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IMPLEMENTATION COMPLETION REPORT

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT
(CR. 2100-IN AND LOAN 3175-IN)

November 3, 1999

Rural Development Sector Unit
South Asia Region

CURRENCY EQUIVALENTS

Currency Unit	=	Rupee (Rs)
At Appraisal (June, 1989): US$1.00	=	16.43
Completion Year (1999): US$1.00	=	43.39

WEIGHTS AND MEASURES

Metric System

FISCAL YEAR

April 1 – March 31

ABBREVIATIONS AND ACRONYMS

FAO/CP	FAO/World Bank Cooperative Programme
GIS	Geographical Information System
GOI	Government of India
IBRD	International Bank for Construction and Development
ICR	Implementation Completion Report
IDA	International Development Association
JFM	Joint Forest Management
MOA	Ministry of Agriculture
MTR	Mid-term Review
NBC	Natural Breeding Centers
NWDPRA	Natural Watershed Development Project for Rainfed Areas
SOPs	Silt Observation posts
T&V	Training and Visit Extension System
VDC	Village Development Committees
WPIO	Watershed Planning and Implementation Office

Vice President:	Mieko Nishimizu
Country Director:	Edwin R. Lim
Sector Manager:	Ridwan Ali
Task Leader:	T.C. Jain

IMPLEMENTATION COMPLETION REPORT

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT
(Cr.2100-IN and Ln3175-IN)

TABLE OF CONTENTS

APPENDICES:

IMPLEMENTATION COMPLETION REPORT

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS)) PROJECT

(Cr. 2100-IN/Ln. 3175-IN)

Preface

This is the Implementation Completion Report (ICR) for the Integrated Watershed Development (Hills) Project in India for which Cr.2100-IN in the amount of SDR56.8 million (US$75 million) and Ln. 3175-IN in the amount of US$13 million were approved by the Board on March 6, 1990, signed on 11 January 1991 and made effective on 10 May 1991.

The original financing plan was modified by cancellation of the loan in December 1991 and by extending the original credit closing date by one year and nine months to 31 March, 1999. The final disbursement as of September 5, 1999 is SDR47.86 million (US$67.55 million) utilizing 84.26% of total credit.

This ICR draft was prepared by an FAO/World Bank Co-operative Program (FAO/CP) mission[1] which visited India from 16 May to 2 June, 1999. Dr. T. C. Jain, Task Manager for the project joined the mission for the latter part of its program of field visits and for the final meetings with each state. The ICR is based on the Staff Appraisal Report, Loan, Credit and Project Agreements, Supervision Reports and documents in the project files as well as project impact evaluation reports and briefing documents prepared for the mission's visit by the project staff. Borrower's contribution from the participating states was made available to the ICR mission. A consolidated report from the Ministry of Agriculture, Government of India, is annexed as Attachment B. In addition, and with the full collaboration of the responsible line departments, the mission undertook a program of field visits in order to allow on site inspection and discussions with field staff and beneficiaries.

[11] J. H. Weatherhogg (FAO/CP Mission Leader, Agricultural Economist), J. V. Alexander (Soil Conservation/Watershed Management Consultant), S. K. Ranjhan (Livestock/Fodder Specialist Local Consultant) and Mrs. R. M. Sethi (Rural Sociologist Local Consultant.

IMPLEMENTATION COMPLETION REPORT

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(Cr. 2100-IN/Ln. 3175-IN)

Evaluation Summary

Introduction

1. Government of India (GOI) strategy for agricultural development in the Seventh and Eighth Five Year Plans (1985/90 & 1990/95) emphasized stabilization of natural resource systems in the rainfed sub-sector. Previous experience under World Bank supported projects, in particular the Kandi Watershed Area Development Project (Ln.1897–IN) as well as the Himalayan Watershed Management Project (Ln.2295-LN) and the Rainfed Areas Watershed Development Project (Cr. 1424-IN) had helped to demonstrate sustainable and cost effective treatments to arrest and reverse the degradation of watersheds. This project, together with a companion project in the plains areas (Integrated Watershed Development (Plains) Project – Cr.2131-IN/Ln.3197-IN) were therefore expected to have significant positive effects for the entire rainfed sector in India.

Project Objectives

2. The project's main objective was to slow and reverse degradation of the natural environment, through appropriate soil and moisture conservation technology. Improved soil and moisture conservation were to increase production and income from grain crops, horticulture, fodder, fibre, fuelwood and livestock to keep pace with population growth and reduce floods and other damage in the project area and adjacent plains. For this, the project was to promote known vegetative conservation technologies and verified others, developed co-ordinated, interactive planning and strengthened management of non-arable lands.

3. **Project components.** Project design included a degree of flexibility over the seven-year implementation period and this was reflected in the components. The **Initial Sub-Watersheds** component included 15 sub-watersheds in the four participating states of Punjab, Haryana, Himachal Pradesh and Jammu & Kashmir, covering an area of 110,000 ha identified for priority treatment. This included vegetative barriers on steep slopes and farm boundaries and programs for on-farm fodder production, horticulture, silvipasture, afforestation, drainage line treatments and livestock improvement. Planning allowed for interaction with rural communities to agree the type and volume of treatments, cost and benefit sharing arrangements and resource management responsibilities. This was the basis for annual work programs for each sub-watershed, identifying responsibilities for both implementing agencies and beneficiaries. The component also included treatment of around 16,000 ha of upper watershed, mainly forest land in Ropar and Hoshiapur districts of Punjab and construction of small water harvesting tanks[1] with a bund height of 10-15 meters to provide for domestic and livestock water needs and be able to command an area of 40-100 ha. The **Additional Sub-Watersheds** component provided for extension of the types of treatment developed and tested under the above component over an additional 120,000ha of upland sub-watersheds, contingent on satisfactory implementation of works on the initial watersheds and as agreed at the project's Mid-Term Review (MTR). The **Technology Improvement and Application** component included three sub-components. The first, for Nursery Development, focussed on provision of vetiver, forage species, horticultural and tree planting material in adequate quantities in all areas. Rainfed Farming Technology Demonstrations provided planting material and other inputs free to farmers for them to establish demonstrations and as a way to provide training to extension subject matter specialists and University trainers. On-Farm

[1] 30 sites were identified by the time of appraisal, resulting in a plan to construct some 27 water harvesting tanks.

Applied Research by the zonal research stations of the State Agricultural Universities in a few selected sub-watersheds aimed to determine the impact of their treatment and identify any constraints.. The **Project Implementation** component provided for the establishment of a Watershed Planning and Implementation Office (WPIO) in each of the four states. These offices were to include staff of a mix of disciplines, seconded from their line agencies and to be responsible for the bulk of implementation, in close collaboration with the relevant line departments. Finance was included for incremental staff, vehicles, equipment, offices and staff housing, training and study tours, a Geographical Information System (GIS) in each state to facilitate planning and monitoring, contracts for baseline and impact evaluation studies, and short term consultancies. The final component for **Central Support** was to be implemented by the Ministry of Agriculture (MOA) of GOI and consisted of Training and Technical Assistance sub-components. Training was supported at the Punjab Agricultural University Regional Research Center at Ballowal Saunkhri through workshops/retreats involving staff from all the participating states, for which funds were provided for buildings and equipment, cost of lecturers and support staff and other operating costs. The project was also to set up a training facility at the Punjab Remote Sensing Center in Ludhiana to help establish GIS in the four states and provide regular in-service training, for which funds for rental costs, equipment and consultants were provided. Technical assistance was to be provided by a team of consultants, preferably local, who would be recruited to train staff in interdisciplinary watershed planning, participatory preparation and implementation of sub-watershed treatment schemes, and organizing, supporting and empowering local communities to assume management responsibility.

4. **Covenants and agreements** were mainly aimed at ensuring adequate and timely staffing of the WPIOs and release of sufficient budget to enable effective implementation.

5. **Evaluation of project objectives.** The project objectives were clear and benefited from the experience gained from earlier projects. Design was good in allowing for interaction with rural communities in deciding the scope and extent of activities to be supported and had flexibility to allow for adjustment following the MTR of the project.

Implementation Experience and Results

6. Implementation started slowly as a result of non-recruitment of consultants by the MOA of GOI, difficulties in recruiting and posting staff and establishing the Watershed Planning and Implementation Offices (WPIOs). Security was a problem in Punjab up to 1992 and from then onwards in Jammu Kashmir, which prevented WB supervision visits, the latter task being regularly undertaken by MOA. From project start-up in July 1991 activities commenced in 24 sub-watersheds. Because of the lack of consultants the project staff had to develop their own approaches to participative planning and implementation with local communities, which was successfully accomplished. The original design provided a degree of flexibility but following the MTR in 1994 the project activities were adjusted to bring them still more closely into line with communities' needs and flexibility increased through sensitive supervision.

7. The project has proven highly successful in promoting vegetative means for soil and water conservation. Expansion of activities at the MTR and extension of the credit closing date have resulted in a total area treated by the project of over 352,000 ha, or 43% higher than the 246,0000 ha planned at appraisal. Treatment of **non-arable land** (forest and village community land) accounts for about 45% of total project investments and has proved very successful, particularly the use of contour trenches for reducing run-off and increasing moisture infiltration. **Arable area** treatments covering 28,600 ha include introduction of improved inputs as well as better husbandry and soil and water conservation practices. As a result, maize average yield has risen from 0.8 tons/ha to 1.4 tons/ha and wheat yield has increased from 0.9 tons/ha to 1.8 tons/ha. **Rainfed horticulture** has been successfully promoted with some 7,500 ha being planted with fruit trees, most commonly mango. **Livestock development** has been supported through breed improvement by both AI of cattle and buffalo and natural breeding, improved feeding by planting of fodder grasses and better use of crop residues and improved animal health by establishing dispensaries with a significant increase in milk production. **Drainage line stabilization** using a mixture of engineering and vegetative means has been successful in protecting the banks of choes (torrents) and in some cases reclaiming part of the bed for agricultural

use. **Water harvesting** as originally proposed with medium sized tanks with bunds 10-15m high was dropped in favor of smaller tanks and a variety of schemes including improving existing ponds and tanks, tapping springs and provision of simple facilities for domestic uses and for watering animals. In addition these small schemes give an opportunity for providing 'life-saving' irrigation to field and tree crops in times of drought as well as creation of 2,000ha of perennial irrigated area. **Technology development** financed by the project has been valuable in promoting use of improved technology, carrying out on-farm applied research and monitoring the effects of treatments on soil loss, run-off and infiltration. **Project implementation support** in particular the establishment of multi-disciplinary WPIOs in each state was satisfactorily implemented and has operated well. Project staff have helped in the formation of some 480 Village Development Committees to assist in planning and implementation of project investments and share responsibility for their subsequent maintenance and protection. **Central support** for training and technical assistance had mixed success. Training of project staff at the Ballowal Saunkhri Regional Research Center was satisfactory, but since the training was on-station, tended to bias the benefit towards staff close to the Center. Technical assistance to be financed by MOA for consultants to assist in initial operation/staff training and for the establishment of the GIS were never recruited, so that initial implementation was slowed and no GIS established

8. **Sustainability**. The credit for a second phase, five year project is already approved so continuity of staffing and some follow-up in the existing project areas is assured. For the longer term sustainability of both this project and the second phase action is required in three respects, namely (a) at the end of IDA financial support either the WPIOs will need to be dismantled and staff returned to their parent line departments, or else the WPIOs will need to be reduced in size so as not to be too heavy a burden on Government budget; (b) Village Development Committees (VDC) formed with the support of the project will require further guidance and help to become fully operational and also to link themselves into the local government system (Panchayat); and (c) at present arrangements for division of responsibilities and benefits between Forest Department and village communities need to be clarified in order to provide a firm basis for further partnership and management. Since the phase II project will provide time for resolution of these potential risks, sustainability of the project is rated likely.

9. **Project cost and financing.** Total project costs are estimated at credit closing at Rs3.05 billion (US$92.8 million) compared with the estimated cost at appraisal of Rs2.40 billion (US$125.6.million) (Table 8A). Government share of funding is estimated at ICR at around 23% of the total project costs, or about Rs0.69 billion (US$21 million), the same proportion as the Rs0.55 billion (US$29.million) estimated at appraisal (Table 8B). As of September 5, 1999, SDR47.86 million (US$67.55 million) was disbursed, utilizing 84.26% of the total credit

10. **The main factors affecting the project** have been generally positive. In all four states Government support to the project has been good, or very good. The method of operation of the WPIOs in adopting a participative and needs-based approach to planning and implementation has been reflected in generally good commitment of rural communities to the project. Constraints for the project have been posed by the initial security problems in Punjab up to 1992 and similar difficulties since then in Jammu Kashmir, which have prevented visits by Bank supervision missions, slowness in filling important staff positions, too frequent movement of staff, use of project vehicles for other purposes (in Himachal Pradesh) and non-recruitment of consultants required for project start-up and establishment of the GIS by MOA.

11. **The Bank's performance** in project preparation and design was good, based on experience of other watershed and forestry development projects and with a degree of built-in flexibility. The MTR was useful in adjusting the scale of the treatments financed to community needs and supervision was good, sensitive to the need for flexibility in implementation and encouraged interaction between the four states. Cancellation of the loan and extension of the credit closing date showed correct judgement and assisted successful implementation.

12. **Borrower performance** has generally been good, or very good, with strong project support by the four States. Weak points were some slowness in filling key staff posts, sometimes too frequent transfer of staff and limitation of transport in Himachal Pradesh by using project financed

vehicles for non-project purposes. MOA failed to recruit consultants to assist staff in project start-up and establishment of a GIS, slowing implementation and preventing GIS establishment.

13. **Assessment of project outcome.** The project has generally reached or exceeded the level of activities and achievement expected at appraisal. Farm incomes are significantly higher as a result of treatment of arable areas. Quantifying only benefits from increased production of field crops, horticulture, and wood and non-wood forest products from the non-arable areas treated by the project the economic rate of return is calculated at about 17% (the same as at appraisal). Benefits from livestock development, reduction or prevention of flooding, land reclamation, improved groundwater regime and other environmental benefits claimed for the project have not been quantified. In addition, the success in building the four WPIOs to be effective in promoting vegetative means of soil and water conservation in approaches, which are now accepted nationally is a significant and valuable benefit. Moreover the participative approach to project planning and implementation is reflected in a good commitment by the rural communities to the project who have contributed 10-14% of the value of total field operations in their own labor.

