Migration cost per HH was Rs. 30125 before watershed and Rs. 9125 after watershed at Finchod project. The minimum increase in income by reducing migration costs was found in the Finchod project at 69.71 percent.

Taking all income criteria into account, the increase in average annual total income per household in IWDP catchments was estimated at 293.28 percent. The average annual total income was Rs. 220898.36 before watershed and Rs. 1030882.14 after watershed at Unchi Dhanal watershed project. The maximum income increase was found in the Unchi Dhanal project at 366.68 percent. The average annual income per HH was Rs. 186976.67 before watershed and Rs. 589591.67 after watershed in Kadwadi project. The minimum income increase was found in the Kadwadi project at 215.33 percent.

The advantage of the project is the increase in performance after the implementation of the watershed compared to its pre-project scenario. In this study, benefits from various income indicators were identified that contribute to an increase in total annual watershed income. The total annual income per household was multiplied by the total number of households and the product was taken as the total utility of the watershed. The present value and present value have been calculated for a period of 20 years based on the discount factor of 10 percent. To calculate the present value of the costs, the one-off total costs of the project were taken into account. However, in some watersheds, funds were released periodically throughout the project lifecycle. Additionally, to calculate the NPV of benefits, the benefits were counted from the 4th year of project implementation since the benefits start after 3-4 years of project implementation. The net present value of the IWDP watersheds ranged from 3416.93 lacs to 8764.12 lacs, while the present cost value ranged from 570.78 lacs to 3416.93 lacs.

The NPV was 8764.12 lacs and PVC was found at 951.30 lacs in the Unchi Dhanal watershed with a maximum BCR of 9.21. The NPV was found to be 3416.93 lacs and the PVC to be 1418.76 lacs in the Ravol watershed with a minimum BCR of 2.41. Therefore, the BCR in IWDP watersheds ranged from 2.41 to 9.21.

8.4 Impact of DPAP watershed projects on Soil erosion and Groundwater recharge

In the Parsoda project, the soil erosion rate was estimated at 229.92 t/ha/year before the watershed and reduced to 137.77 t/ha/year after implementation of the watershed under DPAP. The maximum reduction in soil erosion at the Parsoda project was 92.15 percent. In the Vankaneda project, the soil erosion rate before the watershed was estimated at 182.25 t/ha/year and reduced to 105.27 t/ha/year after implementation of the watershed under DPAP. The minimum reduction in soil erosion at the Vankaneda project was 76.98 percent. Soil erosion change has been estimated at 76.98 percent to 92.15 percent for DPAP projects.

In the Vankaneda project, the rise in groundwater level after catchment interventions was estimated at 19.31 percent, the maximum of all DPAP projects. In the Molli project, the rise in groundwater level after river basin intervention was estimated at 8.70 percent, which was the lowest of any DPAP project. The change in groundwater recharge has been estimated at 8.70 percent to 19.31 percent for DPAP projects.

8.5 Impact of DPAP watershed projects on Agriculture and Livestock

8.5.1 Change in Crop Productivity and Cropping Intensity

In the Parsoda projects, pre-watershed crop productivity was estimated at 1575 kg/ha and then increased to 3637.50 kg/ha. After implementing the watershed under DPAP for the rainy season. The maximum increase in crop productivity was found in the Parsoda project at 130.95 percent in the rainy season. In other words, crop productivity has increased 1.31 times in the Parsoda watershed. In the Molli project, crop productivity was estimated at 1775 kg/ha before the watershed and then increased to 3637.50 kg/ha after the DPAP watershed was implemented for the wet season. The minimum increase in crop productivity was found in the Molli project at 104.93 percent in the rainy season. In other words, crop productivity has increased 1.05 times in the Molli watershed.

Similarly, in the Molli project, pre-watershed crop productivity was estimated at 1316.83 kg/ha, which was then increased to 3613.83 kg/ha after the watershed was implemented under DPAP for the irrigation season. The maximum increase in crop productivity was found in the Molli project at 174.43 percent during the irrigation season. In other words, crop productivity has increased 1.74 times in the Molli watershed. In the Parsoda project, pre-watershed crop productivity was estimated at 1386.41 kg/ha and then increased to 3363.04 kg/ha. After implementing the watershed under DPAP for the irrigation season. The minimum increase in crop productivity was found in the Paroda project at 142.57 percent in the irrigation season. In other words, crop productivity has increased 1.43 times in the Parsoda watershed.

In the Molli project, the pre-watershed cropping intensity was estimated at 127.05, which increased to 139.54 under DPAP after the implementation of the watershed. The maximum increase in cropping intensity was found in the Molli project at 9.83 percent. In the Parsoda project, the cropping intensity was estimated at 162.91 before the watershed and increased to 167.08 under DPAP after the implementation of the watershed. The minimum increase in cropping intensity was found in the Parsoda project at 2.56 percent.

8.5.2 Change in Livestock

In the Parsoda project, pre-watershed livestock numbers were estimated at 1.57 per household and increased to 2.86 per household after implementation of the DPAP watershed. The maximum livestock increase recorded at the Parsoda project was 81.82 percent. In the Molli project, the number of pre-watershed livestock was estimated at 1.57 per household, which increased to 2.43 after implementation of the watershed under DPAP. The minimum livestock increase in the Molli project was 54.55 percent.

Due to the increase in livestock, milk production and income from milk production have increased in the catchment area. In the Parsoda project, pre-watershed milk production was estimated at 9.43 liters/day/HH, which increased to 17.14 liters/day/HH after implementation of the DPAP watershed. The maximum increase in milk production was found in the Parsoda project at 81.82. In the Molli project, pre-watershed milk production was estimated at 9.43 litres/day/HH, which increased to 14.57 litres/day/HH under DPAP after implementation of the watershed. The minimum increase in milk production was found in the Molli project at 54.55 percent.

In the Parsoda project, the annual income from milk production was increased to Rs. 99,603.43 per HH before watershed, then increased to Rs. 231,428.14 per HH or after watershed implementation under DPAP. The maximum increase in milk production was found in the Parsoda project at 132.35 percent. In other words, the annual income from milk production has increased 1.32 times in the Parsoda catchment area. The Molli Project estimated the annual income from milk production before the watershed at Rs. 99,603.43 per HH, then increased to Rs. 1,96,714.29 per HH after implementation of the watershed under DPAP. The minimal increase in milk yield was found in the Molli project at 97.50 percent.

8.6 Impact of DPAP watershed projects on Social and Economical indicators

8.6.1 Changes in Rural Employment, Saving, and Expenditure capacity and migration

After the implementation of watershed projects under DPAP, the increase in man-days was noted in all DPAP projects. However, a maximum increase in man-days of 12.24 percent was observed at the Vankaneda project and a minimal increase in man-days at 8.16 percent for the Parsoda project. The average saving and expenditure capacity (in Rs. /year) was observed and analyzed for each DPAP catchment before and after the implementation of catchment projects. The maximum change in expenditure capacity was observed in the Vankaneda watershed at 54 percent and the minimum change in expenditure capacity in the Molli watershed at 44 percent. Similarly, the maximum saving capacity change observed in the Vankaneda watershed was 60 percent and the minimum saving capacity change observed in the Molli watershed was 40 percent. As an indicator of the ability to save and expend, the average value for the ability to save and expend was considered as a single value. Therefore, the change in average saving and expenditure capacity for the Vankaneda watershed was calculated to be 57 percent as the maximum and 42 percent as the minimum in the Molli watershed.

The average number of migrating individuals per HH was found to be 2.00 before the watershed and 0.43 after the watershed in the Parsoda watershed, with a change in migration of 78.57 percent, which is the maximum among all DPAP watersheds. In comparison, the average number of migrating individuals per HH was 2.43 before the

watershed and 1.14 after the watershed in the Molli watershed, with a migration change of 52.94 percent, which is the minimum among all DPAP watersheds.

8.6.2 Increase in Total Income and Benefit-Cost Ratio

The annual average income per HH from farming was Rs. 51503.57 before watershed and Rs. 247678.57 after watershed in Vankaneda project, which is the maximum increase in farming income achieved in Vankaneda project with 380, 90 percent was found. The annual average income per household from farming was Rs. 45,205.36 before watershed and Rs. 211,789.29 after watershed in Molli project, which is the minimum increase in farming income achieved in Molli project at 368.50 percent was detected.

Due to the increase in livestock, milk production and thus income due to milk production was increased, resulting in the average annual income from livestock nearly 1.12 times found in the post-watershed scenario. The average annual income per HH from livestock was Rs. 99,603.43 before watershed and Rs. 231,428.57 after watershed at Parsoda project. The maximum increase in income from livestock was found in the Parsoda project at 132.35 percent. The average annual income per HH from livestock was Rs. 99603.43 before watershed and Rs. 196714.29 after watershed at Molli project. The minimum increase in income from livestock farming was found in the Molli project to be 97.50 percent.

Migration cost per HH was Rs. 24057.14 before watershed and Rs. 3900.00 after watershed at Parsoda project. The maximum increase in income from the reduction in migration costs was found in the Parsoda project at 83.79 percent. Migration cost per HH was Rs. 29164.29 before watershed and Rs. 10342.86 after watershed at Molli project. The minimal increase in income by reducing migration costs was found in the Molli project to be 64.54 percent. The average annual total income was Rs. 113851.64 before the watershed and Rs. 407482.14 after the watershed in the Parsoda watershed. The maximum yield increase was found at the Parsoda project at 257.91 percent. The average annual income per HH was Rs. 148731.00 before watershed and Rs. 484192.86 after watershed in Vankaneda project. The minimum income increase was found in the Vankaneda project at 225.55 percent.

The net present value of the DPAP watersheds ranged from 2570.34 lacs to 3524.27 lacs while the present cost value ranged from 577.92 lacs to 742.56 lacs. The NPV was 3524.27

lacs and PVC 577.92 lacs in the Vankaneda watershed with a maximum BCR of 6.10. The NPV was 2570.34 lacs and PVC was found to have 742.56 lacs in the Molli watershed with a minimum BCR of 3.46. Therefore, the BCR in DPAP watersheds ranged from 3.46 to 6.10.

8.7 Impact of IWMP watershed projects on Soil erosion and Groundwater recharge

2 IWMP projects carried out in the study area were selected to analyze the impact of watershed interventions on two hydrological parameters, i.e., reducing soil erosion and increasing groundwater recharge. In the Ajavas project, the soil erosion rate before the watershed was estimated at 149.34 t/ha/year and reduced to 90.70 t/ha/year after implementation of the watershed under IWMP, reducing soil erosion by 58.64 percent. In the Dhemada project, the pre-watershed soil erosion rate was estimated at 200.11 t/ha/year, which was then reduced to 119.55 t/ha/year after implementation of the watershed under IWMP, with soil erosion reduced by 80.56 percent has been reduced.

At the Ajavas project, the groundwater level rise after watershed interventions was estimated at 28.00 percent, the maximum among the two IWMP projects. In the Dhemada project, the rise in groundwater level after watershed interventions was estimated at 18.38 percent, which was the lowest value in IWMP projects.

8.8 Impact of IWMP watershed projects on Agriculture and Livestock

8.8.1 Change in Crop Productivity and Cropping Intensity

In the Ajavas project, crop productivity was estimated at 1379.17 kg/ha before the watershed, which increased to 3329.17 kg/ha after implementation of the watershed under IWMP for the wet season. The maximum increase in plant productivity was found in the Ajavas project at 141.39 percent in the rainy season. In other words, crop productivity has increased 1.41 times in the Ajavas watershed. In the Dhemada project, pre-watershed crop productivity was estimated at 1402.19 kg/ha and then increased to 3296.56 kg/ha. After implementing the watershed under IWMP for the wet season. The minimum increase in crop productivity was found in the Dhemada project at 135.10 percent in the rainy season. In other words, crop productivity has increased 1.35 times in the Dhemada watershed.

Similarly, in the Ajavas project, pre-watershed crop productivity was estimated at 1163.51 kg/ha and then increased to 2650.79 kg/ha. After implementing the watershed under IWMP for the irrigation season. The maximum increase in crop productivity was found in the Ajavas project with 127.83 percent watering season. In other words, crop productivity has increased 1.28 times in the Ajavas watershed. In the Dhemada project, pre-watershed crop productivity was estimated at 3118.27 kg/ha and then increased to 6390.37 kg/ha. After implementing the watershed under IWMP for the irrigation season. The minimum crop productivity increase was found in the Dhemada project at 104.93 percent in the irrigation season. In other words, crop productivity has increased by 1.05 times in the Dhemada watershed.

In the Ajavas project, the pre-watershed crop intensity was estimated at 114.80, which increased to 127.24 after the watershed implementation under IWMP. The maximum increase in crop intensity was found in the Ajavas project at 10.84 percent. In the Dhemada project, the pre-watershed crop intensity was estimated at 153.25, which increased to 158.00 after the implementation of the watershed under IWMP. The minimum increase in crop intensity was found in the Dhemada project at 3.10 percent.

8.8.2 Change in Livestock

In the Ajavas project, pre-watershed livestock numbers were estimated at 2.05 per household and increased to 4.00 per household after implementation of the watershed under IWMP, with an increase of 95.35 percent. In the Dhemada project, the pre-watershed livestock population was estimated at 1.98 per household, which increased to 4.28 after implementation of the watershed under IWMP, with an increase of 116.46 percent. In the Ajavas project, pre-watershed milk production was estimated at 12.29 litres/day/HH, which was then increased to 24.00 litres/day/HH after implementation of the watershed under IWMP with a 95.35 percent increase. In the Dhemada project, pre-catchment milk production was estimated at 11.85 liters/day/HH, which was then increased to 25.65 liters/day/HH after the catchment implemented under IWMP with an increase of 116.46 percent.

In Ajavas project, the annual income from milk production before watershed was increased to Rs. 129,786.29 per HH, then increased to Rs. 324,000 per HH or after implementation of watershed under IWMP at 149.64 percent. In other words, the annual income from milk

production has increased 1.49 times in the Ajavas watershed. At Dhemada Project, the annual income from milk production before the watershed was increased to Rs. 125,183.40 per HH, then increased to Rs. 346,275 per HH after implementation of the watershed under IWMP with an increase of 176.61 percent.

8.9 Impact of IWMP watershed projects on Social and Economical indicators

8.9.1 Changes in Rural Employment, Saving, and Expenditure capacity and migration

After the implementation of watershed projects under IWMP, the increase in man-days was noted in all IWMP projects. Nevertheless, a maximum increase in man-days of 40.82 percent was observed in the Dhemada project and a minimal increase in man-days of 35.71 percent in the Ajavas project.

The maximum change in expenditure capacity was observed in the Dhemada watershed at 106 percent, and the minimum change in expenditure capacity was observed in the Ajavas watershed at 90 percent. Similarly, the maximum change in saving capacity was observed in the Dhemada watershed at 113.33 percent, and the minimum change in saving capacity was observed in the Ajavas watershed at 106.67 percent. Therefore, the change in average saving and expenditure capacity was calculated to be 109.67 percent for the Dhemada watershed as the maximum and 98.33 percent as the minimum for the Ajavas watershed. The average number of migrating persons per HH was found at 2.20 before the watershed and 0.43 after the watershed in the Dhemada watershed with a migration change of 80.68 percent.

8.9.2 Increase in Total Income and Benefit-Cost Ratio

The average annual income per HH from agriculture was Rs. 53179.29 before watershed and Rs. 251112.14 after watershed in Ajavas project with 372.20 percent. The average annual income per HH from agriculture was Rs. 66143.25 before watershed and Rs. 304038.50 after watershed in Dhemada project with 359.67 percent. 129,786.29 before watershed and Rs. 324,000 after watershed at Ajavas project with 149.64 percent. The annual average income per HH from livestock was Rs. 125,183.40 before watershed and Rs. 346,275 after watershed at Dhemada project with 176.61 percent.

The migration cost per HH was Rs. 28654.76 before watershed and Rs. 4738.10 after watershed in Ajavas project with 83.46 percent. The migration cost per HH was Rs. 26383.75 before watershed and Rs. 3850.00 after watershed in Dhemada project with 85.41 percent.

When all income criteria were taken into account, the increase in average annual total income per household in IWMP watersheds was estimated at 280.78 percent. The average annual total income was Rs. 154310.81 before watershed and Rs. 570374.05 after watershed in Ajavas watershed with 269.63 percent. The average annual income per HH was Rs. 164,942.90 before watershed and Rs. 646,463.50 after watershed in Dhemada project with 291.93 percent.

The NPV was 17128.65 lacs and PVC was found with 3055.50 lacs in the Ajavas watershed with a maximum BCR of 5.61. The NPV was 15834.05 lacs and PVC was recorded with 2890.86 lacs in the Dhemada watershed with a minimum BCR of 5.48.

8.10 The relative importance of WPBI with impact indicators

WPBI was calculated from ten indicators as mentioned in this study for each of the selected watershed projects of the study area. As concerned about the results for each watershed, WPBI varies from 4.45 to 8.49; the overall quantity parameter values fall under the good to very good range (05 -7.5). In the quantity aspect, the watershed performance is good to very good, which suggests that the lower development category watersheds need to increase their performance by adopting different measures considering the optimum use of watershed development guidelines.

WPBI for IWDP watershed projects ranges from 4.45 to 8.49, with the lowest development category to the highest development category.

WPBI value of 6.60 in the Rellavada project comes from the ten indicator values but CCI and IEX values are found to be lower as 1.00 and 3.00 respectively on 11-point scale which reflect the change in cropping intensity and increase in the capacity of saving and expenditure is not achieved well after the implementation of watershed.

WPBI value of 4.45 in the Kadwadi project comes from the ten indicator values but RSE, IGWT, CCI, ILS, IEM and IEX values are found to be lower as 3.00, 1.00, 1.00, 3.00, 3.00 and 3.00 respectively on 11-point scale which reflect the reduction in soil erosion, increase in ground water table, change in cropping intensity, increase in livestock, increase in employment and increase in the capacity of saving and expenditure is not achieved well after the implementation of watershed.

WPBI value of 7.43 in the Valuna project comes from the ten indicator values but RSE, and BCR values are found to be lower as 4.00, and 6.00 respectively on 11-point scale which reflect the reduction in soil erosion, and benefits achieved from the project are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 8.49 in the Modersumba project comes from the ten indicator values but CCI, and BCR values are found to be lower as 4.00, and 6.00 respectively on 11-point scale which reflect the reduction in soil erosion, and benefits achieved from the project against costare less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 5.98 in the Shikakampa project comes from the ten indicator values but RSE, and CCI values are found to be lower as 3.00, and 1.00 respectively on 11-point scale which reflect the reduction in soil erosion, and increase in cropping intensity are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 6.67 in the Dahegamda project comes from the ten indicator values but IGWT, CCI, and IEM values are found to be lower as 5.00, 5.00 and 3.00 respectively on 11-point scale which reflect the increase in ground water table, increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 5.99 in the Unchi Dhanal project comes from the ten indicator values but RSE, IGWT, CCI, and IEM values are found to be lower as 3.00, 5.00, 1.00 and 4.00 respectively on 11-point scale which reflect the reduction in soil erosion, increase in ground water table, increase in cropping intensity and increase in employment are less

compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.11 in the Limda project comes from the ten indicator values but CCI, ILS, BCR, and IEM values are found to be lower as 1.00, 5.00, 5.00 and 5.00 respectively on 11-point scale which reflect the increase in cropping intensity, increase in livestock, benefits achieved from the project against cost and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.09 in the Dhansor project comes from the ten indicator values but CCI, and IEM values are found to be lower as 3.00, and 3.00 respectively on 11-point scale which reflect the increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 6.68 in the Sunsar project comes from the ten indicator values but RSE, CCI, and IEM values are found to be lower as 5.00, 1.00 and 4.00 respectively on 11-point scale which reflect the reduction in soil erosion, increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.19 in the Raheda project comes from the ten indicator values but CCI, and IEM values are found to be lower as 1.00, and 4.00 respectively on 11-point scale which reflect the increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.06 in the Ravol project comes from the ten indicator values but CCI, BCR and IEM values are found to be lower as 1.00, 3.00 and 4.00 respectively on 11-point scale which reflect the increase in cropping intensity, benefits achieved from project against cost and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 8.27 in the Dotad project comes from the ten indicator values but CCI, and IEM values are found to be lower as 1.00, and 5.00 respectively on 11-point scale which reflect the increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.58 in the Finchod project comes from the ten indicator values but CCI, and IEM values are found to be lower as 1.00, and 4.00 respectively on 11-point scale which reflect the increase in cropping intensity and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 6.04 in the Molli project comes from the ten indicator values but IGWT, CCI, ILS, BCR, IEM and IEX values are found to be lower as 3.00, 2.00, 4.00, 4.00, 2.00 and 5.00 respectively on 11-point scale which reflect the increase in ground water table, increase in cropping intensity, increase in livestock, benefits achieved from project against cost, increase in employment and increase in the capacity of saving and expenditure are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 6.68 in the Parsoda project comes from the ten indicator values but IGWT, CCI, BCR, and IEM values are found to be lower as 4.00, 1.00, 5.00, and 2.00 respectively on 11-point scale which reflect the increase in ground water table, increase in cropping intensity, benefits achieved from project against cost, and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 6.73 in the Vankaneda project comes from the ten indicator values but CCI, ILS, and IEM values are found to be lower as 1.00, 5.00, and 3.00 respectively on 11-point scale which reflect the increase in cropping intensity, increase in livestock, and increase in employment are less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.12 in the Ajawas project comes from the ten indicator values but CCI values are found to be lower as 3.00 on 11-point scale which reflect the increase in

cropping intensity is less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

WPBI value of 7.48 in the Dhemada project comes from the ten indicator values but CCI values are found to be lower as 1.00 on 11-point scale which reflect the increase in cropping intensity is very less compared to others after the implementation of watershed. All other indicators reflect the overall good impact of project after implementation.

The lowest WPBI value of 4.45 in the Kadwadi project reflects the gaps and drawbacks in watershed implementation under IWDP. Due to the poor soil and water conservation measures, inadequate control of soil erosion and groundwater recharge, inadequate involvement of local communities in development work, and improper institutional development, the watershed implementation has not impacted the area's development.

In IWDP, the watersheds having WPBI 8.49 (Modersumba), 8.27 (Dotad), 7.58 (Finchod), and 7.43 (Valuna) have good scores values when compared to other watersheds. Almost all the indicator scores are higher than in other watersheds in these watersheds. These watersheds are good for agricultural activities, soil erosion reduction, and groundwater recharge.

WPBI for DPAP watershed projects ranges from 6.04 to 6.73, with the lowest and highest development category. WPBI values 6.04, 6.68, and 6.73 in Molli, Parsoda, and Vankaneda projects reflect the good development category. Still, the CCI and IEM indicators reflect the poor cropping intensity and employment after implementing watersheds. There is a very low change in cropping intensity and employment generation in Molli, Parsoda, and Vankaneda watersheds. However, the RSE and CCP indicators having high values reflect the reduction in soil erosion and crop productivity in a very good manner. In DPAP projects, the soil and water conservation measures seem to be implemented very well. Still, due to inadequate involvement of local communities in development work and improper institutional development, the watershed implementation has not had much impact on the area's socio-economic development.

WPBI for IWMP watershed projects has 7.12 and 7.48 in Ajavas and Dhemada watershed projects. WPBI values 7.12 and 7.48 in Ajavas and Dhemada projects reflect a very good development category, but the CCI indicator reflects the poor cropping intensity after implementing watersheds. There is a very low change in cropping intensity in Ajavas and

Dhemada watersheds. However, all other indicators having moderate to high values reflect the reduction in soil erosion, increase in groundwater, crop productivity, and employment and migration reduction in a very good manner. In IWMP projects, the soil and water conservation measures seem to be implemented very well. Still, due to traditional agricultural practices and lack of knowledge and awareness in agricultural interventions, the watershed implementation has not much impact on the potential agriculture development of the area.

The relative importance of WPBI with impact indicators is given in Table 8.1.

Table 8.1 Relative importance of WPBI with impact indicators

Watershed	WPBI	Indicators having lower values	Status after implementation
Rellavada	6.60	CCI and IEX	change in cropping intensity and increase in the capacity of saving and expenditure is not achieved well
Kadvadi	4.45	RSE, IGWT, CCI, ILS, IEM, and IEX	reduction in soil erosion, increase in the ground water table, change in cropping intensity, increase in livestock, increase in employment, and increase in the capacity of saving and expenditure is not achieved well
Valuna	7.43	RSE and BCR	reduction in soil erosion, and the benefit-cost ratio is not achieved well
Modarsumba	8.49	CCI and BCR	change in cropping intensity and the benefit-cost ratio is not achieved well
Shika Kampa	5.98	RSE and CCI	reduction in soil erosion and change in cropping intensity is not achieved well
Dahegamda	6.67	IGWT, CCI, and IEM	increase in the ground water table, change in cropping intensity, and increase in employment are not achieved well
Unchi Dhanal	5.99	RSE, IGWT, CCI, and IEM	reduction in soil erosion, increase in the ground water table, change in cropping intensity, and increase in employment are not achieved well
Limda	7.11	CCI, ILS, BCR, and IEM	change in cropping intensity, increase in livestock, increase in employment, and the benefit-cost ratio is not achieved well

Dhansor	7.09	CCI and IEM	change in cropping intensity and increase in employment is not achieved well
Sunsar	6.68	RSE, CCI, and IEM	reduction in soil erosion, change in cropping intensity, and increase in employment are not achieved well
Raheda	7.19	CCI and IEM	change in cropping intensity and increase in employment is not achieved well
Ravol	7.06	CCI, BCR, and IEM	reduction in soil erosion, increase in the ground water table, change in cropping intensity, increase in livestock, increase in employment, and increase in the capacity of saving and expenditure is not achieved well
Dotad	8.27	CCI and IEM	change in cropping intensity and increase in employment is not achieved well
Finchod	7.58	CCI, and IEM	change in cropping intensity, and increase in employment is not achieved well
Molli	6.04	IGWT, CCI, ILS, BCR, IEM and IEX	reduction in soil erosion, increase in ground water table, change in cropping intensity, increase in livestock, increase in employment and increase in the capacity of saving and expenditure is not achieved well
Parsoda	6.68	IGWT, CCI, BCR, and IEM	increase in ground water table, change in cropping intensity, benefit cost ratio, and increase in employment is not achieved well
Vankaneda	6.73	CCI, ILS, and IEM	change in cropping intensity, increase in livestock, and increase in employment is not achieved well
Ajwas	7.12	CCI	change in cropping intensity is not achieved well
Dhemada	7.48	CCI	change in cropping intensity is not achieved well

CHAPTER 9

Major Findings, Issues and Deficiencies in Implementation of Watershed Projects, Suggestions and Remedies

9.1 Main Findings of Research

The results of the study are summarized from changes in hydrological, agricultural, economical and social parameters, watershed performance benchmarking index and statistical analysis of watershed impacts. However, after implementation, due to conservation practices such as contour bunds, farm bunds, gully plugging, bench terracing, afforestation, etc., drainage of the fertile soil layer was stopped. Thus, it was found that soil erosion was reduced.

The IWDP watersheds faced water shortages for irrigation and potable water as stormwater typically runs off by runoff into tributaries, resulting in less or no possible recharge of groundwater prior to the watershed implementation. After implementation, soil and water conservation practices such as construction of contour bunds, farm bunds, gully plugging, bench terracing, afforestation, nalla plugging, gabion structures, etc. were naturally recharged and surface and groundwater sources were rejuvenated.

Precipitation is an important factor for groundwater recharge in semi-arid regions. However, when comparing the IWDP watershed projects in the same climatic environment, it becomes clear that the increase in groundwater recharge mainly depends on the effect of soil and water conservation measures taken in watershed management.

Since soil and water are essential for agricultural production, providing sufficient water by raising the water table, improving soil fertility, and conserving surface water are influential. Given the availability of water and fertile soil, farmers tend to adopt new cropping patterns and agricultural diversification. Both agricultural diversification and intensification result in increased agricultural productivity in the regions where watershed programs are effectively implemented.

The majority of watersheds have seen an increase in yield of grains, legumes, cash crops, etc. However, this is not uniform across the watersheds. This was made possible by increasing the availability of moisture in the soil and expanding irrigation from surface and groundwater. Farmers show interest in commercial plantations (cotton and tobacco).

In these watersheds, the average cropping intensity increased by 8.87 percent with the increase in soil moisture availability and the expansion of irrigation from surface and groundwater through intercropping, double cropping and intercropping.

There is also increased livestock and dairy production due to watershed development programs in the region. Only the concentration is given for milk production. An increase in biomass in the pastures and availability of forage helped the farmer produce milk and as such there is an improvement in economic status. After the implementation of watershed programs, the average livestock income per household increased in almost all IWDP watersheds except the Kadwadi project. Due to the increase in livestock, milk production and thus income from milk production increased, resulting in the average annual income from livestock being almost 1.6 times the post-watershed scenario.

After the implementation of the IWDP, the average man-days worked by the beneficiaries in almost all selected watersheds increased. It was also reported that the opportunity to find work in government programs has increased slightly due to the convergence of different programs with IWDP.

After implementing IWDP, it was observed that beneficiaries had higher income with increased crop productivity and agricultural improvement. This also increased their ability to save and expend.