Summary of Findings, Future Operations and Key Lessons Learned

14. **The overall finding** of the ICR mission is that the project has been successful in significantly exceeding the area of treatment anticipated at appraisal. The project has also been satisfactory in promoting vegetative means of soil and water conservation now adopted in projects and programs in many states of India, and in establishing a participatory approach to planning and implementation. The project has also generated other benefits including the creation of a multidisciplinary project management office in each of the four states, significant increases in livestock production, particularly milk, reduction in flooding, reclamation of some stream bed land for agriculture, creation of around 2,000 ha of perennial irrigated area, and improvement of the groundwater regime. Higher rainfed farming yields have resulted in significant increases in farm incomes and these together with benefits from horticulture and non-arable areas are sufficient to give the project a satisfactory economic rate of return of 17%.

15. **Future operation** of the project will depend largely upon the sustainability of the Village Development Committees, set up with project support. The second phase project will ensure continuity of staffing and some follow-up support for this project's activities. Future project operation of the project should, therefore, be adequate and the project's sustainability is rated as likely.

16. **Key lessons learned.** The main lessons learned are: (a) this type of project needs to address the communities' priorities - particularly provision of water supply; (b) for participatory projects a degree of flexibility in the choice of project activities is essential; (c) for a Village Development Committee (VDC) to be successful it has to have some activity and investment as a focus for its activity; (d) project activities must be needs based, not for example based mainly on geographic considerations, as for example the Natural Breeding Centers (NBC) in Himachal Pradesh; (e) for projects of a participative type there is a need for a pre-construction phase in which communities can be fully involved and consulted; (f) closely integrated; multi-disciplinary teams can be an effective means of implementing watershed projects. and (g) in view of the adverse effect on the project of lack of the necessary technical assistance, it would be prudent if technical assistance contracts were prepared and ready for signing as a condition for negotiations

IMPLEMENTATION COMPLETION REPORT

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT
(including Cr. 2100/Ln.3175-IN))

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. STATEMENT/EVALUATION OF OBJECTIVES

1. The main project objective was to slow and reverse degradation of the natural environment, through the use of appropriate soil and moisture conservation technology. In the process of conserving soil and *in-situ* moisture, it would also improve production and income from grain crops, horticulture, fodder, fibre, fuelwood and livestock, and reduce flooding and other devastation caused by degradation in both the project area and in the adjoining plains. The project aims to lay a foundation for sustainable production increases sufficient to keep pace with population growth. To this end the project has promoted known vegetative conservation technologies, and verified innovative approaches, developed awareness for co-ordinated, interactive planning, and strengthened management and use of non-arable areas.

2. These objectives were clear and well chosen, supporting the Government's key strategy, as set out in the Seventh and Eighth Five Year Plans (1985/90 and 1990/95), to stabilize natural resource systems in the rainfed sector. Project objectives and design also benefited from the implementation experience of previous WB supported projects, in particular the Kandi Watershed Area Development Project (Ln.1897–IN), the Himalayan Watershed Management Project (Ln.2295-LN) and the Rainfed Areas Watershed Development Project (Cr. 1424-IN), as well as some social forestry projects, including the Jammu/Kashmir and Haryana Social Forestry Project (Cr.1286-IN) and the National Social Forestry Project (Cr.1611-IN) and a number of GOI's centrally sponsored schemes.

3. As well as the project's ultimate objectives the immediate aims of having a project that adopted an integrated, multidisciplinary approach; that promoted relatively low-cost vegetative means of soil and water conservation; that sought interaction with village communities in planning and implementation; and which embodied a degree of flexibility over the type and extent of treatments applied according to beneficiary needs, were also well identified.

B. ACHIEVEMENT OF OBJECTIVES

4. The project was appraised in June/July 1989, but because of delay in recruitment of consultants by MOA, the sometimes problematic security situation and difficulties in recruiting and posting staff and establishing the Watershed Planning and Implementation Offices (WPIO) in each

state the credit and loan only became effective on 10 May 1991. Following a start-up workshop in July 1991 project activities started in 24 sub-watersheds (2 in Haryana, 6 in Himachal Pradesh, 3 in Jammu and Kashmir, and 13 in Punjab). In 9 of the initial 13 sub-watersheds in Punjab, project activities were undertaken only in the upper catchment areas, concentrating on treating the non-arable areas and drainage lines. The lower catchment areas of these 9 sub-watersheds will be treated during the second phase of the project. Activities were extended to an additional 20 sub-watersheds following the mid-term review (MTR), and a further 15 sub-watersheds were added when the credit closing date was extended. As a result of these changes and extension to the project the total area treated is more than 352,000 ha, or about 43% more than the 246,000 ha estimated at appraisal.

5. The project design gave considerable prominence to the introduction of new and innovative conservation technologies for the stabilization of arable areas. In reality the main soil erosion problems in the Shivalik zone are caused by uncontrolled run-off from the upper catchment areas, and when these areas are revegetated and stabilized, the land degradation problems in the lower drainage lines and arable areas are significantly reduced.

6. As summarized in Table 5 the project has been largely successful in reaching or exceeding the targets set at appraisal and the revised targets drawn up following the MTR. Generally any shortfall in project output for any particular item reflects communities' participation and choice regarding the type of treatments to be applied. Initial assumptions regarding the use of vegetative contour barriers, particularly in respect of farmer acceptance and the suitability of vetiver grass (*Vetiveria zizanoides*) did not prove successful, but there has been good progress with across-slope vegetative barriers using other species that have productive value for farmers. The main success has been with forage grasses, and in particular Napier grass (*Pennisetum purpureum*) and also setaria (*Setaria splendens*). Other species that provide economic benefits such as bhabbar grass (*Eulaliopsis binata*) which is used for rope making, and *Dodenea viscosa* which is used for fuelwood, have also been successfully used as vegetative barriers, particularly in non-arable areas.

7. **Non-arable treatments** including afforestation, silvipasture and pasture account for around 45% of total project investments. Contour trenches for controlling surface run-off and increasing moisture infiltration are an important technical success. This has resulted to very good tree and grass survival rates in all states, as well as a more even flow in drainage lines, reduction in flooding and protection of the lower arable areas.

8. Tree and shrub species have been selected in conjunction with local communities, and species composition varies related to changes in ecological conditions. The most common tree species planted have been khair (*Acacia catechu*), sisham (*Dalbergia sissoo*) and reru (*Acacia leucophloea*). The most common shrub species has been *Dodenea viscosa*. Plant survival in project plantations has been satisfactory and usually above 70%. In some areas the number of surviving tree seedlings actually exceeds the number of seedlings planted because seed has also been sown along the contour trenches. The total non-arable area that has been treated is 109,330 ha, of which the largest single activity has been afforestation which has been undertaken on over 50,000 ha.

9. **Arable areas treatment** has included 28,600 ha of on-farm, improved rainfed farming demonstrations which have promoted introduction of new varieties, seed treatment, fertilizer, pesticide and moisture conservation practices. As a result there has been a marked increase in average yields and production. Maize grown in the kharif or monsoon season has increased from a pre- and without-project SAR estimate of 0.8 tons/ha to an average of 1.4 tons/ha. Similarly wheat grown in the rabi or winter season has risen from 0.9 tons/ha to an average with-project of 1.8 tons/ha. In

addition there has been some diversification in cropping, particularly introduction of vegetables and fodders such as berseem and sorghum. Prevention of post-harvest losses was promoted by distribution of grain storage bins to farmers (Table 5).

10. **Rainfed horticulture** activities have been reasonably successful. Before the project fruit growing under totally rainfed conditions was not common in the Shivalik zone. The total area planted with fruit trees assisted by the project is around 7,500 ha and the considerable potential for rainfed horticulture is well demonstrated. Farmer preference has mainly been to plant mango trees (*Mangifera indica*), but the success with this species has been mixed and there has been considerable mortality of newly planted seedlings, and this species does require supplementary irrigation at least in the initial years. The impact evaluation surveys indicate that average seedling survival rate for horticultural plantations has been approximately 50% on average, but this does not appear to allow for any subsequent in-filling by farmers. Project supported research at the Regional Research Station at Ballowal Saunkhri indicates that while mango is suited for soils with a good moisture holding capacity, on marginal soils amla (*Emblica officinalis*), and ber (*Zizyphus mauritiana*) may be better suited.

11. **Livestock development** aimed particularly at increase in milk production through upgrading cattle and buffaloes using AI and matured breeding, increasing feed resources through growing fodder grasses on field bunds and boundaries as silvipasture and improving use of crop residues through chopping and stall feeding. In addition, the project established veterinary dispensaries. As shown in Table 5, the project has generally been successful in exceeding the targets set for breed improvement through AI. Reduction in livestock numbers through purchase of scrub animals was started but proved unworkable and was abandoned. Initially the project also provided supplementary feed for in-calf animals and for calf rearing as an inducement to adopt improved management practices, but this was discontinued after the MTR. The program for promotion of fodder grasses has been highly successful and is now widely adopted with benefits both in improved nutrition as well as in time saved in collection of the use of crop residues and repairs or construction of stalls to promote stall feeding (Table 5). Animal health infrastructure has been improved by construction of 3 new veterinary hospitals and 12 dispensaries in Haryana and 8 dispensaries in Punjab.

12. **Drainage line stabilization** by a mixture of engineering works, particularly cratewire structures (gabions) and vegetative means has been generally successful. Species performing well include *Ipomea carnea, Vitex negunda, Dodenea viscosa* and *Arundo donex,* with productive species such as bamboo and sisal (*Sizal sizlian*) planted within the drainage line and often resulting in part of the bed being reclaimed for cultivation.

13. **Water harvesting** plans, originally to be 27 medium sized water harvesting structures (10-15m high), were not proceeded with, particularly due to the Bank's requirement to establish a Dam Review Panel in each state. Following the MTR, and in response to demands from the rural communities, much greater emphasis was placed on water resources development in many ways, including construction of small tanks of below 10m in height, rehabilitation of existing village tanks or new construction, tapping of springs, and provision of pipes and storage tanks for village water supply. These initiatives have proved to be the most widely appreciated component of the project, since they directly address the rural communities' greatest priority – water – for drinking and other domestic uses, for livestock and for irrigation. The area reported to have been brought under perennial irrigation is reported to be quite small, only about 2,000ha, but the availability of water in these communities gives the possibility of also providing "life-saving" irrigation to field and horticultural

crops in times of drought. Arguably the greatest benefit of all has come from the large saving in time in collection of water for the house and animals by women.

14. **Technology development** in the form of improved nursery technology and demonstration of rainfed farming technology was satisfactorily integrated with the treatments described above. On-farm applied research was undertaken by the State Agricultural Universities in each state, in particular by the Punjab Agricultural University, through their Regional Research Station at Ballowal Saunkhri. Reports of some of the studies financed by the project are listed in Table 7. Establishment of silt observation posts (SOPs) provided some information on soil loss, as discussed under environmental impact below.

15. **Project implementation support.** Establishment of multi-disciplinary WPIOs in each state is one of the notable achievements of the project. These have performed well in developing participative planning and implementation with communities and the organization of such communities into Village Development Committees (VDCs), some 480 of which have been formed of which perhaps about half are presently considered fully active. Start-up of the WPIOs and development of a Geographical Information System (GIS) for project progress monitoring as well as an input into project planning were constrained by lack of consultancy assistance, as described below. All the states had plans for improving their office and staff accommodation, but in the event it was only Haryana which ultimately carried out a significant program, including 4 offices (around 3,900 m^2) and 71 staff quarters (totalling 3,800 m^2)

16. **Central support** with project funding through MOA was provided for training of project staff and provision of technical assistance. Training was provided by the Ballowal Saunkhri Regional Research Station through 86 courses involving over 2,000 participant project staff, for which the project also financed expansion in accommodation and training facilities, salaries and other operating costs. Although the training quality has been good and appropriate, since the training was on-station it tended to benefit those closer units and staff, to the disadvantage of those in more remote areas.

17. Technical assistance for initial staff training and for training in the use of GIS was intended to be through consultants contracted by MOA. In the event the consultants were never recruited and consequently the WPIOs had to develop their own methods of operation and although the GIS equipment was financed the system has as yet to be developed and activated.

18. **Environmental impact** of the project has been positive and substantial, and includes reduction in soil loss, more regulated discharge of water from the project sub-watersheds, reduction in flooding, protection of streambanks and recharge of groundwater systems. The project impact evaluation studies have attempted to quantify the environmental benefits, particularly soil loss, run-off, infiltration and surface leaf litter. As presented in Appendix C, Table 8, the results show considerable variation between sites and states, but despite inadequate data on the pre-or without project situation, the general inference from the measurements available is that the impact of the project on soil and moisture conservation is strongly positive.

C. MAJOR FACTORS AFFECTING THE PROJECT

19. **Factors not generally subject to Government control.** The main factors affecting performance were the initially poor security situation in Punjab up to 1992 and in Jammu Kashmir thereafter, which prevented visits by WB supervision missions and record floods in the Kandi Zone in

1995 and 1996. The project approach and management system were both new innovations and this resulted in some difficulty in finding suitably qualified staff and establishing the WPIOs.

20. **Factors generally subject to Government control.** Lack of consultant recruitment by MOA to assist project management in the start-up phase slowed initial implementation. Similarly the failure to contract consultants meant that the GIS has yet to be established. Generally Government support to the project was good, or very good, in all four states. Release of budget has usually been timely and adequate. Weak points which have constrained activities have been slowness in filling important staff positions, too frequent movement of staff, and, in the case of Himachal Pradesh, lack of transport as a result of retaining vehicles financed by the project for other uses.

21. **Factors generally subject to implementing agency control.** The WPIOs in each state have developed a good multidisciplinary way of working which allows for interaction and participation by the local communities as well as flexibility. This has allowed the project to be increasingly tailored to the requirements of the local communities, as illustrated by the change in emphasis from vetiver to other grass varieties and the increasing emphasis on water resources development.

D. PROJECT SUSTAINABILITY

22. A second phase, five year project has already been approved and retroactive financing is agreed from March 1, 1999 to provide continuity with this project. This will allow for continuity of project staffing and some follow-up in areas covered by this project. Sustainability considerations are therefore common both to this project and the Phase II project now commencing and consist of project management; community organization; and non-arable area assignment of responsibilities/benefits.

23. Project management in this project and the Phase II is by the WPIOs, cost of operation of which accounts for almost 20% of total project costs. Unless there is any still further phase of the project, before the end of the Phase II project the WPIOs will either (a) need to be dismantled and the staff and responsibilities transferred to the relevant line departments, or, (b) the WPIOs size and operating costs adjusted to a level where they can be financed out of Government budget without too great a difficulty.

24. Some 480 Village Development Committees (VDCs) have been formed with the project's support. At present probably only about half are fully operational and the balance will need further support and guidance to become self-reliant. Initially these VDC were formed for the purpose of the project and had no linkage with the local government structure. With encouragement from the project and in line with the 73rd Constitutional Amendment[1] these are now forming links with the local government structure. It will be important for future sustainability of the project investments that the VDCs remain active in furthering the projects aims and operation of assets such as water supply systems; as a forum for agreement on further community and area development as well as for resolution of any disputes between beneficiaries; and as the representatives of the community in any discussions with government agencies.

25. Non-arable areas treated by the project would generally revert to Forest Department responsibility in the case of government lands or to Panchayat management in respect of common

[1] Regarding Panchayat Raj legislation

lands. At the moment arrangements for assignment of responsibility for protection of these areas, for fire control and for sharing of benefits, particularly long-term production benefits, lack clarity. GOI and forest departments in most states of India are moving towards systems of joint forest management (JFM) between the Forest Department and communities for management of forest areas close to villages. However, as yet in the project areas the legislative basis and arrangements for sharing responsibilities and benefits are not clear enough to provide a solid foundation for JFM.

26. Although immediate project sustainability is virtually guaranteed by virtue of the Phase II project and sustainability is therefore rated likely, in the longer term the sustainability of investments supported by the project and its successor phase, or phases, will depend on satisfactory solution of the aspects mentioned above on management support, village institutions and sharing of responsibilities and benefits in non-arable areas.

E. BANK PERFORMANCE

27. Bank performance in project preparation and design was good. Design drew on past experience and included a degree of flexibility. The MTR allowed for some modification of the project components. Supervision was good, highlighting constraints to successful implementation, supportive of project management and sensitive to the need for flexibility. The Bank played a helpful and innovative role in encouraging interaction and exchange of ideas between the participatory states through arranging workshops and visits associated with supervision missions. The Bank was also sympathetic to project and Government needs and correct in cancelling the loan as requested by GOI as well as in agreeing to extension of the project closing date.

F. BORROWER PERFORMANCE

28. Government support for project implementation was generally good in all four states. Weak points were occasional slowness in filling staff positions, too frequent transfer of staff and use of vehicles financed by the project for other uses in Himachal Pradesh. GOI performance in provision of central support for the project has been less satisfactory. Non-recruitment of consultants slowed the project start-up as well as preventing the establishment of a GIS, which could have materially helped the project in monitoring as well as being a potentially valuable input into planning. Due to security problems in Jammu Kashmir, GOI has also been responsible for project supervision in the state since 1993.

G. ASSESSMENT OF OUTCOME

29. The project has been successful in reaching or exceeding the level of activities expected at appraisal. Analysis of the benefits from treatments to arable areas shows a significant positive impact on farm incomes. Taking only the benefits from farm land (field crops and horticulture) as well as anticipated benefits from non-arable area, the economic rate of return for the whole project is calculated at around 17%, the same as the SAR estimate. Other benefits credited to the project from prevention of flooding, reclamation of land for agriculture from the beds of watercourses, improved groundwater characteristics and other environmental benefits have not been quantified.

30. A further considerable benefit of the project, which also has not been quantified, is the institutional development effect. WPIOs have developed an effective, multi-disciplinary and participative approach to watershed development. The project has been instrumental in promoting

vegetative methods of soil and water conservation. These have been accepted by project field staff and are now being adopted in other watershed development programs, in particular the centrally sponsored National Watershed Development Project for Rainfed Areas (NWDPRA). Commitment of the rural communities to the project has been encouraged by the participative approach adopted for planning and implementation. This has been reflected in a readiness on the part of the communities to contribute part of the costs of project treatments, particularly in the form of their own labor. Such beneficiary contributions vary between the states from about 10-14% of the total cost of field operations. The overall project outcome is therefore assessed as satisfactory.

H. FUTURE OPERATION

31. Satisfactory future project operation during the next five years is largely guaranteed by the existence of the Phase II project. Funding provided under the latter will allow for project staff to continue to provide support and guidance to the more recently formed VDCs. It will be particularly important to resolve the division of responsibilities and benefits arising from project activities in non-arable areas.

I. KEY LESSONS LEARNED

32. Watershed development projects, to be successful, need to address the communities' priorities. A good example in this project was the increasing stress following the MTR given to provision of water supplies to rural communities, which was in direct response to the villagers requests.

33. For participatory projects to work project design has to include a degree of flexibility in the choice of project activities. In this project the degree of flexibility built into the project design was subsequently broadened after MTR by sensitive supervision. This enabled the project to better cater to the communities' needs with consequently greater commitment to the project by these same communities.

34. For a Village Development Committee (VDC) to be successful it has to have some activity and investment as a focus for its activity. If there is an extended period without any real reason for existing and holding meetings the members and office holders will lose interest. Introduction at an early stage of the project of relatively simple components, such as improving drinking water availability can be a valuable catalyst to community group development.

35. Project activities must be needs based, not for example based mainly on geographic considerations. To be successful all components need to respond to community needs. Planning, for example, natural breeding centers (NBCs) on a geographical basis in Himachal Pradesh led to some NBCs being established in villages where bulls were lightly used and farmers were unwilling to contribute towards operating costs.

36. For projects of a participative type there is a need for a pre-construction phase in which communities can be fully involved and consulted. Since gaining the communities' support is crucial for the project's success the sooner interaction between project staff and communities starts the sooner those communities will be able to develop fully operational groups and become more committed to the project. Building consensus in villages is a time consuming process and these 'social

engineering' requires a longer time to implement than the more physical works financed by the project.

37. Closely integrated, multi-disciplinary teams can be an effective means of implementing watershed projects. The project's implementation performance has demonstrated the success that can be achieved by a well motivated, multidisciplinary team.

38. Lack of necessary technical assistance delayed project start-up and prevented GIS establishment. To avoid this situation technical assistance contracts should be prepared and ready for signing as a condition for negotiations.

39. The supervision of the state of Jammu & Kashmir was done through the Ministry of Agriculture, Government of India, which was quite helpful in monitoring project progress. However, to make project supervision fully effective, it should be done through an independent agency. This has been taken care of under the follow-up IWDP Hills II project.

PART II: STATISTICAL TABLES

Table 1: Summary of Assessments

A. Achievement of objectives	Substantial (✓)	Partial (✓)	Negligible (✓)	Not Applicable (✓)
Macro policies	☐	☑	☐	☐
Sector policies	☐	☑	☐	☐
Financial objectives	☑	☐	☐	☐
Institutional development	☑	☐	☐	☐
Physical objectives	☑	☐	☐	☐
Poverty reduction	☐	☑	☐	☐
Gender issues	☐	☑	☐	☐
Other social objectives	☐	☑	☐	☐
Environmental objectives	☑	☐	☐	☐
Public sector management	☑	☐	☐	☐
Private sector development	☐	☐	☐	☑
Other (specify)	☐	☐	☐	☑

B. Project sustainability	Likely (✓)	Unlikely (✓)	Uncertain (✓)
	☑	☐	☐

C. Bank performance	Highly satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Identification	☐	☑	☐
Preparation assistance	☐	☑	☐
Appraisal	☐	☑	☐
Supervision	☑	☐	☐

D. Borrower performance	Highly satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Preparation	☐	☑	☐
Implementation	☑	☐	☐
Covenant compliance	☐	☑	☐
Operation (if applicable)	☐	☑	☐

E. Assessment of outcome	Highly satisfactory (✓)	Satisfactory (✓)	Unsatisfactory (✓)	Highly unsatisfactory (✓)
	☐	☑	☐	☐

Table 2: Related Bank Loans/Credits

Loan/credit title	Purpose	Year of approval	Status
Preceding operations			
1. Kandi Watershed and Area Development Project. (Ln. 1897)	Rehabilitation of the Kandi tract	July 20, 1980	Completed March 31, 1998
2. Himalayan Watershed Management Project (Ln.2295)	Rehabilitation/Development of Areas of the Himalayan foothills	May 31, 1983	Completed Sept.30, 1992
3. Pilot Project on Watershed Development in Rainfed Areas. (Cr. 1424)	Watershed rehabilitation and development	Dec. 8, 1983	Completed Dec. 31, 1993
Following operations			
1. Integrated Watershed Development (Plains) Project (Cr. 2131 and Ln. 3197)	Rehabilitation of watersheds in plains areas of Gujarat, Orissa and Rajasthan	May 15, 1990	Completed March 31, 1999
2. Integrated Watershed Development (Hills) Project Phase II	Continuation of watershed rehabilitation through integrated and participative approach	June 1999	Signing July 1999. Retroactive financing from March 1, 1999

Table 3: Project Timetable

Steps in project cycle	Date planned	Date actual/ latest estimate
Identification (Executive Project Summary)	N.A.	N.A.
Preparation	N.A.	N.A.
Appraisal	N.A.	June/July 1989
Negotiations	N.A.	January 16-23 1990
Letter of development policy (if applicable)	-	-
Board approval	March 6 1990	March 6 1990
Signing	N.A.	January 11 1991
Effectiveness	N.A.	May 10 1991
First tranche release (if applicable)	-	-
Midterm review (if applicable)	December 1994	September/October 1994
Second (and third) tranche release (if applicable)	-	-
Project completion	June 30 1997	March 31 1999
Loan closing	June 30 1997	March 31 1999

Table 4: Loan/Credit Disbursements: Cumulative Estimated and Actual (US$ thousands)

	FY'90	FY'91	FY'92	FY'93	FY'94	FY'95	FY'96	FY'97	FY'98	FY'99
Appraisal estimate	4.0	12.0	24.0	39.0	55.0	67.0	78.0	88.0	-	-
Actual	-	-	5.5	12.9	22.3	30.1	40.1	47.7	55.0	67.55
Actual as % of estimate	-	-	23	33	41	45	51	54	63	84.3
Date of final disbursement	16 August 1999									

Table 5 (a) Punjab

Achievement of Physical Targets				
Activity	**Unit**	**Initial Target**	**Revised Target [1]**	**Project Achievement**
ARABLE LANDS				
Vegetative barriers/field barriers	ha	7,783	7,718	6,439
Rainfed horticulture	ha	116	203	673
Rainfed crop demonstrations	ha	5,620	6,943	8,283
On-farm fodder production	ha	525	635	850
NON-ARABLE LANDS				
PRIVATE				
Shrub barriers	ha	181	No data	1,219
Vegetative barrier – production component	ha	513		4,090
Silvipasture	ha	779		7,698
Afforestation	ha	2,426		12,050
VILLAGE COMMON LANDS				
Shrub barriers	ha	173		730
Vegetative barrier – production component	ha	568		2,911
Silvipasture	ha	581		2,951
Afforestation	ha	2,669		5,214
FOREST LANDS				
Shrub barriers	ha	142		339
Vegetative barrier – production component	ha	431		2,529
Silvipasture	ha	830		678
Afforestation	ha	990		4,573
DRAINAGE LINES				
Masonry cement structures	m^3	49,043	41,455	48,765
Cratewire structures (gully stabilization)	m^3	72,017	67,556	72,660
Dry stone structures	m^3	213,713	165,410	156,876
Vegetative check dams	m	258,039	296,489	283,407
Cratewire structures (streambank protection)	m^3	21,406	46,820	69,041
Vegetative spurs	km	523	572	832
Village ponds	no	28	26	28
Rehabilitation of ponds	no	53	34	41
Makhowal structures	no	17	34	37
Water harvesting structures	no	7	0	0
Silt retention dams	no	0	116	220
ANIMAL HUSBANDRY				
Livestock improvement	no	26,844	35,694	47,604
Supplementary feeding				
Late pregnancy ration	no	16,487	9,478	9,478
Female calf rearing	no	8,180	5,498	5,498

[1/] The targets were revised at the MTR and again at the time of the two extensions in time

Table 5 (b) Haryana

Achievement of Physical Targets				
Activity	**Unit**	**Initial Target**	**Revised Target [1]**	**Project Achievement**
ARABLE LANDS				
Vegetative barriers	ha	786	13	13
Terrace repair/vegetative reinforcement	ha	785	23	23
Vegetative field boundaries	ha	1,318	8,377	7,859
Rainfed horticulture	ha	52	1,160	1,443
Rainfed crop demonstrations	ha	1,765	4,959	4,515
Herb garden	no	0	1	1
NON-ARABLE LANDS				
PRIVATE				
Vegetative/shrub barriers	ha	222	1,184	363
Silvipasture	ha	171	1,191	311
Afforestation	ha	40	7,271	6,589
VILLAGE COMMON LANDS				
Vegetative/shrub barriers	ha	320	657	448
Silvipasture	ha	204	504	129
Afforestation	ha	50	2,674	3,224
FOREST LANDS				
Vegetative/shrub barriers	ha	1,093	1,835	1,863
Silvipasture	ha	124		355
Afforestation	ha	474	1,062	3,794
DRAINAGE LINES				
Cratewire structures (gully stabilization)	m^3	13,248	61,693	26,842
Earthen gully plugs	no	124	472	782
Masonry cement structures	m^3	8,000	58,489	58,702
Dry stone structures	m^3	11,760	79,313	60,119
Small stone check dams	m^3	22,800	60,800	56,731
Vegetative check dams	m	249	880	3,055
Silt detention structures	no	35	173	275
Cratewire structures (streambank protection)	m^3	6,420	6,420	3,306
Vegetative spurs	m	878	14,878	4,452
Village tanks/ponds	no	39	311	269
Sub-surface dam	no	0	11	19
Water harvesting structures	no	5	0	0
Water supply system large	no	0	4	31
Water supply system small	no	0	32	24
ANIMAL HUSBANDRY				
Artificial insemination	no	0	36,500	53,866
Health coverage	no	0	510,000	940,264
Supplementary feeding	no	220	2,820	2,769

[1/] The targets were revised at the MTR and again at the time of the two extensions in time.