After the watershed intervention, the average number of people who migrated was reduced in all studied watershed projects under IWDP. Because of the Watershed project, the beneficiaries found more employment in their village's agricultural and related labor activities. Therefore, the number of people who migrated was reduced to a negligible level.

The average farm income per household increased following the implementation of watershed programs in almost all IWDP watersheds. Due to increase in crop productivity and change in cropping intensity with improved cultivation pattern, the average annual

income from agricultural interventions was found almost three times in the post-watershed scenario.

Due to the decrease in migration, the number of people migrating outside the watershed in search of work has been reduced. This also reduced the costs for the migration. After the implementation of the project, it was found that the changes or reductions in migration costs in the IWDP watersheds average 81.14 percent. These reduced migration costs due to the reduction in migration were considered savings, so they were included as income for the economical analysis of income.

The net present value of the IWDP watersheds ranged from 3416.93 lacs to 8764.12 lacs, while the present cost value ranged from 570.78 lacs to 3416.93 lacs. Therefore, the BCR in IWDP watersheds ranged from 2.41 to 9.21.

The DPAP watersheds were at significant risk of soil erosion prior to the implementation of the watershed program. However, after implementation, due to conservation practices such as contour bunds, farm bunds, gully plugging, bench terracing, afforestation, etc., drainage of the fertile soil layer was stopped. Thus, it was found that soil erosion was reduced. Soil erosion change has been estimated at 76.98 percent to 92.15 percent for DPAP projects.

The DPAP watersheds faced water shortages for irrigation and potable water as stormwater typically runs off by runoff into tributaries, resulting in little or no potential groundwater recharge prior to the watershed implementation. Nonetheless, after the implementation of the soil and water conservation practices such as the construction of contour bunds, farm bunds, gully plugging, bench terracing, afforestation, nalla plugging, gabion structures, etc., the water was naturally recharged. The surface and groundwater sources have been rejuvenated. The change in groundwater recharge has been estimated at 8.70 percent to 19.31 percent for DPAP projects.

Precipitation is an important factor for groundwater recharge in semi-arid regions. However, when comparing the DPAP watershed projects in the same climatic environment, it becomes clear that the increase in groundwater recharge mainly depends on the impact of soil and water conservation measures taken in watershed management.

Since soil and water are essential for agricultural production, providing sufficient water by raising the water table, improving soil fertility, and conserving surface water are influential. Given the availability of water and fertile soil, farmers tend to adopt new cropping patterns and agricultural diversification. Both agricultural diversification and intensification result in increased agricultural productivity in the regions where watershed programs are effectively implemented

In these watersheds, the average cropping intensity increased by 5.77 percent with the increase in soil moisture availability and the expansion of irrigation from surface and groundwater through intercropping, double cropping and intercropping.

In DPAP, the productivity of all crops is increased in the post-watershed scenario. The study found an increase in the productivity of seasonal crops, grains and cash crops.

There is also increased livestock and dairy production due to watershed development programs in the region. An increase in biomass in the pastures and availability of forage helped the farmer produce milk and as such there is an improvement in economic status.

After the implementation of DPAP, the average man-days worked by beneficiaries increased in almost all selected watersheds. After the implementation of DPAP, increased beneficiary income was observed with increased crop productivity and agricultural improvement. This also increased their ability to save and expend. The average saving and expenditure capacity (in Rs. /year) was observed and analyzed for each DPAP catchment before and after the implementation of catchment projects.

After the watershed intervention, the average number of people migrations was reduced in all studied watershed projects under DPAP. Because of the Watershed project, the beneficiaries found more employment in their village's agricultural and related labor activities. Therefore, the number of people who migrated was reduced to a negligible level.

The average farm income per household increased in almost all DPAP watersheds following the implementation of watershed programs. Due to increase in crop productivity and change in cropping intensity with improved cultivation pattern, the average annual income from agricultural interventions was found almost three times in the post-watershed scenario.

The average livestock income per household increased following the implementation of watershed programs in almost all DPAP watersheds. Due to the increase in livestock, milk production and thus income from milk production increased, resulting in the average annual income from livestock being almost 1.12 times the post-watershed scenario.

Due to the decrease in migration, the number of people migrating outside the watershed in search of work has been reduced. This also reduced the costs for the migration. After implementation of the project, changes or reductions in migration costs in the DPAP watersheds averaged 77.22 percent. These reduced migration costs due to the reduction in migration were considered savings, so they were included as income for the economical analysis of income.

Taking all income criteria into account, the increase in mean annual total income per household in DPAP catchments was estimated at 242.58 percent.

The IWMP watersheds were at significant risk of soil erosion prior to the implementation of the watershed program. However, after implementation, due to conservation practices such as building contour bunds, farm bunds, gully plugging, bank terracing, afforestation, etc., drainage of the fertile soil layer was stopped. Thus, it was found that soil erosion was reduced.

The IWMP watersheds faced water shortages for irrigation and potable water as stormwater tended to runoff into tributaries, resulting in little or no potential groundwater recharge prior to the watershed implementation. Nonetheless, after the implementation of the soil and water conservation practices such as the construction of contour bunds, farm bunds, gully plugging, bank terracing, afforestation, nalla plugging, gabion structures, etc., the water was naturally recharged. The surface and groundwater sources have been rejuvenated.

Precipitation is an important factor for groundwater recharge in semi-arid regions. However, when comparing the watershed projects under IWMP in the same climatological environment, it becomes clear that the increase in groundwater recharge mainly depends on the effect of soil and water conservation measures taken in watershed management.

After the watershed intervention, the average number of people who migrated was reduced in all studied watershed projects under IWMP. Because of the Watershed project, the beneficiaries found more employment in their village's agricultural and related labor activities. Therefore, the number of people who migrated was reduced to a negligible level.

When all income criteria were taken into account, the increase in average annual total income per household in IWMP watersheds was estimated at 280.78 percent.

WPBI varies from 4.45 to 8.49; the parameter values of the total amount are in the good to very good range (05 -7.5). In terms of quantity, the catchment performance is good to very good, suggesting that the lower development category watersheds need to improve their performance by taking various measures to consider the best use of the catchment development guidelines.

WPBI for IWDP watershed projects ranges from 4.45 to 8.49, with the lowest development category to the highest development category. In IWDP, the watersheds have good scores with WPBI 8.49 (Modersumba), 8.27 (Dotad), 7.58 (Finchod) and 7.43 (Valuna) compared to other watersheds. Almost all indicator values are higher in these watersheds than in other watersheds. These watersheds are good for agricultural activities, soil erosion reduction and groundwater recharge.

WPBI for DPAP Watershed projects ranges from 6.04 to 6.73, with the lowest and highest development category. In DPAP projects, soil and water protection measures seem to be implemented very well. However, due to the insufficient involvement of local communities in development work and inadequate institutional development, the implementation of the watershed did not have a large impact on the socio-economic development of the area. WPBI for IWMP watershed projects have 7.12 and 7.48 in watershed projects, which reflects a very good development category, but the CCI indicator reflects the low cultivation intensity after the implementation of watersheds.

In IWMP projects, soil and water protection measures seem to be implemented very well. However, due to traditional agricultural practices and the lack of knowledge and awareness of agricultural interventions, the implementation of the watershed does not have a major impact on the potential agricultural development of the area.

All sample watersheds have suffered unpredictable rainfall patterns during the lifetime of the watershed project, which has been a vulnerable condition for livelihood enhancement, especially in the rainy area, greater impact on livelihood opportunities. However, all of the sample watersheds belonged to the same state agroclimatic zones.

The increase in forage and improved livestock and dairy development was reported by 48 percent of the community in the study area.

According to the results obtained in the study area, animal husbandry has shown the highest income generation activity in terms of increasing milk production and income due to milk production by improving feed availability. The farm-based products arose due to the development of market links.

Water availability for drinking and irrigation purposes was found to be optimal in the watershed region and in line with the needs of the community. However, the soil moisture content was only found to be high in the case of Modersumba Watershed under IWDP as the soil and water conservation techniques were very well adopted by the watershed community.

The majority of people have reported getting employment through the implementation of watershed projects. In addition, the increase in job creation by the people of the study area was reported for the reference years 2000 to 2018 when the watershed development works in the watersheds were carried out under various government programs.

Much uncultivated land has been converted to pasture through the watershed management program, which is now useful for livestock grazing to produce a sufficient quantity of milk for the business. The watershed development program in the study area increases the monthly income of the head of the family.

9.2 Issues And Deficiencies in The Implementation of Watershed Programs

In the IWDP and DPAP watershed projects, the role of the Panchayati Raj Institutions (PRIs) was negligible. The watershed management was carried out exclusively by the village watershed committee and the watershed association, which had to be formed before

the implementation of the watershed. The role of the Panchayati Raj Institutions (PRIs) has been considered in common turning point guidelines for IWMP programs.

For IWDP and DPAP watersheds, there were no technical criteria for watershed selection. Instead, the micro-watersheds of 500 hectares each with one or more villages were proposed to develop the watershed. However, in IWMP, the watershed project to be implemented was selected by forming a cluster of villages and about 5000 hectares by delineating the watersheds on topographic maps.

The main interventions of the watershed development projects in IWMP were divided into (i) preparatory, (ii) works and (iii) consolidation and withdrawal phase, but in the pre-IWMP only one work phase was considered; however, the provision of entry point activities has been considered.

The duration of the watershed project in pre-IWMP was standardized at four years. Eventually it was extended to 7 years, disrupting the sequencing of works such as land treatment, drainage line treatment, major fortification works, etc.

Unit cost of watershed development from Rs. 6000 per hectare was worked out in IWDP and DPAP watersheds, which turned out to be less, but in IWMP it was increased from Rs. 6000 per ha. to Rs. 12,000 per ha. in plains and Rs. 15,000 per ha. in difficult/hilly areas to address the following three aspects: (a) Improvement of crop productivity through agricultural systems, (b) Coverage of the entire area below the watershed, including common/forest land, and (c) Increase in the cost of materials and minimum wages for workers.

Conflicts between different government departments related to agriculture, rural development and forests, and conflicts between the government administration and elected officials in their eagerness to control funds, are a major problem in watershed management programs that must be resolved as a matter of priority.

Soil texture analysis, installing a rain gauge, and recording regularly after each rain are essential in a micro-watershed. There was no provision or institutional support for these activities in watershed development programs.

There was no provision to monitor groundwater levels for selected wells located at varying distances from watercourses and water intake structures within a micro watershed. A detailed analysis of the groundwater and the water balance for the respective water catchment area was not planned. There was no provision for retrieving slope information of the selected parcels to be obtained through topo sheets/GIS based information in IWDP and DPAP watersheds.

For income generation within the catchment area, the creation of revolving funds, bank savings and credit linkage as part of watershed management activities is lacking to motivate local organizations. There have been no projects to optimize crop production with limited irrigation facilities, reduce cash outlay, vary water harvesting technology, store and

efficiently use surface and groundwater, develop drought mitigation and high-yielding crop varieties, and develop dryland areas at a Watershed emphasizes base. Cultivation pattern change and crop diversification are not encouraged, favoring crops with low water requirements.

9.3 Suggestions And Remedies

The unbiased distribution of benefits to the poor and marginalized sections of the target group should have been ensured, particularly for artisan, grazing plantation and pastoralist groups.

Ecological improvement and ecological balance through proper use of land, water and vegetation could have been achieved through increasing vegetation cover on wastelands and pastures and agroforestry on agricultural fields.

The operational policies at the project level had to be formulated and implemented objectively in order to achieve the desired results.

The land use pattern should be used according to the demand for cropping patterns in a particular area.

The market connection should be strengthened together with the sourcing centers, especially in the vegetable, fruit and other grain or legume growing areas in watershed areas to get more yields.

The increase or decrease in any of the livelihood components should be reported to the project implementation agency and corrected so that no institutions expire.

The results of the livelihood deviation indicators should be analyzed at specified time intervals. The contribution of the people should be mandatory in every activity of the IWMP, the members of the watershed committee should be changed every year and their position should rotate.

Watershed works should be carried out by user groups or watershed committees; the contract system should be abolished, soil protection and land leveling works should be strengthened, water conservation works should be strengthened, and group wells should be provided through the convergence of different systems.

In order to improve the environmental and social sustainability of project interventions, the project duration should be designed to last at least 8-10 years, with the first two years devoted to repo building, staff orientation, training and capacity building visits.

The government should consider the possible transfer of the water from vast areas to arid or rain-fed areas through the construction of small canals approaching the connection of rivers independently

Watershed follow-up by the IWDP and DPAP Watershed Implementation Agency after completion of activities in various areas will support institutional capacity building and sustainability of watershed projects.

Due to its dynamic properties, the WPBI, when applied to different time periods, can provide an idea of the evolution of watershed sustainability over the years, help stakeholders and decision-makers in their planning and decision-making process, and provide an adaptable management tool for the assessment of watershed projects.

An in-depth analysis can be performed solely on the basis of the knowledge, understanding and reactions of the beneficiaries to policies to improve the policy for better implementation of the program. Conservation work must be planned with individual farms/farmers in mind.

Advances in remote sensing and GIS technology are providing more site-specific data. Universities and research institutions should be encouraged and supported to use the technology for effective watershed implementation.

Watershed selection should be based on watershed priority activities or an appropriate weighting of people's participation in watersheds with acute drinking water shortages, watersheds with a non-forested wasteland/degraded land program and with a variety of common areas.

The catchment should move from pure soil and moisture conservation and water harvesting measures to a healthy, community-based integrated management approach and inclusion of the rural poor.

CHAPTER 10

Conclusion

10.1 Conclusion

The following conclusions have been drawn based on the study:

In the present study, the impacts of the programs on hydrological, agricultural, economical, and social parameters have been assessed and found that the overall watershed management practices in the study area produce positive and effective changes in agricultural crop production, crop productivity, soil erosion reduction, land use, water resources, migration, and saving and expenditure capacity.

The watershed performance benchmarking index from the impacts of the watershed program activities in a given study area has been designed and assessed based on AHP tool which gives the project wise scenario of watershed development.

The watershed programs for identification of existing issues and deficiencies in the implementation of the programs have been compared based on selected indicators and WPBI and also suggested remedial measures

The procedural adequacy of the implementation of the integrated watershed management program remained satisfactory under the new 2008 common guidelines. However, some procedures in the guidelines need to be improved for better implementation.

Peripheral and smallholder irrigated areas increased positively; the conversion of uncultivable land into cultivable land was noted. A noticeable change in the land use pattern of the watershed was recorded.

Improving socio-economic conditions and institutional participation has not been very effective. Awareness and participation of watershed users at the watershed level for planning, organization and preparation of participatory network planning and participatory rural assessment remained good enough. However, participatory implementation and people's contribution practices need to be improved.

The execution of works by the contract system in some sections of watershed ruined the basic purpose of the participatory watershed treatment works.

Activities at the entry point remained need-based and fruitful to establish good relationships with IWDP watershed projects. Most of the soil and conservation work is in good condition. However, the project guidelines do not provide any maintenance for this work.

Irrigation sources increased significantly. Increasing the number of wells and boreholes brought more acreage with secured irrigation systems. Change in watering method and watering pattern positively noticeable.

An impressive improvement was seen in drinking water availability and a reduction in distance to point of use and in time. The majority of watershed beneficiaries experienced a notable change in farmer numbers and acreage, crop productivity, and total yields in all seasons due to soil and moisture conservation measures.

The introduction of new crops and improvement in cash crop area throughout the different seasons indicated a turning point project succession. Traditional packages of farming practices have been replaced by modern tools and techniques for most farm beneficiaries.

A positive change was observed in the per capita milk production and the total milk production in the project area.

After the completion of the watershed intervention, opportunities for wage earning and self-employment have improved significantly; This reduced the migration ratio of people and duration. Most of them found equivalent work at a reasonable wage in their village.

10.2 Limitations of the Study

The present research work required the collection of Primary and Secondary data before and after the watershed projects implementation. In this regard the author has antagonized with the following problems.

(i) IWDP and DPAP watershed projects were implemented in study area and finally surrendered to Panchayati Raj Institutions (PRIs) through the exit protocol process so the micro-watershed project wise implementation data was only available with the Gram

Panchayat of each watershed village. However, the physical and financial data regarding the watershed were not available in records of panchayats.

(ii) The data regarding the changes in various impact parameters before and after watershed was prepared through the questionnaire survey, focused group discussions and joint field visits so not covered each and every household of the villages. The sample households were surveyed and the data obtained were analyzed to interpret for per household values.

(iii) People were unenthusiastic to disclose their income and land they owned. There is a general boredom towards observing the questionnaires, because most of the respondents questioned about their own benefit.

(iv) The hydrological and biophysical status of the watershed was studied from the perspective of local people along with the field observations.

(v) The error due to improper remembrance is also a constraint but it is diminished by constructing proper questionnaire and cross checking the household survey with the focus group discussion and key informant survey.

(vi) Integrating quantitative and qualitative aspect in a study is a challenging task as quantification of data is not always possible. Therefore, the study emphasizes on quantitative as well as qualitative data collected through primary source.

(vii) Some variations in the watershed region cannot be attributed solely to the watershed development project as there are other developmental projects operating in the study region and also there are some changes by natural processes.

The above-mentioned problems became the main obstacles in obtaining the data which restricted sometimes. The analysis is based on whatever information available with various government departments and with household beneficiaries.

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List of Publications

[1] V. R. Gor and V. M. Patel, "Evaluating the Changes in Soil Erosion for Micro Watersheds of Sabarkantha and Aravalli Districts of Gujarat, India," Applied Ecology and Environmental Sciences., vol. 10, no. 3, pp. 69–78, 2022, Doi: 10.12691/aees-10-3-1.

[2] V. R. Gor and V. M. Patel, "Evaluating Socio-economic Impacts for Micro Watersheds of Sabarkantha and Aravalli Districts of Gujarat, India," International. Journal of Innovative Science, Research and Technology., vol. 7, no. 3, pp. 865–870, 2022.

[3] V. R. Gor and V. M. Patel, "Benchmarking the impact of micro watersheds of Sabarkantha and Aravalli Districts of Gujarat, India," Agricultural Science Digest, Agricultural Research Communication Centre, online first articles, 2022. DOI: 10.18805/ag.D-5618.

Appendices

Appendix – I (Questionnaire survey format – Part A)
Household Survey of Sample households in Watershed project
(Before and after watershed scenario)

I. GENERAL INFORMATION:

1.1 Name of the watershed: _____

1.2 Village: _____

1.3 Faliya: _____ Survey No. _____

1.4 Taluka: _____

1.5 District: _____

1.6 Total No. of family members: _____

1.7 Caste: _____ [SC / ST / OBC / Gen]

1.8 Name of the Head of the HH: _____

1.9 Main occupation of the HH: _____

1.10 Literacy in the HH: Educated_____(no.) and Uneducated _____(no.)

Note: Consider B.W = 'Before Watershed' and A.W = 'After Watershed' in this form

II. LAND USE & IRRIGATION: (Ha.)

2.1 Land use

Land type (1)	Area in Ha. (B.W) (2)	Area in Ha. (A.W) (3)	Change in Land area (4) = (3) – (2)
Rainfed			
Irrigated			
Current fallow			
Permanent fallow			
Total			

2.2 Irrigated area and sources

Season	Irrigated area in Ha. (B.W)	Irrigated area in Ha. (A.W)	Sources of Irrigation (well, pond, spring, river, canal etc.)	Increase in sources of Irrigation	Ownership of sources
Kharif					
Rabi					
Summer					

2.3 Information of Irrigation Sources

Sources of Irrigation	No. of Sources (B.W)	No. of Sources (A.W)	Water availability upto the month of (yes/no) (B.W)			Water availability upto the month of (yes/no) (A.W)		
			Oct.	Feb.	May	Oct.	Feb.	May
Wells								
Ponds								
Streams								
Canal								
Others								

2.4 Information Regarding Drinking Water

(a) B.W

Season	Sources of water						Distance from Residence*						Time spent in getting water**					
	Com. Hand	Own hand pump	Well	River	Pond	Others	Com. Hand	Own hand pump	Well	River	Pond	Others	Com. Hand	Own hand pump	Well	River	Pond	Others
Winter																		
Monsoon																		
Summer																		

•* Below 0.5 Km – 1; 0.5 to 1 Km - 2; 1 Km to 1.5 Km -3; Above 1.5 Km -4

• ** Below 0.5 hr – 1; 0.5 to 1 Hr – 2; More than 1 Hr – 3;

(b) A.W

Season	Sources of water						Distance from Residence*						Time spent in getting water**					
	Com. Hand pump	Own hand pump	Well	River	Pond	Others	Com. Hand pump	Own hand pump	Well	River	Pond	Others	Com. Hand pump	Own hand pump	Well	River	Pond	Others
Winter																		
Monsoon																		
Summer																		

2.5 Crops Productivity: (For Major Crops)

(a) B.W

Season	Crop sown	Rainfed				Irrigated			
		Area (Ha.)	Production (tonne)	Productivity (Kgs/Ha.)	Income	Area (Ha.)	Production (tonne)	Productivity (Kgs/Ha.)	Income
Kharif									
Rabi									
Summer									

(b) A.W

Season	Crop sown	Rainfed				Irrigated			
		Area (Ha.)	Production (tonne)	Productivity (Kgs/Ha.)	Income	Area (Ha.)	Production (tonne)	Productivity (Kgs/Ha.)	Income

Kharif									
Rabi									
Summer									

III. Changes in Livestock: (No.)

Livestock category	Nos. (B.W.)	Nos. (A.W.)	Milk production Litre per day (B.W)	Milk production Litre per day (A.W)	Income (Rs.) (B.W)	Income (Rs.) (A.W)
Cows						
Buffaloes						
Sheep						
Goat						

IV. Migration Status

(a) B.W

No. of persons migrating			No. of days per year of migration	Reason for migration	Distance of place of migration (Km)	Income from such occupation (yearly) (Rs.)
Men	Women	Total				

(b) A.W

No. of persons migrating			No. of days per year of migration	Reason for migration	Distance of place of migration (Km)	Income from such occupation (yearly) (Rs.)
Men	Women	Total				

V. Income Details: (Rs. /Year) B.W A.W

AGRICULTURE _____ _____

LABOUR _____ _____

MIGRATION _____ _____

LIVESTOCK _____ _____

HORTICULTURE _____ _____

OTHER _____ _____

Appendix-II (Questionnaire survey format – Part B)
Village level Survey of Watershed project
(Before and after watershed scenario)

I. GENERAL INFORMATION:

1. Name of watershed : _____
2. Name of watershed scheme : _____
3. Name of the village : _____
4. Name of block : _____
5. Name of district : _____
6. Name of PIA : _____
7. Total population: Male [ ] Female [ ]
   ST [ ] SC [ ] OBC [ ] Others [ ]
8. Total No. of HHs : _____
9. Total landlord family : _____
10. Total landless family : _____
11. Female headed HHs (No.) : _____
12. HHs with BPL cards : _____
13. HH with NREGS card _____

II. Amenities:

(a) Electricity HHs with connection Availability

hour/day

Domestic

Agriculture

Others (specify)

(b) Educational facilities Availability in village If no, distance

Primary School Yes / No

High / Hr. Sec. School Yes / No

Other if any (specify) Yes / No

(c) Health facilities Availability in village If no, distance

PHC Yes / No

Hospital/Dispensary Yes / No

Medical shop Yes / No

(d) Other infrastructure and civic facilities availability — Availability in village — If no, distance

Post Office Yes / No

Anganvadi Yes / No

Bus Stop Yes / No

Bank Yes / No

Market/ local haat Yes / No

Co-operative Society Yes / No

(e) Drinking water — Total No. (B.W, A.W) — Working No. (B.W, A.W)

Public Well

Private Well

Public Hand pump

Private Hand pump

Piped water inside house

River

Ponds

Others (specify)

(f) Water Table Depth

(i) B.W

Sr.No.	Location of water body/ well	Depth of water table from Ground Level in Summer	Depth of water table from Ground Level in Winter	Depth of water table from Ground Level in Monsoon

(ii) A.W

Sr.No.	Location of water body/ well	Depth of water table from Ground Level in Summer	Depth of water table from Ground Level in Winter	Depth of water table from Ground Level in Monsoon

III. Land use:

Sr.No.	Land Category	Area in Ha. (B.W)	Area in Ha. (A.W)
1	Cultivated irrigated		
2	Cultivated rainfed		
3	Uncultivated waste land • Temporary fallow • Permanent fallow		
4	Forest land		
5	Community Land/Gauchar		

IV. Soil classification and topography

Soil type: Sandy / silty / clayey/ loamy / sandy clay / Silty clay/ clayey loam / Silty loam / clayey sand / Silty sand / loamy sand

Topography: Undulating / flat

Average slope of land: _____

V. Self help groups

No. of SHGs formed in project: _____

Operation of SHGs since year: _____

No. of SHGs actively working now: _____

No. of SHGs linked with bank: _____

Average saving of SHGs per SHG group till now: _____

No. of SHG groups graded till date: _____

Percentage of SHG members to total female population: _____

VI. Social fencing and maintenance fund

Free grazing observed/followed: (Yes / No)

If "No", what action has the VWC taken?