Table 5 (c) Himachal Pradesh

Achievement of Physical Targets				
Activity	**Unit**	**Initial Target**	**Revised Target [1]**	**Project Achievement**
ARABLE LANDS				
Vegetative barriers	ha	285	285	285
Terrace repair/vegetative reinforcement	ha	1,648	7,998	5,814
Vegetative field boundaries	ha	2,180	9,787	8,742
Rainfed horticulture	ha	422	2,358	2,172
Rainfed crop demonstrations	ha	1,581	8,466	7,831
On-farm fodder production	ha	1,176	5,171	3,844
NON-ARABLE LANDS				
PRIVATE				
Pasture development	ha	788	3,830	2,927
Afforestation	ha	381	2,069	2,702
Silvipasture	ha	0	15	15
Vegetative shrub barriers	ha	0	13	13
VILLAGE COMMON LANDS				
Vegetative shrub barriers	ha	141	505	536
Woodlots	ha	84	524	144
Silvipasture	ha	17	346	166
Afforestation	ha	17	884	321
Rehabilitation	ha	90	90	90
Replenishment	ha	0	1,000	25
FOREST LANDS				
Vegetative shrub barriers	ha	473	2,907	2,792
Silvipasture	ha	150	2,010	1,746
Afforestation	ha	239	4,641	4,546
Replenishment	ha	283	2,499	2,568
Rehabilitation	ha	230	3,639	1,980
Smokeless chullahs	no	0	6,225	5,503
DRAINAGE LINES				
Masonry cement structures	no	5	81	83
Dry stone structures	m^3	24,656	163,103	123,998
Brushwood check dams	km	0	300	254
Brushwood check dams	m^3	53,375	53,375	53,375
Cratewire structures	m^3	10,102	62,723	78,662
Livehedge spurs	km	0	301	205
Livehedge spurs	m^3	90,669	90,669	90,669
Landslide treatment	ha	75	429	431
Village ponds	no	85	525	623
Earthen run-off structures	no	18	64	46
Water harvesting structures – large	no	6	0	0
Water harvesting structures – small	no	0	89	69
Roadside erosion control	km	0	1,533	113
Roadside erosion control	m^3	4,812	4,812	5,312
Roadside erosion control	ha	0	0	28

Achievement of Physical Targets

Activity	Unit	Initial Target	Revised Target [1]	Project Achievement
ANIMAL HUSBANDRY				
Natural breeding centers	no	9	69	65
Livestock reduction	no	218	2,018	231
Supplementary feeding				
Late pregnancy ration	no	1,089	7,114	6,933
Calf starter	no	493	493	493
Female calf rearing	no	796	4,446	3,321
Construction of stalls	no	407	7,732	8,662
Rehabilitation of stalls	no	794	3,294	1,034
Chaff cutters	no	0	3,739	3,223
POST HARVEST PROTECTION				
Grain storage bins	no	2,656	13,606	13,828

[1] The targets were revised at the MTR and again at the time of the two extensions in time

Table 5 (d) Jammu and Kashmir

Achievement of Physical Targets				
Activity	**Unit**	**Initial Target**	**Revised Target[1]**	**Project Achievement**
ARABLE LANDS				
Vegetative barriers	ha	5,870	774	665
Terrace repair/vegetative reinforcement	ha	3,020	7,355	6,415
Vegetative field boundaries	ha	2,813	8,954	7,883
Rainfed horticulture	ha	334	4,100	3,197
Rainfed crop demonstrations	ha	5,400	9,518	8,018
On-farm fodder production	ha	891	2,134	2,250
Horticultural rejuvenation	ha	172	2,927	1,728
NON-ARABLE LANDS				
PRIVATE				
Vegetative barriers	ha	110	140	132
Pasture development	ha	130	100	62
Silvipasture	ha	1,845	1,728	1,728
Afforestation	ha	150	550	464
VILLAGE COMMON LANDS				
Vegetative barriers	ha	873	1,115	822
Pasture development	ha	0	100	50
Silvipasture	ha	671	2,967	2,563
Afforestation	ha	653	3,574	3,306
FOREST LANDS				
Vegetative barriers	ha	2,320	1,665	1,559
Pasture development	ha	1,395	2,595	2,390
Silvipasture	ha	2,091	2,112	1,977
Afforestation	ha	2,164	3,997	3,992
Forest Augmentation	ha	2,203	7,868	7,663
DRAINAGE LINES				
Dry stone structures	m^3	185,000	634,350	634,350
Earthen run-off dams	no	25	200	198
Cratewire structures (gully stabilization)	m^3	125,000	125,000	116,818
Vegetative gully control	m	9300	300,000	342,367
Cratewire structures (streambank protection)	m^3	98,000	98,000	53,207
Vegetative spurs	m	11,000	300,000	238,843
Village ponds	no	256	800	736
Water harvesting structures – large	no	6	0	0
Water harvesting structures – small	no	0	241	184
Roadside erosion control	m	1,100	50,000	93,917
Landslide treatment	ha	127	0	0
Landslide treatment	m	0	200,000	187,318
ANIMAL HUSBANDRY				
Livestock reduction	no	No data		
Livestock improvement	no			
Supplementary feeding				
Late pregnancy ration	no			
Female calf rearing	no			

[1]. The targets were revised at the MTR and again at the time of the two extensions in time.

Table 6. Key Indicators for Project Operation

		PUNJAB		HARYANA		HIMACHAL PRADESH		J & K	
	Unit	Pre-Project Status	Present Status	Pre-Project Status	Present Status	Pre-Project Status	Present Status	Pre-Project Status	Present Status
1. Sustainability/Village Development Committee									
- No. of VDC	no.	-	216	-	100	-	104	-	62
- Registered	no.	-	8	-	50	-	12	-	0
- Functional	no.	-	106	-	50	-	104	-	32
2. Run-off and soil loss from established SOP	t/ha	1994-95 87.27	1996-97 25.88	1992-93 2.95	0.416	200	67.96	1990-91 74.32	1997-99 35
3. Area protected/reclaimed	ha	-	2,790	-	4.094	-	623	-	435
(i) Structure saved									
- School	no.	-	12	-	8	-	72	-	-
- Village	no.	-	47	-	16	-	238	-	15
- Common buildings	no.	-	2	-	6	-	244	-	1
(ii) Roads	km	-	11.6	-	5	-	106	-	6
(ii) Perenniality status									
(a) Total Khads	no.	27	38	-	12	-	04	-	32
(b) Total length	km	56	195	-	12	-	638	-	320
4. Increase in yield of crop									
(i) Wheat	qt/ha	9	18.7	17.9	22.6	20.87	25.61	19.	32
(ii) Maize	qt/ha	8	15.5	13	20	19.35	30.71	31	35
5. Horticulture									
(i) Area covered	ha	0	673	-	1,344	-	2,172	-	8,018
- Survival (%)			65	-	42	-	69		
(ii) Production level (6th year)	qt/ha		Guava 35, Mango 20	-	32.4	-	5	-	Apple 95 Guava 30 Citrus 35 Mango 25
(iii) Income	Rs		14,000 10,000	-	14,200	-	7,000	-	40,000 12,000 8,000 9,000
6. Increased availability of:									
(i) Plantations	ha	-	44,982	-	16,721	-	7,603	-	11,128
(ii) Bhabbar (air dry)	t/ha	1	3	-	3	-	-	-	-
(iii) Grasses (green)	t/ha	1	4.5	-	4	3.1	7.6	-	9
(iv) Fuelwood	t/ha	1.5	5	-	7	-	74.4	-	10
(v) Projected timber (maturity)	m^3/ha	0	65 (20 years)	-	75 (25 years)	-	717.5	-	60
7. Increase in milk production:									
(i) Artificial insemination	no.	-	47,604	-	53,866	-	16,448	-	5,645
(ii) Natural services	no.	-	-	-	-	-	16,934	-	-
(iii) Female calves born	no.	-	9,200	-	7,219	-	12,372	-	1,455
(iv) Improved milch cattle	no.	-	3,135	-	1,698	-	12,460	-	1,025
(iv) Milk yield	lt/d/ha	3.7	8.1	2.6	6.7	6	12	-	8-9

Table 7: Studies Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
1. Impact Evaluation (IWDP) Hills Project	As title	Completed 1998	Detailed study analyzing impact of the project in the Punjab project areas (by the Institute for Development and Communication).
2. An Impact Assessment of the IDWP (Hills) Haryana	As title	February 1999	As above for Haryana (by the Department of Agricultural Economics, Haryana Agricultural University).
3. Impact Evaluation IWDP (Hills) Himachal Pradesh	As title	March 1999	As above for Himchal Pradesh (by the Institute for Development and Communication).

Table 8A: Project Costs

Item	Appraisal estimate (US$M)			Actual/latest estimate (US$M)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
Initial Sub-Watersheds	28.3	1.4	29.7	74.7	0.2	74.9
Additional Sub-Watersheds.	38.5	2.0	40.5			
Technology Procurement.	2.7	0.1	2.8	0.9	0.4	1.3
Project Implementation	20.3	1.3	21.6	16.0	0.3	16.3
Central Support	0.5	0.3	0.8	0.3	-	0.3
Base Cost	90.4	5.1	95.5	91.9	0.9	92.8
Physical Contingencies	15.1	0.8	15.9	-	-	-
Price Contingencies	13.0	1.2	14.2	91.9	-	-
Total Project Costs	118.5	7.1	125.6	91.9	0.9	92.8

Table 8B: Project Financing

Source	Appraisal estimate (US$M)			Actual/latest estimate (US$M)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
IBRD/IDA	80.9	7.1	88.0	66.6	0.9	67.5
State Governments	28.5	-	28.5	20.7	-	20.7
GOI	0.5	-	0.5	0.3	-	0.3
Beneficiaries	8.6	-	8.6	5.0	-	5.0
TOTAL	118.5	7.1	125.6	92.6	0.9	93.5

Table 9: Economic Costs and Benefits

Economic rate of return calculated on total project costs and benefits only from increased production of wheat, maize, horticultural crops and production from non-arable area treatments in the form of grasses, other non-wood forest products and timber is calculated at 17%.

Table 10: Status of Legal Covenants

INDIA
Integrated Watershed Development (Hills) Project

Agreement Section	Covenant type [1/]	Present status [2/]	Original fulfilment date	Revised fulfilment date	Description of covenant	Comments
	ADT	1	-	-	GOHP shall have records and accounts for each focal year audited by independent auditors acceptable to the Association and the Bank	
	MAN	1	-	-	GOHP shall staff their WP10s with qualified staff in adequate numbers, including a Project Director for effective management and operation of the respective WP10.	
	ORG	1	-	-	GOHP shall establish a Steering Committee to review and approve sub-watershed plans, annual work programs under the project and relevant draft budgets.	
	ORG	5	-	-	GOHP shall constitute a Dam Review Panel for purposes of reviewing feasibility studies re: the design and construction of water harvesting tasks.	
	MAN	2	-	-	GOHP shall, for purposes of disseminating the rainfed vegetative technology on arable lands, deploy in project area village extension workers to achieve the ratio of at least one village extension worker per 400 farm families during sub-watershed treatments.	
HP para.2.01 and 2.03 PA	MAN	2	-	-	Cause to be provided, promptly as needed, the funds, facilities, services and other resources required; and use of goods and services.	
	CRY	1	-	-	GOHP shall achieve arrangements for cost sharing, either in cash or in kind, in the project area.	
	ADT	1	-	-	GOH shall have records and accounts for each fiscal year audited by independent auditors acceptable to the Association and the Bank	
	MAN	1	-	-	GOH shall staff their WP10s with qualified staff in adequate numbers, including a Project Director for effective management and operation of the respective WP10.	

	Covenant type [1/]	Present status [2/]	Original fulfilment date	Revised fulfilment date	Description of covenant	Comments
	ORG	1	-	-	GOH shall establish a Steering Committee to review and approve sub-watershed plans, annual work programs under the project and relevant draft budgets.	
	ORG	5	-	-	GOH shall constitute a Dam Review Panel for purposes of reviewing feasibility studies re: the design and construction of water harvesting tanks.	
	MAN	1	-	-	GOH shall, for purposes of disseminating the rainfed vegetative technology on arable land, deploy in project area village extension workers to achieve the ratio of at least one village extension worker per 400 farm families during sub-watershed treatments.	
	CRY	1	-	-	GOH shall achieve arrangements for cost sharing, either in cash or in kind, in the project area.	
	ADT	1	-	-	GOJ&K shall have records and accounts for each fiscal year audited by independent auditors acceptable to the Association and the Bank	
	MAN	1	-	-	GOJ&K shall staff their WP10s with qualified staff in adequate numbers, including a Project Director for effective management and operation of the respective WP10.	
	ORG	1	-	-	GOJ&K shall establish a Steering Committee to review and approve sub-watershed plans, annual work programs under the project and relevant draft budgets.	
	ORG	5	-	-	GOJ&K shall constitute a Dam Review Panel for purposes of reviewing feasibility studies re: the design and construction of water harvesting tanks.	
	MAN	2	-	-	GOJ&K shall, for purposes of disseminating the rainfed vegetative technology on arable lands, deploy in project area village extension workers to achieve the ratio of at least one village extension worker per 400 farm families during sub-watershed treatments.	

	Covenant type [1/]	Present status [2/]	Original fulfilment date	Revised fulfilment date	Description of covenant	Comments
	CRY	1	-	-	GOJ&K shall achieve arrangements for cost sharing, either in cash or in kind, in the project area.	
	ADT	1	-	-	GOP shall have records and accounts for each fiscal year audited by independent auditors acceptable to the Association and the Bank.	
	MAN	1	-	-	GOP shall staff their WP10s with qualified staff in adequate numbers, including a Project Director for effective management and operation of the respective WP10..	
	ORG	1	-	-	GOP shall establish a Steering Committee to review and approve sub-watershed plans, annual work programs under the project and relevant draft budgets.	
	ORG	5	-	-	GOP shall constitute a Dam Review Panel for purposes of reviewing feasibility studies re: the design and construction of water harvesting tanks.	
	MAN	1	-	-	GOP shall, for purposes of disseminating the rainfed vegetative technology on arable land, deploy in project area village extension workers to achieve the ratio of at least one village extension worker per 400 farm families during sub-watershed treatments.	
	CRY	1	-	-	GOP shall achieve arrangements for cost sharing, either in cash or in kind, in the project area.	

[1/] Covenant Types

ADT = Audit
CRY = Cost Recovery
FIN = Financial
MAN = Management and Staffing
ORG = Organizational
RPT = Reporting
STD = Studies
TCH = Technical

[2/] Status

1 = Fully complied
2 = Partially complied.
3 = Non-compliance
4 = Not yet due
5 = Covenant no longer applicable – should be deleted;/modified
6 = Compliance date requires revision
A1 = Audit 1 year overdue
A2 = Audit 2 or more years overdue

Table 11: Compliance with Operational Manual Statements

Statement number and title	Describe and comment on lack of compliance
1. Disbursements suspended for J&K during 1996-97	Delay in submission of audit certificate
2. SOE procedure was suspended for 1997-98	Delay in submission of audit certificate
There was usual delay in submission of audit certificate by the states by 2-3 months, but this delay was too long and too often from the state of Jammu & Kashmir. Release of funds by the state Government and claiming reimbursement of expenditures was, by and large, satisfactory.	

Table 12: Bank Resources: Staff Inputs

Stage of project cycle	Planned		Revised		Actual	
	Weeks	US$('000)	Weeks	US$('000)	Weeks	US$('000)
Preparation to appraisal	n.a.	n.a.	n.a.	n.a.	180.2	325.2
Appraisal	n.a.	n.a.	n.a.	n.a.	62.5	135.7
Negotiations through Board approval	n.a.	n.a.	n.a.	n.a.	12.8	38.3
Supervision	n.a.	n.a.	n.a.	n.a.	244.9	316.8
Completion	21.8	-	10.0	45.0	10.0	45.0
TOTAL	-	-	-	-	510.4	861.0

Table 13: Bank Resources: Missions

Stage of project cycle	Month/ year	Number of persons	Days in field	Specialized staff skills represented	Performance rating		Types of problems
					Implementation status	Development objectives	
Through appraisal	6-7/89	9	21	Agronomy Agricultural Research/Extension Institutions. Specialist Economics Sociology Forestry	-	-	Risk of relatively new technology
Appraisal through Board approval	-	-	-	-	-	-	-
Supervision 1.	7/91	3	14	Agriculturalist Research/Extension Forestry	2	2	Establishment of Watershed Planning and Implementation Offices. GOI to finalize TA component. Shortage of counterpart financing in H.P. and J and K and of vehicles in Haryana and H.P
2.	2-4/92	3	9	Agriculturalist Research/Extension Forestry	2	2	Project staffing – particularly SMS and arrangements for TA.
3.	10-11/92	4	7	Agriculturalist Research/Extension Forestry Rural sociology	2	2	Arrangements for TA.. Identification of common property management arrangements.
4.	6-7/93	2	16	Forestry Research/Extension	2	2	Finalization of TA arrangements and GIS and development of institutions at village level to promote participation
5.	1-2/94	3	11	Agriculturalist Forestry Research/Extension	S	S	Institutional development for common property management and cost sharing for development of non-arable lands.
MTR							
6.	9-10/94	3	15	Agriculturalist Forestry Research/Extension	S	S	Lack of institutional arrangements for participatory management of common property resources; lack of agreement on sharing of cost of development of non-arable lands;

Stage of project cycle	Month/ year	Number of persons	Days in field	Specialized staff skills represented	Performance rating		Types of problems
					Implementation status	Development objectives	
							GOI to appoint TA consultants; need to strengthen farmer and extension staff training programs.
7.	1-5/95	4	14	Economist Agriculturalist Research specialist Soil conservation specialist	S	S	Need for suitable arrangement to be developed with users for protection, management and sharing of produce by State Government of Punjab and J and K. GOHP to provide needed staff and return 13 vehicles to the project. Better use of measurable indicators. Improve quality of technological models. Need to launch TA components by GOI.
8.	5/96	3	11	Research specialist Forester (S. C. Sharma)	S	S	Lack of MOA action to implement TA and GIS. Lack of project vehicles in HP. Lack of training and involvement of women in project activities. Delay in completion of civil works in Punjab and Haryana and lack of Government resolution on management of common property resources/cost sharing in J and K..
9.	1/97 [1/]	2	2	Research Specialist (S. Vani)	-	-	Improving sustainability through beneficiary involvement cost sharing and maintenance and protection of assets created by the project. Use of independent agency for impact evaluation.
10	4/97	1	3	Research specialist	S	S	Weakness of MOA in project monitoring and technical assistance. Slowdown in activity due to uncertainty over extension of credit closing date.
11.	6/97 [2/]	3	4	Research specialist Extension specialist Soil conservation	S	S	Project financed vehicles not made available. Delay in filling key posts and undue movement of staff.
12.	7/97	2	18	Economist	S	S	-

Stage of project cycle	Month/ year	Number of persons	Days in field	Specialized staff skills represented	Performance rating		Types of problems
					Implementation status	Development objectives	
				Agricultural Research and Watershed Management			
13.	11/97	1	2	Agricultural Research and Watershed Management	-	-	Slowness in MOA support for TA
14.	7/98 2/	2	4	Agricultural Research and Watershed Management (Ms. M. Singh)	-	-	Project financed vehicles not made available. Delay in filling key posts. Need for decentralized management.
15.	10/98 3/	6	5	Agricultural Research and Watershed Management Agronomist Economist Forester Sociologist (N. Harshadeep)	S	S	Need for transfer of assets created to the constituted committee/respective line departments

1/ Review of physical and financial progress.

2/ Himachal Pradesh only.

3/ Joint supervision/preparation of Phase II mission.

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX A

MISSION'S AIDE-MEMOIRE

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX A

MISSION'S AIDE-MEMOIRE

1. Introduction

1. An FAO/World Bank Co-operative Programme (FAO/CP) mission consisting of J.H.Weatherhogg (FAO/CP Mission Leader/Economist), J.V. Alexander (Soil Conservation/Watershed Management Specialist, Consultant), S.K. Ranjhan (Livestock/Fodder Specialist, Local Consultant) and Mrs. R.M. Sethi (Rural Sociologist, Local Consultant) visited India from 16 May to 1 June 1999, to prepare an Implementation Completion Report (ICR) on the above project. For the latter part of the field visit programme and for the final discussions with each of the states the mission was joined by Dr. T.C.Jain, World Bank Task Manager for the project. Mr. K.K.Narula, Deputy Commissioner, Soil Conservation, Government of India joined the mission for the whole of the field programme. At the end of its field visit programme the mission met with the Chief Minister of Haryana, Mr. Bansi Lal and his Principal Secretary on 26 May 1999. This Aide-Memoire is based on discussions with the project staff and the staff of the Departments of Agriculture, Animal Husbandry and Forestry (AD, AHD and FD), and the Regional Research Station of the Punjab Agricultural University (PAU) at Ballowal Saunkhri and with the rural communities. The mission carried out a programme of field visits to a number of watersheds in the Kandi Tract in Punjab, and other parts of the Shiwaliks in Haryana and Himachal Pradesh which included discussions with farmers and local staff of the concerned government agencies. Each of the four states has prepared its own Implementation Completion Report and with the exception on Jammu & Kashmir each has completed an Impact Evaluation Study. That for Jammu & Kashmir is expected to be finalised in late June. In addition to these reports a number of briefing documents prepared for the mission by the project staff have also been very helpful in provision of data on implementation and impact of the project.

2. This draft Aide-Memoire will be finalised and amended based on the discussions at the wrap-up meeting to reflect the views of Government and the World Bank and will be attached as an appendix to the ICR. (Note: This version of the Aide-Memoire includes small amendments made following the final meeting but does not yet include any comments the Government and the World Bank may have).

3. The mission wishes to thank the project staff in each of the states and staff of the line departments for their time given in the discussions and the information and opinions provided, and expresses its appreciation for all the assistance and hospitality received.

2. Background

4. **Project origin.** The project is a further phase of assistance to that provided by the World Bank in Punjab for the Kandi Watershed Area Development Project (Ln. 1897-IN) as well

as pursuing similar objectives to the Rainfed Areas Watershed Development Project (Cr.1424-IN) and the Himalayan Watershed Management Project (Ln.2295-IN).

5. **Project objectives.** The project aim is to slow and reverse degradation of the natural environment, through the use of appropriate soil and moisture conservation technology and by so doing to improve production and income from grain crops, horticulture, fodder, livestock and forest products. In addition the project would reduce flooding and other devastation caused by the degradation in both the project area and the adjacent plains. The project also aims to lay the foundation for sustainable increases in production to keep pace with population growth. This would include promotion of known vegetative technologies and verification of new ones, development of co-ordinated interactive planning, and strengthening of management and use of non-arable lands.

6. **Covenants** were limited and focused on project records and accounts, staffing, establishment of steering committees and dam safety panels, adequate deployment of village extension workers and development of cost sharing arrangements.

7. **Project organisation.** The aim of the project's institutional arrangements is to facilitate inter-departmental collaboration to provide an integrated approach to planning and implementation. Each state has a Watershed Planning and Implementation Office (WPIO). In Punjab this is attached to the Joint Development Commissioner's office, in Haryana to the AD and in Himachal Pradesh and Jammu & Kashmir to the FD. Each WPIO consists of a multi-disciplinary team of specialists posted, or on secondment from their respective line departments.

8. **Project implementation** started slowly, mainly due to the difficulty in recruiting suitable staff. In general project implementation has proceeded in a reasonably timely manner, although somewhat slower than anticipated at appraisal. Implementation in Jammu & Kashmir was made more difficult due to the security situation. Following the project Mid-Term Review (MTR) implementation accelerated. An additional one year extension of the credit closing date to 31 March 1999 was granted to allow the completion of project components. Establishment of a close dialogue between staff responsible for implementing other domestic and externally supported watershed development programmes has been an important achievement.

3. Mission Findings

9. **Project design** allowed for a degree of flexibility, through a "menu" of watershed treatment options with activities focussed on pilot watersheds during the first half of the project, a mid-term review and a total implementation period of seven years (subsequently extended to eight). As well as the watershed rehabilitation activities the project also provided project implementation support, training of project staff and beneficiaries and technical assistance - mainly through local consultants.

10. **Soil and moisture conservation technology.** The project has adopted a range of conservation activities that are appropriate and technically effective. An important project objective was to identify and introduce relevant and cost-effective soil and moisture conservation technologies, with particular emphasis on vegetative conservation. The adoption of across-slope vegetative barriers to improve *in-situ* soil and moisture conservation and reduce soil erosion by controlling surface run-off and increasing the infiltration of water was an important element of this strategy. Although there has been considerable variation between states in success in implementing conservation activities, an important achievement of the project has been the wide consensus on the effectiveness of this strategy. Original assumptions regarding likely farmer acceptance and the effectiveness of Vetiver grass *(Vetiveria zizanoides)* have not been proven, and there has been limited success in establishing this species. However, there has been good success

with vegetative barriers using species that have a productive value for farmers, particularly with the forage grass Napier *(Pennisetum purpureum)*. There has also been good success with species such as Bhabbar grass *(Eulaliopsis binata)* and *Dodenea viscosa* as vegetative barriers in non-arable areas.

11. **Area treated.** The project has undertaken treatments in 59 watersheds covering an area of 352,000 ha, against a target of 246,000 ha (110,000 ha in initial sub-watersheds, 16,000 ha in upper catchment areas in Punjab, and 120,000 ha in additional sub-watersheds).

12. **Non-arable land treatments.** A major portion of project investments (about 40%) have been utilised for afforestation, silvipasture and pasture development activities. The most important technical innovation has been the widespread adoption of contour trenches for controlling surface run-off and increasing moisture infiltration. This technique has contributed to very good tree survival rates in all states, and has had an important impact on reducing flows in lower drainage lines and in protecting lower arable areas. Species have been selected in conjunction with local communities, and there is considerable variation in the species being planted related to changes in ecological conditions. The most common tree species planted has been khair *(Acacia catechu)*, and the most common shrub species has been Dodenea viscosa. Plant survival in project plantations has been satisfactory and usually above 70%. At the end of project activities the treated areas revert to line department management in respect of government lands, and to Panchayat management in respect of common lands. A major issue that remains unresolved at the end of the project is clarity in respect of the sharing of the long-term production benefits with the local communities that have co-operated in developing the non-arable areas, particularly in respect of government land. Effective techniques for controlling the weed lantana *(Lantana camara)*, and the introduction of fire control strategies are important issues that also remain to be addressed in respect of the non-arable areas that have been treated.

13. **On-farm development.** A high percentage of the farmers throughout all project sub-watersheds have received inputs for at least one on-farm rainfed cropping demonstration. These demonstrations have successfully promoted the introduction of improved varieties, seed treatment (particularly for termite control), appropriate fertiliser and pesticide treatments, and improved agronomic practices to ensure moisture conservation. Significant yield increases have been reported for rainfed crops – both for the main kharif maize crop as well as the main rabi wheat crop. The improved moisture status on arable lands has resulted in a diversification of crop production, particularly with the introduction of vegetable crops (for example tomatoes in Himachal Pradesh), and an increase in on-farm fodder production especially from bherseem and sorghum.

14. **Rainfed horticulture:** There has been reasonable success in introducing fruit production as a viable activity in rainfed areas. Farmer preference has mainly been for mango, but the success with this species has been mixed and there has been considerable mortality of newly planted seedlings and this species does require supplementary irrigation at least in the initial three years. Project supported research at Ballowal Saunkhri (PAU Regional Research Station for the Kandi Area) indicates that while mango is suited for soils with a good moisture holding capacity, better results on marginal soils in the Shivalik zone can be obtained with guava, amla *(Emblica officinalis)*, and ber *(Zizyphus sp)*.

15. **Drainage line treatments.** There has been good success in treating the extensive and deeply eroded drainage lines (Choes) which are a feature of the Shivalik zone. A major innovation has been the focus on the use of vegetative stabilisation in conjunction with the judicious use of engineered structures, which have included masonry and cratewire drop structures in drainage lines and of cratewire spurs to protect streambanks. Species that have performed well in

stabilising drainage lines include *Ipomea carnea, Vitex negunda, Dodenea viscosa and Arundo donex.* A feature of this activity has been the reduction in the width of choes, often with land being brought back into production using tree and grass plantations.

16. **Water supply.** The project had initially planned to support the construction of medium sized (10 to 15 m wall height) water harvesting structures in all states. It was a World Bank requirement that each state establish a Dam Review Panel to oversee this activity, a process which was found to be complex and none of the planned structures were constructed. This activity was deleted at the MTR and replaced by a more flexible approach, which allowed project staff in close collaboration with local communities, to identify and construct small-scale water supply systems. These systems involve the diversion of water from springs or perennial streams, the construction of small dams (wall height less than 10m), and below surface earthen tanks. Water reticulation has normally been by gravity feed. This more flexible approach to addressing water requirements has been one of the most successful components of the project, and has been greatly appreciated by beneficiaries who usually identify water shortage as their number one development need throughout the Shivalik zone. This activity has improved the availability of water for domestic and livestock purposes, and for life-saving irrigation of field and horticultural crops, however the area brought under permanent irrigation has not been significant (less than 2,000 ha). Women have benefited from the improved availability of domestic water resources, and in many areas this has resulted in a significant reduction in the labour required to transporting drinking water.

17. **Livestock aspects.** The project supported livestock development in a number of ways, through **breed improvement** of cattle and buffaloes, both by artificial insemination (AI) and natural breeding[1]; **improved nutrition** through establishment of fodder on bunds, farm boundaries and as part of silvi-pastural systems, increased use of agricultural by-products, better feed treatment and introduction of stall feeding; and **improved veterinary and animal health services,** including construction of dispensaries and hospitals. Proposals included at appraisal for provision of supplementary feeds and for reduction of cattle numbers were dropped at the MTR.