Amount of fine: _____

Is the Maintenance Fund being used? (Yes / No). If "Yes",

For what purpose_____

Appendix-III (Responses and calculation from data obtained through questionnaire survey)

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
RELLAVADA	RELLAVADA	Thakor Faliyu	45	4	1	3.54	0.81	0.17	0.00	-0.17	0.00
	RELLAVADA	Patel Faliya	152	4	0	8.33	1.90	0.23	0.23	-0.23	0.00
	RELLAVADA	Azad Faliyu	106	4	0	7.45	1.70	0.32	0.00	-0.32	0.00
	RELLAVADA	Azad Faliyu	168	4	2	9.46	2.16	0.18	0.18	-0.18	0.00
	RELLAVADA	Vankar Faliyu	16	5	0	10.62	2.43	0.20	0.20	-0.20	0.00
	RELLAVADA	Darbar Faliyu	213	4	0	8.14	1.86	0.32	0.00	-0.32	0.00
KADVADI	KADVADI	Thakar Vas	276	2	3	7.80	1.78	0.16	0.16	-0.16	0.00
	KADVADI	Mukhi Nu Faliya	100	2	2	11.25	2.57	0.22	0.22	-0.22	0.00
	KADVADI	Thakar Vas	224	3	2	9.75	2.23	0.25	0.00	-0.25	0.00
	KADVADI	Mukhi Nu Faliya	84	1	2	6.55	1.50	0.32	0.32	-0.32	0.00
	KADVADI	Thakar Vas	189	2	3	4.30	0.98	0.00	0.00	0.00	0.00
	KADVADI	Patel Vas	186	4	0	9.50	2.17	0.16	0.00	-0.16	0.00
	KADVADI	Mukhi Nu Faliyu	50	2	3	12.64	2.89	0.14	0.00	-0.14	0.00
	KADVADI	Mukhi Nu Fal	14	2	2	8.78	2.01	0.00	0.00	0.00	0.00
	KADVADI	Thakar Vas	147	3	2	7.70	1.76	0.00	0.00	0.00	0.00
VALUNA	VALUNA	Shaktinagar	69	2	1	2.00	0.46	0.26	0.26	0.00	-0.26
	VALUNA	Shaktinagar	80	2	4	2.70	0.62	0.33	0.33	-0.33	0.00
	VALUNA	Makavana Vas	1	1	4	3.20	0.73	0.16	0.16	-0.16	0.00
	VALUNA	Shaktinagar	19	2	3	3.40	0.78	0.33	0.33	-0.11	-0.22
	VALUNA	Patel Vas	45	2	0	4.00	0.91	0.26	0.26	-0.15	-0.11

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
	VALUNA	Shaktinagar	64	4	2	3.50	0.80	0.27	0.27	-0.27	0.00
	VALUNA	Shaktinagar	108	2	1	3.00	0.69	0.22	0.22	-0.22	0.00
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	5	1	3.00	0.69	0.12	0.12	-0.12	0.00
	MODARSUMBA	Dairivala	46	3	3	4.00	0.91	0.17	0.17	0.00	-0.17
	MODARSUMBA	Parmar	67	4	1	2.40	0.55	0.18	0.18	-0.18	0.00
	MODARSUMBA	Parmar	58	4	1	2.60	0.59	0.18	0.18	-0.10	-0.08
	MODARSUMBA	Parmar	60	3	2	3.00	0.69	0.19	0.00	-0.19	0.00
	MODARSUMBA	Parmar	66	1	5	3.20	0.73	0.24	0.24	-0.24	0.00
	MODARSUMBA	Parmar	61	7	0	2.80	0.64	0.22	0.22	-0.22	0.00
	MODARSUMBA	Parmar	62	3	2	3.60	0.82	0.28	0.28	0.00	-0.28
	MODARSUMBA	Parmar	52	1	4	6.00	1.37	0.32	0.00	-0.32	0.00
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	2	4	5.66	1.29	0.28	0.28	-0.28	0.00
	MALEKPUR	Vadla Faliyu	108	4	1	1.77	0.40	0.00	0.00	0.00	0.00
	MALEKPUR	Shayaro Faliyu	120	3	3	1.06	0.24	0.00	0.00	0.00	0.00
	MALEKPUR	Bhathiji Faliyu	6	2	3	5.66	1.29	0.16	0.08	-0.16	0.00
	SHIKA KAMPA	Gamtal	Gamtal	10	0	53.00	12.11	1.20	0.80	-0.80	-0.40
	SHIKA KAMPA	Chowk	805	5	0	21.22	4.85	0.68	0.68	-0.68	0.00
	SHIKA KAMPA	Chowk	600	6	0	35.00	8.00	0.00	0.00	0.00	0.00
	SHIKA KAMPA	Gamtal	808	4	1	14.16	3.24	0.00	0.00	0.00	0.00
DAHEGAMDA	DAHEGAMDA	School Faliya	110	8	0	4.24	0.97	0.32	0.32	0.16	-0.81
	DAHEGAMDA	Mukhivalu Faliyu	138	3	5	4.20	0.96	0.32	0.32	0.16	-0.81
	DAHEGAMDA	Mukhivalu Faliyu	142	9	3	4.94	1.13	0.20	0.20	-0.20	0.00
	DAHEGAMDA	Thakor Faliyu	69	5	3	2.12	0.48	0.00	0.00	0.00	0.00
	DAHEGAMDA	River Faliya	235	7	1	7.08	1.62	0.30	0.00	-0.30	0.00
	DAHEGAMDA	Master Faliya	45	3	2	2.83	0.65	0.00	0.00	0.00	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	4	0	1.00	0.23	0.00	0.00	0.00	0.00
	UNCHI DHANAL	Toran Chowk	400	3	1	17.00	3.89	0.78	0.50	-0.78	0.00
	UNCHI DHANAL	Patel Vas	531	5	0	30.00	6.86	1.26	1.02	-1.26	0.00
	UNCHI DHANAL	Mandvi Chowk	388	6	0	20.00	4.57	1.43	0.00	-1.43	0.00
	UNCHI DHANAL	Moti Faliyu	202	4	0	20.00	4.57	1.28	1.00	-1.28	0.00
	UNCHI DHANAL	Parmar Faliyu	5	5	2	3.00	0.69	0.00	0.00	0.00	0.00
	UNCHI DHANAL	Mahadev Faliyu	138	5	0	25.00	5.71	0.00	1.79	0.00	0.00
LIMDA	LIMDA	Pipli Faliyu	136	2	2	5.25	1.20	0.20	0.20	-0.20	0.00
	LIMDA	Mothadiya	363	4	0	5.25	1.20	0.10	0.10	-0.10	0.00
	LIMDA	Asari Faliyu	350	10	0	14.00	3.20	1.06	0.80	-1.06	0.00
	LIMDA	Dungri Faliyu	2	4	1	2.63	0.60	0.00	0.00	0.00	0.00
	LIMDA	Pipli Faliyu	134	4	1	7.00	1.60	0.20	0.20	-0.20	0.00
	LIMDA	Pipli Faliyu	138	5	1	7.00	1.60	0.15	0.00	-0.15	0.00
DHANSOR	DHANSOR	Cholviya	220	3	0	6.20	1.42	0.30	0.30	0.00	-0.30
	DHANSOR	Cholviya	140	7	0	6.30	1.44	0.26	0.26	-0.26	0.00
	DHANSOR	Cholviya	46	6	0	5.40	1.23	0.14	0.14	-0.14	0.00
	DHANSOR	Sovaliya	202	6	1	10.63	2.43	0.58	0.58	-0.51	-0.07
	DHANSOR	Modiya	270	5	0	8.24	1.88	0.00	0.00	0.00	0.00
	DHANSOR	Baranda	279	5	0	7.70	1.76	0.16	0.16	-0.16	0.00
	DHANSOR	Baranda	4	5	0	10.23	2.34	0.85	0.65	-0.45	-0.40
	DHANSOR	Varsat	27	6	0	9.75	2.23	0.45	0.00	-0.45	0.00
	DHANSOR	Cholviya	224	3	0	6.55	1.50	0.18	0.18	-0.18	0.00
SUNSAR	SUNSAR	Harijan Vas	38	4	2	4.40	1.01	0.00	0.00	0.00	0.00
	SUNSAR	Harijan Vas	45	6	0	9.10	2.08	0.00	0.00	0.00	0.00
	SUNSAR	Baranda	85	5	1	12.50	2.86	0.96	0.76	-0.96	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
	SUNSAR	Patel Faliya	110	3	0	13.25	3.03	0.46	0.46	-0.46	0.00
	SUNSAR	Parmar Vas	155	4	1	6.50	1.49	0.00	0.00	0.00	0.00
	SUNSAR	Parmar Vas	161	7	2	5.00	1.14	0.20	0.20	0.00	-0.20
	SUNSAR	Thakor Faliyu	184	6	1	4.60	1.05	0.00	0.00	0.00	0.00
RAHEDA	RAHEDA	Harijan Vas	33	5	1	3.00	0.69	0.00	0.00	0.00	0.00
	RAHEDA	Patel Faliya	374	7	0	26.00	5.94	1.47	1.47	-1.47	0.00
	RAHEDA	Patel Faliya	389	6	0	23.00	5.26	1.06	1.06	-1.06	0.00
	RAHEDA	Bus Stand Faliya	128	4	0	12.25	2.80	0.44	0.00	-0.44	0.00
	RAHEDA	Thakor Vas	258	3	1	5.25	1.20	0.00	0.00	0.00	0.00
	RAHEDA	Bus Stand Faliya	138	7	0	9.00	2.06	0.13	0.13	0.00	-0.13
	RAHEDA	Patel Faliya	289	4	0	8.75	2.00	0.00	0.00	0.00	0.00
RAVOL	RAVOL	Vaghari	140	2	2	3.00	0.69	0.00	0.00	0.00	0.00
	RAVOL	Vaghari	144	4	2	2.80	0.64	0.00	0.00	0.00	0.00
	RAVOL	Nanavaash	104	3	2	3.00	0.69	0.00	0.00	0.00	0.00
	RAVOL	Motavaash	110	3	5	4.50	1.03	0.15	0.00	-0.15	0.00
	RAVOL	Parmarvaash	42	6	0	5.00	1.14	0.10	0.10	-0.10	0.00
	RAVOL	Parmar Faliyu	147	3	1	5.00	1.14	0.00	0.00	0.00	0.00
	RAVOL	Parmar Faliyu	182	5	0	5.20	1.19	0.09	0.09	-0.09	0.00
DOTAD	DOTAD	Vankar Faliyu	265	6	1	3.00	0.69	0.00	0.00	0.00	0.00
	DOTAD	Parmar Faliyu	94	4	1	4.00	0.91	0.10	0.00	-0.10	0.00
	DOTAD	Patel Vas	224	3	0	5.50	1.26	0.15	0.00	0.00	-0.15
	DOTAD	Asari Faliyu	64	4	1	4.00	0.91	0.14	0.14	0.00	0.00
	DOTAD	Chowk	11	5	2	3.80	0.87	0.00	0.00	0.00	0.00
	DOTAD	Harijan Vas	279	5	1	3.40	0.78	0.00	0.00	0.00	0.00
	DOTAD	Darbar Faliyu	45	6	2	4.50	1.03	0.10	0.00	-0.10	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
FINCHOD	FINCHOD	Asari Faliyu	14	7	3	2.50	0.57	0.00	0.00	0.00	0.00
	FINCHOD	Parmar Faliyu	54	5	0	3.00	0.69	0.00	0.00	0.00	0.00
	FINCHOD	Patel Vas	112	4	0	8.00	1.83	0.16	0.16	-0.16	0.00
	FINCHOD	Bus Stand Faliya	68	4	1	6.00	1.37	0.10	0.10	-0.10	0.00
	FINCHOD	Vankar Faliyu	165	6	2	3.80	0.87	0.00	0.00	0.00	0.00
	FINCHOD	Harijan Vas	180	5	1	4.20	0.96	0.11	0.11	-0.11	0.00
MOLLI	MOLLI	Juni Molli	175	9	1	4.00	0.91	0.10	0.10	-0.10	0.00
	MOLLI	Molllikhant	327	3	1	6.00	1.37	0.56	0.56	-0.50	-0.06
	MOLLI	Suratanpur	110	4	1	7.00	1.60	0.48	0.48	-0.48	0.00
	MOLLI	Molli	45	5	0	5.60	1.28	0.00	0.00	0.00	0.00
	MOLLI	Goraya	112	11	1	5.70	1.30	0.16	0.16	-0.16	0.00
	MOLLI	Molli	49	3	0	4.60	1.05	0.00	0.00	0.00	0.00
	MOLLI	Nanaji	141	9	2	3.00	0.69	0.00	0.00	0.00	0.00
PARSODA	PARSODA	Rathod Faliyu	123	7	1	4.00	0.91	0.10	0.10	0.00	-0.10
	PARSODA	Panchal Faliyu	54	6	1	5.30	1.21	0.00	0.00	0.00	0.00
	PARSODA	Patel Faliyu	69	6	0	5.00	1.14	0.17	0.17	-0.17	0.00
	PARSODA	Patel Faliyu	78	5	0	4.80	1.10	0.00	0.00	0.00	0.00
	PARSODA	Prajapati Vas	114	4	0	4.30	0.98	0.00	0.00	0.00	0.00
	PARSODA	Prajapati Vas	120	5	2	4.10	0.94	0.10	0.10	-0.10	0.00
	PARSODA	Modh Vas	144	5	0	4.00	0.91	0.00	0.00	0.00	0.00
VANKANEDA	VANKANEDA	Poojara Vas	211	4	1	6.80	1.55	0.00	0.00	0.00	0.00
	VANKANEDA	Parmar Vas	302	4	0	7.00	1.60	0.18	0.18	-0.18	0.00
	VANKANEDA	Patel Faliyu	117	5	0	6.00	1.37	0.26	0.00	-0.26	0.00
	VANKANEDA	Rathod Faliyu	81	6	1	4.60	1.05	0.00	0.00	0.00	0.00
	VANKANEDA	Patel Faliyu	112	6	0	7.00	1.60	0.23	0.23	-0.23	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
	VANKANEDA	Patel Faliyu	122	6	0	8.00	1.83	0.43	0.43	-0.13	-0.30
	VANKANEDA	Bus Stand Faliya	77	4	0	4.00	0.91	0.00	0.00	0.00	0.00
AJAWAS	KALIKANKAR	Patel Faliyu	138	3	1	3.54	0.81	0.32	0.00	-0.32	0.00
	KALIKANKAR	Thakor Faliyu	288	7	1	9.33	2.13	0.18	0.18	-0.18	0.00
	KALIKANKAR	Prajapati Vas	142	6	0	12.17	2.78	0.20	0.20	-0.20	0.00
	KALIKANKAR	Vankar Faliyu	168	6	0	21.26	4.86	0.32	0.00	-0.32	0.00
	KALIKANKAR	Vankar Faliyu	169	5	0	10.58	2.42	0.16	0.16	-0.16	0.00
	MAMAPIPALA	Damor Vas	110	5	1	8.14	1.86	0.22	0.22	-0.22	0.00
	MAMAPIPALA	Damor Vas	114	5	0	9.23	2.11	0.25	0.00	-0.25	0.00
	MAMAPIPALA	Pandor Vas	147	6	0	9.25	2.11	0.32	0.32	-0.32	0.00
	MAMAPIPALA	Pandor Vas	151	3	0	9.75	2.23	0.00	0.00	0.00	0.00
	MAMAPIPALA	Pandor Vas	155	4	0	6.55	1.50	0.16	0.00	-0.16	0.00
	BEDI	Ninama Vas	94	6	0	4.30	0.98	0.14	0.00	-0.14	0.00
	BEDI	Ninama Vas	97	5	2	9.50	2.17	0.00	0.00	0.00	0.00
	BEDI	Harijan Vas	62	3	0	11.22	2.56	0.00	0.00	0.00	0.00
	BEDI	Harijan Vas	58	4	1	8.78	2.01	0.26	0.26	0.00	-0.26
	BEDI	Harijan Vas	53	7	0	7.70	1.76	0.33	0.33	-0.33	0.00
	AJAWAS	Ninama Vas	45	6	1	5.00	1.14	0.16	0.16	-0.16	0.00
	AJAWAS	Pandor Vas	14	5	2	2.70	0.62	0.33	0.33	-0.11	-0.22
	AJAWAS	Harijan Faliyu	54	7	1	3.20	0.73	0.26	0.26	-0.15	-0.11
	AJAWAS	Prajapati Vas	112	6	1	3.40	0.78	0.27	0.27	-0.27	0.00
	AJAWAS	Prajapati Vas	114	4	0	8.40	1.92	0.22	0.22	-0.22	0.00
	AJAWAS	Vankar Faliyu	165	3	0	3.50	0.80	0.12	0.12	-0.12	0.00
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	7	0	3.00	0.69	0.17	0.17	0.00	-0.17
	DAMOR DHUNDHA	Damor Vas	184	4	1	3.00	0.69	0.18	0.18	-0.18	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
	DAMOR DHUNDHA	Damor Vas	198	2	0	4.00	0.91	0.18	0.18	-0.10	-0.08
	DAMOR DHUNDHA	Damor Vas	221	4	0	5.40	1.23	0.19	0.00	-0.19	0.00
	DAMOR DHUNDHA	Damor Vas	223	3	2	2.60	0.59	0.24	0.24	-0.24	0.00
	DHEMADA	Parmar Faliyu	16	3	2	3.00	0.69	0.22	0.22	-0.22	0.00
	DHEMADA	Parmar Faliyu	18	6	2	6.38	1.46	0.28	0.28	0.00	-0.28
	DHEMADA	Parmar Faliyu	22	3	1	2.80	0.64	0.32	0.00	-0.32	0.00
	DHEMADA	Parmar Faliyu	26	5	0	3.60	0.82	0.28	0.28	-0.28	0.00
	DHEMADA	Parmar Faliyu	29	6	1	6.00	1.37	0.00	0.00	0.00	0.00
	DHEMADA	Parmar Faliyu	33	3	0	5.66	1.29	0.00	0.00	0.00	0.00
	MOTI MOYDI	Vadla Faliyu	186	7	1	1.77	0.40	0.16	0.08	-0.16	0.00
	MOTI MOYDI	Harijan Vas	224	6	1	1.06	0.24	1.20	0.80	-0.80	-0.40
	MOTI MOYDI	Bhathiji Faliyu	268	6	1	5.66	1.29	0.68	0.68	-0.68	0.00
	MOTI MOYDI	Gamtal	Gamtal	5	0	14.33	3.28	0.00	0.00	0.00	0.00
	MOTI MOYDI	Chowk	106	5	0	12.11	2.77	0.00	0.00	0.00	0.00
	MOTI MOYDI	Vadla Faliyu	134	5	0	9.67	2.21	0.32	0.32	0.16	-0.81
	PATEL DHUNDHA	Gamtal	Gamtal	6	1	3.54	0.81	0.32	0.32	0.16	-0.81
	PATEL DHUNDHA	School Faliya	213	3	0	11.33	2.59	0.20	0.20	-0.20	0.00
	PATEL DHUNDHA	Mukhivalu Faliyu	276	4	0	14.17	3.24	0.00	0.00	0.00	0.00
	PATEL DHUNDHA	Mukhivalu Faliyu	278	6	0	9.35	2.14	0.30	0.00	-0.30	0.00
	PATEL DHUNDHA	Thakor Faliyu	224	5	0	8.48	1.94	0.00	0.00	0.00	0.00
	PATEL DHUNDHA	River Faliya	84	3	0	8.14	1.86	0.00	0.00	0.00	0.00
	PATEL DHUNDHA	Gameti Faliya	189	4	2	7.80	1.78	0.78	0.50	-0.78	0.00
	UNDAVA	Harijan Vas	186	7	0	9.34	2.13	1.26	1.02	-1.26	0.00
	UNDAVA	Thakor Faliyu	58	6	1	9.75	2.23	1.43	0.00	-1.43	0.00
	UNDAVA	Patel Faliya	14	5	0	6.55	1.50	1.28	1.00	-1.28	0.00

Name of Watershed	Village	Faliya	Survey No.	Literacy (No.)		Land Area		Change in land area (Ha.)			
				Educated	uneducated	Vigha	Hectare	Rainfed	Irrigated	Current fallow	Permanent fallow
	UNDAVA	Gameti Faliyu	106	7	1	4.30	0.98	0.32	0.00	-0.32	0.00
	UNDAVA	Gameti Faliyu	117	6	2	9.50	2.17	0.18	0.18	-0.18	0.00
	UNDAVA	Vankar Faliyu	16	4	1	10.32	2.36	0.20	0.20	-0.20	0.00
	UNDAVA	Darbar Faliyu	213	3	1	8.78	2.01	0.32	0.00	-0.32	0.00
	UNDAVA	Thakor Vas	276	7	0	7.70	1.76	0.16	0.16	-0.16	0.00
	VADATHALI	Thakor Vas	100	4	0	2.00	0.46	0.22	0.22	-0.22	0.00
	VADATHALI	Thakor Vas	112	2	0	2.70	0.62	0.25	0.00	-0.25	0.00
	VADATHALI	Makavana Vas	84	4	1	9.87	2.26	0.32	0.32	-0.32	0.00
	VADATHALI	Makavana Vas	89	3	0	3.40	0.78	0.00	0.00	0.00	0.00
	VADATHALI	Patel Vas	186	3	0	4.00	0.91	0.16	0.00	-0.16	0.00
	VADATHALI	Patel Vas	188	6	2	6.67	1.52	0.14	0.00	-0.14	0.00
	VADATHALI	Patel Vas	204	3	2	3.00	0.69	0.00	0.00	0.00	0.00
	VADATHALI	Thakor Vas	114	5	2	8.44	1.93	0.00	0.00	0.00	0.00

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
RELLAVADA	RELLAVADA	Thakor Faliyu	45	0.23	0.15		NO	YES	NO	YES	NO	YES
	RELLAVADA	Patel Faliya	152	0.36	0.16		NO	YES	NO	YES	NO	YES
	RELLAVADA	Azad Faliyu	106	0.33	-		NO	YES	NO	YES	NO	YES
	RELLAVADA	Azad Faliyu	168	0.32	0.32		NO	YES	NO	YES	NO	YES
	RELLAVADA	Vankar Faliyu	16	-	-		NO	YES	NO	YES	NO	YES
	RELLAVADA	Darbar Faliyu	213	0.33	0.33		NO	YES	NO	YES	NO	YES
KADVADI	KADVADI	Thakar Vas	276	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	KADVADI	Mukhi Nu Faliya	100	0.16	-	-	NO	YES	NO	YES	NO	YES
	KADVADI	Thakar Vas	224	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	KADVADI	Mukhi Nu Faliya	84	0.32	0.32	-	NO	YES	NO	YES	NO	YES
	KADVADI	Thakar Vas	189	-	-	-	NO	YES	NO	YES	NO	YES
	KADVADI	Patel Vas	186	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	KADVADI	Mukhi Nu Faliyu	50	0.32	0.16	-	NO	YES	NO	YES	NO	YES
	KADVADI	Mukhi Nu Fal	14	-	0.16	-	NO	YES	NO	YES	NO	YES
	KADVADI	Thakar Vas	147	0.40	1.60	-	NO	YES	NO	YES	NO	YES
VALUNA	VALUNA	Shaktinagar	69	0.16	0.16	-	NO	YES	YES	YES	NO	YES
	VALUNA	Shaktinagar	80	0.32	0.32	-	NO	YES	YES	YES	NO	YES
	VALUNA	Makavana Vas	1	0.16	0.16	-	NO	YES	YES	YES	NO	YES
	VALUNA	Shaktinagar	19	0.48	0.48	-	NO	YES	YES	YES	NO	YES
	VALUNA	Patel Vas	45	0.17	0.17	-	NO	YES	YES	YES	NO	YES
	VALUNA	Shaktinagar	64	0.16	0.17	-	NO	YES	YES	YES	NO	YES
	VALUNA	Shaktinagar	108	0.16	0.08	-	NO	YES	YES	YES	NO	YES
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	0.32	0.32	-	NO	YES	NO	YES	NO	YES

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	MODARSUMBA	Dairivala	46	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	67	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	58	0.24	0.40	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	60	0.24	-	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	66	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	61	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	62	0.16	0.32	-	NO	YES	NO	YES	NO	YES
	MODARSUMBA	Parmar	52	0.32	0.32	-	NO	YES	NO	YES	NO	YES
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	0.36	0.16		NO	YES	NO	YES	NO	YES
	MALEKPUR	Vadla Faliyu	108	0.33	-		NO	YES	NO	YES	NO	YES
	MALEKPUR	Shayaro Faliyu	120	0.32	0.32		NO	YES	NO	YES	NO	YES
	MALEKPUR	Bhathiji Faliyu	6	-	-		NO	YES	NO	YES	NO	YES
	SHIKA KAMPA	Gamtal	Gamtal	0.33	0.33		NO	YES	NO	YES	NO	YES
	SHIKA KAMPA	Chowk	805	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	SHIKA KAMPA	Chowk	600	0.16	-	-	NO	YES	NO	YES	NO	YES
	SHIKA KAMPA	Gamtal	808	0.16	0.16	-	NO	YES	NO	YES	NO	YES
DAHEGAMDA	DAHEGAMDA	School Faliya	110	0.32	0.32	-	NO	YES	NO	YES	NO	YES
	DAHEGAMDA	Mukhivalu Faliyu	138	-	-	-	NO	YES	NO	YES	NO	YES
	DAHEGAMDA	Mukhivalu Faliyu	142	0.16	0.16	-	NO	YES	NO	YES	NO	YES
	DAHEGAMDA	Thakor Faliyu	69	0.32	0.16	-	NO	YES	NO	YES	NO	YES
	DAHEGAMDA	River Faliya	235	-	0.16	-	NO	YES	NO	YES	NO	YES
	DAHEGAMDA	Master Faliya	45	0.40	1.60	-	NO	YES	NO	YES	NO	YES
UNCHI	UNCHI DHANAL	Harijan Vas	118/2	0.16	0.16	-	NO	YES	NO	YES	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
DHANAL	UNCHI DHANAL	Toran Chowk	400	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	UNCHI DHANAL	Patel Vas	531	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	UNCHI DHANAL	Mandvi Chowk	388	0.48	0.48	-	NO	YES	NO	YES	NO	NO
	UNCHI DHANAL	Moti Faliyu	202	0.17	0.17	-	NO	YES	NO	YES	NO	NO
	UNCHI DHANAL	Parmar Faliyu	5	0.16	0.17	-	NO	YES	NO	YES	NO	NO
	UNCHI DHANAL	Mahadev Faliyu	138	0.16	0.08	-	NO	YES	NO	YES	NO	NO
LIMDA	LIMDA	Pipli Faliyu	136	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	LIMDA	Mothadiya	363	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	LIMDA	Asari Faliyu	350	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	LIMDA	Dungri Faliyu	2	0.24	0.40	-	NO	NO	NO	NO	NO	NO
	LIMDA	Pipli Faliyu	134	0.24	-	-	NO	NO	NO	NO	NO	NO
	LIMDA	Pipli Faliyu	138	0.16	0.16	-	NO	NO	NO	NO	NO	NO
DHANSOR	DHANSOR	Cholviya	220	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	DHANSOR	Cholviya	140	0.16	0.32	-	NO	NO	NO	NO	NO	NO
	DHANSOR	Cholviya	46	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	DHANSOR	Sovaliya	202	0.36	0.16		NO	NO	NO	NO	NO	NO
	DHANSOR	Modiya	270	0.33	-		NO	NO	NO	NO	NO	NO
	DHANSOR	Baranda	279	0.32	0.32		NO	NO	NO	NO	NO	NO
	DHANSOR	Baranda	4	-	-		NO	NO	NO	NO	NO	NO
	DHANSOR	Varsat	27	0.33	0.33		NO	NO	NO	NO	NO	NO
	DHANSOR	Cholviya	224	0.16	0.16	-	NO	NO	NO	NO	NO	NO
SUNSAR	SUNSAR	Harijan Vas	38	0.16	-	-	NO	NO	NO	NO	NO	NO
	SUNSAR	Harijan Vas	45	0.16	0.16	-	NO	NO	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	SUNSAR	Baranda	85	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	SUNSAR	Patel Faliya	110	-	-	-	NO	NO	NO	NO	NO	NO
	SUNSAR	Parmar Vas	155	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	SUNSAR	Parmar Vas	161	0.32	0.16	-	NO	NO	NO	NO	NO	NO
	SUNSAR	Thakor Faliyu	184	-	0.16	-	NO	NO	NO	NO	NO	NO
RAHEDA	RAHEDA	Harijan Vas	33	0.40	1.60	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Patel Faliya	374	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Patel Faliya	389	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Bus Stand Faliya	128	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Thakor Vas	258	0.48	0.48	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Bus Stand Faliya	138	0.17	0.17	-	NO	NO	NO	NO	NO	NO
	RAHEDA	Patel Faliya	289	0.16	0.17	-	NO	NO	NO	NO	NO	NO
RAVOL	RAVOL	Vaghari	140	0.16	0.08	-	NO	NO	NO	NO	NO	NO
	RAVOL	Vaghari	144	0.32	0.32	-	NO	NO	YES	NO	NO	NO
	RAVOL	Nanavaash	104	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	RAVOL	Motavaash	110	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	RAVOL	Parmarvaash	42	0.24	0.40	-	NO	NO	NO	NO	NO	NO
	RAVOL	Parmar Faliyu	147	0.24	-	-	NO	NO	NO	NO	NO	NO
	RAVOL	Parmar Faliyu	182	0.16	0.16	-	NO	NO	NO	NO	NO	NO
DOTAD	DOTAD	Vankar Faliyu	265	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	DOTAD	Parmar Faliyu	94	0.16	0.32	-	NO	NO	NO	NO	NO	NO
	DOTAD	Patel Vas	224	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	DOTAD	Asari Faliyu	64	0.36	0.16		NO	NO	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	DOTAD	Chowk	11	0.33	-		NO	NO	NO	NO	NO	NO
	DOTAD	Harijan Vas	279	0.32	0.32		NO	NO	NO	NO	NO	NO
	DOTAD	Darbar Faliyu	45	-	-		NO	NO	NO	NO	NO	NO
FINCHOD	FINCHOD	Asari Faliyu	14	0.33	0.33		NO	NO	NO	NO	NO	NO
	FINCHOD	Parmar Faliyu	54	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	FINCHOD	Patel Vas	112	0.16	-	-	NO	NO	NO	NO	NO	NO
	FINCHOD	Bus Stand Faliya	68	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	FINCHOD	Vankar Faliyu	165	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	FINCHOD	Harijan Vas	180	-	-	-	NO	NO	NO	NO	NO	NO
MOLLI	MOLLI	Juni Molli	175	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	MOLLI	Molllikhant	327	0.32	0.16	-	NO	YES	NO	YES	NO	NO
	MOLLI	Suratanpur	110	-	0.16	-	NO	YES	NO	YES	NO	NO
	MOLLI	Molli	45	0.40	1.60	-	NO	YES	NO	YES	NO	NO
	MOLLI	Goraya	112	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	MOLLI	Molli	49	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	MOLLI	Nanaji	141	0.16	0.16	-	NO	YES	YES	YES	NO	NO
PARSODA	PARSODA	Rathod Faliyu	123	0.48	0.48	-	NO	YES	NO	YES	NO	NO
	PARSODA	Panchal Faliyu	54	0.17	0.17	-	NO	YES	NO	YES	NO	NO
	PARSODA	Patel Faliyu	69	0.16	0.17	-	NO	YES	NO	YES	NO	NO
	PARSODA	Patel Faliyu	78	0.16	0.08	-	NO	YES	NO	YES	NO	NO
	PARSODA	Prajapati Vas	114	0.32	0.32	-	NO	NO	NO	NO	NO	NO
	PARSODA	Prajapati Vas	120	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	PARSODA	Modh Vas	144	0.16	0.16	-	NO	NO	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
VANKANEDA	VANKANEDA	Poojara Vas	211	0.24	0.40	-	NO	YES	NO	YES	NO	NO
	VANKANEDA	Parmar Vas	302	0.24	-	-	NO	NO	NO	NO	NO	NO
	VANKANEDA	Patel Faliyu	117	0.16	0.16	-	NO	NO	NO	NO	NO	NO
	VANKANEDA	Rathod Faliyu	81	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	VANKANEDA	Patel Faliyu	112	0.16	0.32	-	NO	YES	NO	YES	NO	NO
	VANKANEDA	Patel Faliyu	122	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	VANKANEDA	Bus Stand Faliya	77	0.36	0.16		NO	NO	NO	NO	NO	NO
AJAWAS	KALIKANKAR	Patel Faliyu	138	0.33	-		NO	YES	NO	NO	NO	NO
	KALIKANKAR	Thakor Faliyu	288	0.32	0.32		NO	YES	NO	YES	NO	NO
	KALIKANKAR	Prajapati Vas	142	-	-		NO	YES	NO	YES	NO	NO
	KALIKANKAR	Vankar Faliyu	168	0.33	0.33		NO	YES	NO	YES	NO	NO
	KALIKANKAR	Vankar Faliyu	169	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	MAMAPIPALA	Damor Vas	110	0.16	-	-	NO	YES	NO	NO	NO	NO
	MAMAPIPALA	Damor Vas	114	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	MAMAPIPALA	Pandor Vas	147	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	MAMAPIPALA	Pandor Vas	151	-	-	-	NO	YES	NO	YES	NO	NO
	MAMAPIPALA	Pandor Vas	155	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	BEDI	Ninama Vas	94	0.32	0.16	-	NO	YES	NO	NO	NO	NO
	BEDI	Ninama Vas	97	-	0.16	-	NO	YES	NO	YES	NO	NO
	BEDI	Harijan Vas	62	0.40	1.60	-	NO	YES	NO	YES	NO	NO
	BEDI	Harijan Vas	58	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	BEDI	Harijan Vas	53	0.32	0.32	-	NO	YES	NO	NO	NO	NO
	AJAWAS	Ninama Vas	45	0.16	0.16	-	NO	YES	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	AJAWAS	Pandor Vas	14	0.48	0.48	-	NO	YES	NO	YES	NO	NO
	AJAWAS	Harijan Faliyu	54	0.17	0.17	-	NO	YES	NO	YES	NO	NO
	AJAWAS	Prajapati Vas	112	0.16	0.17	-	NO	YES	NO	YES	NO	NO
	AJAWAS	Prajapati Vas	114	0.16	0.08	-	NO	YES	NO	NO	NO	NO
	AJAWAS	Vankar Faliyu	165	0.32	0.32	-	NO	YES	NO	NO	NO	NO
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	DAMOR DHUNDHA	Damor Vas	184	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	DAMOR DHUNDHA	Damor Vas	198	0.24	0.40	-	NO	YES	NO	YES	NO	NO
	DAMOR DHUNDHA	Damor Vas	221	0.24	-	-	NO	YES	NO	NO	NO	NO
	DAMOR DHUNDHA	Damor Vas	223	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	DHEMADA	Parmar Faliyu	16	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	DHEMADA	Parmar Faliyu	18	0.16	0.32	-	NO	YES	NO	YES	NO	NO
	DHEMADA	Parmar Faliyu	22	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	DHEMADA	Parmar Faliyu	26	0.36	0.16		NO	YES	YES	NO	NO	NO
	DHEMADA	Parmar Faliyu	29	0.33	-		NO	YES	NO	NO	NO	NO
	DHEMADA	Parmar Faliyu	33	0.32	0.32		NO	YES	NO	YES	NO	NO
	MOTI MOYDI	Vadla Faliyu	186	-	-		NO	YES	NO	YES	NO	NO
	MOTI MOYDI	Harijan Vas	224	0.33	0.33		NO	YES	NO	YES	NO	NO
	MOTI MOYDI	Bhathiji Faliyu	268	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	MOTI MOYDI	Gamtal	Gamtal	0.16	-	-	NO	YES	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	MOTI MOYDI	Chowk	106	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	MOTI MOYDI	Vadla Faliyu	134	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	PATEL DHUNDHA	Gamtal	Gamtal	-	-	-	NO	YES	NO	YES	NO	NO
	PATEL DHUNDHA	School Faliya	213	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	PATEL DHUNDHA	Mukhivalu Faliyu	276	0.32	0.16	-	NO	YES	NO	NO	NO	NO
	PATEL DHUNDHA	Mukhivalu Faliyu	278	-	0.16	-	NO	YES	NO	YES	NO	NO
	PATEL DHUNDHA	Thakor Faliyu	224	0.40	1.60	-	NO	YES	NO	YES	NO	NO
	PATEL DHUNDHA	River Faliya	84	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	PATEL DHUNDHA	Gameti Faliya	189	0.32	0.32	-	NO	YES	NO	NO	NO	NO
	UNDAVA	Harijan Vas	186	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	UNDAVA	Thakor Faliyu	58	0.48	0.48	-	NO	YES	YES	YES	NO	NO
	UNDAVA	Patel Faliya	14	0.17	0.17	-	NO	YES	NO	YES	NO	NO
	UNDAVA	Gameti Faliyu	106	0.16	0.17	-	NO	YES	NO	YES	NO	NO
	UNDAVA	Gameti Faliyu	117	0.16	0.08	-	NO	YES	NO	NO	NO	NO
	UNDAVA	Vankar Faliyu	16	0.32	0.32	-	NO	YES	YES	NO	NO	NO
	UNDAVA	Darbar Faliyu	213	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	UNDAVA	Thakor Vas	276	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	VADATHALI	Thakor Vas	100	0.24	0.40	-	NO	YES	NO	YES	NO	NO
	VADATHALI	Thakor Vas	112	0.24	-	-	NO	YES	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Change in irrigated area (Ha.)			Any change in availability of water from irrigation sources upto month yes/no			Change in Drinking water availability (yes/No)		
				Kharif	Rabi	Summer	Oct.	Feb.	May	Winter	Monsoon	Summer
	VADATHALI	Makavana Vas	84	0.16	0.16	-	NO	YES	NO	NO	NO	NO
	VADATHALI	Makavana Vas	89	0.16	0.16	-	NO	YES	NO	YES	NO	NO
	VADATHALI	Patel Vas	186	0.16	0.32	-	NO	YES	NO	YES	NO	NO
	VADATHALI	Patel Vas	188	0.32	0.32	-	NO	YES	NO	YES	NO	NO
	VADATHALI	Patel Vas	204	0.16	0.32	-	NO	YES	NO	NO	NO	NO
	VADATHALI	Thakor Vas	114	0.32	0.32	-	NO	YES	NO	NO	NO	NO

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
RELLAVADA	RELLAVADA	Thakor Faliyu	45	1062	2690.4	1123	2732	27312.5	135560	1628.4	1609
	RELLAVADA	Patel Faliya	152	3665.2	6330.8	5031	8566	108702.5	372420	2665.6	3535
	RELLAVADA	Azad Faliyu	106	2533	5662	5275	11874	97600	438400	3129	6599
	RELLAVADA	Azad Faliyu	168	3594.8	7568	8433	16508	150347.5	601900	3973.2	8075
	RELLAVADA	Vankar Faliyu	16	3610.8	8071.2	3744	8272	91935	408580	4460.4	4528
	RELLAVADA	Darbar Faliyu	213	2442	6186.4	2643	6087	63562.5	306835	3744.4	3444
KADVADI	KADVADI	Thakar Vas	276	2340	6552	2444	6654	59800	330150	4212	4210
	KADVADI	Mukhi Nu Faliya	100	3375	8550	3654	8692	87862.5	431050	5175	5038
	KADVADI	Thakar Vas	224	2925	7410	3444	7580	79612.5	374750	4485	4136
	KADVADI	Mukhi Nu Faliya	84	1965	5109	2054	5280	50237.5	259725	3144	3226
	KADVADI	Thakar Vas	189	1290	3268	1432	3080	34025	158700	1978	1648
	KADVADI	Patel Vas	186	2850	7220	2999	6508	73112.5	343200	4370	3509
	KADVADI	Mukhi Nu Faliyu	50	5308.8	11123.2	5406	10600	133935	543080	5814.4	5194
	KADVADI	Mukhi Nu Fal	14	2634	6672.8	2754	6768	67350	336020	4038.8	4014
	KADVADI	Thakar Vas	147	2310	5852	2368	6062	58475	297850	3542	3694
VALUNA	VALUNA	Shaktinagar	69	600	1520	585	1680	14812.5	80000	920	1095
	VALUNA	Shaktinagar	80	972	2052	983	2165	24437.5	105425	1080	1182
	VALUNA	Makavana Vas	1	960	2304	1004	2218	24550	113050	1344	1214
	VALUNA	Shaktinagar	19	1020	2584	1165	2356	27312.5	123500	1564	1191
	VALUNA	Patel Vas	45	1200	3040	1175	2670	29687.5	142750	1840	1495
	VALUNA	Shaktinagar	64	1330	2660	1287	2402	32712.5	126550	1330	1115
	VALUNA	Shaktinagar	108	900	2280	894	1880	22425	104000	1380	986
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	900	2040	780	1980	21000	100500	1140	1200
	MODARSUMBA	Dairivala	46	1200	3040	1288	3240	31100	157000	1840	1952

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	MODARSUMBA	Parmar	67	864	1824	890	1680	21925	87600	960	790
	MODARSUMBA	Parmar	58	780	1976	800	2055	19750	100775	1196	1255
	MODARSUMBA	Parmar	60	900	2280	1005	2070	23812.5	108750	1380	1065
	MODARSUMBA	Parmar	66	960	2432	860	2020	22750	111300	1472	1160
	MODARSUMBA	Parmar	61	840	2128	763	2260	20037.5	109700	1288	1497
	MODARSUMBA	Parmar	62	1584	2808	1676	3080	40750	147200	1224	1404
	MODARSUMBA	Parmar	52	1800	4560	1875	4780	45937.5	233500	2760	2905
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	1698	4301.6	1778	4445	43450	218665	2603.6	2667
	MALEKPUR	Vadla Faliyu	108	531	1345.2	459	1500	12375	71130	814.2	1041
	MALEKPUR	Shayaro Faliyu	120	318	805.6	300	775	7725	39515	487.6	475
	MALEKPUR	Bhathiji Faliyu	6	1698	4301.6	1570	4780	40850	227040	2603.6	3210
	SHIKA KAMPA	Gamtal	Gamtal	29680	40280	32464	46870	776800	2178750	10600	14406
	SHIKA KAMPA	Chowk	805	6366	14005.2	6456	15600	160275	740130	7639.2	9144
	SHIKA KAMPA	Chowk	600	10500	26600	11200	27800	271250	1360000	16100	16600
	SHIKA KAMPA	Gamtal	808	4248	9062.4	4348	10300	107450	484060	4814.4	5952
DAHEGAMDA	DAHEGAMDA	School Faliya	110	1272	3222.4	1290	3385	32025	165185	1950.4	2095
	DAHEGAMDA	Mukhivalu Faliyu	138	1260	3192	1200	3350	30750	163550	1932	2150
	DAHEGAMDA	Mukhivalu Faliyu	142	1482	3754.4	1309	3655	34887.5	185235	2272.4	2346
	DAHEGAMDA	Thakor Faliyu	69	636	1441.6	589	1530	15312.5	74290	805.6	941
	DAHEGAMDA	River Faliya	235	2124	5380.8	2064	5186	52350	264170	3256.8	3122
	DAHEGAMDA	Master Faliya	45	849	2150.8	922	2245	22137.5	109895	1301.8	1323
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	420	760	444	800	10800	39000	340	356
	UNCHI DHANAL	Toran Chowk	400	5100	12920	5274	14005	129675	673125	7820	8731
	UNCHI DHANAL	Patel Vas	531	9000	22800	8843	25680	223037.5	1212000	13800	16837

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	UNCHI DHANAL	Mandvi Chowk	388	6000	15200	5565	16700	144562.5	797500	9200	11135
	UNCHI DHANAL	Moti Faliyu	202	6000	15200	5644	14400	145550	740000	9200	8756
	UNCHI DHANAL	Parmar Faliyu	5	1020	2280	1124	2344	26800	115600	1260	1220
	UNCHI DHANAL	Mahadev Faliyu	138	7500	17500	7211	16460	183887.5	849000	10000	9249
LIMDA	LIMDA	Pipli Faliyu	136	1575	3990	1642	4110	40212.5	202500	2415	2468
	LIMDA	Mothadiya	363	1575	4122	1622	4230	39962.5	208800	2547	2608
	LIMDA	Asari Faliyu	350	5600	10640	5523	11200	139037.5	546000	5040	5677
	LIMDA	Dungri Faliyu	2	789	1998.8	756	2180	19312.5	104470	1209.8	1424
	LIMDA	Pipli Faliyu	134	2100	5040	1934	5160	50425	255000	2940	3226
	LIMDA	Pipli Faliyu	138	2100	5320	2045	5440	51812.5	269000	3220	3395
DHANSOR	DHANSOR	Cholviya	220	1860	4712	2068	4680	49100	234800	2852	2612
	DHANSOR	Cholviya	140	1890	4788	1756	4500	45575	232200	2898	2744
	DHANSOR	Cholviya	46	1620	4104	1544	4320	39550	210600	2484	2776
	DHANSOR	Sovaliya	202	3189	7866.2	2976	3080	77062.5	273655	4677.2	104
	DHANSOR	Modiya	270	2472	6262.4	2343	2440	60187.5	217560	3790.4	97
	DHANSOR	Baranda	279	2310	5852	2433	6020	59287.5	296800	3542	3587
	DHANSOR	Baranda	4	2864.4	7774.8	2987	7980	73142.5	393870	4910.4	4993
	DHANSOR	Varsat	27	2925	7410	2876	7520	72512.5	373250	4485	4644
	DHANSOR	Cholviya	224	1965	4454	1834	4530	47487.5	224600	2489	2696
SUNSAR	SUNSAR	Harijan Vas	38	1320	3344	1444	3140	34550	162100	2024	1696
	SUNSAR	Harijan Vas	45	2730	6916	2811	7090	69262.5	350150	4186	4279
	SUNSAR	Baranda	85	3750	9500	3680	8050	92875	438750	5750	4370
	SUNSAR	Patel Faliya	110	3975	10070	3788	9480	97037.5	488750	6095	5692
	SUNSAR	Parmar Vas	155	1820	4940	1598	5230	42725	254250	3120	3632

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	SUNSAR	Parmar Vas	161	1500	3300	1455	3444	36937.5	168600	1800	1989
	SUNSAR	Thakor Faliyu	184	1380	3496	1411	3658	34887.5	178850	2116	2247
RAHEDA	RAHEDA	Harijan Vas	33	900	2280	873	2456	22162.5	118400	1380	1583
	RAHEDA	Patel Faliya	374	7800	19760	8043	17680	198037.5	936000	11960	9637
	RAHEDA	Patel Faliya	389	7360	17480	7144	15690	181300	829250	10120	8546
	RAHEDA	Bus Stand Faliya	128	3675	9310	3545	9580	90250	472250	5635	6035
	RAHEDA	Thakor Vas	258	1575	3465	1480	3555	38187.5	175500	1890	2075
	RAHEDA	Bus Stand Faliya	138	2700	6840	2611	7042	66387.5	347050	4140	4431
	RAHEDA	Patel Faliya	289	2625	6650	2544	6580	64612.5	330750	4025	4036
RAVOL	RAVOL	Vaghari	140	900	2280	810	2375	21375	116375	1380	1565
	RAVOL	Vaghari	144	840	2016	911	2150	21887.5	104150	1176	1239
	RAVOL	Nanavaash	104	1080	2280	990	2380	25875	116500	1200	1390
	RAVOL	Motavaash	110	1350	3420	1430	3610	34750	175750	2070	2180
	RAVOL	Parmarvaash	42	1500	3800	1622	4020	39025	195500	2300	2398
	RAVOL	Parmar Faliyu	147	1500	3920	1690	3844	39875	194100	2420	2154
	RAVOL	Parmar Faliyu	182	1560	3120	1480	3220	38000	158500	1560	1740
DOTAD	DOTAD	Vankar Faliyu	265	900	2280	790	2042	21125	108050	1380	1252
	DOTAD	Parmar Faliyu	94	1200	3040	1270	2856	30875	147400	1840	1586
	DOTAD	Patel Vas	224	1650	4180	1469	4260	38987.5	211000	2530	2791
	DOTAD	Asari Faliyu	64	1200	3040	1380	3242	32250	157050	1840	1862
	DOTAD	Chowk	11	1140	2356	1290	2505	30375	121525	1216	1215
	DOTAD	Harijan Vas	279	1020	2584	1080	2640	26250	130600	1564	1560
	DOTAD	Darbar Faliyu	45	1350	3420	1267	3310	32712.5	168250	2070	2043
FINCHOD	FINCHOD	Asari Faliyu	14	900	1900	890	1823	22375	93075	1000	933

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	FINCHOD	Parmar Faliyu	54	900	2280	793	2150	21162.5	110750	1380	1357
	FINCHOD	Patel Vas	112	2400	7680	2444	7430	60550	377750	5280	4986
	FINCHOD	Bus Stand Faliya	68	1800	4560	1989	4160	47362.5	218000	2760	2171
	FINCHOD	Vankar Faliyu	165	1444	2888	1560	3020	37550	147700	1444	1460
	FINCHOD	Harijan Vas	180	1260	3192	1150	3100	30125	157300	1932	1950
MOLLI	MOLLI	Juni Molli	175	1520	3360	1430	3255	36875	165375	1840	1825
	MOLLI	Molllikhant	327	2280	5040	1167	5160	43087.5	255000	2760	3993
	MOLLI	Suratanpur	110	3080	5600	2544	5480	70300	277000	2520	2936
	MOLLI	Molli	45	2128	4704	1480	4570	45100	231850	2576	3090
	MOLLI	Goraya	112	2166	4788	1500	4390	45825	229450	2622	2890
	MOLLI	Molli	49	2300	3864	1690	4060	49875	198100	1564	2370
	MOLLI	Nanaji	141	1140	2460	890	2570	25375	125750	1320	1680
PARSODA	PARSODA	Rathod Faliyu	123	1120	3360	1080	3210	27500	164250	2240	2130
	PARSODA	Panchal Faliyu	54	2014	4452	2100	4260	51425	217800	2438	2160
	PARSODA	Patel Faliyu	69	1900	4200	1867	3845	47087.5	201125	2300	1978
	PARSODA	Patel Faliyu	78	1824	3744	1134	3380	36975	178100	1920	2246
	PARSODA	Prajapati Vas	114	1462	3612	983	3390	30562.5	175050	2150	2407
	PARSODA	Prajapati Vas	120	1558	3444	1389	3190	36837.5	165850	1886	1801
	PARSODA	Modh Vas	144	1520	3360	1500	2940	37750	157500	1840	1440
VANKANEDA	VANKANEDA	Poojara Vas	211	2584	5712	1455	5820	50487.5	288300	3128	4365
	VANKANEDA	Parmar Vas	302	2240	5040	1570	5168	47625	255200	2800	3598
	VANKANEDA	Patel Faliyu	117	2280	5040	2560	5230	60500	256750	2760	2670
	VANKANEDA	Rathod Faliyu	81	1748	3864	1590	3646	41725	187750	2116	2056
	VANKANEDA	Patel Faliyu	112	2660	5880	2060	5480	59000	284000	3220	3420

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	VANKANEDA	Patel Faliyu	122	3040	6080	2875	5590	73937.5	291750	3040	2715
	VANKANEDA	Bus Stand Faliya	77	1200	3360	980	3440	27250	170000	2160	2460
AJAWAS	KALIKANKAR	Patel Faliyu	138	1062	2690.4	3654	8692	58950	284560	1628.4	5038
	KALIKANKAR	Thakor Faliyu	288	2799	7090.8	3444	7580	78037.5	366770	4291.8	4136
	KALIKANKAR	Prajapati Vas	142	3651	9492.6	2054	5280	71312.5	369315	5841.6	3226
	KALIKANKAR	Vankar Faliyu	168	6378	16157.6	1432	3080	97625	480940	9779.6	1648
	KALIKANKAR	Vankar Faliyu	169	3174	8040.8	2999	6508	77162.5	363720	4866.8	3509
	MAMAPIPALA	Damor Vas	110	3418.8	7163.2	5406	10600	110310	444080	3744.4	5194
	MAMAPIPALA	Damor Vas	114	2769	7014.8	2754	6768	69037.5	344570	4245.8	4014
	MAMAPIPALA	Pandor Vas	147	2775	7030	2368	6062	64287.5	327300	4255	3694
	MAMAPIPALA	Pandor Vas	151	2925	7410	585	1680	43875	227250	4485	1095
	MAMAPIPALA	Pandor Vas	155	2358	4978	983	2165	41762.5	178575	2620	1182
	BEDI	Ninama Vas	94	1290	3096	1004	2218	28675	132850	1806	1214
	BEDI	Ninama Vas	97	2850	7220	1165	2356	50187.5	239400	4370	1191
	BEDI	Harijan Vas	62	3366	8527.2	1175	2670	56762.5	279930	5161.2	1495
	BEDI	Harijan Vas	58	3336.4	6672.8	1287	2402	57792.5	226870	3336.4	1115
	BEDI	Harijan Vas	53	2310	5852	894	1880	40050	193300	3542	986
	AJAWAS	Ninama Vas	45	1500	3400	780	1980	28500	134500	1900	1200
	AJAWAS	Pandor Vas	14	810	2052	1288	3240	26225	132300	1242	1952
	AJAWAS	Harijan Faliyu	54	1152	2432	890	1680	25525	102800	1280	790
	AJAWAS	Prajapati Vas	112	1020	2584	800	2055	22750	115975	1564	1255
	AJAWAS	Prajapati Vas	114	2520	6384	1005	2070	44062.5	211350	3864	1065
	AJAWAS	Vankar Faliyu	165	1050	2660	860	2020	23875	117000	1610	1160
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	900	2280	763	2260	20787.5	113500	1380	1497

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	DAMOR DHUNDHA	Damor Vas	184	1320	2340	1676	3080	37450	135500	1020	1404
	DAMOR DHUNDHA	Damor Vas	198	1200	3040	1875	4780	38437.5	195500	1840	2905
	DAMOR DHUNDHA	Damor Vas	221	1620	4104	1778	4445	42475	213725	2484	2667
	DAMOR DHUNDHA	Damor Vas	223	780	1976	459	1500	15487.5	86900	1196	1041
	DHEMADA	Parmar Faliyu	16	900	2280	300	775	15000	76375	1380	475
	DHEMADA	Parmar Faliyu	18	1914	4848.8	1570	4780	43550	240720	2934.8	3210
	DHEMADA	Parmar Faliyu	22	1568	2128	32464	46870	425400	1224950	560	14406
	DHEMADA	Parmar Faliyu	26	1080	2376	6456	15600	94200	449400	1296	9144
	DHEMADA	Parmar Faliyu	29	1800	4560	11200	27800	162500	809000	2760	16600
	DHEMADA	Parmar Faliyu	33	1698	3622.4	4348	10300	75575	348060	1924.4	5952
	MOTI MOYDI	Vadla Faliyu	186	531	1345.2	1290	3385	22762.5	118255	814.2	2095
	MOTI MOYDI	Harijan Vas	224	318	805.6	1200	3350	18975	103890	487.6	2150
	MOTI MOYDI	Bhathiji Faliyu	268	1698	4301.6	1309	3655	37587.5	198915	2603.6	2346
	MOTI MOYDI	Gamtal	Gamtal	4299	9744.4	589	1530	61100	281860	5445.4	941
	MOTI MOYDI	Chowk	106	3633	9203.6	2064	5186	71212.5	359740	5570.6	3122
	MOTI MOYDI	Vadla Faliyu	134	2901	7349.2	922	2245	47787.5	239855	4448.2	1323
	PATEL DHUNDHA	Gamtal	Gamtal	1486.8	2690.4	444	800	24135	87260	1203.6	356
	PATEL DHUNDHA	School Faliya	213	3399	8610.8	5274	14005	108412.5	565395	5211.8	8731
	PATEL DHUNDHA	Mukhivalu Faliyu	276	4251	10769.2	8843	25680	163675	911230	6518.2	16837
	PATEL DHUNDHA	Mukhivalu Faliyu	278	2805	7106	5565	16700	104625	595150	4301	11135
	PATEL DHUNDHA	Thakor Faliyu	224	2544	6444.8	5644	14400	102350	521120	3900.8	8756
	PATEL DHUNDHA	River Faliya	84	2767.6	6186.4	1124	2344	48645	213260	3418.8	1220
	PATEL DHUNDHA	Gameti Faliya	189	2340	5928	3654	8692	74925	365500	3588	5038
	UNDAVA	Harijan Vas	186	2802	7098.4	3444	7580	78075	366960	4296.4	4136

Name of Watershed	Village	Faliya	Survey No.	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Crop Production (Kg.) (B.W.)	Crop Production (Kg.) (A.W.)	Income due to Agriculture (Rs.) (B.W.)	Income due to Agriculture (Rs.) (A.W.)	Change in crop production (kg)	
				Rainfed	Rainfed	Irrigated	Irrigated			Rainfed	Irrigated
	UNDAVA	Thakor Faliyu	58	2925	7605	2054	5280	62237.5	322125	4680	3226
	UNDAVA	Patel Faliya	14	1965	4978	1432	3080	42462.5	201450	3013	1648
	UNDAVA	Gameti Faliyu	106	1290	3268	2999	6508	53612.5	244400	1978	3509
	UNDAVA	Gameti Faliyu	117	3990	8360	5406	10600	117450	474000	4370	5194
	UNDAVA	Vankar Faliyu	16	3096	7843.2	2754	6768	73125	365280	4747.2	4014
	UNDAVA	Darbar Faliyu	213	2634	6672.8	2368	6062	62525	318370	4038.8	3694
	UNDAVA	Thakor Vas	276	2310	5852	585	1680	36187.5	188300	3542	1095
	VADATHALI	Thakor Vas	100	720	1520	983	2165	21287.5	92125	800	1182
	VADATHALI	Thakor Vas	112	810	1944	1004	2218	22675	104050	1134	1214
	VADATHALI	Makavana Vas	84	2961	7501.2	1165	2356	51575	246430	4540.2	1191
	VADATHALI	Makavana Vas	89	1020	2584	1175	2670	27437.5	131350	1564	1495
	VADATHALI	Patel Vas	186	1520	3040	1287	2402	35087.5	136050	1520	1115
	VADATHALI	Patel Vas	188	2001	5069.2	894	1880	36187.5	173730	3068.2	986
	VADATHALI	Patel Vas	204	900	2040	780	1980	21000	100500	1140	1200
	VADATHALI	Thakor Vas	114	2532	6414.4	1288	3240	47750	241360	3882.4	1952

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
RELLAVADA	RELLAVADA	Thakor Faliyu	45	1312.50	3325.00	1387.89	3376.41	2012.50	1988.52
	RELLAVADA	Patel Faliya	152	1925.00	3325.00	2642.33	4498.95	1400.00	1856.62
	RELLAVADA	Azad Faliyu	106	1487.50	3325.00	3097.73	6972.99	1837.50	3875.25
	RELLAVADA	Azad Faliyu	168	1662.50	3500.00	3900.04	7634.51	1837.50	3734.47
	RELLAVADA	Vankar Faliyu	16	1487.50	3325.00	1542.37	3407.72	1837.50	1865.35
	RELLAVADA	Darbar Faliyu	213	1312.50	3325.00	1420.53	3271.58	2012.50	1851.04
KADVADI	KADVADI	Thakar Vas	276	1312.50	3675.00	1370.83	3732.21	2362.50	2361.38
	KADVADI	Mukhi Nu Faliya	100	1312.50	3325.00	1421.00	3380.22	2012.50	1959.22
	KADVADI	Thakar Vas	224	1312.50	3325.00	1545.38	3401.28	2012.50	1855.90
	KADVADI	Mukhi Nu Faliya	84	1312.50	3412.50	1371.95	3526.72	2100.00	2154.77
	KADVADI	Thakar Vas	189	1312.50	3325.00	1456.98	3133.72	2012.50	1676.74
	KADVADI	Patel Vas	186	1312.50	3325.00	1381.12	2997.11	2012.50	1615.99
	KADVADI	Mukhi Nu Faliyu	50	1837.50	3850.00	1871.14	3668.91	2012.50	1797.77
	KADVADI	Mukhi Nu Fal	14	1312.50	3325.00	1372.29	3372.44	2012.50	2000.14
	KADVADI	Thakar Vas	147	1312.50	3325.00	1345.45	3444.32	2012.50	2098.86
VALUNA	VALUNA	Shaktinagar	69	1312.50	3325.00	1279.69	3675.00	2012.50	2395.31
	VALUNA	Shaktinagar	80	1575.00	3325.00	1592.82	3508.10	1750.00	1915.28
	VALUNA	Makavana Vas	1	1312.50	3150.00	1372.66	3032.42	1837.50	1659.77
	VALUNA	Shaktinagar	19	1312.50	3325.00	1499.08	3031.62	2012.50	1532.54
	VALUNA	Patel Vas	45	1312.50	3325.00	1285.16	2920.31	2012.50	1635.16
	VALUNA	Shaktinagar	64	1662.50	3325.00	1608.75	3002.50	1662.50	1393.75
	VALUNA	Shaktinagar	108	1312.50	3325.00	1303.75	2741.67	2012.50	1437.92
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	1312.50	2975.00	1137.50	2887.50	1662.50	1750.00
	MODARSUMBA	Dairivala	46	1312.50	3325.00	1408.75	3543.75	2012.50	2135.00
	MODARSUMBA	Parmar Faliyu	67	1575.00	3325.00	1622.40	3062.50	1750.00	1440.10