18. **Breed improvement** supported by the project has had a widespread and significant impact, both in cattle and buffaloes. However to ensure sustainability the Lay Inseminators appointed in Punjab cannot survive on AI alone and require a broader role and realistic payments for their services. Natural Breeding Centres (NBC) should only be established when requested by a particular village and care should be taken to rotate the bulls at 3-year intervals in order to avoid inbreeding. Project financial support should be confined to bull purchase and all feeding and bull health care costs should be met by the village out of revenue charged for natural service.

19. **Improved nutrition** measures introduced by the project have been highly successful. Increased fresh fodder from grasses and fodder trees planted by the beneficiaries, increased availability of field crop straws and stovers, provision of feeding troughs, chaff cutters and introduction of stall feeding have all resulted in significantly increased milk production. The main need now is for more attention to feeding mineral supplements to lactating and growing animals to improve production and reproduction.

20. **Veterinary and animal health services** improvement supported by the project, particularly through provision of infrastructure has been significant. However, at present the facilities provided are under-utilised due to inadequate animal husbandry staff. For successful future operation it will be important that animal health matters remain the responsibility of the

[1] In Himachal Pradesh a number of Natural Breeding Centres (NBC) have been set up by the project whereby a bull is provided for natural service in remoter village areas.

Animal Husbandry Department and the latter deploys an adequately staffed and equipped field service.

21. **Research.** Considerable and correctly focussed research has been undertaken in support of the project activities by the Regional Research Station at Ballowal of the Punjab Agricultural University and by the Agricultural Universities in each of the participating states. Still more research is required and will be supported under the second phase. One particularly serious problem in forest areas requiring the attention of researchers is the need to find a means of suppressing lantana *(Lantana camara)*, which is a widespread and noxious weed.

22. **Studies.** As a result of the significant programme of research undertaken a number of studies have been completed covering important aspects of integrated watershed management. These have provided a sound basis for planning the technical treatment of sub-watersheds as well as implementation of the various components and training of staff.

23. **Training**. The project has supported a centralised project training facility located at the Punjab Agricultural University regional research station at Ballowal Saunkhri, which has provided training for project staff on technical and project management subjects. Farmer training has been the responsibility of the state project implementation teams. Funds for the centralised training activities were released through the central government and about half of the funds were utilised for civil works for improving the accommodation and training facilities at Ballowal Saunkhri, and the other half on salaries and operating costs. Since the beginning of the project 86 training courses have been conducted, and 2,136 project staff have participated. The training has been appropriate, but because of the geographical extent of the project, the project units that are located in closer proximity to the centralised training centre, and in particular Punjab (about 50% of the trainees have been from this state), have been able to obtain greater benefits from the training activities. A very important advantage of this centralised training facility has been the provision of a forum for project staff from all participating states to meet and to share experiences gained while implementing the project. Future training programmes should include training for rural women in improved livestock practices, and regular training provided to animal husbandry staff in fodder conservation methods.

24. **Geographic information systems (GIS).** There has been no success in establishing functional GIS systems in any of the four participating states. The technical support for this activity was planned to be provided by a consultant to be recruited under the central government component, with training to be provided by the Punjab Remote Sensing Centre at Ludhiana in Punjab, also funded from the central government component. Although computer hardware and GIS software was purchased in all four states, the consultant who was to guide this activity was not recruited, and this was an important factor in the lack of progress with GIS.

25. **Administrative and Staff Housing.** The project financed the construction of a number of offices, staff quarters and other buildings in each of the four states, with a particularly significant programme of construction in Haryana.

26. **Project benefits.** The project has provided substantial production and environmental benefits. The on-farm benefits include increased productivity of cereal, fruit, vegetable and fodder crops, and off-farm benefits have included fodder grass, and fuelwood. Benefits from timber produced in afforestation plantations will only be available in future years. Project activities have extended over a large geographical area with considerable variations in agro-ecological and agricultural production systems. Significant increases in yield as a result of the project are reported for both the main kharif maize crop as well as the rabi wheat crop.

27. **Environmental impact.** Studies undertaken during project implementation indicate significant reductions in soil erosion, however the total environmental benefits are difficult to quantify. Benefits include a reduction in soil lost due to erosion in both the upper catchment areas and in the lower arable areas, a more regulated discharge of water from project sub-watersheds which reduce flooding both in and downstream of the project sub-watersheds, improved productivity in arable and non-arable areas due to improved soil moisture, the protection and reclamation of land adjacent to streambanks and the recharge of groundwater systems.

28. **Social aspects.** Project design recognised the importance of interactive project planning and implementation, however the proposal for the central government to recruit consultants to train staff in participatory planning and to assist in developing strategies for cost and benefit-sharing arrangements was not implemented. Project staff have developed their own strategies for mobilising community groups to interact with project staff to identify priority community development needs, and to plan and implement project activities. Notable progress has been made in forming community groups, usually called Village Development Committees (VDCs), to interact with project staff. Community mobilisation activities vary considerably between states, and there are also large differences in the effectiveness of the groups that have been formed.

29. The project appears to have had a generally positive social impact. Improved water and fodder supplies have been of particular benefit to village women in reducing the time taken up in carrying both home from remote locations. Increased production and availability of the necessary raw materials has also led to growth in income generating activities such as rope and basket making. Improvement in the socio-economic conditions of the beneficiaries is reflected in improvements to their houses, increased land values and better marriage opportunities for the village youth. The project has also had a good impact in the establishment of village institutions and empowerment of villagers, and this could be one of the project's major benefits. However, while good models of effective community groups exist, considerable progress remains to be made in having the intended beneficiaries assume greater ownership of project activities, particularly in encouraging further participation by women in the Village Development Committees (VDC), on which they are generally unrepresented. The situation of women's participation is relatively better in Himachal Pradesh. Creation of truly self-sustaining VDCs will take time and will require continued support. For the future still more training will be required both of project staff and VDC members to improve their ability to pursue the communities' objectives; additional income generating activities will need to be introduced; training programmes could be introduced for NGOs assisting the VDCs; and clarification will be required on communities rights in forest areas.

30. **Sustainability**. The longer-term sustainability of the physical assets that have been created by the project, and in particular the water supply and non-arable land improvements that provide community benefits, will depend on the continued operation and viability of the Village Development Committees (VDC) that have been formed with project support. These committees need to be able to facilitate equitable access to these assets, and also to introduce arrangements for maintenance and protection. Consideration also needs to be given to continuing technical support and assistance to slower developing VDCs beyond the three year period normally provided. An important sustainability issue that has not yet been satisfactorily addressed is the identification of arrangements for sharing the long-term production benefits from the non-arable areas, particularly Government lands, that have been developed with the co-operation of local communities.

31. **Borrower performance** was generally satisfactory in project implementation. Identification and posting of suitable staff was generally well done, such that the WPIO in each state operate quite well. In each state the project has received the backing of Government and

availability and timeliness of counterpart funds has been generally adequate. Weak points have been too rapid transfer of staff into and out of the project, leaving some senior project positions unfilled for extended periods and not releasing for the use of the project the vehicles financed for that purpose[1] in Himachal Pradesh.

32. **Bank performance** has been generally satisfactory in project preparation, appraisal and supervision. The Bank willingness to adopt a flexible approach, accept a relatively long disbursement period, extend the project period and prepare and appraise a second phase project are all commendable. The Mid-Term Review and careful project supervision have undoubtedly contributed to the project's success.

33. **Donor/borrower relationship** has been good throughout the implementation period.

34. **Implementing agency performance** of the WPIOs in each state has been very satisfactory. Despite a slow start in adoption of participative methods of planning and implementation due to initial reliance on consultants - which did not work - the project staff have subsequently developed their own very effective methods. The degree of integration of the various disciplines and the good working relationships within, and between, the individual WPIO are very satisfactory.

35. **Project Operations Plan (POP).** The second phase of the project has already been negotiated and the credit is expected to become effective in July 1999. The second phase project allows for continuation of project activities, but with still greater community participation, as well as providing limited finance for follow-up of those communities and areas benefited in this project.

4. Lessons Learned

36. Based on its work so far the mission's provisional list of lessons learned as a result of the project implementation experience are as follows:

(i) This type of project needs to address the communities' priorities - particularly provision of water supply.

(ii) For participatory projects a degree of flexibility in the choice of project activities is essential.

(iii) For a Village Development Committee (VDC) to be successful it has to have some activity and investment as a focus for its activity.

(iv) Project activities must be needs based, not for example based mainly on geographic considerations (e.g. NBC in Himachal Pradesh).

(v) For projects of a participative type there is a need for a pre-construction phase in which communities can be fully involved and consulted.

(vi) Closely integrated, multi-disciplinary teams can be an effective means of implementing watershed projects.

[1] In Himachal Pradesh 16 vehicles were financed by the project, but for most of the project only 8 were handed over. Currently 11 are with the project.

5. Follow-Up

37. The mission will prepare an ICR report which will be transmitted to WB by early July, 1999. The project staff in each of the four states have already prepared their own Implementation Completion Reports. It would be valuable if a short report summarising the implementation experience in all four states could be prepared for inclusion in the ICR. General guidance for the Government contribution is presented in Attachment 1.

Delhi,
1 June, 1999.

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX B

BORROWER'S CONTRIBUTION

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT (Cr.2100-IN/Ln.3175-IN)

APPENDIX B

IMPLEMENTATION COMPLETION REPORT (ICR) MINISTRY OF AGRICULTURE

1.0 Project Background:

Since Independence, Government of India (GoI) development plans have emphasized agriculture and sought to raise foodgrains production by increasing the use of fertilizer, plant protection chemicals and modern inputs such as improved seed varieties. In support of these objectives, GoI has strengthened the institutions supporting this sector in agricultural extension and research seed production, and agriculture credit and accelerated the development of irrigation. As a result of these efforts, the annual growth rate in food grain production has averaged 2.7%, slightly above the population growth rate of 2.2%.

With the irrigated areas just reaching its limits and realising the fact that 50% of the rural population is dependent on rainfed areas which constitute nearly 65% of country's cultivated land, rainfed farming has received increasing priority as an instrument of agricultural strategy articulated in Seventh Five Year Plan (1985-1990). The investments were directed to address one of the most serious environmental problem i.e. watershed degradation, with the objective of increasing productivity of agricultural crops, fodder and fuelwood.

With these considerations, a seven year (1991-98) Integrated Watershed Development Project – IWDP (Hills) was executed with World Bank assistance to cover 2.30,000 ha in the sub-tropical Shivaliks and the Temperate Karewas in the States of Punjab, Haryana, Himachal Pradesh, and Jammu & Kashmir.

Shivaliks which form more than 90% of the project area, have been identified as one of the eight most degraded rainfed agro-ecosystems of the country and hence included in the priority areas for watershed development. Highly erodible low water retentive soils which crust easily, severe soil erosion, water scarcity despite 1000-1500 mm annual rainfall, acute shortage of fodder and fuel, subsistence oriented crop production, and low genetic potential and productivity of live-stock are some of the constraints of Shivalik region which this project was trying to address.

The main objective of the project was to slow and reverse degradation of the natural environment through the use of appropriate soil and moisture conservation technology. The process of conserving soil and in situ moisture, would improve the production and income from grain crops, horticulture, fodder, fiber, fuelwood and livestock, and reduce flooding and other devastation caused by degradation in both the project area and adjacent plains. The aim was to lay the foundation for sustainable increases in production to keep pace with population growth.

2.0 Project design:

The project was designed to address one of the India's most serious environmental problems of watershed degradation. The Integrated Watershed Development Project (Hills) was envisaged to cover the ecologically fragile area of the lower Shivaliks which were environmentally importunate. This project became operational on 11.01. 91 with a total provision of $56.8 million SDRs. The project was under extension till March, 1999.

In order to check degradation, an integrated approach was adopted by including various activities/interventions which have bearing on the land use (viz. forestry, agriculture, horticulture, Animal Husbandry, soil conservation. As a policy, the works were to be executed only in the representative units for demonstration purposes (pre MTR) so that the people of the watershed area got sensitized to use the technology and adopt/adapt it for holistic improvement of the area. Later on additional sub-watersheds were taken up for treatment (Post MTR). Overall emphasis was laid on creating an enabling environment for greater participation of local communities in management of the natural resources.

3.0 Project Implementation:

The project envisaged the treatment of 1,10,000 ha of gross area in 15 sub-watersheds during its pilot phase (1991-94) and a further area of 1,20,000 ha during expansion phase in 20 sub-watersheds. Overall physical coverage achieved upto the end of the project period in 1,47,501 ha against the gross targeted area of 2,30,000 ha. Against the financial targets of Rs. 292.00 crores, Rs. 286.05 crores (98%) had been utilized by the participating States.

At the time of initiation it was envisaged that following benefits should accrue due to the project interventions:

- About 84,000 ha of existing forests and 59,000 of common lands would be rehabilitated and protected from further degradation. Approx. 1,00,000 farming families, 10,000 landless families and 5,000 livestock herds would benefit from the project in four States.

- Per hectare yields of maize and wheat would increase by 50% and 55% respectively.

- Production on non-arable lands (grasses, fuelwood, timber) through afforestation, silvipasture, pasture and vegetative barrier measured in terms of dry mass would increase by 400% , 650%, 700% & 1233% respectively on a 30 years production cycle.

- Net farm income of an average farmer would increase by 240%.

- Estimated internal rate of return at the end of the project would be 17%.

Impact assesment exercises have revealed impressive increase in the productivity of maize and wheat, cultivated fodder, milk and wool due to project interventions. Reduction in number of draught animals and increase in the number of improved livestock breeds, decline in grazing pressure and increased stall feeding, reduced soil loss, ground water recharge with increased availability of water in wells, enhanced survival percentage of plants, increase in the income of rural population from Community Property Resources (CPRS) and horticulture, and increased natural regeneration of bio-mass in the project areas have also been observed. Componentwise details are in furnished Annexure-I.

4.0 **Lessons of Experience**: Strengths & Constraints

4.1 **Technical Component**:

The project stressed targets for physical progress but the rigid commitments of the staff to achieve the project objectives remained a weak link.