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
	MODARSUMBA	Parmar Faliyu	58	1312.50	3325.00	1346.15	3457.93	2012.50	2111.78
	MODARSUMBA	Parmar Faliyu	60	1312.50	3325.00	1465.63	3018.75	2012.50	1553.13
	MODARSUMBA	Parmar Faliyu	66	1312.50	3325.00	1175.78	2761.72	2012.50	1585.94
	MODARSUMBA	Parmar Faliyu	61	1312.50	3325.00	1192.19	3531.25	2012.50	2339.06
	MODARSUMBA	Parmar Faliyu	62	1925.00	3412.50	2036.81	3743.06	1487.50	1706.25
	MODARSUMBA	Parmar Faliyu	52	1312.50	3325.00	1367.19	3485.42	2012.50	2118.23
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	1312.50	3325.00	1374.34	3435.84	2012.50	2061.51
	MALEKPUR	Vadla Faliyu	108	1312.50	3325.00	1134.53	3707.63	2012.50	2573.09
	MALEKPUR	Shayaro Faliyu	120	1312.50	3325.00	1238.21	3198.70	2012.50	1960.50
	MALEKPUR	Bhathiji Faliyu	6	1312.50	3325.00	1213.56	3694.79	2012.50	2481.23
	SHIKA KAMPA	Gamtal	Gamtal	2450.00	3325.00	2679.81	3868.99	875.00	1189.17
	SHIKA KAMPA	Chowk	805	1312.50	2887.50	1331.06	3216.31	1575.00	1885.25
	SHIKA KAMPA	Chowk	600	1312.50	3325.00	1400.00	3475.00	2012.50	2075.00
	SHIKA KAMPA	Gamtal	808	1312.50	2800.00	1343.40	3182.38	1487.50	1838.98
DAHEGAMDA	DAHEGAMDA	School Faliya	110	1312.50	3325.00	1331.07	3492.78	2012.50	2161.70
	DAHEGAMDA	Mukhivalu Faliyu	138	1312.50	3325.00	1250.00	3489.58	2012.50	2239.58
	DAHEGAMDA	Mukhivalu Faliyu	142	1312.50	3325.00	1159.29	3236.97	2012.50	2077.68
	DAHEGAMDA	Thakor Faliyu	69	1312.50	2975.00	1215.51	3157.43	1662.50	1941.92
	DAHEGAMDA	River Faliya	235	1312.50	3325.00	1275.42	3204.63	2012.50	1929.20
	DAHEGAMDA	Master Faliya	45	1312.50	3325.00	1425.35	3470.63	2012.50	2045.27
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	1837.50	3325.00	1942.50	3500.00	1487.50	1557.50
	UNCHI DHANAL	Toran Chowk	400	1312.50	3325.00	1357.28	3604.23	2012.50	2246.95
	UNCHI DHANAL	Patel Vas	531	1312.50	3325.00	1289.60	3745.00	2012.50	2455.40
	UNCHI DHANAL	Mandvi Chowk	388	1312.50	3325.00	1217.34	3653.13	2012.50	2435.78
	UNCHI DHANAL	Moti Faliyu	202	1312.50	3325.00	1234.63	3150.00	2012.50	1915.38

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				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
	UNCHI DHANAL	Parmar Faliyu	5	1487.50	3325.00	1639.17	3418.33	1837.50	1779.17
	UNCHI DHANAL	Mahadev Faliyu	138	1312.50	3062.50	1261.93	2880.50	1750.00	1618.58
LIMDA	LIMDA	Pipli Faliyu	136	1312.50	3325.00	1368.33	3425.00	2012.50	2056.67
	LIMDA	Mothadiya	363	1312.50	3435.00	1351.67	3525.00	2122.50	2173.33
	LIMDA	Asari Faliyu	350	1750.00	3325.00	1725.94	3500.00	1575.00	1774.06
	LIMDA	Dungri Faliyu	2	1312.50	3325.00	1257.60	3626.43	2012.50	2368.82
	LIMDA	Pipli Faliyu	134	1312.50	3150.00	1208.75	3225.00	1837.50	2016.25
	LIMDA	Pipli Faliyu	138	1312.50	3325.00	1278.13	3400.00	2012.50	2121.88
DHANSOR	DHANSOR	Cholviya	220	1312.50	3325.00	1459.27	3302.42	2012.50	1843.15
	DHANSOR	Cholviya	140	1312.50	3325.00	1219.44	3125.00	2012.50	1905.56
	DHANSOR	Cholviya	46	1312.50	3325.00	1250.93	3500.00	2012.50	2249.07
	DHANSOR	Sovaliya	202	1312.50	3237.50	1224.84	1267.64	1925.00	42.80
	DHANSOR	Modiya	270	1312.50	3325.00	1244.01	1295.51	2012.50	51.50
	DHANSOR	Baranda	279	1312.50	3325.00	1382.39	3420.45	2012.50	2038.07
	DHANSOR	Baranda	4	1225.00	3325.00	1277.43	3412.76	2100.00	2135.33
	DHANSOR	Varsat	27	1312.50	3325.00	1290.51	3374.36	2012.50	2083.85
	DHANSOR	Cholviya	224	1312.50	2975.00	1225.00	3025.76	1662.50	1800.76
SUNSAR	SUNSAR	Harijan Vas	38	1312.50	3325.00	1435.80	3122.16	2012.50	1686.36
	SUNSAR	Harijan Vas	45	1312.50	3325.00	1351.44	3408.65	2012.50	2057.21
	SUNSAR	Baranda	85	1312.50	3325.00	1288.00	2817.50	2012.50	1529.50
	SUNSAR	Patel Faliya	110	1312.50	3325.00	1250.75	3130.19	2012.50	1879.43
	SUNSAR	Parmar Vas	155	1225.00	3325.00	1075.58	3520.19	2100.00	2444.62
	SUNSAR	Parmar Vas	161	1312.50	2887.50	1273.13	3013.50	1575.00	1740.38
	SUNSAR	Thakor Faliyu	184	1312.50	3325.00	1341.98	3479.08	2012.50	2137.09
RAHEDA	RAHEDA	Harijan Vas	33	1312.50	3325.00	1273.13	3581.67	2012.50	2308.54

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				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
	RAHEDA	Patel Faliya	374	1312.50	3325.00	1353.39	2975.00	2012.50	1621.61
	RAHEDA	Patel Faliya	389	1400.00	3325.00	1358.91	2984.51	1925.00	1625.60
	RAHEDA	Bus Stand Faliya	128	1312.50	3325.00	1266.07	3421.43	2012.50	2155.36
	RAHEDA	Thakor Vas	258	1312.50	2887.50	1233.33	2962.50	1575.00	1729.17
	RAHEDA	Bus Stand Faliya	138	1312.50	3325.00	1269.24	3423.19	2012.50	2153.96
	RAHEDA	Patel Faliya	289	1312.50	3325.00	1272.00	3290.00	2012.50	2018.00
RAVOL	RAVOL	Vaghari	140	1312.50	3325.00	1181.25	3463.54	2012.50	2282.29
	RAVOL	Vaghari	144	1312.50	3150.00	1423.44	3359.38	1837.50	1935.94
	RAVOL	Nanavaash	104	1575.00	3325.00	1443.75	3470.83	1750.00	2027.08
	RAVOL	Motavaash	110	1312.50	3325.00	1390.28	3509.72	2012.50	2119.44
	RAVOL	Parmarvaash	42	1312.50	3325.00	1419.25	3517.50	2012.50	2098.25
	RAVOL	Parmar Faliyu	147	1312.50	3430.00	1478.75	3363.50	2117.50	1884.75
	RAVOL	Parmar Faliyu	182	1312.50	2625.00	1245.19	2709.13	1312.50	1463.94
DOTAD	DOTAD	Vankar Faliyu	265	1312.50	3325.00	1152.08	2977.92	2012.50	1825.83
	DOTAD	Parmar Faliyu	94	1312.50	3325.00	1389.06	3123.75	2012.50	1734.69
	DOTAD	Patel Vas	224	1312.50	3325.00	1168.52	3388.64	2012.50	2220.11
	DOTAD	Asari Faliyu	64	1312.50	3325.00	1509.38	3545.94	2012.50	2036.56
	DOTAD	Chowk	11	1312.50	2712.50	1485.20	2884.05	1400.00	1398.85
	DOTAD	Harijan Vas	279	1312.50	3325.00	1389.71	3397.06	2012.50	2007.35
	DOTAD	Darbar Faliyu	45	1312.50	3325.00	1231.81	3218.06	2012.50	1986.25
FINCHOD	FINCHOD	Asari Faliyu	14	1575.00	3325.00	1557.50	3190.25	1750.00	1632.75
	FINCHOD	Parmar Faliyu	54	1312.50	3325.00	1156.46	3135.42	2012.50	1978.96
	FINCHOD	Patel Vas	112	1312.50	4200.00	1336.56	4063.28	2887.50	2726.72
	FINCHOD	Bus Stand Faliya	68	1312.50	3325.00	1450.31	3033.33	2012.50	1583.02
	FINCHOD	Vankar Faliyu	165	1662.50	3325.00	1796.05	3476.97	1662.50	1680.92

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
	FINCHOD	Harijan Vas	180	1312.50	3325.00	1197.92	3229.17	2012.50	2031.25
MOLLI	MOLLI	Juni Molli	175	1662.5	3675.00	1564.06	3560.16	2012.50	1996.09
	MOLLI	Molllikhant	327	1662.5	3675.00	850.94	3762.50	2012.50	2911.56
	MOLLI	Suratanpur	110	1925	3500.00	1590.00	3425.00	1575.00	1835.00
	MOLLI	Molli	45	1662.5	3675.00	1156.25	3570.31	2012.50	2414.06
	MOLLI	Goraya	112	1662.5	3675.00	1151.32	3369.52	2012.50	2218.20
	MOLLI	Molli	49	2187.5	3675.00	1607.34	3861.41	1487.50	2254.08
	MOLLI	Nanaji	141	1662.5	3587.50	1297.92	3747.92	1925.00	2450.00
PARSODA	PARSODA	Rathod Faliyu	123	1225	3675.00	1181.25	3510.94	2450.00	2329.69
	PARSODA	Panchal Faliyu	54	1662.5	3675.00	1733.49	3516.51	2012.50	1783.02
	PARSODA	Patel Faliyu	69	1662.5	3675.00	1633.63	3364.38	2012.50	1730.75
	PARSODA	Patel Faliyu	78	1662.5	3412.50	1033.59	3080.73	1750.00	2047.14
	PARSODA	Prajapati Vas	114	1487.5	3675.00	1000.15	3449.13	2187.50	2448.98
	PARSODA	Prajapati Vas	120	1662.5	3675.00	1482.16	3403.96	2012.50	1921.80
	PARSODA	Modh Vas	144	1662.5	3675.00	1640.63	3215.63	2012.50	1575.00
VANKANEDA	VANKANEDA	Poojara Vas	211	1662.5	3675.00	936.12	3744.49	2012.50	2808.36
	VANKANEDA	Parmar Vas	302	1400	3150.00	981.25	3230.00	1750.00	2248.75
	VANKANEDA	Patel Faliyu	117	1662.5	3675.00	1866.67	3813.54	2012.50	1946.88
	VANKANEDA	Rathod Faliyu	81	1662.5	3675.00	1512.23	3467.66	2012.50	1955.43
	VANKANEDA	Patel Faliyu	112	1662.5	3675.00	1287.50	3425.00	2012.50	2137.50
	VANKANEDA	Patel Faliyu	122	1662.5	3325.00	1572.27	3057.03	1662.50	1484.77
	VANKANEDA	Bus Stand Faliya	77	1312.5	3675.00	1071.88	3762.50	2362.50	2690.63
AJAWAS	KALIKANKAR	Patel Faliyu	138	1312.50	3325.00	4515.89	10742.23	2012.50	6226.34
	KALIKANKAR	Thakor Faliyu	288	1312.50	3325.00	1614.95	3554.39	2012.50	1939.44
	KALIKANKAR	Prajapati Vas	142	1312.50	3412.50	738.39	1898.11	2100.00	1159.72

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated
	KALIKANKAR	Vankar Faliyu	168	1312.50	3325.00	294.68	633.82	2012.50	339.13
	KALIKANKAR	Vankar Faliyu	169	1312.50	3325.00	1240.13	2691.16	2012.50	1451.03
	MAMAPIPALA	Damor Vas	110	1837.50	3850.00	2905.56	5697.17	2012.50	2791.62
	MAMAPIPALA	Damor Vas	114	1312.50	3325.00	1305.39	3208.02	2012.50	1902.63
	MAMAPIPALA	Pandor Vas	147	1312.50	3325.00	1120.00	2867.16	2012.50	1747.16
	MAMAPIPALA	Pandor Vas	151	1312.50	3325.00	262.50	753.85	2012.50	491.35
	MAMAPIPALA	Pandor Vas	155	1575.00	3325.00	656.58	1446.09	1750.00	789.50
	BEDI	Ninama Vas	94	1312.50	3150.00	1021.51	2256.69	1837.50	1235.17
	BEDI	Ninama Vas	97	1312.50	3325.00	536.51	1085.00	2012.50	548.49
	BEDI	Harijan Vas	62	1312.50	3325.00	458.17	1041.11	2012.50	582.94
	BEDI	Harijan Vas	58	1662.50	3325.00	641.30	1196.90	1662.50	555.60
	BEDI	Harijan Vas	53	1312.50	3325.00	507.95	1068.18	2012.50	560.23
	AJAWAS	Ninama Vas	45	1312.50	2975.00	682.50	1732.50	1662.50	1050.00
	AJAWAS	Pandor Vas	14	1312.50	3325.00	2087.04	5250.00	2012.50	3162.96
	AJAWAS	Harijan Faliyu	54	1575.00	3325.00	1216.80	2296.88	1750.00	1080.08
	AJAWAS	Prajapati Vas	112	1312.50	3325.00	1029.41	2644.30	2012.50	1614.89
	AJAWAS	Prajapati Vas	114	1312.50	3325.00	523.44	1078.13	2012.50	554.69
	AJAWAS	Vankar Faliyu	165	1312.50	3325.00	1075.00	2525.00	2012.50	1450.00
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	1312.50	3325.00	1112.71	3295.83	2012.50	2183.13
	DAMOR DHUNDHA	Damor Vas	184	1925.00	3412.50	2444.17	4491.67	1487.50	2047.50
	DAMOR DHUNDHA	Damor Vas	198	1312.50	3325.00	2050.78	5228.13	2012.50	3177.34
	DAMOR DHUNDHA	Damor Vas	221	1312.50	3325.00	1440.51	3601.27	2012.50	2160.76

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	**Rainfed**	**Irrigated**	**Irrigated**	**Rainfed**	**Irrigated**
	DAMOR DHUNDHA	Damor Vas	223	1312.50	3325.00	772.36	2524.04	2012.50	1751.68
	DHEMADA	Parmar Faliyu	16	1312.50	3325.00	437.50	1130.21	2012.50	692.71
	DHEMADA	Parmar Faliyu	18	1312.50	3325.00	1076.61	3277.82	2012.50	2201.21
	DHEMADA	Parmar Faliyu	22	2450.00	3325.00	50725.00	73234.38	875.00	22509.38
	DHEMADA	Parmar Faliyu	26	1312.50	2887.50	7845.83	18958.33	1575.00	11112.50
	DHEMADA	Parmar Faliyu	29	1312.50	3325.00	8166.67	20270.83	2012.50	12104.17
	DHEMADA	Parmar Faliyu	33	1312.50	2800.00	3360.87	7961.57	1487.50	4600.71
	MOTI MOYDI	Vadla Faliyu	186	1312.50	3325.00	3188.56	8366.88	2012.50	5178.32
	MOTI MOYDI	Harijan Vas	224	1312.50	3325.00	4952.83	13826.65	2012.50	8873.82
	MOTI MOYDI	Bhathiji Faliyu	268	1312.50	3325.00	1011.82	2825.20	2012.50	1813.38
	MOTI MOYDI	Gamtal	Gamtal	1312.50	2975.00	179.82	467.11	1662.50	287.29
	MOTI MOYDI	Chowk	106	1312.50	3325.00	745.66	1873.55	2012.50	1127.89
	MOTI MOYDI	Vadla Faliyu	134	1312.50	3325.00	417.14	1015.71	2012.50	598.57
	PATEL DHUNDHA	Gamtal	Gamtal	1837.50	3325.00	548.73	988.70	1487.50	439.97
	PATEL DHUNDHA	School Faliya	213	1312.50	3325.00	2036.52	5407.93	2012.50	3371.41
	PATEL DHUNDHA	Mukhivalu Faliyu	276	1312.50	3325.00	2730.28	7928.72	2012.50	5198.44
	PATEL DHUNDHA	Mukhivalu Faliyu	278	1312.50	3325.00	2603.94	7814.17	2012.50	5210.23
	PATEL DHUNDHA	Thakor Faliyu	224	1312.50	3325.00	2911.85	7429.25	2012.50	4517.39
	PATEL DHUNDHA	River Faliya	84	1487.50	3325.00	604.12	1259.83	1837.50	655.71
	PATEL	Gameti Faliya	189	1312.50	3325.00	2049.52	4875.32	2012.50	2825.80

Name of Watershed	Village	Faliya	Survey No.	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Crop Productivity (Kg./ha.) (B.W.)	Crop Productivity (Kg./ha.) (A.W.)	Change in crop productivity (kg/ha.)	Change in crop productivity (kg/ha.)
				Rainfed	**Rainfed**	**Irrigated**	**Irrigated**	**Rainfed**	**Irrigated**
	DHUNDHA								
	UNDAVA	Harijan Vas	186	1312.50	3325.00	1613.22	3550.59	2012.50	1937.37
	UNDAVA	Thakor Faliyu	58	1312.50	3412.50	921.67	2369.23	2100.00	1447.56
	UNDAVA	Patel Faliya	14	1312.50	3325.00	956.49	2057.25	2012.50	1100.76
	UNDAVA	Gameti Faliyu	106	1312.50	3325.00	3051.31	6621.51	2012.50	3570.20
	UNDAVA	Gameti Faliyu	117	1837.50	3850.00	2489.61	4881.58	2012.50	2391.97
	UNDAVA	Vankar Faliyu	16	1312.50	3325.00	1167.51	2869.19	2012.50	1701.67
	UNDAVA	Darbar Faliyu	213	1312.50	3325.00	1179.95	3020.64	2012.50	1840.69
	UNDAVA	Thakor Vas	276	1312.50	3325.00	332.39	954.55	2012.50	622.16
	VADATHALI	Thakor Vas	100	1575.00	3325.00	2150.31	4735.94	1750.00	2585.63
	VADATHALI	Thakor Vas	112	1312.50	3150.00	1626.85	3593.98	1837.50	1967.13
	VADATHALI	Makavana Vas	84	1312.50	3325.00	516.40	1044.33	2012.50	527.93
	VADATHALI	Makavana Vas	89	1312.50	3325.00	1511.95	3435.66	2012.50	1923.71
	VADATHALI	Patel Vas	186	1662.50	3325.00	1407.66	2627.19	1662.50	1219.53
	VADATHALI	Patel Vas	188	1312.50	3325.00	586.39	1233.13	2012.50	646.74
	VADATHALI	Patel Vas	204	1312.50	2975.00	1137.50	2887.50	1662.50	1750.00
	VADATHALI	Thakor Vas	114	1312.50	3325.00	667.65	1679.50	2012.50	1011.85

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
RELLAVADA	RELLAVADA	Thakor Faliyu	45	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	RELLAVADA	Patel Faliya	152	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	RELLAVADA	Azad Faliyu	106	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	RELLAVADA	Azad Faliyu	168	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	RELLAVADA	Vankar Faliyu	16	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	RELLAVADA	Darbar Faliyu	213	2.0	3.0	1.0	12	18	6.00	278.00	300.00
KADVADI	KADVADI	Thakar Vas	276	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	KADVADI	Mukhi Nu Faliya	100	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	KADVADI	Thakar Vas	224	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	KADVADI	Mukhi Nu Faliya	84	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	KADVADI	Thakar Vas	189	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	KADVADI	Patel Vas	186	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	KADVADI	Mukhi Nu Faliyu	50	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	KADVADI	Mukhi Nu Fal	14	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	KADVADI	Thakar Vas	147	2.0	3.0	1.0	12	18	6.00	278.00	300.00
VALUNA	VALUNA	Shaktinagar	69	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	VALUNA	Shaktinagar	80	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	VALUNA	Makavana Vas	1	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	VALUNA	Shaktinagar	19	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	VALUNA	Patel Vas	45	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	VALUNA	Shaktinagar	64	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	VALUNA	Shaktinagar	108	1.0	4.0	3.0	6	24	18.00	278.00	300.00
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	MODARSUMBA	Dairivala	46	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	MODARSUMBA	Parmar	67	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	MODARSUMBA	Parmar	58	3.0	6.0	3.0	18	36	18.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	MODARSUMBA	Parmar	60	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MODARSUMBA	Parmar	66	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MODARSUMBA	Parmar	61	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	MODARSUMBA	Parmar	62	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	MODARSUMBA	Parmar	52	2.0	4.0	2.0	12	24	12.00	278.00	300.00
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	3.0	7.0	4.0	18	42	24.00	278.00	300.00
	MALEKPUR	Vadla Faliyu	108	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	MALEKPUR	Shayaro Faliyu	120	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	MALEKPUR	Bhathiji Faliyu	6	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	SHIKA KAMPA	Gamtal	Gamtal	2.0	6.0	4.0	12	36	24.00	278.00	300.00
	SHIKA KAMPA	Chowk	805	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	SHIKA KAMPA	Chowk	600	1.0	6.0	5.0	6	36	30.00	278.00	300.00
	SHIKA KAMPA	Gamtal	808	2.0	4.0	2.0	12	24	12.00	278.00	300.00
DAHEGAMDA	DAHEGAMDA	School Faliya	110	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	DAHEGAMDA	Mukhivalu Faliyu	138	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	DAHEGAMDA	Mukhivalu Faliyu	142	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DAHEGAMDA	Thakor Faliyu	69	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DAHEGAMDA	River Faliya	235	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	DAHEGAMDA	Master Faliya	45	2.0	4.0	2.0	12	24	12.00	278.00	300.00
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	UNCHI DHANAL	Toran Chowk	400	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	UNCHI DHANAL	Patel Vas	531	2.0	7.0	5.0	12	42	30.00	278.00	300.00
	UNCHI DHANAL	Mandvi Chowk	388	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	UNCHI DHANAL	Moti Faliyu	202	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	UNCHI DHANAL	Parmar Faliyu	5	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	UNCHI DHANAL	Mahadev Faliyu	138	1.0	5.0	4.0	6	30	24.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
LIMDA	LIMDA	Pipli Faliyu	136	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	LIMDA	Mothadiya	363	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	LIMDA	Asari Faliyu	350	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	LIMDA	Dungri Faliyu	2	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	LIMDA	Pipli Faliyu	134	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	LIMDA	Pipli Faliyu	138	2.0	4.0	2.0	12	24	12.00	278.00	300.00
DHANSOR	DHANSOR	Cholviya	220	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	DHANSOR	Cholviya	140	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	DHANSOR	Cholviya	46	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	DHANSOR	Sovaliya	202	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DHANSOR	Modiya	270	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	DHANSOR	Baranda	279	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	DHANSOR	Baranda	4	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	DHANSOR	Varsat	27	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	DHANSOR	Cholviya	224	2.0	4.0	2.0	12	24	12.00	278.00	300.00
SUNSAR	SUNSAR	Harijan Vas	38	1.0	1.0	0.0	6	6	0.00	278.00	300.00
	SUNSAR	Harijan Vas	45	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	SUNSAR	Baranda	85	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	SUNSAR	Patel Faliya	110	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	SUNSAR	Parmar Vas	155	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	SUNSAR	Parmar Vas	161	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	SUNSAR	Thakor Faliyu	184	1.0	2.0	1.0	6	12	6.00	278.00	300.00
RAHEDA	RAHEDA	Harijan Vas	33	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	RAHEDA	Patel Faliya	374	1.0	5.0	4.0	6	30	24.00	278.00	300.00
	RAHEDA	Patel Faliya	389	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	RAHEDA	Bus Stand Faliya	128	2.0	4.0	2.0	12	24	12.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	RAHEDA	Thakor Vas	258	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	RAHEDA	Bus Stand Faliya	138	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	RAHEDA	Patel Faliya	289	2.0	4.0	2.0	12	24	12.00	278.00	300.00
RAVOL	RAVOL	Vaghari	140	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	RAVOL	Vaghari	144	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	RAVOL	Nanavaash	104	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	RAVOL	Motavaash	110	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	RAVOL	Parmarvaash	42	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	RAVOL	Parmar Faliyu	147	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	RAVOL	Parmar Faliyu	182	2.0	5.0	3.0	12	30	18.00	278.00	300.00
DOTAD	DOTAD	Vankar Faliyu	265	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	DOTAD	Parmar Faliyu	94	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DOTAD	Patel Vas	224	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	DOTAD	Asari Faliyu	64	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DOTAD	Chowk	11	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DOTAD	Harijan Vas	279	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	DOTAD	Darbar Faliyu	45	2.0	4.0	2.0	12	24	12.00	278.00	300.00
FINCHOD	FINCHOD	Asari Faliyu	14	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	FINCHOD	Parmar Faliyu	54	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	FINCHOD	Patel Vas	112	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	FINCHOD	Bus Stand Faliya	68	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	FINCHOD	Vankar Faliyu	165	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	FINCHOD	Harijan Vas	180	2.0	4.0	2.0	12	24	12.00	278.00	300.00
MOLLI	MOLLI	Juni Molli	175	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	MOLLI	Molllikhant	327	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	MOLLI	Suratanpur	110	1.0	1.0	0.0	6	6	0.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	MOLLI	Molli	45	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MOLLI	Goraya	112	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	MOLLI	Molli	49	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	MOLLI	Nanaji	141	1.0	2.0	1.0	6	12	6.00	278.00	300.00
PARSODA	PARSODA	Rathod Faliyu	123	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	PARSODA	Panchal Faliyu	54	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	PARSODA	Patel Faliyu	69	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	PARSODA	Patel Faliyu	78	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	PARSODA	Prajapati Vas	114	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	PARSODA	Prajapati Vas	120	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	PARSODA	Modh Vas	144	2.0	4.0	2.0	12	24	12.00	278.00	300.00
VANKANEDA	VANKANEDA	Poojara Vas	211	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	VANKANEDA	Parmar Vas	302	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	VANKANEDA	Patel Faliyu	117	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	VANKANEDA	Rathod Faliyu	81	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	VANKANEDA	Patel Faliyu	112	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	VANKANEDA	Patel Faliyu	122	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	VANKANEDA	Bus Stand Faliya	77	2.0	3.0	1.0	12	18	6.00	278.00	300.00
AJAWAS	KALIKANKAR	Patel Faliyu	138	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	KALIKANKAR	Thakor Faliyu	288	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	KALIKANKAR	Prajapati Vas	142	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	KALIKANKAR	Vankar Faliyu	168	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	KALIKANKAR	Vankar Faliyu	169	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	MAMAPIPALA	Damor Vas	110	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MAMAPIPALA	Damor Vas	114	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	MAMAPIPALA	Pandor Vas	147	2.0	3.0	1.0	12	18	6.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	MAMAPIPALA	Pandor Vas	151	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	MAMAPIPALA	Pandor Vas	155	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	BEDI	Ninama Vas	94	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	BEDI	Ninama Vas	97	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	BEDI	Harijan Vas	62	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	BEDI	Harijan Vas	58	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	BEDI	Harijan Vas	53	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	AJAWAS	Ninama Vas	45	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	AJAWAS	Pandor Vas	14	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	AJAWAS	Harijan Faliyu	54	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	AJAWAS	Prajapati Vas	112	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	AJAWAS	Prajapati Vas	114	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	AJAWAS	Vankar Faliyu	165	2.0	4.0	2.0	12	24	12.00	278.00	300.00
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	DAMOR DHUNDHA	Damor Vas	184	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	DAMOR DHUNDHA	Damor Vas	198	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	DAMOR DHUNDHA	Damor Vas	221	3.0	7.0	4.0	18	42	24.00	278.00	300.00
	DAMOR DHUNDHA	Damor Vas	223	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	DHEMADA	Parmar Faliyu	16	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	DHEMADA	Parmar Faliyu	18	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	DHEMADA	Parmar Faliyu	22	2.0	6.0	4.0	12	36	24.00	278.00	300.00
	DHEMADA	Parmar Faliyu	26	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	DHEMADA	Parmar Faliyu	29	1.0	6.0	5.0	6	36	30.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	DHEMADA	Parmar Faliyu	33	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MOTI MOYDI	Vadla Faliyu	186	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	MOTI MOYDI	Harijan Vas	224	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	MOTI MOYDI	Bhathiji Faliyu	268	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MOTI MOYDI	Gamtal	Gamtal	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	MOTI MOYDI	Chowk	106	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	MOTI MOYDI	Vadla Faliyu	134	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	PATEL DHUNDHA	Gamtal	Gamtal	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	PATEL DHUNDHA	School Faliya	213	3.0	6.0	3.0	18	36	18.00	278.00	300.00
	PATEL DHUNDHA	Mukhivalu Faliyu	276	2.0	7.0	5.0	12	42	30.00	278.00	300.00
	PATEL DHUNDHA	Mukhivalu Faliyu	278	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	PATEL DHUNDHA	Thakor Faliyu	224	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	PATEL DHUNDHA	River Faliya	84	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	PATEL DHUNDHA	Gameti Faliya	189	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	UNDAVA	Harijan Vas	186	1.0	2.0	1.0	6	12	6.00	278.00	300.00
	UNDAVA	Thakor Faliyu	58	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	UNDAVA	Patel Faliya	14	2.0	2.0	0.0	12	12	0.00	278.00	300.00
	UNDAVA	Gameti Faliyu	106	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	UNDAVA	Gameti Faliyu	117	2.0	4.0	2.0	12	24	12.00	278.00	300.00
	UNDAVA	Vankar Faliyu	16	3.0	4.0	1.0	18	24	6.00	278.00	300.00
	UNDAVA	Darbar Faliyu	213	2.0	3.0	1.0	12	18	6.00	278.00	300.00
	UNDAVA	Thakor Vas	276	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	VADATHALI	Thakor Vas	100	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	VADATHALI	Thakor Vas	112	3.0	5.0	2.0	18	30	12.00	278.00	300.00
	VADATHALI	Makavana Vas	84	1.0	3.0	2.0	6	18	12.00	278.00	300.00
	VADATHALI	Makavana Vas	89	2.0	4.0	2.0	12	24	12.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	livestock (No.) (B.W)	livestock (No.) (A.W)	Change in livestock (No.)	milk production (lit./day) (B.W.)	milk production (lit./day) (A.W.)	Change in milk production (lit./day)	Ave. days of milking (B.W)	Ave. days of milking (A.W)
	VADATHALI	Patel Vas	186	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	VADATHALI	Patel Vas	188	1.0	4.0	3.0	6	24	18.00	278.00	300.00
	VADATHALI	Patel Vas	204	2.0	5.0	3.0	12	30	18.00	278.00	300.00
	VADATHALI	Thakor Vas	114	2.0	5.0	3.0	12	30	18.00	278.00	300.00

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
RELLAVADA	RELLAVADA	Thakor Faliyu	45	38.00	45.00	190152.00	324000.00	133848	3	1	-2
	RELLAVADA	Patel Faliya	152	38.00	45.00	126768.00	324000.00	197232	2	1	-1
	RELLAVADA	Azad Faliyu	106	38.00	45.00	126768.00	405000.00	278232	1	0	-1
	RELLAVADA	Azad Faliyu	168	38.00	45.00	63384.00	162000.00	98616	0	0	0
	RELLAVADA	Vankar Faliyu	16	38.00	45.00	126768.00	243000.00	116232	1	0	-1
	RELLAVADA	Darbar Faliyu	213	38.00	45.00	126768.00	243000.00	116232	3	1	-2
KADVADI	KADVADI	Thakar Vas	276	38.00	45.00	190152.00	324000.00	133848	3	1	-2
	KADVADI	Mukhi Nu Faliya	100	38.00	45.00	126768.00	162000.00	35232	1	0	-1
	KADVADI	Thakar Vas	224	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	KADVADI	Mukhi Nu Faliya	84	38.00	45.00	126768.00	243000.00	116232	2	0	-2
	KADVADI	Thakar Vas	189	38.00	45.00	126768.00	162000.00	35232	4	1	-3
	KADVADI	Patel Vas	186	38.00	45.00	190152.00	324000.00	133848	2	0	-2
	KADVADI	Mukhi Nu Faliyu	50	38.00	45.00	126768.00	324000.00	197232	1	0	-1
	KADVADI	Mukhi Nu Fal	14	38.00	45.00	190152.00	324000.00	133848	0	0	0
	KADVADI	Thakar Vas	147	38.00	45.00	126768.00	243000.00	116232	3	1	-2
VALUNA	VALUNA	Shaktinagar	69	38.00	45.00	126768.00	405000.00	278232	3	0	-3
	VALUNA	Shaktinagar	80	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	VALUNA	Makavana Vas	1	38.00	45.00	190152.00	405000.00	214848	3	1	-2
	VALUNA	Shaktinagar	19	38.00	45.00	63384.00	243000.00	179616	2	0	-2
	VALUNA	Patel Vas	45	38.00	45.00	126768.00	324000.00	197232	0	0	0
	VALUNA	Shaktinagar	64	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	VALUNA	Shaktinagar	108	38.00	45.00	63384.00	324000.00	260616	3	1	-2
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	MODARSUMBA	Dairivala	46	38.00	45.00	126768.00	405000.00	278232	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	MODARSUMBA	Parmar	67	38.00	45.00	190152.00	486000.00	295848	3	0	-3
	MODARSUMBA	Parmar	58	38.00	45.00	190152.00	486000.00	295848	3	1	-2
	MODARSUMBA	Parmar	60	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	MODARSUMBA	Parmar	66	38.00	45.00	126768.00	324000.00	197232	4	2	-2
	MODARSUMBA	Parmar	61	38.00	45.00	63384.00	243000.00	179616	2	0	-2
	MODARSUMBA	Parmar	62	38.00	45.00	63384.00	324000.00	260616	1	0	-1
	MODARSUMBA	Parmar	52	38.00	45.00	126768.00	324000.00	197232	2	0	-2
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	38.00	45.00	190152.00	567000.00	376848	2	0	-2
	MALEKPUR	Vadla Faliyu	108	38.00	45.00	190152.00	486000.00	295848	2	0	-2
	MALEKPUR	Shayaro Faliyu	120	38.00	45.00	190152.00	405000.00	214848	2	0	-2
	MALEKPUR	Bhathiji Faliyu	6	38.00	45.00	190152.00	486000.00	295848	2	0	-2
	SHIKA KAMPA	Gamtal	Gamtal	38.00	45.00	126768.00	486000.00	359232	0	0	0
	SHIKA KAMPA	Chowk	805	38.00	45.00	126768.00	405000.00	278232	3	1	-2
	SHIKA KAMPA	Chowk	600	38.00	45.00	63384.00	486000.00	422616	0	0	0
	SHIKA KAMPA	Gamtal	808	38.00	45.00	126768.00	324000.00	197232	2	0	-2
DAHEGAMDA	DAHEGAMDA	School Faliya	110	38.00	45.00	63384.00	162000.00	98616	2	0	-2
	DAHEGAMDA	Mukhivalu Faliyu	138	38.00	45.00	126768.00	243000.00	116232	2	1	-1
	DAHEGAMDA	Mukhivalu Faliyu	142	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	DAHEGAMDA	Thakor Faliyu	69	38.00	45.00	126768.00	324000.00	197232	3	0	-3
	DAHEGAMDA	River Faliya	235	38.00	45.00	63384.00	324000.00	260616	4	2	-2
	DAHEGAMDA	Master Faliya	45	38.00	45.00	126768.00	324000.00	197232	3	1	-2
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	38.00	45.00	126768.00	243000.00	116232	4	1	-3
	UNCHI DHANAL	Toran Chowk	400	38.00	45.00	190152.00	486000.00	295848	4	2	-2
	UNCHI DHANAL	Patel Vas	531	38.00	45.00	126768.00	567000.00	440232	2	0	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	UNCHI DHANAL	Mandvi Chowk	388	38.00	45.00	126768.00	405000.00	278232	2	1	-1
	UNCHI DHANAL	Moti Faliyu	202	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	UNCHI DHANAL	Parmar Faliyu	5	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	UNCHI DHANAL	Mahadev Faliyu	138	38.00	45.00	63384.00	405000.00	341616	0	0	0
LIMDA	LIMDA	Pipli Faliyu	136	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	LIMDA	Mothadiya	363	38.00	45.00	190152.00	324000.00	133848	3	1	-2
	LIMDA	Asari Faliyu	350	38.00	45.00	126768.00	324000.00	197232	1	0	-1
	LIMDA	Dungri Faliyu	2	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	LIMDA	Pipli Faliyu	134	38.00	45.00	190152.00	405000.00	214848	3	1	-2
	LIMDA	Pipli Faliyu	138	38.00	45.00	126768.00	324000.00	197232	2	0	-2
DHANSOR	DHANSOR	Cholviya	220	38.00	45.00	126768.00	243000.00	116232	1	0	-1
	DHANSOR	Cholviya	140	38.00	45.00	63384.00	162000.00	98616	2	0	-2
	DHANSOR	Cholviya	46	38.00	45.00	126768.00	162000.00	35232	3	1	-2
	DHANSOR	Sovaliya	202	38.00	45.00	126768.00	324000.00	197232	1	1	0
	DHANSOR	Modiya	270	38.00	45.00	63384.00	243000.00	179616	2	0	-2
	DHANSOR	Baranda	279	38.00	45.00	63384.00	243000.00	179616	3	1	-2
	DHANSOR	Baranda	4	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	DHANSOR	Varsat	27	38.00	45.00	190152.00	405000.00	214848	4	2	-2
	DHANSOR	Cholviya	224	38.00	45.00	126768.00	324000.00	197232	2	0	-2
SUNSAR	SUNSAR	Harijan Vas	38	38.00	45.00	63384.00	81000.00	17616	2	0	-2
	SUNSAR	Harijan Vas	45	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	SUNSAR	Baranda	85	38.00	45.00	126768.00	324000.00	197232	1	0	-1
	SUNSAR	Patel Faliya	110	38.00	45.00	63384.00	243000.00	179616	0	0	0
	SUNSAR	Parmar Vas	155	38.00	45.00	63384.00	243000.00	179616	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	SUNSAR	Parmar Vas	161	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	SUNSAR	Thakor Faliyu	184	38.00	45.00	63384.00	162000.00	98616	2	1	-1
RAHEDA	RAHEDA	Harijan Vas	33	38.00	45.00	126768.00	243000.00	116232	2	0	-2
	RAHEDA	Patel Faliya	374	38.00	45.00	63384.00	405000.00	341616	0	0	0
	RAHEDA	Patel Faliya	389	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	RAHEDA	Bus Stand Faliya	128	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	RAHEDA	Thakor Vas	258	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	RAHEDA	Bus Stand Faliya	138	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	RAHEDA	Patel Faliya	289	38.00	45.00	126768.00	324000.00	197232	2	0	-2
RAVOL	RAVOL	Vaghari	140	38.00	45.00	190152.00	324000.00	133848	3	1	-2
	RAVOL	Vaghari	144	38.00	45.00	126768.00	243000.00	116232	2	0	-2
	RAVOL	Nanavaash	104	38.00	45.00	190152.00	405000.00	214848	2	0	-2
	RAVOL	Motavaash	110	38.00	45.00	126768.00	324000.00	197232	2	1	-1
	RAVOL	Parmarvaash	42	38.00	45.00	63384.00	243000.00	179616	3	1	-2
	RAVOL	Parmar Faliyu	147	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	RAVOL	Parmar Faliyu	182	38.00	45.00	126768.00	405000.00	278232	2	0	-2
DOTAD	DOTAD	Vankar Faliyu	265	38.00	45.00	63384.00	243000.00	179616	2	1	-1
	DOTAD	Parmar Faliyu	94	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	DOTAD	Patel Vas	224	38.00	45.00	63384.00	324000.00	260616	2	0	-2
	DOTAD	Asari Faliyu	64	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	DOTAD	Chowk	11	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	DOTAD	Harijan Vas	279	38.00	45.00	63384.00	162000.00	98616	2	1	-1
	DOTAD	Darbar Faliyu	45	38.00	45.00	126768.00	324000.00	197232	2	0	-2
FINCHOD	FINCHOD	Asari Faliyu	14	38.00	45.00	126768.00	324000.00	197232	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	FINCHOD	Parmar Faliyu	54	38.00	45.00	126768.00	324000.00	197232	2	1	-1
	FINCHOD	Patel Vas	112	38.00	45.00	63384.00	243000.00	179616	2	2	0
	FINCHOD	Bus Stand Faliya	68	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	FINCHOD	Vankar Faliyu	165	38.00	45.00	63384.00	162000.00	98616	2	0	-2
	FINCHOD	Harijan Vas	180	38.00	45.00	126768.00	324000.00	197232	3	1	-2
MOLLI	MOLLI	Juni Molli	175	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	MOLLI	Molllikhant	327	38.00	45.00	126768.00	162000.00	35232	3	2	-1
	MOLLI	Suratanpur	110	38.00	45.00	63384.00	81000.00	17616	1	1	0
	MOLLI	Molli	45	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	MOLLI	Goraya	112	38.00	45.00	126768.00	243000.00	116232	2	1	-1
	MOLLI	Molli	49	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	MOLLI	Nanaji	141	38.00	45.00	63384.00	162000.00	98616	2	1	-1
PARSODA	PARSODA	Rathod Faliyu	123	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	PARSODA	Panchal Faliyu	54	38.00	45.00	126768.00	243000.00	116232	0	0	0
	PARSODA	Patel Faliyu	69	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	PARSODA	Patel Faliyu	78	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	PARSODA	Prajapati Vas	114	38.00	45.00	63384.00	162000.00	98616	2	1	-1
	PARSODA	Prajapati Vas	120	38.00	45.00	63384.00	162000.00	98616	2	0	-2
	PARSODA	Modh Vas	144	38.00	45.00	126768.00	324000.00	197232	2	0	-2
VANKANEDA	VANKANEDA	Poojara Vas	211	38.00	45.00	126768.00	243000.00	116232	0	0	0
	VANKANEDA	Parmar Vas	302	38.00	45.00	126768.00	243000.00	116232	1	1	0
	VANKANEDA	Patel Faliyu	117	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	VANKANEDA	Rathod Faliyu	81	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	VANKANEDA	Patel Faliyu	112	38.00	45.00	63384.00	162000.00	98616	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	VANKANEDA	Patel Faliyu	122	38.00	45.00	190152.00	405000.00	214848	1	1	0
	VANKANEDA	Bus Stand Faliya	77	38.00	45.00	126768.00	243000.00	116232	1	0	-1
AJAWAS	KALIKANKAR	Patel Faliyu	138	38.00	45.00	126768.00	162000.00	35232	1	0	-1
	KALIKANKAR	Thakor Faliyu	288	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	KALIKANKAR	Prajapati Vas	142	38.00	45.00	126768.00	243000.00	116232	2	0	-2
	KALIKANKAR	Vankar Faliyu	168	38.00	45.00	126768.00	162000.00	35232	4	1	-3
	KALIKANKAR	Vankar Faliyu	169	38.00	45.00	190152.00	324000.00	133848	2	0	-2
	MAMAPIPALA	Damor Vas	110	38.00	45.00	126768.00	324000.00	197232	1	0	-1
	MAMAPIPALA	Damor Vas	114	38.00	45.00	190152.00	324000.00	133848	0	0	0
	MAMAPIPALA	Pandor Vas	147	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	MAMAPIPALA	Pandor Vas	151	38.00	45.00	126768.00	405000.00	278232	3	0	-3
	MAMAPIPALA	Pandor Vas	155	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	BEDI	Ninama Vas	94	38.00	45.00	190152.00	405000.00	214848	3	1	-2
	BEDI	Ninama Vas	97	38.00	45.00	63384.00	243000.00	179616	2	0	-2
	BEDI	Harijan Vas	62	38.00	45.00	126768.00	324000.00	197232	0	0	0
	BEDI	Harijan Vas	58	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	BEDI	Harijan Vas	53	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	AJAWAS	Ninama Vas	45	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	AJAWAS	Pandor Vas	14	38.00	45.00	126768.00	405000.00	278232	3	1	-2
	AJAWAS	Harijan Faliyu	54	38.00	45.00	190152.00	486000.00	295848	3	0	-3
	AJAWAS	Prajapati Vas	112	38.00	45.00	190152.00	486000.00	295848	3	1	-2
	AJAWAS	Prajapati Vas	114	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	AJAWAS	Vankar Faliyu	165	38.00	45.00	126768.00	324000.00	197232	4	2	-2
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	38.00	45.00	63384.00	243000.00	179616	2	0	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	DAMOR DHUNDHA	Damor Vas	184	38.00	45.00	63384.00	324000.00	260616	1	0	-1
	DAMOR DHUNDHA	Damor Vas	198	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	DAMOR DHUNDHA	Damor Vas	221	38.00	45.00	190152.00	567000.00	376848	2	0	-2
	DAMOR DHUNDHA	Damor Vas	223	38.00	45.00	190152.00	486000.00	295848	2	0	-2
	DHEMADA	Parmar Faliyu	16	38.00	45.00	190152.00	405000.00	214848	2	0	-2
	DHEMADA	Parmar Faliyu	18	38.00	45.00	190152.00	486000.00	295848	2	0	-2
	DHEMADA	Parmar Faliyu	22	38.00	45.00	126768.00	486000.00	359232	0	0	0
	DHEMADA	Parmar Faliyu	26	38.00	45.00	126768.00	405000.00	278232	3	1	-2
	DHEMADA	Parmar Faliyu	29	38.00	45.00	63384.00	486000.00	422616	0	0	0
	DHEMADA	Parmar Faliyu	33	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	MOTI MOYDI	Vadla Faliyu	186	38.00	45.00	63384.00	162000.00	98616	2	0	-2
	MOTI MOYDI	Harijan Vas	224	38.00	45.00	126768.00	243000.00	116232	2	1	-1
	MOTI MOYDI	Bhathiji Faliyu	268	38.00	45.00	126768.00	324000.00	197232	2	0	-2
	MOTI MOYDI	Gamtal	Gamtal	38.00	45.00	126768.00	324000.00	197232	3	0	-3
	MOTI MOYDI	Chowk	106	38.00	45.00	63384.00	324000.00	260616	4	2	-2
	MOTI MOYDI	Vadla Faliyu	134	38.00	45.00	126768.00	324000.00	197232	3	1	-2
	PATEL DHUNDHA	Gamtal	Gamtal	38.00	45.00	126768.00	243000.00	116232	4	1	-3
	PATEL DHUNDHA	School Faliya	213	38.00	45.00	190152.00	486000.00	295848	4	2	-2
	PATEL DHUNDHA	Mukhivalu Faliyu	276	38.00	45.00	126768.00	567000.00	440232	2	0	-2
	PATEL DHUNDHA	Mukhivalu Faliyu	278	38.00	45.00	126768.00	405000.00	278232	2	1	-1
	PATEL DHUNDHA	Thakor Faliyu	224	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	PATEL DHUNDHA	River Faliya	84	38.00	45.00	126768.00	324000.00	197232	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Rate of milk (Rs./lit.) (B.W.)	Rate of milk (Rs./lit.) (A.W.)	Annual income due to M.P (Rs.) (B.W.)	Annual income due to M.P (Rs.) (A.W.)	Change in annual income due to M.P (Rs.)	No. of persons migrating (B.W.)	No. of persons migrating (A.W.)	Change in migration (No.)
	PATEL DHUNDHA	Gameti Faliya	189	38.00	45.00	126768.00	162000.00	35232	1	0	-1
	UNDAVA	Harijan Vas	186	38.00	45.00	63384.00	162000.00	98616	3	1	-2
	UNDAVA	Thakor Faliyu	58	38.00	45.00	126768.00	243000.00	116232	2	0	-2
	UNDAVA	Patel Faliya	14	38.00	45.00	126768.00	162000.00	35232	4	1	-3
	UNDAVA	Gameti Faliyu	106	38.00	45.00	190152.00	324000.00	133848	2	0	-2
	UNDAVA	Gameti Faliyu	117	38.00	45.00	126768.00	324000.00	197232	1	0	-1
	UNDAVA	Vankar Faliyu	16	38.00	45.00	190152.00	324000.00	133848	0	0	0
	UNDAVA	Darbar Faliyu	213	38.00	45.00	126768.00	243000.00	116232	3	1	-2
	UNDAVA	Thakor Vas	276	38.00	45.00	126768.00	405000.00	278232	3	0	-3
	VADATHALI	Thakor Vas	100	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	VADATHALI	Thakor Vas	112	38.00	45.00	190152.00	405000.00	214848	3	1	-2
	VADATHALI	Makavana Vas	84	38.00	45.00	63384.00	243000.00	179616	2	0	-2
	VADATHALI	Makavana Vas	89	38.00	45.00	126768.00	324000.00	197232	0	0	0
	VADATHALI	Patel Vas	186	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	VADATHALI	Patel Vas	188	38.00	45.00	63384.00	324000.00	260616	3	1	-2
	VADATHALI	Patel Vas	204	38.00	45.00	126768.00	405000.00	278232	2	0	-2
	VADATHALI	Thakor Vas	114	38.00	45.00	126768.00	405000.00	278232	3	1	-2

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
RELLAVADA	RELLAVADA	Thakor Faliyu	45	8	240	180	5760	1440	50	70662.55	43662.55	-27000
	RELLAVADA	Patel Faliya	152	8	242	182	3872	1456	50	58862.55	43762.55	-15100
	RELLAVADA	Azad Faliyu	106	8	242	182	1936	0	50	46762.55	34662.55	-12100
	RELLAVADA	Azad Faliyu	168	8	245	185	0	0	50	34662.55	34662.55	0
	RELLAVADA	Vankar Faliyu	16	8	243	183	1944	0	50	46812.55	34662.55	-12150
	RELLAVADA	Darbar Faliyu	213	8	238	178	5712	1424	50	70362.55	43562.55	-26800
KADVADI	KADVADI	Thakar Vas	276	8	240	180	5760	1440	50	35176.61	8176.61	-27000
	KADVADI	Mukhi Nu Faliya	100	8	242	182	1936	0	50	11276.61	-823.39	-12100
	KADVADI	Thakar Vas	224	8	242	182	5808	1456	50	35476.61	8276.61	-27200
	KADVADI	Mukhi Nu Faliya	84	8	245	185	3920	0	50	23676.61	-823.39	-24500
	KADVADI	Thakar Vas	189	8	243	182	7776	1456	50	47776.61	8276.61	-39500
	KADVADI	Patel Vas	186	8	238	185	3808	0	50	22976.61	-823.39	-23800
	KADVADI	Mukhi Nu Faliyu	50	8	240	183	1920	0	50	11176.61	-823.39	-12000
	KADVADI	Mukhi Nu Fal	14	8	240	178	0	0	50	-823.39	-823.39	0
	KADVADI	Thakar Vas	147	8	240	180	5760	1440	50	35176.61	8176.61	-27000
VALUNA	VALUNA	Shaktinagar	69	8	242	182	5808	0	50	35645.67	-654.33	-36300
	VALUNA	Shaktinagar	80	8	242	182	3872	0	50	23545.67	-654.33	-24200
	VALUNA	Makavana Vas	1	8	245	185	5880	1480	50	36095.67	8595.67	-27500
	VALUNA	Shaktinagar	19	8	243	183	3888	0	50	23645.67	-654.33	-24300
	VALUNA	Patel Vas	45	8	238	178	0	0	50	-654.33	-654.33	0
	VALUNA	Shaktinagar	64	8	240	182	5760	1456	50	35345.67	8445.67	-26900
	VALUNA	Shaktinagar	108	8	240	185	5760	1480	50	35345.67	8595.67	-26750
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	8	240	183	3840	0	50	23199.85	-800.15	-24000
	MODARSUMBA	Dairivala	46	8	242	178	5808	1424	50	35499.85	8099.85	-27400

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	MODARSUMBA	Parmar Faliyu	67	8	242	180	5808	0	50	35499.85	-800.15	-36300
	MODARSUMBA	Parmar Faliyu	58	8	245	182	5880	1456	50	35949.85	8299.85	-27650
	MODARSUMBA	Parmar Faliyu	60	8	243	183	5832	1464	50	35649.85	8349.85	-27300
	MODARSUMBA	Parmar Faliyu	66	8	238	178	7616	2848	50	46799.85	16999.85	-29800
	MODARSUMBA	Parmar Faliyu	61	8	240	180	3840	0	50	23199.85	-800.15	-24000
	MODARSUMBA	Parmar Faliyu	62	8	240	180	1920	0	50	11199.85	-800.15	-12000
	MODARSUMBA	Parmar Faliyu	52	8	242	182	3872	0	50	23399.85	-800.15	-24200
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	8	242	182	3872	0	50	23889.4	-310.6	-24200
	MALEKPUR	Vadla Faliyu	108	8	245	185	3920	0	50	24189.4	-310.6	-24500
	MALEKPUR	Shayaro Faliyu	120	8	243	183	3888	0	50	23989.4	-310.6	-24300
	MALEKPUR	Bhathiji Faliyu	6	8	238	178	3808	0	50	23489.4	-310.6	-23800
	SHIKA KAMPA	Gamtal	Gamtal	8	240	180	0	0	50	-310.6	-310.6	0
	SHIKA KAMPA	Chowk	805	8	240	182	5760	1456	50	35689.4	8789.4	-26900
	SHIKA KAMPA	Chowk	600	8	240	180	0	0	50	-310.6	-310.6	0
	SHIKA KAMPA	Gamtal	808	8	242	182	3872	0	50	23889.4	-310.6	-24200
DAHEGAMDA	DAHEGAMDA	School Faliya	110	8	242	182	3872	0	50	23449.6	-750.4	-24200
	DAHEGAMDA	Mukhivalu Faliyu	138	8	245	185	3920	1480	50	23749.6	8499.6	-15250
	DAHEGAMDA	Mukhivalu Faliyu	142	8	243	183	3888	0	50	23549.6	-750.4	-24300
	DAHEGAMDA	Thakor Faliyu	69	8	238	178	5712	0	50	34949.6	-750.4	-35700
	DAHEGAMDA	River Faliya	235	8	240	182	7680	2912	50	47249.6	17449.6	-29800
	DAHEGAMDA	Master Faliya	45	8	240	185	5760	1480	50	35249.6	8499.6	-26750
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	8	242	183	7744	1464	50	47560.58	8310.58	-39250
	UNCHI DHANAL	Toran Chowk	400	8	242	178	7744	2848	50	47560.58	16960.58	-30600
	UNCHI DHANAL	Patel Vas	531	8	245	180	3920	0	50	23660.58	-839.42	-24500

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	UNCHI DHANAL	Mandvi Chowk	388	8	243	182	3888	1456	50	23460.58	8260.58	-15200
	UNCHI DHANAL	Moti Faliyu	202	8	238	178	3808	0	50	22960.58	-839.42	-23800
	UNCHI DHANAL	Parmar Faliyu	5	8	240	180	5760	1440	50	35160.58	8160.58	-27000
	UNCHI DHANAL	Mahadev Faliyu	138	8	240	180	0	0	50	-839.42	-839.42	0
LIMDA	LIMDA	Pipli Faliyu	136	8	242	182	5808	1456	50	35186.61	7986.61	-27200
	LIMDA	Mothadiya	363	8	242	185	5808	1480	50	35186.61	8136.61	-27050
	LIMDA	Asari Faliyu	350	8	245	183	1960	0	50	11136.61	-1113.39	-12250
	LIMDA	Dungri Faliyu	2	8	243	178	5832	1424	50	35336.61	7786.61	-27550
	LIMDA	Pipli Faliyu	134	8	238	180	5712	1440	50	34586.61	7886.61	-26700
	LIMDA	Pipli Faliyu	138	8	240	182	3840	0	50	22886.61	-1113.39	-24000
DHANSOR	DHANSOR	Cholviya	220	8	236	176	1888	0	50	11174.72	-625.28	-11800
	DHANSOR	Cholviya	140	8	240	180	3840	0	50	23374.72	-625.28	-24000
	DHANSOR	Cholviya	46	8	240	180	5760	1440	50	35374.72	8374.72	-27000
	DHANSOR	Sovaliya	202	8	245	182	1960	1456	50	11624.72	8474.72	-3150
	DHANSOR	Modiya	270	8	243	185	3888	0	50	23674.72	-625.28	-24300
	DHANSOR	Baranda	279	8	238	183	5712	1464	50	35074.72	8524.72	-26550
	DHANSOR	Baranda	4	8	240	178	5760	1424	50	35374.72	8274.72	-27100
	DHANSOR	Varsat	27	8	236	180	7552	2880	50	46574.72	17374.72	-29200
	DHANSOR	Cholviya	224	8	240	182	3840	0	50	23374.72	-625.28	-24000
SUNSAR	SUNSAR	Harijan Vas	38	8	240	180	3840	0	50	23439.11	-560.89	-24000
	SUNSAR	Harijan Vas	45	8	245	185	5880	1480	50	36189.11	8689.11	-27500
	SUNSAR	Baranda	85	8	243	183	1944	0	50	11589.11	-560.89	-12150
	SUNSAR	Patel Faliya	110	8	238	178	0	0	50	-560.89	-560.89	0
	SUNSAR	Parmar Vas	155	8	240	180	5760	1440	50	35439.11	8439.11	-27000

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	SUNSAR	Parmar Vas	161	8	236	182	5664	1456	50	34839.11	8539.11	-26300
	SUNSAR	Thakor Faliyu	184	8	240	185	3840	1480	50	23439.11	8689.11	-14750
RAHEDA	RAHEDA	Harijan Vas	33	8	240	183	3840	0	50	23609.02	-390.98	-24000
	RAHEDA	Patel Faliya	374	8	245	178	0	0	50	-390.98	-390.98	0
	RAHEDA	Patel Faliya	389	8	243	180	5832	1440	50	36059.02	8609.02	-27450
	RAHEDA	Bus Stand Faliya	128	8	238	182	5712	1456	50	35309.02	8709.02	-26600
	RAHEDA	Thakor Vas	258	8	240	180	5760	1440	50	35609.02	8609.02	-27000
	RAHEDA	Bus Stand Faliya	138	8	236	176	5664	1408	50	35009.02	8409.02	-26600
	RAHEDA	Patel Faliya	289	8	240	180	3840	0	50	23609.02	-390.98	-24000
RAVOL	RAVOL	Vaghari	140	8	240	180	5760	1440	50	35303.05	8303.05	-27000
	RAVOL	Vaghari	144	8	245	182	3920	0	50	23803.05	-696.95	-24500
	RAVOL	Nanavaash	104	8	243	185	3888	0	50	23603.05	-696.95	-24300
	RAVOL	Motavaash	110	8	238	183	3808	1464	50	23103.05	8453.05	-14650
	RAVOL	Parmarvaash	42	8	240	178	5760	1424	50	35303.05	8203.05	-27100
	RAVOL	Parmar Faliyu	147	8	236	180	5664	1440	50	34703.05	8303.05	-26400
	RAVOL	Parmar Faliyu	182	8	240	182	3840	0	50	23303.05	-696.95	-24000
DOTAD	DOTAD	Vankar Faliyu	265	8	240	180	3840	1440	50	23433.61	8433.61	-15000
	DOTAD	Parmar Faliyu	94	8	245	185	3920	0	50	23933.61	-566.39	-24500
	DOTAD	Patel Vas	224	8	243	183	3888	0	50	23733.61	-566.39	-24300
	DOTAD	Asari Faliyu	64	8	238	178	5712	1424	50	35133.61	8333.61	-26800
	DOTAD	Chowk	11	8	240	180	5760	1440	50	35433.61	8433.61	-27000
	DOTAD	Harijan Vas	279	8	236	176	3776	1408	50	23033.61	8233.61	-14800
	DOTAD	Darbar Faliyu	45	8	240	180	3840	0	50	23433.61	-566.39	-24000
FINCHOD	FINCHOD	Asari Faliyu	14	8	240	180	5760	1440	50	34942.92	7942.92	-27000