Although on-farm yields have increased, horticulture and animal husbandry components have done very well and are popular among villagers, establishing the vegetative barriers on field boundaries and contour ridges has been only moderately successful, probably because of weak extension efforts and transfer of appropriate technology. Needless emphasis was placed on Vetiver during the initial years while local grasses such as Bhabbar and Nappier which not only conserved soil and moisture but also yielded good income and fodder are preferred by the farmers. Technology selection would have been need based and decided in consultation with local people by acknowledging the importance of ITK prevalent in the area. In the later stage of the project beneficiaries have started sharing of cost for developing water resources. Construction of Makkowal Tanks during later phase of the project have been very popular among people for providing water for cattle, human use and limited irrigation. Therefore, due emphasis on water resources development and greater flexibility in treatment practices was needed from the beginning of the project.

Project could only provide partial control to grazing by stray cattle. The landless population who owns significant number of cattle could not be effectively switched over to stall feeding. Even the social barriers at the village level failed

to come up to the desired expectation to control the grazing menace. Thus there is a need to broad basing of animal husbandry programmes by direct linkage with line departments.

4.2 Community Participation & Institutional Development:

Potential beneficiaries of project especially women and other disadvantaged groups should be involved at all stages of the project from planning to implementation and subsequent maintenance for ensuring sustainability. Short-term gains to the beneficiaries are critical for eliciting people's participation and hence should be catered for in project design. This is particularly true for forestry models where bamboo and grasses provide intermediate returns to beneficiaries after 2-3 years on a regular basis as against trees which have a fairly long gestation period of 15-20 years. Before the MTR, beneficiaries had difficulty in perceiving benefits of forestry development. It is only after MTR people' participation has improved and they are coming forward to adopt forestry treatments. However, people's willingness to protect their resource after the project ends is still not upto the mark because of insufficient stress on early maturing species.

Women make significant contribution to the income of both farming an non-framing families. Their contribution is particularly valuable in livestock rearing, fodder and fuelwood collection and their active involvement in watershed development is necessary for ensuring sustainability. This is an area which has not yet received adequate attention.

Enough arrangements do not exist in the project to build or strengthen institutional arrangements. Institutional developments which prompt coordinated social, faster association and inhibit detrimental behaviours did not receive adequate attention at the beginning of the project. Most states now have Joint Forest Management Resolutions for benefit sharing with a view to involving the people in projectactivities, yet social organisations suited to manage and maintain the project interventions are at a rudimentary stage of development.

4.3 Capacity Building:

Capacity building of implementing personnel and the user community is important for effective development of participatory planning and implementation process. The staff training programme was late by two years and in pre MTR period generally remained weak. These weaknesses were overcome in the post MTR when a number of training courses were organised. The staff at all levels was encouraged to visit project areas in other states. They were also exposed to the work being done by other projects in the country. Now the staff is better equipped for project implementation. A separate training institute to cater to training needs staff at all levels has been created in the project.

The project did not provide for training of beneficiaries. In the post MTR period the project promoted visits of beneficiaries to neighboring areas to improve their perception and facilitate participation. This helped in better targeting of project intervention. It is suggested that for future projects, capacity building should commence immediately and ahead of project implementation if sustainability is to be achieved. Staff must be trained both in technical skills, community mobilisation, participating methods and socio-economic aspects.

4.4 **Sustainability:**

Although provision for cost and benefit sharing, exist in the project lack of properly established cost and benefit sharing arrangements with beneficiaries leading to their inadequate commitment individually as well jointly to project activities, sustainability remain a serious concern till today. Each state is pursuing this in its own way that too in fragmented form to ensure sustainability of the project activities. Some definite measures based on past experiences need to be adopted to improve the prospects of sustainability.

4.5 **Research:**

Depending on ecological and socio-economic setting of the watersheds to be treated, there is a need for a detailed analysis on current farming system/practices etc. Due weightage should also be given to the experiences and skills of the farmers for finalising the choice of treatments. Watershed development research need to be better focussed by laying emphasis on low cost technologies, local needs and prevalent practices.

4.6 **Monitoring & Evaluation:**

Monitoring of the progress of water management programme is necessary to ensure proper utilisation of outlays in accordance with the objectives. However, in the field of watershed management, the monitoring becomes slightly difficult in view of diversity of activities that have different yardsticks and spread of activities over large and divergent areas. For effective monitoring GIS facility is still underutilized by the States.

5.0 Future Strategy:

5.1 **Technology:**

Notwithstanding the somewhat disappointing extent of spontaneous uptake by farmers, vegetative conservation technology should continue to be the key element in conservation efforts of the project. However, considering the experience gained so far, the range and mix of conservation flora should be widened, giving flexibility of choice of species according to edaphoclimatic

situations and farmers acceptance particularly with respect to achieving sufficient immediate and intermediate benefits.

Watershed management needs to be a people's movement. Involvement of project beneficiaries in awareness generation, project formulation, implementation, evaluation and monitoring of the project would need effective extension agency within the project which should follow miscommunication approach. The extension agency alongwith project functionaries should be engaged in intensive awareness creation drive among villagers atleast during the first year. Use of mass media and group contact methods need to be intensified.

Conservation measures promoting *in situ* moisture conservation and appropriate planning to improve 'Farm Ecology is required to be adopted with suitable research feed back in generating various types of technology packages. A model watershed needs to be developed in each state for training and demonstration purposes with association of research and extension agencies.

It needs to be realised that the technical solution alone can not solve the complex equation of poverty and resource degradation. In fact, both technical and social strategy for the project must be chosen from the outset.

5.2 **Research**:

The Following suggestions are made to improve the research back up to the project:

- to identify researchable topics on which additional technology is needed for viable and sustained production.

- to identify the strength and weakness of the participatory institutions and concerned scientists and develop detailed recommendations for institutional, organisational and financial improvement in the research and transfer of technology system with a view to ensuring the sustainable, efficient and productive research and development input at a low cost.

- to develop a general work plan on the line of interdisciplinary and inter-institutional cooperation/collaboration and this should be based on the centre of excellence approach with net working arrangements with various organisations and farmers participatory research.

- to develop a systems of contractual problem oriented research.

- to assess the training needs of the scientists engaged in R&D work related to the project component.

- to review the research needs at bi-annual meetings (Rabi and Kharif) at district level in which the beneficiaries should also participate.

5.3 Monitoring & Evaluation:

Simple monitoring in terms of physical and financial achievements may not indicate the actual effectiveness of the programme. It is necessary to make a consolidated assessment of problem area treated. Therefore, it is imperative to identify quantifiable performance indicators on on which observations could be made at pre-determined intervals. Some performance indicators are suggested below:

- area protected from permanent loss through erosion.
- area reclaimed or developed for more productive management.
- likely reduction in sediment/run-off.
- water storage created and area benefitted by supplementary irrigation.
- increase in productivity of agricultural crops, forests and grass lands.
- appreciation of land value in post treatment phase.
- generation of one time as well as regular employment opportunities.
- number of functional village level institutions, their involvement and cost sharing in the project activities.

  Number of cross breed animals, acceptability by local people and milk yield assessment.

5.4 Institutional Development & Capacity Building:

In order to involve the people and also to cater the individual benefits before he/she would care for ecology, the watershed development teams should involve the disciplines of sociology and economics. Morever, to generate catalytic effects for large scale people's participation, NGOs and other Voluntary Agencies having appropriate expertise should be associated in the project.

Since many project activities are going to be looked after by the project for a limited period, the concerned line departments should also be involved right from the stage of planning and implementation, so that the necessary linkages are forged and these continued to be effectively maintained.

5.5 Sustainability & Replicability:

Prerequisites of sustainability of the activities, particularly on non-arable and common lands need to be built from the very beginning in the project. Afforestation of private lands without adequate cost sharing by land holders is not financially sustainable. Similarly, for small scale tree planting, an assured supply of seedlings of desired species at a reasonable distance from the planting site is necessary, which can be ensured by establishing a large number of farmer operated nurseries. For large scale tree planting on private lands, the farmers, particularly the poor, need access to financial resources.

Provision of adequate finances on a continuing basis is necessary to retard the continuing trend of eco-degradation. The low economic capability of the beneficiaries and somewhat long gestation period before benefits start flowing from the programmes make it difficult to attract institutional finance. It becomes more difficult as the eligibility for credit support is judged mostly on the basis of financial returns of crop yields alone. Consideration of multiple benefits, such as, protection of land base, appreciation of land value, creation of new land stock, generation of micro-irrigation potential, employment opportunities etc. is required for working out viable criteria for adequate flow of Institutional finance.

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX C

SOIL CONSERVATION / WATERSHED MANAGEMENT ACTIVITIES

TABLE OF CONTENTS

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175 IN)

APPENDIX C

SOIL CONSERVATION/WATERSHED MANAGEMENT ACTIVITIES

1. Introduction

1. The mission visited three (Punjab, Haryana and Himachal Pradesh) of the four states that participate in this project, to examine project implementation and to assess the impact on agricultural production, the environment and on the intended beneficiaries. This report summarizes the findings of the Soil Conservation/Watershed Management Specialist, and the information in this report is based on data contained in the Implementation Completion Reports that had been prepared by all states, Impact Evaluation reports that had been prepared by all states except Jammu and Kashmir, and in discussions with project staff and beneficiaries.

2. From a soil and water conservation perspective, the Integrated Watershed Development (Hills) Project has been satisfactorily implemented and has successfully demonstrated a range of watershed improvement activities that are appropriate and technically effective. Some of the original project design assumptions in respect of across-slope vegetative barriers have not proven to be as successful as was anticipated, but effective alternatives have been identified and introduced. There have been significant increases in the production of grain, fruit, fodder and fuelwood, and from the available it appears that the project has been successful in reducing soil erosion and in regulating surface run-off. Beneficiaries provided anecdotal information on improvements in the perenniality of stream and spring flows, and in rising groundwater levels.

2. The Project Area

3. The project has been implemented in 59 sub-watersheds which have a total area of 350,000 ha, in comparison to an initial project target of treating 246,000 ha (110,000 ha in initial sub-watersheds, 16,000 ha in upper catchment areas in Punjab, and 120,000 ha to be treated in additional sub-watersheds). The major focus of the project is on controlling land degradation in the Shivalik zone. However the project did include one sub-watershed located in the temperate Karewas zone in Kashmir.

4. The Shivaliks consist of a narrow belt of hills that run along the sub-tropical southern foothills of the Himalayan ranges. The western end of the Shivalik zone commences in the Jammu Region and extends through to Nepal and on to Sikkim in the east. The project sub-watersheds in Punjab and Haryana are located where the southern slopes of the outer Shivaliks merge into the Indo-

Gangetic Plain. The project areas in these two states are on the southern border of the Shivalik hills of Himachal Pradesh. The soils of the Shivalik zone consist of deposits of torrents and flood basins, which have a loose structure and are highly prone to erosion. The Karewas are located north of the Shivaliks and consist of old lakebed deposits some of which have been uplifted to form hill plateaus, often with steep ravines.

5. The total area of the Shivalik zone in the four participating states is nearly three million hectares with Jammu and Kashmir, and Himachal Pradesh having relatively larger Shivalik areas than the other two states. Summary details on the respective areas of the Karewas and Shivaliks in the participating states are given in the table below.

Table 1. Shivalik and Karewas - Details by State

State	Karewas (ha)	Shivaliks (ha)	Total area (ha)
Haryana		192,000	192,000
Himachal Pradesh		1,170,000	1,170,000
Jammu and Kashmir	195,000	755,000	950,000
Punjab		490,000	490,000
Total	**195,000**	**2,607,000**	**2,802,000**

6. Pradesh, 3 in Jammu and Kashmir, and 13 in Punjab). In 9 of the initial 13 sub-watersheds in Punjab, project activities were undertaken only in the upper catchment areas, concentrating on treating the non-arable areas and drainage lines. The lower catchment areas of these 9 sub-watersheds will be treated during the second phase of the project. Activities were extended to an additional 20 sub-watersheds following the mid-term review (MTR), and a further 15 sub-watersheds were added when the project was extended in time (1997/98). Details of the names and size of all 59 sub-watersheds that have been treated under this project are given in Attachment 1.

7. Summary information for the sub-watersheds that have been treated is provided in the table below.

Table 2. Summary Details on Treated Sub-Watersheds

State	Sub-Watersheds	Arable Area (ha)	Non-arable Area (ha)	Total area (ha)
Haryana	9	60,159	44,025	104,184
Himachal Pradesh	27	25,008	50,287	75,295
Jammu and Kashmir	3	20,124	28,152	48,276
Punjab	20	36,854	87,569	124,423
Total	**59**	**142,145**	**210,033**	**352,178**

Soil and Moisture Conservation Technology

8. The main objective of the project is to slow and reverse environmental degradation through the adoption of appropriate and cost-effective soil and moisture conservation technologies. Central to the technical orientation was a focus on biological treatments, particularly the promotion of across-slope vegetative barriers in agricultural areas in place of conventional conservation treatments that required larger investments, such as earthen bunding and land leveling. Although there has been considerable variation in the success that the participating states have had in implementing the conservation activities, an important achievement of the project is the wide consensus amongst project staff on the appropriateness of this strategy.

9. The focus on vegetative conservation measures was not technically complex, but it did represent a considerable change in approach for field staff, and at first this approach was not universally accepted. Initial assumptions regarding the use of vegetative contour barriers, particularly in respect of farmer acceptance and the suitability of Vetiver grass (*Vetiveria zizanoides*) did not prove successful, but there has been good progress with across-slope vegetative barriers using other species that have productive value for farmers. The main success has been with forage grasses, and in particular Napier grass (*Pennisetum purpureum*) and also Setaria (*Setaria splendens*). Other species that provide economic benefits such as Bhabbar grass (*Eulaliopsis binata*) which is used for rope making, and *Dodenea viscosa* which is used for fuelwood, have also been successfully used as vegetative barriers, particularly in non-arable areas.

10. In addition to project field staff accepting the vegetative soil and moisture conservation technologies that have been promoted by this project, this approach is now being adopted in other watershed development programs. Of particular significance is the promotion of vegetative conservation technologies through the centrally sponsored National Watershed Development Project for Rainfed Areas (NWDPRA).

11. The project design gave considerable prominence to the introduction of new and innovative conservation technologies for the stabilization of arable areas. In reality the main soil erosion problems in the Shivalik zone are caused by uncontrolled run-off from the upper catchment areas, and when these areas are revegetated and stabilized, the land degradation problems in the lower drainage lines and arable areas are significantly reduced.

12. The implementation of the field activities has been on an integrated and multi-disciplinary approach with the treatments in the upper catchment and usually non-arable areas, the lower arable areas, and the drainage lines being planned and implemented as components of a linked system. A Watershed Planning and Implementation Office (WPIO) has been established in each state to implement the project, and technical staff from the disciplines of forestry, agriculture, animal husbandry, horticulture and soil conservation have been seconded to the project from relevant line departments. This seemingly complex organizational arrangement has in fact worked well, and there has been a high level of integration of the sectoral activities.