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	FINCHOD	Parmar Faliyu	54	8	240	182	3840	1456	50	22942.92	8042.92	-14900
	FINCHOD	Patel Vas	112	8	245	185	3920	2960	50	23442.92	17442.92	-6000
	FINCHOD	Bus Stand Faliya	68	8	243	183	5832	1464	50	35392.92	8092.92	-27300
	FINCHOD	Vankar Faliyu	165	8	238	178	3808	0	50	22742.92	-1057.08	-23800
	FINCHOD	Harijan Vas	180	8	240	180	5760	1440	50	34942.92	7942.92	-27000
MOLLI	MOLLI	Juni Molli	175	8	236	182	5664	1456	50	33972.61	7672.61	-26300
	MOLLI	Molllikhant	327	8	240	180	5760	2880	50	34572.61	16572.61	-18000
	MOLLI	Suratanpur	110	8	240	180	1920	1440	50	10572.61	7572.61	-3000
	MOLLI	Molli	45	8	245	185	5880	1480	50	35322.61	7822.61	-27500
	MOLLI	Goraya	112	8	243	183	3888	1464	50	22872.61	7722.61	-15150
	MOLLI	Molli	49	8	238	178	5712	1424	50	34272.61	7472.61	-26800
	MOLLI	Nanaji	141	8	240	180	3840	1440	50	22572.61	7572.61	-15000
PARSODA	PARSODA	Rathod Faliyu	123	8	236	176	3776	0	50	23036.3	-563.7	-23600
	PARSODA	Panchal Faliyu	54	8	240	182	0	0	50	-563.7	-563.7	0
	PARSODA	Patel Faliyu	69	8	240	185	5760	1480	50	35436.3	8686.3	-26750
	PARSODA	Patel Faliyu	78	8	240	183	5760	1464	50	35436.3	8586.3	-26850
	PARSODA	Prajapati Vas	114	8	240	178	3840	1424	50	23436.3	8336.3	-15100
	PARSODA	Prajapati Vas	120	8	245	180	3920	0	50	23936.3	-563.7	-24500
	PARSODA	Modh Vas	144	8	243	182	3888	0	50	23736.3	-563.7	-24300
VANKANEDA	VANKANEDA	Poojara Vas	211	8	238	178	0	0	50	-805.81	-805.81	0
	VANKANEDA	Parmar Vas	302	8	240	180	1920	1440	50	11194.19	8194.19	-3000
	VANKANEDA	Patel Faliyu	117	8	236	182	5664	1456	50	34594.19	8294.19	-26300
	VANKANEDA	Rathod Faliyu	81	8	240	185	5760	1480	50	35194.19	8444.19	-26750
	VANKANEDA	Patel Faliyu	112	8	240	183	5760	1464	50	35194.19	8344.19	-26850

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	VANKANEDA	Patel Faliyu	122	8	240	178	1920	1424	50	11194.19	8094.19	-3100
	VANKANEDA	Bus Stand Faliya	77	8	240	180	1920	0	50	11194.19	-805.81	-12000
AJAWAS	KALIKANKAR	Patel Faliyu	138	8	245	182	1960	0	50	11559.07	-690.93	-12250
	KALIKANKAR	Thakor Faliyu	288	8	243	183	5832	1464	50	35759.07	8459.07	-27300
	KALIKANKAR	Prajapati Vas	142	8	238	178	3808	0	50	23109.07	-690.93	-23800
	KALIKANKAR	Vankar Faliyu	168	8	240	182	7680	1456	50	47309.07	8409.07	-38900
	KALIKANKAR	Vankar Faliyu	169	8	236	185	3776	0	50	22909.07	-690.93	-23600
	MAMAPIPALA	Damor Vas	110	8	240	183	1920	0	50	11309.07	-690.93	-12000
	MAMAPIPALA	Damor Vas	114	8	240	178	0	0	50	-690.93	-690.93	0
	MAMAPIPALA	Pandor Vas	147	8	240	180	5760	1440	50	35309.07	8309.07	-27000
	MAMAPIPALA	Pandor Vas	151	8	245	182	5880	0	50	36059.07	-690.93	-36750
	MAMAPIPALA	Pandor Vas	155	8	243	183	3888	0	50	23609.07	-690.93	-24300
	BEDI	Ninama Vas	94	8	238	178	5712	1424	50	35009.07	8209.07	-26800
	BEDI	Ninama Vas	97	8	240	180	3840	0	50	23309.07	-690.93	-24000
	BEDI	Harijan Vas	62	8	236	176	0	0	50	-690.93	-690.93	0
	BEDI	Harijan Vas	58	8	240	180	5760	1440	50	35309.07	8309.07	-27000
	BEDI	Harijan Vas	53	8	240	182	5760	1456	50	35309.07	8409.07	-26900
	AJAWAS	Ninama Vas	45	8	240	185	3840	0	50	23309.07	-690.93	-24000
	AJAWAS	Pandor Vas	14	8	240	183	5760	1464	50	35309.07	8459.07	-26850
	AJAWAS	Harijan Faliyu	54	8	245	178	5880	0	50	36059.07	-690.93	-36750
	AJAWAS	Prajapati Vas	112	8	243	180	5832	1440	50	35759.07	8309.07	-27450
	AJAWAS	Prajapati Vas	114	8	238	182	5712	1456	50	35009.07	8409.07	-26600
	AJAWAS	Vankar Faliyu	165	8	240	180	7680	2880	50	47309.07	17309.07	-30000
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	8	236	176	3776	0	50	23192.59	-407.41	-23600

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	DAMOR DHUNDHA	Damor Vas	184	8	240	180	1920	0	50	11592.59	-407.41	-12000
	DAMOR DHUNDHA	Damor Vas	198	8	240	180	3840	0	50	23592.59	-407.41	-24000
	DAMOR DHUNDHA	Damor Vas	221	8	240	180	3840	0	50	23592.59	-407.41	-24000
	DAMOR DHUNDHA	Damor Vas	223	8	240	180	3840	0	50	23592.59	-407.41	-24000
	DHEMADA	Parmar Faliyu	16	8	245	182	3920	0	50	24092.59	-407.41	-24500
	DHEMADA	Parmar Faliyu	18	8	243	185	3888	0	50	23892.59	-407.41	-24300
	DHEMADA	Parmar Faliyu	22	8	238	183	0	0	50	-407.41	-407.41	0
	DHEMADA	Parmar Faliyu	26	8	240	178	5760	1424	50	35592.59	8492.59	-27100
	DHEMADA	Parmar Faliyu	29	8	236	180	0	0	50	-407.41	-407.41	0
	DHEMADA	Parmar Faliyu	33	8	240	182	3840	0	50	23592.59	-407.41	-24000
	MOTI MOYDI	Vadla Faliyu	186	8	240	180	3840	0	50	23592.59	-407.41	-24000
	MOTI MOYDI	Harijan Vas	224	8	240	180	3840	1440	50	23592.59	8592.59	-15000
	MOTI MOYDI	Bhathiji Faliyu	268	8	245	185	3920	0	50	24092.59	-407.41	-24500
	MOTI MOYDI	Gamtal	Gamtal	8	243	182	5832	0	50	36042.59	-407.41	-36450
	MOTI MOYDI	Chowk	106	8	238	185	7616	2960	50	47192.59	18092.59	-29100
	MOTI MOYDI	Vadla Faliyu	134	8	240	183	5760	1464	50	35592.59	8742.59	-26850
	PATEL DHUNDHA	Gamtal	Gamtal	8	236	178	7552	1424	50	46792.59	8492.59	-38300
	PATEL DHUNDHA	School Faliya	213	8	240	180	7680	2880	50	47592.59	17592.59	-30000
	PATEL DHUNDHA	Mukhivalu Faliyu	276	8	240	182	3840	0	50	23592.59	-407.41	-24000
	PATEL DHUNDHA	Mukhivalu Faliyu	278	8	240	180	3840	1440	50	23592.59	8592.59	-15000
	PATEL DHUNDHA	Thakor Faliyu	224	8	240	180	3840	0	50	23592.59	-407.41	-24000
	PATEL DHUNDHA	River Faliya	84	8	240	180	5760	1440	50	35592.59	8592.59	-27000
	PATEL DHUNDHA	Gameti Faliya	189	8	245	182	1960	0	50	11842.59	-407.41	-12250
	UNDAVA	Harijan Vas	186	8	243	185	5832	1480	50	36042.59	8842.59	-27200

Name of Watershed	Village	Faliya	Survey No.	Ave. Labour duration (Hrs)	Ave. no. of days (B.W)	Ave. no. of days (A.W)	Migratory Labour Period (hours per year) (B.W)	Migratory Labour Period (hours per year) (A.W)	Migratory Expenses (Rs./person/day)	Migratory Expenses (Rs./year) (B.W)	Migratory Expenses (Rs./year) (A.W)	Change in Migratory Expenses (Rs./year)
	UNDAVA	Thakor Faliyu	58	8	238	183	3808	0	50	23392.59	-407.41	-23800
	UNDAVA	Patel Faliya	14	8	240	178	7680	1424	50	47592.59	8492.59	-39100
	UNDAVA	Gameti Faliyu	106	8	236	180	3776	0	50	23192.59	-407.41	-23600
	UNDAVA	Gameti Faliyu	117	8	240	182	1920	0	50	11592.59	-407.41	-12000
	UNDAVA	Vankar Faliyu	16	8	240	180	0	0	50	-407.41	-407.41	0
	UNDAVA	Darbar Faliyu	213	8	240	180	5760	1440	50	35592.59	8592.59	-27000
	UNDAVA	Thakor Vas	276	8	240	180	5760	0	50	35592.59	-407.41	-36000
	VADATHALI	Thakor Vas	100	8	245	185	3920	0	50	24092.59	-407.41	-24500
	VADATHALI	Thakor Vas	112	8	243	183	5832	1464	50	36042.59	8742.59	-27300
	VADATHALI	Makavana Vas	84	8	238	178	3808	0	50	23392.59	-407.41	-23800
	VADATHALI	Makavana Vas	89	8	240	180	0	0	50	-407.41	-407.41	0
	VADATHALI	Patel Vas	186	8	236	182	5664	1456	50	34992.59	8692.59	-26300
	VADATHALI	Patel Vas	188	8	240	185	5760	1480	50	35592.59	8842.59	-26750
	VADATHALI	Patel Vas	204	8	237	183	3792	0	50	23292.59	-407.41	-23700
	VADATHALI	Thakor Vas	114	8	235	178	5640	1424	50	34842.59	8492.59	-26350

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
RELLAVADA	RELLAVADA	Thakor Faliyu	45	27000	160848	0.64	0.81	0.64	0.81
	RELLAVADA	Patel Faliya	152	15100	212332	2.75	3.21	2.36	2.59
	RELLAVADA	Azad Faliyu	106	12100	290332	3.17	3.49	2.92	3.24
	RELLAVADA	Azad Faliyu	168	0	98616	4.85	5.22	4.68	4.86
	RELLAVADA	Vankar Faliyu	16	12150	128382	2.56	2.97	2.23	2.43
	RELLAVADA	Darbar Faliyu	213	26800	143032	1.58	1.90	1.54	1.86
KADVADI	KADVADI	Thakar Vas	276	27000	160848	1.78	2.10	1.62	1.78
	KADVADI	Mukhi Nu Faliya	100	12100	47332	2.55	3.00	2.35	2.57
	KADVADI	Thakar Vas	224	27200	125816	2.22	2.47	1.98	2.23
	KADVADI	Mukhi Nu Faliya	84	24500	140732	1.44	2.08	1.18	1.50
	KADVADI	Thakar Vas	189	39500	74732	1.37	1.37	0.98	0.98
	KADVADI	Patel Vas	186	23800	157648	2.34	2.50	2.01	2.17
	KADVADI	Mukhi Nu Faliyu	50	12000	209232	2.95	3.09	2.75	2.89
	KADVADI	Mukhi Nu Fal	14	0	133848	2.20	2.20	2.01	2.01
	KADVADI	Thakar Vas	147	27000	143232	1.85	1.85	1.76	1.76
VALUNA	VALUNA	Shaktinagar	69	36300	314532	0.52	1.04	0.46	0.46
	VALUNA	Shaktinagar	80	24200	302432	0.40	1.06	0.29	0.62
	VALUNA	Makavana Vas	1	27500	242348	0.63	0.95	0.57	0.73
	VALUNA	Shaktinagar	19	24300	203916	0.72	1.38	0.67	0.78
	VALUNA	Patel Vas	45	0	197232	0.80	1.32	0.76	0.91
	VALUNA	Shaktinagar	64	26900	287516	0.55	1.10	0.53	0.80
	VALUNA	Shaktinagar	108	26750	287366	0.53	0.98	0.47	0.69
MODARSUMBA	MODARSUMBA	Ramdev Falia	52	24000	302232	0.67	0.92	0.57	0.69
	MODARSUMBA	Dairivala	46	27400	305632	1.05	1.38	0.91	0.91
	MODARSUMBA	Parmar Faliyu	67	36300	332148	0.42	0.78	0.37	0.55

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	MODARSUMBA	Parmar Faliyu	58	27650	323498	0.52	0.88	0.49	0.59
	MODARSUMBA	Parmar Faliyu	60	27300	224532	0.54	0.73	0.50	0.69
	MODARSUMBA	Parmar Faliyu	66	29800	227032	0.55	1.03	0.49	0.73
	MODARSUMBA	Parmar Faliyu	61	24000	203616	0.44	0.89	0.42	0.64
	MODARSUMBA	Parmar Faliyu	62	12000	272616	0.91	1.47	0.82	0.82
	MODARSUMBA	Parmar Faliyu	52	24200	221432	2.00	2.32	1.05	1.37
SHIKA KAMPA	MALEKPUR	Paniyar Faliya	165	24200	401048	1.75	2.31	1.01	1.29
	MALEKPUR	Vadla Faliyu	108	24500	320348	0.76	0.76	0.40	0.40
	MALEKPUR	Shayaro Faliyu	120	24300	239148	0.44	0.44	0.24	0.24
	MALEKPUR	Bhathiji Faliyu	6	23800	319648	2.08	2.32	1.13	1.29
	SHIKA KAMPA	Gamtal	Gamtal	0	359232	18.74	20.74	11.31	12.11
	SHIKA KAMPA	Chowk	805	26900	305132	7.67	9.03	4.17	4.85
	SHIKA KAMPA	Chowk	600	0	422616	14.74	14.74	8.00	8.00
	SHIKA KAMPA	Gamtal	808	24200	221432	5.75	5.75	3.24	3.24
DAHEGAMDA	DAHEGAMDA	School Faliya	110	24200	122816	1.44	2.09	1.13	0.97
	DAHEGAMDA	Mukhivalu Faliyu	138	15250	131482	1.55	2.20	1.12	0.96
	DAHEGAMDA	Mukhivalu Faliyu	142	24300	221532	1.67	2.07	0.93	1.13
	DAHEGAMDA	Thakor Faliyu	69	35700	232932	1.00	1.00	0.48	0.48
	DAHEGAMDA	River Faliya	235	29800	290416	1.65	1.95	1.32	1.62
	DAHEGAMDA	Master Faliya	45	26750	223982	0.85	0.85	0.65	0.65
UNCHI DHANAL	UNCHI DHANAL	Harijan Vas	118/2	39250	155482	0.45	0.45	0.23	0.23
	UNCHI DHANAL	Toran Chowk	400	30600	326448	4.78	6.06	3.11	3.89
	UNCHI DHANAL	Patel Vas	531	24500	464732	8.85	11.13	5.60	6.86
	UNCHI DHANAL	Mandvi Chowk	388	15200	293432	5.60	7.03	3.14	4.57
	UNCHI DHANAL	Moti Faliyu	202	23800	302032	5.22	7.50	3.29	4.57

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	UNCHI DHANAL	Parmar Faliyu	5	27000	224232	1.05	1.05	0.69	0.69
	UNCHI DHANAL	Mahadev Faliyu	138	0	341616	8.85	10.64	5.71	5.71
LIMDA	LIMDA	Pipli Faliyu	136	27200	143432	1.78	2.18	1.00	1.20
	LIMDA	Mothadiya	363	27050	160898	1.95	2.15	1.10	1.20
	LIMDA	Asari Faliyu	350	12250	209482	3.50	5.36	2.14	3.20
	LIMDA	Dungri Faliyu	2	27550	143782	0.89	0.89	0.60	0.60
	LIMDA	Pipli Faliyu	134	26700	241548	1.56	1.96	1.40	1.60
	LIMDA	Pipli Faliyu	138	24000	221232	1.78	1.93	1.45	1.60
DHANSOR	DHANSOR	Cholviya	220	11800	128032	1.86	2.46	1.42	1.42
	DHANSOR	Cholviya	140	24000	122616	1.56	2.08	1.18	1.44
	DHANSOR	Cholviya	46	27000	62232	1.76	2.04	1.09	1.23
	DHANSOR	Sovaliya	202	3150	200382	2.54	3.70	1.92	2.43
	DHANSOR	Modiya	270	24300	203916	2.43	2.43	1.88	1.88
	DHANSOR	Baranda	279	26550	206166	2.08	2.40	1.60	1.76
	DHANSOR	Baranda	4	27100	143332	2.23	3.73	1.89	2.34
	DHANSOR	Varsat	27	29200	244048	1.90	2.35	1.78	2.23
	DHANSOR	Cholviya	224	24000	221232	1.47	1.83	1.32	1.50
SUNSAR	SUNSAR	Harijan Vas	38	24000	41616	1.45	1.45	1.01	1.01
	SUNSAR	Harijan Vas	45	27500	224732	3.43	3.43	2.08	2.08
	SUNSAR	Baranda	85	12150	209382	3.70	5.42	1.90	2.86
	SUNSAR	Patel Faliya	110	0	179616	4.65	5.57	2.57	3.03
	SUNSAR	Parmar Vas	155	27000	206616	2.75	2.75	1.49	1.49
	SUNSAR	Parmar Vas	161	26300	223532	1.65	2.05	1.14	1.14
	SUNSAR	Thakor Faliyu	184	14750	113366	1.86	1.86	1.05	1.05
RAHEDA	RAHEDA	Harijan Vas	33	24000	140232	0.87	0.87	0.69	0.69

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	RAHEDA	Patel Faliya	374	0	341616	8.20	11.14	4.47	5.94
	RAHEDA	Patel Faliya	389	27450	288066	8.00	10.12	4.20	5.26
	RAHEDA	Bus Stand Faliya	128	26600	223832	3.65	4.09	2.36	2.80
	RAHEDA	Thakor Vas	258	27000	224232	2.06	2.06	1.20	1.20
	RAHEDA	Bus Stand Faliya	138	26600	287216	3.76	4.02	2.06	2.06
	RAHEDA	Patel Faliya	289	24000	221232	3.80	3.80	2.00	2.00
RAVOL	RAVOL	Vaghari	140	27000	160848	1.23	1.23	0.69	0.69
	RAVOL	Vaghari	144	24500	140732	0.78	0.78	0.64	0.64
	RAVOL	Nanavaash	104	24300	239148	0.87	0.87	0.69	0.69
	RAVOL	Motavaash	110	14650	211882	1.08	1.23	0.88	1.03
	RAVOL	Parmarvaash	42	27100	206716	1.87	2.07	1.04	1.14
	RAVOL	Parmar Faliyu	147	26400	125016	1.65	1.65	1.14	1.14
	RAVOL	Parmar Faliyu	182	24000	302232	1.83	2.01	1.10	1.19
DOTAD	DOTAD	Vankar Faliyu	265	15000	194616	1.60	1.60	0.69	0.69
	DOTAD	Parmar Faliyu	94	24500	221732	1.45	1.55	0.81	0.91
	DOTAD	Patel Vas	224	24300	284916	1.67	1.82	1.26	1.26
	DOTAD	Asari Faliyu	64	26800	224032	1.43	1.71	0.91	0.91
	DOTAD	Chowk	11	27000	224232	1.23	1.23	0.87	0.87
	DOTAD	Harijan Vas	279	14800	113416	1.04	1.04	0.78	0.78
	DOTAD	Darbar Faliyu	45	24000	221232	1.45	1.55	0.93	1.03
FINCHOD	FINCHOD	Asari Faliyu	14	27000	224232	0.96	0.96	0.57	0.57
	FINCHOD	Parmar Faliyu	54	14900	212132	1.02	1.02	0.69	0.69
	FINCHOD	Patel Vas	112	6000	185616	1.89	2.21	1.67	1.83
	FINCHOD	Bus Stand Faliya	68	27300	125916	1.67	1.87	1.27	1.37
	FINCHOD	Vankar Faliyu	165	23800	122416	1.33	1.33	0.87	0.87

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	FINCHOD	Harijan Vas	180	27000	224232	1.45	1.67	0.85	0.96
MOLLI	MOLLI	Juni Molli	175	26300	124916	1.03	1.23	0.81	0.91
	MOLLI	Molllikhant	327	18000	53232	1.00	2.12	0.87	1.37
	MOLLI	Suratanpur	110	3000	20616	1.34	2.30	1.12	1.60
	MOLLI	Molli	45	27500	224732	1.56	1.56	1.28	1.28
	MOLLI	Goraya	112	15150	131382	1.54	1.86	1.14	1.30
	MOLLI	Molli	49	26800	143032	1.34	1.34	1.05	1.05
	MOLLI	Nanaji	141	15000	113616	1.04	1.04	0.69	0.69
PARSODA	PARSODA	Rathod Faliyu	123	23600	220832	1.65	1.85	0.91	0.91
	PARSODA	Panchal Faliyu	54	0	116232	1.78	1.78	1.21	1.21
	PARSODA	Patel Faliyu	69	26750	142982	1.65	1.99	0.97	1.14
	PARSODA	Patel Faliyu	78	26850	125466	1.43	1.43	1.10	1.10
	PARSODA	Prajapati Vas	114	15100	113716	1.44	1.44	0.98	0.98
	PARSODA	Prajapati Vas	120	24500	123116	1.56	1.76	0.84	0.94
	PARSODA	Modh Vas	144	24300	221532	1.78	1.78	0.91	0.91
VANKANEDA	VANKANEDA	Poojara Vas	211	0	116232	1.90	1.90	1.55	1.55
	VANKANEDA	Parmar Vas	302	3000	119232	2.05	2.41	1.42	1.60
	VANKANEDA	Patel Faliyu	117	26300	142532	2.00	2.26	1.11	1.37
	VANKANEDA	Rathod Faliyu	81	26750	125366	1.88	1.88	1.05	1.05
	VANKANEDA	Patel Faliyu	112	26850	125466	1.78	2.24	1.37	1.60
	VANKANEDA	Patel Faliyu	122	3100	217948	2.54	3.40	1.70	1.83
	VANKANEDA	Bus Stand Faliya	77	12000	128232	1.58	1.58	0.91	0.91
AJAWAS	KALIKANKAR	Patel Faliyu	138	12250	47482	2.55	2.87	2.25	2.57
	KALIKANKAR	Thakor Faliyu	288	27300	125916	2.22	2.59	2.05	2.23
	KALIKANKAR	Prajapati Vas	142	23800	140032	1.44	1.85	1.30	1.50

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	KALIKANKAR	Vankar Faliyu	168	38900	74132	1.37	1.69	0.66	0.98
	KALIKANKAR	Vankar Faliyu	169	23600	157448	2.34	2.66	2.01	2.17
	MAMAPIPALA	Damor Vas	110	12000	209232	2.95	3.40	2.67	2.89
	MAMAPIPALA	Damor Vas	114	0	133848	2.20	2.45	1.76	2.01
	MAMAPIPALA	Pandor Vas	147	27000	143232	1.85	2.49	1.44	1.76
	MAMAPIPALA	Pandor Vas	151	36750	314982	0.52	0.52	0.46	0.46
	MAMAPIPALA	Pandor Vas	155	24300	302532	0.40	0.56	0.46	0.62
	BEDI	Ninama Vas	94	26800	241648	0.63	0.77	0.59	0.73
	BEDI	Ninama Vas	97	24000	203616	0.72	0.72	0.78	0.78
	BEDI	Harijan Vas	62	0	197232	0.80	0.80	0.91	0.91
	BEDI	Harijan Vas	58	27000	287616	0.55	1.07	0.80	0.80
	BEDI	Harijan Vas	53	26900	287516	0.53	1.19	0.36	0.69
	AJAWAS	Ninama Vas	45	24000	302232	0.67	0.99	0.53	0.69
	AJAWAS	Pandor Vas	14	26850	305082	1.05	1.71	0.80	0.91
	AJAWAS	Harijan Faliyu	54	36750	332598	0.42	0.94	0.40	0.55
	AJAWAS	Prajapati Vas	112	27450	323298	0.52	1.07	0.32	0.59
	AJAWAS	Prajapati Vas	114	26600	223832	0.54	0.99	0.47	0.69
	AJAWAS	Vankar Faliyu	165	30000	227232	0.55	0.80	0.61	0.73
DHEMADA	DAMOR DHUNDHA	Damor Vas	180	23600	203216	0.44	0.77	0.64	0.64
	DAMOR DHUNDHA	Damor Vas	184	12000	272616	0.91	1.27	0.64	0.82
	DAMOR DHUNDHA	Damor Vas	198	24000	221232	2.00	2.36	1.27	1.37
	DAMOR DHUNDHA	Damor Vas	221	24000	400848	1.75	1.94	1.10	1.29
	DAMOR DHUNDHA	Damor Vas	223	24000	319848	0.76	1.24	0.16	0.40

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	DHEMADA	Parmar Faliyu	16	24500	239348	0.44	0.89	0.02	0.24
	DHEMADA	Parmar Faliyu	18	24300	320148	2.08	2.64	1.29	1.29
	DHEMADA	Parmar Faliyu	22	0	359232	18.74	19.06	11.79	12.11
	DHEMADA	Parmar Faliyu	26	27100	305332	7.67	8.23	4.57	4.85
	DHEMADA	Parmar Faliyu	29	0	422616	14.74	14.74	8.00	8.00
	DHEMADA	Parmar Faliyu	33	24000	221232	5.75	5.75	3.24	3.24
	MOTI MOYDI	Vadla Faliyu	186	24000	122616	1.44	1.68	0.81	0.97
	MOTI MOYDI	Harijan Vas	224	15000	131232	1.55	3.55	0.16	0.96
	MOTI MOYDI	Bhathiji Faliyu	268	24500	221732	1.67	3.03	0.45	1.13
	MOTI MOYDI	Gamtal	Gamtal	36450	233682	1.00	1.00	0.48	0.48
	MOTI MOYDI	Chowk	106	29100	289716	1.65	1.65	1.62	1.62
	MOTI MOYDI	Vadla Faliyu	134	26850	224082	0.85	1.50	0.81	0.65
	PATEL DHUNDHA	Gamtal	Gamtal	38300	154532	0.45	1.10	0.39	0.23
	PATEL DHUNDHA	School Faliya	213	30000	325848	4.78	5.18	3.69	3.89
	PATEL DHUNDHA	Mukhivalu Faliyu	276	24000	464232	8.85	8.85	6.86	6.86
	PATEL DHUNDHA	Mukhivalu Faliyu	278	15000	293232	5.60	5.90	4.27	4.57
	PATEL DHUNDHA	Thakor Faliyu	224	24000	302232	5.22	5.22	4.57	4.57
	PATEL DHUNDHA	River Faliya	84	27000	224232	1.05	1.05	0.69	0.69
	PATEL DHUNDHA	Gameti Faliya	189	12250	47482	2.55	3.83	1.79	2.57
	UNDAVA	Harijan Vas	186	27200	125816	2.22	4.50	0.97	2.23
	UNDAVA	Thakor Faliyu	58	23800	140032	1.44	2.87	0.07	1.50
	UNDAVA	Patel Faliya	14	39100	74332	1.37	3.65	-0.30	0.98

Name of Watershed	Village	Faliya	Survey No.	Change in income/saving due to migration (Rs./year)	Change in income from all sources (Rs./year)	Gross Cropped Area (Ha.) (B.W.)	Gross Cropped Area (Ha.) (A.W.)	Net Sown Area (Ha.) (B.W.)	Net Sown Area (Ha.) (A.W.)
	UNDAVA	Gameti Faliyu	106	23600	157448	2.34	2.66	1.85	2.17
	UNDAVA	Gameti Faliyu	117	12000	209232	2.95	3.32	2.71	2.89
	UNDAVA	Vankar Faliyu	16	0	133848	2.20	2.61	1.81	2.01
	UNDAVA	Darbar Faliyu	213	27000	143232	1.85	2.17	1.44	1.76
	UNDAVA	Thakor Vas	276	36000	314232	0.52	0.84	0.30	0.46
	VADATHALI	Thakor Vas	100	24500	302732	0.40	0.85	0.40	0.62
	VADATHALI	Thakor Vas	112	27300	242148	0.63	0.88	0.48	0.73
	VADATHALI	Makavana Vas	84	23800	203416	0.72	1.36	0.46	0.78
	VADATHALI	Makavana Vas	89	0	197232	0.80	0.80	0.91	0.91
	VADATHALI	Patel Vas	186	26300	286916	0.55	0.71	0.64	0.80
	VADATHALI	Patel Vas	188	26750	287366	0.53	0.67	0.55	0.69
	VADATHALI	Patel Vas	204	23700	301932	0.67	0.67	0.69	0.69
	VADATHALI	Thakor Vas	114	26350	304582	1.05	1.05	0.91	0.91

Appendix-IV Cost-Benefit Analysis of Watershed Projects

COST BENEFIT ANALYSIS OF PROJECT :KADWADI

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	15.680	0.000	-15.680	1.000	-15.680	1.00	15.680
1		0.000	0.000	0.909	0.000	1.10	17.248
2		0.000	0.000	0.826	0.000	1.20	18.816
3		0.000	0.000	0.751	0.000	1.30	20.384
4		966.276	966.276	0.683	659.980	1.40	21.952
5		966.276	966.276	0.621	599.981	1.50	23.520
6		966.276	966.276	0.564	545.438	1.60	25.088
7		966.276	966.276	0.513	495.852	1.70	26.656
8		966.276	966.276	0.467	450.775	1.80	28.224
9		966.276	966.276	0.424	409.795	1.90	29.792
10		966.276	966.276	0.386	372.541	2.00	31.360
11		966.276	966.276	0.350	338.674	2.10	32.928
12		966.276	966.276	0.319	307.885	2.20	34.496
13		966.276	966.276	0.290	279.896	2.30	36.064
14		966.276	966.276	0.263	254.451	2.40	37.632
15		966.276	966.276	0.239	231.319	2.50	39.200
16		966.276	966.276	0.218	210.290	2.60	40.768
17		966.276	966.276	0.198	191.173	2.70	42.336
18		966.276	966.276	0.180	173.793	2.80	43.904
19		966.276	966.276	0.164	157.994	2.90	45.472
20		966.276	966.276	0.149	143.631	3.00	47.040
				NPV=	5807.787	PVC=	658.560
				B/C=	8.82		

COST BENEFIT ANALYSIS OF PROJECT :VALUNA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	19.420	0.000	-19.420	1.000	-19.420	1.00	19.420
1		0.000	0.000	0.909	0.000	1.10	21.362
2		0.000	0.000	0.826	0.000	1.20	23.304
3		0.000	0.000	0.751	0.000	1.30	25.246
4		694.324	694.324	0.683	474.232	1.40	27.188
5		694.324	694.324	0.621	431.120	1.50	29.130
6		694.324	694.324	0.564	391.928	1.60	31.072
7		694.324	694.324	0.513	356.298	1.70	33.014
8		694.324	694.324	0.467	323.907	1.80	34.956
9		694.324	694.324	0.424	294.461	1.90	36.898
10		694.324	694.324	0.386	267.692	2.00	38.840
11		694.324	694.324	0.350	243.356	2.10	40.782
12		694.324	694.324	0.319	221.233	2.20	42.724
13		694.324	694.324	0.290	201.121	2.30	44.666
14		694.324	694.324	0.263	182.837	2.40	46.608
15		694.324	694.324	0.239	166.216	2.50	48.550
16		694.324	694.324	0.218	151.105	2.60	50.492
17		694.324	694.324	0.198	137.368	2.70	52.434
18		694.324	694.324	0.180	124.880	2.80	54.376
19		694.324	694.324	0.164	113.527	2.90	56.318
20		694.324	694.324	0.149	103.207	3.00	58.260
				NPV=	4165.068	PVC=	815.640
				B/C=	5.11		

COST BENEFIT ANALYSIS OF PROJECT :MODERSUMBA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	16.590	0.000	-16.590	1.000	-16.590	1.00	16.590
1		0.000	0.000	0.909	0.000	1.10	18.249
2		0.000	0.000	0.826	0.000	1.20	19.908
3		0.000	0.000	0.751	0.000	1.30	21.567
4		664.400	664.400	0.683	453.794	1.40	23.226
5		664.400	664.400	0.621	412.540	1.50	24.885
6		664.400	664.400	0.564	375.037	1.60	26.544
7		664.400	664.400	0.513	340.942	1.70	28.203
8		664.400	664.400	0.467	309.948	1.80	29.862
9		664.400	664.400	0.424	281.771	1.90	31.521
10		664.400	664.400	0.386	256.155	2.00	33.180
11		664.400	664.400	0.350	232.868	2.10	34.839
12		664.400	664.400	0.319	211.698	2.20	36.498
13		664.400	664.400	0.290	192.453	2.30	38.157
14		664.400	664.400	0.263	174.957	2.40	39.816
15		664.400	664.400	0.239	159.052	2.50	41.475
16		664.400	664.400	0.218	144.593	2.60	43.134
17		664.400	664.400	0.198	131.448	2.70	44.793
18		664.400	664.400	0.180	119.498	2.80	46.452
19		664.400	664.400	0.164	108.635	2.90	48.111
20		664.400	664.400	0.149	98.759	3.00	49.770
				NPV=	3987.558	PVC=	696.780
				B/C=	5.72		

COST BENEFIT ANALYSIS OF PROJECT :MALEKPUR (SHIKA KAMPA)

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	21.760	0.000	-21.760	1.000	-21.760	1.00	21.760
1		0.000	0.000	0.909	0.000	1.10	23.936
2		0.000	0.000	0.826	0.000	1.20	26.112
3		0.000	0.000	0.751	0.000	1.30	28.288
4		1265.105	1265.105	0.683	864.084	1.40	30.464
5		1265.105	1265.105	0.621	785.531	1.50	32.640
6		1265.105	1265.105	0.564	714.119	1.60	34.816
7		1265.105	1265.105	0.513	649.199	1.70	36.992
8		1265.105	1265.105	0.467	590.181	1.80	39.168
9		1265.105	1265.105	0.424	536.528	1.90	41.344
10		1265.105	1265.105	0.386	487.753	2.00	43.520
11		1265.105	1265.105	0.350	443.412	2.10	45.696
12		1265.105	1265.105	0.319	403.102	2.20	47.872
13		1265.105	1265.105	0.290	366.456	2.30	50.048
14		1265.105	1265.105	0.263	333.142	2.40	52.224
15		1265.105	1265.105	0.239	302.856	2.50	54.400
16		1265.105	1265.105	0.218	275.324	2.60	56.576
17		1265.105	1265.105	0.198	250.294	2.70	58.752
18		1265.105	1265.105	0.180	227.540	2.80	60.928
19		1265.105	1265.105	0.164	206.855	2.90	63.104
20		1265.105	1265.105	0.149	188.050	3.00	65.280
				NPV=	7602.664	PVC=	913.920
				B/C=	8.32		

COST BENEFIT ANALYSIS OF PROJECT :DAHEGAMDA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	14.740	0.000	-14.740	1.000	-14.740	1.00	14.740
1		0.000	0.000	0.909	0.000	1.10	16.214
2		0.000	0.000	0.826	0.000	1.20	17.688
3		0.000	0.000	0.751	0.000	1.30	19.162
4		622.717	622.717	0.683	425.324	1.40	20.636
5		622.717	622.717	0.621	386.658	1.50	22.110
6		622.717	622.717	0.564	351.508	1.60	23.584
7		622.717	622.717	0.513	319.552	1.70	25.058
8		622.717	622.717	0.467	290.502	1.80	26.532
9		622.717	622.717	0.424	264.093	1.90	28.006
10		622.717	622.717	0.386	240.084	2.00	29.480
11		622.717	622.717	0.350	218.259	2.10	30.954
12		622.717	622.717	0.319	198.417	2.20	32.428
13		622.717	622.717	0.290	180.379	2.30	33.902
14		622.717	622.717	0.263	163.981	2.40	35.376
15		622.717	622.717	0.239	149.074	2.50	36.850
16		622.717	622.717	0.218	135.521	2.60	38.324
17		622.717	622.717	0.198	123.201	2.70	39.798
18		622.717	622.717	0.180	112.001	2.80	41.272
19		622.717	622.717	0.164	101.819	2.90	42.746
20		622.717	622.717	0.149	92.563	3.00	44.220
				NPV=	3738.196	PVC=	619.080
				B/C=	6.04		

COST BENEFIT ANALYSIS OF PROJECT :UNCHI DHANAL

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	22.650	0.000	-22.650	1.000	-22.650	1.00	22.650
1		0.000	0.000	0.909	0.000	1.10	24.915
2		0.000	0.000	0.826	0.000	1.20	27.180
3		0.000	0.000	0.751	0.000	1.30	29.445
4		1457.971	1457.971	0.683	995.814	1.40	31.710
5		1457.971	1457.971	0.621	905.285	1.50	33.975
6		1457.971	1457.971	0.564	822.987	1.60	36.240
7		1457.971	1457.971	0.513	748.170	1.70	38.505
8		1457.971	1457.971	0.467	680.154	1.80	40.770
9		1457.971	1457.971	0.424	618.322	1.90	43.035
10		1457.971	1457.971	0.386	562.111	2.00	45.300
11		1457.971	1457.971	0.350	511.010	2.10	47.565
12		1457.971	1457.971	0.319	464.554	2.20	49.830
13		1457.971	1457.971	0.290	422.322	2.30	52.095
14		1457.971	1457.971	0.263	383.929	2.40	54.360
15		1457.971	1457.971	0.239	349.027	2.50	56.625
16		1457.971	1457.971	0.218	317.297	2.60	58.890
17		1457.971	1457.971	0.198	288.452	2.70	61.155
18		1457.971	1457.971	0.180	262.229	2.80	63.420
19		1457.971	1457.971	0.164	238.390	2.90	65.685
20		1457.971	1457.971	0.149	216.718	3.00	67.950
				NPV=	8764.120	PVC=	951.300
				B/C=	9.21		

COST BENEFIT ANALYSIS OF PROJECT :LIMDA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	24.900	0.000	-24.900	1.000	-24.900	1.00	24.900
1		0.000	0.000	0.909	0.000	1.10	27.390
2		0.000	0.000	0.826	0.000	1.20	29.880
3		0.000	0.000	0.751	0.000	1.30	32.370
4		792.403	792.403	0.683	541.222	1.40	34.860
5		792.403	792.403	0.621	492.020	1.50	37.350
6		792.403	792.403	0.564	447.291	1.60	39.840
7		792.403	792.403	0.513	406.628	1.70	42.330
8		792.403	792.403	0.467	369.662	1.80	44.820
9		792.403	792.403	0.424	336.056	1.90	47.310
10		792.403	792.403	0.386	305.506	2.00	49.800
11		792.403	792.403	0.350	277.732	2.10	52.290
12		792.403	792.403	0.319	252.484	2.20	54.780
13		792.403	792.403	0.290	229.531	2.30	57.270
14		792.403	792.403	0.263	208.664	2.40	59.760
15		792.403	792.403	0.239	189.695	2.50	62.250
16		792.403	792.403	0.218	172.450	2.60	64.740
17		792.403	792.403	0.198	156.773	2.70	67.230
18		792.403	792.403	0.180	142.521	2.80	69.720
19		792.403	792.403	0.164	129.564	2.90	72.210
20		792.403	792.403	0.149	117.786	3.00	74.700
				NPV=	4750.683	PVC=	1045.800
				B/C=	4.54		

COST BENEFIT ANALYSIS OF PROJECT :DHANSOR

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	19.210	0.000	-19.210	1.000	-19.210	1.00	19.210
1		0.000	0.000	0.909	0.000	1.10	21.131
2		0.000	0.000	0.826	0.000	1.20	23.052
3		0.000	0.000	0.751	0.000	1.30	24.973
4		770.086	770.086	0.683	525.979	1.40	26.894
5		770.086	770.086	0.621	478.163	1.50	28.815
6		770.086	770.086	0.564	434.693	1.60	30.736
7		770.086	770.086	0.513	395.176	1.70	32.657
8		770.086	770.086	0.467	359.251	1.80	34.578
9		770.086	770.086	0.424	326.592	1.90	36.499
10		770.086	770.086	0.386	296.901	2.00	38.420
11		770.086	770.086	0.350	269.910	2.10	40.341
12		770.086	770.086	0.319	245.373	2.20	42.262
13		770.086	770.086	0.290	223.066	2.30	44.183
14		770.086	770.086	0.263	202.788	2.40	46.104
15		770.086	770.086	0.239	184.352	2.50	48.025
16		770.086	770.086	0.218	167.593	2.60	49.946
17		770.086	770.086	0.198	152.357	2.70	51.867
18		770.086	770.086	0.180	138.507	2.80	53.788
19		770.086	770.086	0.164	125.915	2.90	55.709
20		770.086	770.086	0.149	114.468	3.00	57.630
				NPV=	4621.875	PVC=	806.820
				B/C=	5.73		

COST BENEFIT ANALYSIS OF PROJECT :SUNSAR

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	16.180	0.000	-16.180	1.000	-16.180	1.00	16.180
1		0.000	0.000	0.909	0.000	1.10	17.798
2		0.000	0.000	0.826	0.000	1.20	19.416
3		0.000	0.000	0.751	0.000	1.30	21.034
4		687.780	687.780	0.683	469.763	1.40	22.652
5		687.780	687.780	0.621	427.057	1.50	24.270
6		687.780	687.780	0.564	388.234	1.60	25.888
7		687.780	687.780	0.513	352.940	1.70	27.506
8		687.780	687.780	0.467	320.854	1.80	29.124
9		687.780	687.780	0.424	291.686	1.90	30.742
10		687.780	687.780	0.386	265.169	2.00	32.360
11		687.780	687.780	0.350	241.063	2.10	33.978
12		687.780	687.780	0.319	219.148	2.20	35.596
13		687.780	687.780	0.290	199.225	2.30	37.214
14		687.780	687.780	0.263	181.114	2.40	38.832
15		687.780	687.780	0.239	164.649	2.50	40.450
16		687.780	687.780	0.218	149.681	2.60	42.068
17		687.780	687.780	0.198	136.074	2.70	43.686
18		687.780	687.780	0.180	123.703	2.80	45.304
19		687.780	687.780	0.164	112.458	2.90	46.922
20		687.780	687.780	0.149	102.234	3.00	48.540
				NPV=	4128.871	PVC=	679.560
				B/C=	6.08		

COST BENEFIT ANALYSIS OF PROJECT :RAHEDA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	27.020	0.000	-27.020	1.000	-27.020	1.00	27.020
1		0.000	0.000	0.909	0.000	1.10	29.722
2		0.000	0.000	0.826	0.000	1.20	32.424
3		0.000	0.000	0.751	0.000	1.30	35.126
4		1129.739	1129.739	0.683	771.627	1.40	37.828
5		1129.739	1129.739	0.621	701.479	1.50	40.530
6		1129.739	1129.739	0.564	637.708	1.60	43.232
7		1129.739	1129.739	0.513	579.735	1.70	45.934
8		1129.739	1129.739	0.467	527.032	1.80	48.636
9		1129.739	1129.739	0.424	479.120	1.90	51.338
10		1129.739	1129.739	0.386	435.563	2.00	54.040
11		1129.739	1129.739	0.350	395.967	2.10	56.742
12		1129.739	1129.739	0.319	359.970	2.20	59.444
13		1129.739	1129.739	0.290	327.245	2.30	62.146
14		1129.739	1129.739	0.263	297.496	2.40	64.848
15		1129.739	1129.739	0.239	270.451	2.50	67.550
16		1129.739	1129.739	0.218	245.864	2.60	70.252
17		1129.739	1129.739	0.198	223.513	2.70	72.954
18		1129.739	1129.739	0.180	203.194	2.80	75.656
19		1129.739	1129.739	0.164	184.721	2.90	78.358
20		1129.739	1129.739	0.149	167.929	3.00	81.060
				NPV=	6781.592	PVC=	1134.840
				B/C=	5.98		

COST BENEFIT ANALYSIS OF PROJECT :RAVOL

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	33.780	0.000	-33.780	1.000	-33.780	1.00	33.780
1		0.000	0.000	0.909	0.000	1.10	37.158
2		0.000	0.000	0.826	0.000	1.20	40.536
3		0.000	0.000	0.751	0.000	1.30	43.914
4		572.570	572.570	0.683	391.073	1.40	47.292
5		572.570	572.570	0.621	355.521	1.50	50.670
6		572.570	572.570	0.564	323.201	1.60	54.048
7		572.570	572.570	0.513	293.819	1.70	57.426
8		572.570	572.570	0.467	267.108	1.80	60.804
9		572.570	572.570	0.424	242.826	1.90	64.182
10		572.570	572.570	0.386	220.751	2.00	67.560
11		572.570	572.570	0.350	200.682	2.10	70.938
12		572.570	572.570	0.319	182.438	2.20	74.316
13		572.570	572.570	0.290	165.853	2.30	77.694
14		572.570	572.570	0.263	150.776	2.40	81.072
15		572.570	572.570	0.239	137.069	2.50	84.450
16		572.570	572.570	0.218	124.608	2.60	87.828
17		572.570	572.570	0.198	113.280	2.70	91.206
18		572.570	572.570	0.180	102.982	2.80	94.584
19		572.570	572.570	0.164	93.620	2.90	97.962
20		572.570	572.570	0.149	85.109	3.00	101.340
				NPV=	3416.935	PVC=	1418.760
				B/C=	2.41		

COST BENEFIT ANALYSIS OF PROJECT :DOTAD

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	13.590	0.000	-13.590	1.000	-13.590	1.00	13.590
1		0.000	0.000	0.909	0.000	1.10	14.949
2		0.000	0.000	0.826	0.000	1.20	16.308
3		0.000	0.000	0.751	0.000	1.30	17.667
4		641.718	641.718	0.683	438.302	1.40	19.026
5		641.718	641.718	0.621	398.456	1.50	20.385
6		641.718	641.718	0.564	362.233	1.60	21.744
7		641.718	641.718	0.513	329.303	1.70	23.103
8		641.718	641.718	0.467	299.366	1.80	24.462
9		641.718	641.718	0.424	272.151	1.90	25.821
10		641.718	641.718	0.386	247.410	2.00	27.180
11		641.718	641.718	0.350	224.918	2.10	28.539
12		641.718	641.718	0.319	204.471	2.20	29.898
13		641.718	641.718	0.290	185.883	2.30	31.257
14		641.718	641.718	0.263	168.984	2.40	32.616
15		641.718	641.718	0.239	153.622	2.50	33.975
16		641.718	641.718	0.218	139.656	2.60	35.334
17		641.718	641.718	0.198	126.960	2.70	36.693
18		641.718	641.718	0.180	115.419	2.80	38.052
19		641.718	641.718	0.164	104.926	2.90	39.411
20		641.718	641.718	0.149	95.387	3.00	40.770
				NPV=	3853.857	PVC=	570.780
				B/C=	6.75		

COST BENEFIT ANALYSIS OF PROJECT :FINCHOD

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	14.160	0.000	-14.160	1.000	-14.160	1.00	14.160
1		0.000	0.000	0.909	0.000	1.10	15.576
2		0.000	0.000	0.826	0.000	1.20	16.992
3		0.000	0.000	0.751	0.000	1.30	18.408
4		663.298	663.298	0.683	453.041	1.40	19.824
5		663.298	663.298	0.621	411.856	1.50	21.240
6		663.298	663.298	0.564	374.414	1.60	22.656
7		663.298	663.298	0.513	340.377	1.70	24.072
8		663.298	663.298	0.467	309.433	1.80	25.488
9		663.298	663.298	0.424	281.303	1.90	26.904
10		663.298	663.298	0.386	255.730	2.00	28.320
11		663.298	663.298	0.350	232.482	2.10	29.736
12		663.298	663.298	0.319	211.347	2.20	31.152
13		663.298	663.298	0.290	192.134	2.30	32.568
14		663.298	663.298	0.263	174.667	2.40	33.984
15		663.298	663.298	0.239	158.788	2.50	35.400
16		663.298	663.298	0.218	144.353	2.60	36.816
17		663.298	663.298	0.198	131.230	2.70	38.232
18		663.298	663.298	0.180	119.300	2.80	39.648
19		663.298	663.298	0.164	108.455	2.90	41.064
20		663.298	663.298	0.149	98.595	3.00	42.480
				NPV=	3983.346	PVC=	594.720
				B/C=	6.70		

COST BENEFIT ANALYSIS OF PROJECT :MOLLI

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	17.680	0.000	-17.680	1.000	-17.680	1.00	17.680
1		0.000	0.000	0.909	0.000	1.10	19.448
2		0.000	0.000	0.826	0.000	1.20	21.216
3		0.000	0.000	0.751	0.000	1.30	22.984
4		429.425	429.425	0.683	293.303	1.40	24.752
5		429.425	429.425	0.621	266.639	1.50	26.520
6		429.425	429.425	0.564	242.399	1.60	28.288
7		429.425	429.425	0.513	220.363	1.70	30.056
8		429.425	429.425	0.467	200.330	1.80	31.824
9		429.425	429.425	0.424	182.118	1.90	33.592
10		429.425	429.425	0.386	165.562	2.00	35.360
11		429.425	429.425	0.350	150.511	2.10	37.128
12		429.425	429.425	0.319	136.828	2.20	38.896
13		429.425	429.425	0.290	124.389	2.30	40.664
14		429.425	429.425	0.263	113.081	2.40	42.432
15		429.425	429.425	0.239	102.801	2.50	44.200
16		429.425	429.425	0.218	93.455	2.60	45.968
17		429.425	429.425	0.198	84.959	2.70	47.736
18		429.425	429.425	0.180	77.236	2.80	49.504
19		429.425	429.425	0.164	70.214	2.90	51.272
20		429.425	429.425	0.149	63.831	3.00	53.040
				NPV=	2570.339	PVC=	742.560
				B/C=	3.46		

COST BENEFIT ANALYSIS OF PROJECT :PARSODA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	16.890	0.000	-16.890	1.000	-16.890	1.00	16.890
1		0.000	0.000	0.909	0.000	1.10	18.579
2		0.000	0.000	0.826	0.000	1.20	20.268
3		0.000	0.000	0.751	0.000	1.30	21.957
4		493.299	493.299	0.683	336.930	1.40	23.646
5		493.299	493.299	0.621	306.300	1.50	25.335
6		493.299	493.299	0.564	278.455	1.60	27.024
7		493.299	493.299	0.513	253.141	1.70	28.713
8		493.299	493.299	0.467	230.128	1.80	30.402
9		493.299	493.299	0.424	209.207	1.90	32.091
10		493.299	493.299	0.386	190.188	2.00	33.780
11		493.299	493.299	0.350	172.898	2.10	35.469
12		493.299	493.299	0.319	157.180	2.20	37.158
13		493.299	493.299	0.290	142.891	2.30	38.847
14		493.299	493.299	0.263	129.901	2.40	40.536
15		493.299	493.299	0.239	118.092	2.50	42.225
16		493.299	493.299	0.218	107.356	2.60	43.914
17		493.299	493.299	0.198	97.597	2.70	45.603
18		493.299	493.299	0.180	88.724	2.80	47.292
19		493.299	493.299	0.164	80.658	2.90	48.981
20		493.299	493.299	0.149	73.326	3.00	50.670
				NPV=	2956.082	PVC=	709.380
				B/C=	4.17		

COST BENEFIT ANALYSIS OF PROJECT :VANKANEDA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	13.760	0.000	-13.760	1.000	-13.760	1.00	13.760
1		0.000	0.000	0.909	0.000	1.10	15.136
2		0.000	0.000	0.826	0.000	1.20	16.512
3		0.000	0.000	0.751	0.000	1.30	17.888
4		587.058	587.058	0.683	400.969	1.40	19.264
5		587.058	587.058	0.621	364.517	1.50	20.640
6		587.058	587.058	0.564	331.379	1.60	22.016
7		587.058	587.058	0.513	301.254	1.70	23.392
8		587.058	587.058	0.467	273.867	1.80	24.768
9		587.058	587.058	0.424	248.970	1.90	26.144
10		587.058	587.058	0.386	226.336	2.00	27.520
11		587.058	587.058	0.350	205.760	2.10	28.896
12		587.058	587.058	0.319	187.055	2.20	30.272
13		587.058	587.058	0.290	170.050	2.30	31.648
14		587.058	587.058	0.263	154.591	2.40	33.024
15		587.058	587.058	0.239	140.537	2.50	34.400
16		587.058	587.058	0.218	127.761	2.60	35.776
17		587.058	587.058	0.198	116.146	2.70	37.152
18		587.058	587.058	0.180	105.588	2.80	38.528
19		587.058	587.058	0.164	95.989	2.90	39.904
20		587.058	587.058	0.149	87.262	3.00	41.280
				NPV=	3524.271	PVC=	577.920
				B/C=	6.10		

COST BENEFIT ANALYSIS OF PROJECT :AJWAS

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	72.750	0.000	-72.750	1.000	-72.750	1.00	72.750
1		0.000	0.000	0.909	0.000	1.10	80.025
2		0.000	0.000	0.826	0.000	1.20	87.300
3		0.000	0.000	0.751	0.000	1.30	94.575
4		2854.194	2854.194	0.683	1949.453	1.40	101.850
5		2854.194	2854.194	0.621	1772.230	1.50	109.125
6		2854.194	2854.194	0.564	1611.118	1.60	116.400
7		2854.194	2854.194	0.513	1464.653	1.70	123.675
8		2854.194	2854.194	0.467	1331.502	1.80	130.950
9		2854.194	2854.194	0.424	1210.457	1.90	138.225
10		2854.194	2854.194	0.386	1100.415	2.00	145.500
11		2854.194	2854.194	0.350	1000.378	2.10	152.775
12		2854.194	2854.194	0.319	909.434	2.20	160.050
13		2854.194	2854.194	0.290	826.758	2.30	167.325
14		2854.194	2854.194	0.263	751.598	2.40	174.600
15		2854.194	2854.194	0.239	683.271	2.50	181.875
16		2854.194	2854.194	0.218	621.156	2.60	189.150
17		2854.194	2854.194	0.198	564.687	2.70	196.425
18		2854.194	2854.194	0.180	513.352	2.80	203.700
19		2854.194	2854.194	0.164	466.683	2.90	210.975
20		2854.194	2854.194	0.149	424.258	3.00	218.250
				NPV=	17128.653	PVC=	3055.500
				B/C=	5.61		

COST BENEFIT ANALYSIS OF PROJECT :DHEMADA

Year	Costs	Benefits	Net Benefits	Discount Factor for benefit	Present Value of benefit	Discount Factor for cost	Present Value of Cost
0	68.830	0.000	-68.830	1.000	-68.830	1.00	68.830
1		0.000	0.000	0.909	0.000	1.10	75.713
2		0.000	0.000	0.826	0.000	1.20	82.596
3		0.000	0.000	0.751	0.000	1.30	89.479
4		2638.733	2638.733	0.683	1802.290	1.40	96.362
5		2638.733	2638.733	0.621	1638.446	1.50	103.245
6		2638.733	2638.733	0.564	1489.496	1.60	110.128
7		2638.733	2638.733	0.513	1354.087	1.70	117.011
8		2638.733	2638.733	0.467	1230.988	1.80	123.894
9		2638.733	2638.733	0.424	1119.080	1.90	130.777
10		2638.733	2638.733	0.386	1017.346	2.00	137.660
11		2638.733	2638.733	0.350	924.860	2.10	144.543
12		2638.733	2638.733	0.319	840.782	2.20	151.426
13		2638.733	2638.733	0.290	764.347	2.30	158.309
14		2638.733	2638.733	0.263	694.861	2.40	165.192
15		2638.733	2638.733	0.239	631.692	2.50	172.075
16		2638.733	2638.733	0.218	574.265	2.60	178.958
17		2638.733	2638.733	0.198	522.059	2.70	185.841
18		2638.733	2638.733	0.180	474.599	2.80	192.724
19		2638.733	2638.733	0.164	431.454	2.90	199.607
20		2638.733	2638.733	0.149	392.231	3.00	206.490
				NPV=	15834.052	PVC=	2890.860
				B/C=	5.48		

Appendix-V

(Questionnaire survey for decision making of criteria importance of impact parameters in AHP)

I. GENERAL INFORMATION:

1.1 Name of the expert/beneficiary: _____

1.2 Occupation/Designation: _____

II. FUNDAMENTAL SCALE FOR PAIRWISE COMPARISON

The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

Source: Saaty (2005)

III. IMPACT PARAMETERS FOR PAIRWISE COMPARISONS

Impact Parameter	Abbreviation
Reduction in soil erosion	RSE
Increase in Ground water table	IGWT
Change in crop productivity	CCP
Change in cropping intensity	CCI
Increase in Livestock	ILS
BC ratio	BCR
Increase in income	IIN
Increase in employment	IEM
Increase in expenditure	IEX
Reduction in migration	RMI

IV. CRITERIA IMPORTANCE AND INTENSITY

	RSE	IGWT	CCP	CCI	ILS	BCR	IIN	IEM	IEX	RMI
RSE										
IGWT										
CCP										
CCI										
ILS										
BCR										
IIN										
IEM										
IEX										
RMI										