13. The selection of project activities has been from a menu of treatments (listed in the SAR) that are eligible for financing under the project. The range of activities is extensive and allows for choice based on physical and social conditions. The project has successfully demonstrated a range of activities that are appropriate and technically effective and has provided a good basis for the second phase of the project, which has already been prepared and appraised by the World Bank. The menu of conservation treatments that will be eligible for financing in the second phase are essentially the same,

although more emphasis is now being given to water supply activities, and road construction has been added as a new activity.

Non-arable land treatments

14. A major portion of total project investments (44%) has been utilized for afforestation, silvipasture and pasture development activities. The most important technical achievement has been the incorporation into the planting models of contour trenches for controlling surface run-off and increasing moisture infiltration. This technique has contributed to very good tree and grass survival rates in all states, and has had a significant impact in reducing flows in lower drainage lines and in protecting the lower arable areas.

15. Tree and shrub species have been selected in conjunction with local communities, and species composition varies related to changes in ecological conditions. The most common tree species planted have been Khair (*Acacia catechu*), Sisham (*Dalbergia sissoo*) and Reru (*Acacia leucophloea*), and the most common shrub species has been *Dodenea viscosa*. Plant survival in project plantations has been satisfactory and usually above 70%. In some areas the number of surviving tree seedlings actually exceeds the number of seedlings planted because seed has also been sown along the contour trenches. Tree planting density varies between states, and for the afforestation model Haryana has planted 1,000 trees per hectare, Himachal Pradesh has planted 800, Jammu and Kashmir has planted 1,100, and Punjab 550 tree seedlings.

16. The total non-arable area that has been treated is 109,330 ha, of which the largest single activity has been afforestation which has been undertaken on over 50,000 ha. The state-wise distribution of total non-arable treatments has been 17,078 ha completed in Haryana (16% of total), 20,571 in Himachal Pradesh (19%), 26,699 ha in Jammu and Kashmir (24%), and 44,982 ha in Punjab (41%). Of the total non-arable areas treated, 40,363 ha have been on private land (37% of total), 23,630 ha of common land (22%), and 45,337 ha of government land (41%). The table below summarizes the non-arable land treatments by state.

Table 3. Summary of Non-Arable Land Treatments

Activity	Haryana (ha)	Himachal Pradesh (ha)	Jammu & Kashmir (ha)	Punjab (ha)	Total (ha)
Vegetative/shrub barriers	2,676	3,341	2,504	11,818	20,339
Woodlots	-	144	-	-	144
Pasture	-	2,927	2,502	-	5,429
Silvipasture	795	1,927	6,268	11,327	20,317
Afforestation	13,607	7,569	7,762	21,837	50,775
Replenish afforestation	-	2,658	7,663	-	10,321
Rehabilitation of vegetation	-	2,005	-	-	2,005
TOTAL	**17,078**	**20,571**	**26,699**	**44,982**	**109,330**

17. At the end of project activities the non-arable areas that have been treated revert back to line department management in respect of government lands (usually to the Forestry Department), and to Panchayat management in respect of common lands.

18. A major issue that remains to be resolved at the end of the project is clarifying the sharing of the long-term production benefits from the non-arable areas that have been planted in cooperation with local communities. Effective techniques for controlling the weed Lantana (*Lantara camara*), and the introduction of fire control strategies are also important issues that remain to be addressed in respect of the non-arable areas that have been treated.

On-farm development

19. Most farmers living in project sub-watersheds have received inputs for at least one on-farm rainfed cropping demonstration. The total area covered by these demonstrations was 28,647 ha (4,514 ha in Haryana, 7,831 ha in Himachal Pradesh. 8,018 ha in Jammu and Kashmir, and 8,283 ha in Punjab). These demonstrations have successfully promoted the introduction of improved varieties, seed treatment (particularly for termite control), appropriate fertilizer and pesticide treatments, and improved agronomic practices to ensure moisture conservation. The table below provides details on the area covered by rainfed cropping demonstrations in comparison to the total arable land area available in project sub-watersheds. In respect of these demonstrations, it is interesting to note that Haryana, which has the largest arable area in project sub-watersheds, undertook the smallest area of demonstrations.

Table 4. Extent of Rainfed Crop Demonstrations

State	Total Arable Area (ha)	Rainfed Crop Demonstrations (ha)
Haryana	60,159	4,515
Himachal Pradesh	25,008	7,831
Jammu and Kashmir	20,124	8,018
Punjab	36,854	8,283
Total	**142,145**	**28,647**

20. Significant yield increases have been reported for rainfed crops – the main kharif (monsoon season) crop is maize and average yields are reported to have increased to an average of about 1.4 tons/ha from the pre-project SAR estimate of 0.8 tons/ha. The main rabi (winter season) crop is wheat and average yields are reported to have increased to about 1.8 tons/ha from the pre-project SAR estimate of 0.9 tons/ha. The improved moisture status on arable lands has resulted in a diversification of crop production, particularly with the introduction of vegetable crops (for example tomatoes in Himachal Pradesh), and an increase in on-farm fodder production especially from bherseem and sorghum.

Rainfed horticulture

21. There has been reasonable success in introducing fruit production as a viable activity in rainfed areas. The production of fruit under totally rainfed conditions was not common in the Shivalik zone prior to the project, but it is an activity that has considerable potential. The total area that has been planted with fruit trees using project assistance is 7,484 ha (in Haryana 1,442 ha were planted, 2,172 ha in Himachal Pradesh, 3,197 ha in Jammu and Kashmir, and 673 ha in Punjab).

22. Farmer preference has mainly been to plant mango trees (*Mangifera indica*), but the success with this species has been mixed and there has been considerable mortality of newly planted seedlings, and this species does require supplementary irrigation at least in the initial years. The impact evaluation surveys indicate that average seedling survival rate for horticultural plantations has been approximately 50% on average (53% for mango in Haryana, 57% for mango in Himachal Pradesh and only 37% for all species in Punjab). These surveys do not indicate the extent that farmers have replaced dead fruit tree seedlings, however it is likely that the final survival rates will be higher than indicated in the impact surveys.

23. Project supported research at Ballowal Saunkhri (PAU Regional Research Station for the Kandi Area) indicates that while mango is suited for soils with a good moisture holding capacity, better results on marginal soils in the Shivalik zone can be obtained with guava (*Psidium guajava*), amla (*Emblica officinalis*), and ber (*Zizyphus mauritiana*).

Drainage line treatments

24. There has been good success in stabilizing the extensive and deeply eroded drainage lines (choes) which are a feature of the Shivalik zone. A major innovation has been the focus on the use of vegetative stabilization in conjunction with the judicious use of engineered structures, which have included masonry and cratewire drop structures in drainage lines and of cratewire spurs to protect streambanks. Species that have performed well in stabilizing drainage lines include *Ipomea carnea, Vitex negunda, Dodenea viscosa* and *Arundo donex*. A feature of this activity has been the reduction in the width of choes, and the reclamation of riverbeds that have been planted with productive species such as bamboo and sisal (*Sizal sizlian*).

Water supply

25. Water shortages are common throughout the Shivalik zone and it would be difficult to interest the inhabitants of this area in co-operating in any rural development activities unless there is some provision for improving the availability of water. The original project design did not give sufficient attention to assisting the local communities to improve the availability of water, but following the MTR of the project this deficiency was recognized and more attention has been given to addressing community water needs.

26. Initially the project had planned to support the construction of 27 medium sized (10 to 15 m wall height) water harvesting structures in all states. It was a World Bank requirement that each state establish a Dam Review Panel to oversee this activity, a process that was found to be complex, and none of the planned structures were constructed. This activity was deleted at the MTR and replaced by a more flexible approach, which allowed project staff in close collaboration with local communities, to identify and construct small-scale water supply systems. These systems involve the diversion of water from

springs or perennial streams, the construction of small dams (wall height less than 10m), and below surface earthen tanks with distribution generally by gravity.

27. This more flexible approach to addressing water requirements has been one of the most successful components of the project, and has been greatly appreciated by beneficiaries who usually identify water shortages as the number one development need throughout the Shivalik zone. This activity has improved the availability of water for domestic and livestock purposes, and for life-saving irrigation of field and horticultural crops. The total area brought under permanent irrigation has not been significant (less than 2,000 ha). Women have benefited from the improved availability of domestic water resources, and in many areas this has resulted in a significant reduction in the labor required to transport drinking water.

4. Project Planning

28. Project design recognized the importance of interactive project planning and implementation, however the proposal for the Ministry of Agriculture (under the central government component of the project) to recruit consultants to train project staff in participatory planning techniques and to assist in developing strategies for cost and benefit-sharing arrangements, was not implemented, and prior to the MTR the choice of treatments appears to have been driven more by line department priorities than by the needs of the intended beneficiaries.

29. During the course of project implementation the field staff have progressively developed their own strategies for mobilizing community groups to interact with project staff in order to identify priority community development needs, and to plan and implement project activities. Following the MTR notable progress has been made in forming community groups, usually called Village Development Committees (VDC's), to interact with project staff. The success with community mobilization has varied between states, and there are also large differences in the effectiveness of the groups that have been formed. While good models of effective community groups exist, considerable progress remains to be made in having the intended beneficiaries assume a greater role in planning and implementing project activities, and in having adequate representation of women in VDC's. While this shift to a more participatory approach to project planning is essential to ensure community involvement and the longer-term sustainability of project investments, this approach requires flexibility in project implementation and a move away from target driven project execution.

30. The longer-term sustainability of the physical assets that have been created by the project, and in particular the water supply and non-arable land improvements that provide community benefits, will depend on the continued operation and viability of the Village Development Committees that have been formed with project support. These committees need to be able to facilitate equitable community access to these assets, and also to introduce arrangements for maintenance and protection. An important sustainability issue that has not yet been satisfactorily addressed is the identification of arrangements for sharing the long-term production benefits from the non-arable areas that have been developed with the cooperation of local communities.

5. Achievement of Physical Targets

31. No detailed planning of proposed project activities had been undertaken prior to the start of the project, and the activity targets that were established at project appraisal were intended to be indicative and had been established in order to prepare investment cost estimates. It was intended that

these targets be implemented flexibly so as to allow the intended beneficiaries to fully participate in the choice of the treatments to be undertaken in their area.

32. The initial physical targets were revised at the MTR and again when the project implementation period was extended. Good progress has been made in all states in terms of the completion of field activities in comparison to established targets. Details of the achievement of physical targets in all four states are given in Attachment 2. Table 5 provides a summary of achievements of the main land treatment activities.

33. Given the objective of involving the target beneficiaries in activity selection, the performance of the project should be assessed more on the progress in improving socio-economic conditions and reducing land degradation than on completing field activities in comparison to established targets.

INDIA: Integrated Watershed Development (Hills) Project
(Cr. 2100-IN and Ln. 3175-IN)
Implementation Completion Report
Appendix C: Soil Conservation/Watershed Management Activities

Summary of productive land treatments (for financial analysis)

	Haryana		HP		J&K		Punjab		Project Total	
	At MTR	End project	At MTR	End project	At MTR	End project	At MTR	End project	At MTR	End project
ARABLE LANDS										
Rainfed horticulture	151	1,442	455	2,172	214	3,197	55	673	875	7,484
Rainfed crop demonstrations	1,498	4,515	1,680	7,831	607	8,018	1,753	8,283	5,538	28,647
On-farm fodder production			1,184	3,844	1,597	2,250	283	850	3,064	6,944
TOTAL	**1,649**	**5,957**	**3,319**	**13,847**	**2,418**	**13,465**	**2,091**	**9,806**	**9,477**	**43,075**
%		**14%**		**32%**		**31%**		**23%**		**100%**
NON-ARABLE LANDS										
PRIVATE										
Vegetative/shrub barriers	94	363		13		132	1,183	5,309	1,277	5,817
Pasture			717	2,927	37	62			754	2,989
Silvipasture	158	311		15		1,728	947	7,698	1,105	9,752
Afforestation	925	6,589	411	2,702	67	464	2,434	12,050	3,837	21,805
Sub-total	**1,177**	**7,263**	**1,128**	**5,657**	**104**	**2,386**	**4,564**	**25,057**	**6,973**	**40,363**
%		**18%**		**14%**		**6%**		**62%**		**100%**
VILLAGE COMMON LANDS										
Vegetative/shrub barriers	157	448	136	536	146	822	377	3,641	816	5,447
Woodlots			124	144					124	144
Pasture						50			-	50
Silvipasture	158	129	121	166	384	2,563	303	2,951	966	5,809
Afforestation	*551*	*3,224*	*156*	*321*	*659*	*3,306*	*1,931*	*5,214*	*3,297*	*12,065*
Replenish afforestation			150	90					150	90
Rehabilitation of vegetation				25					-	25
Sub-total	**866**	**3,801**	**687**	**1,282**	**1,189**	**6,741**	**2,611**	**11,806**	**5,353**	**23,630**
%		**16%**		**5%**		**29%**		**50%**		**100%**
FOREST LANDS										
Vegetative/shrub barriers	1,183	1,865	564	2,792	240	1,550	471	2,868	2,458	9,075
Pasture					383	2,390			383	2,390
Silvipasture	355	355	326	1,746	622	1,977	450	678	1,753	4,756
Afforestation	602	3,794	716	4,546	436	3,992	1,627	4,573	3,381	16,905
Replenish afforestation			785	2,568	1,957	7,663			2,742	10,231
Rehabilitation of vegetation			713	1,980					713	1,980
Sub-total	**2,140**	**6,014**	**3,104**	**13,632**	**3,638**	**17,572**	**2,548**	**8,119**	**11,430**	**45,337**
%		**13%**		**30%**		**39%**		**18%**		**100%**
NON-ARABLE SUMMARY										
Vegetative/shrub barriers	1,434	2,676	700	3,341	386	2,504	2,031	11,818	4,551	20,339
Woodlots	-	-	124	144	-	-	-	-	124	144
Pasture	-	-	717	2,927	420	2,502	-	-	1,137	5,429
Silvipasture	671	795	447	1,927	1,006	6,268	1,700	11,327	3,824	20,317
Afforestation	2,078	13,607	1,283	7,569	1,162	7,762	5,992	21,837	10,515	50,775
Replenish afforestation	-	-	935	2,658	1,957	7,663	-	-	2,892	10,321
Rehabilitation of vegetation	-	-	713	2,005	-	-	-	-	713	2,005
TOTAL	**4,183**	**17,078**	**4,919**	**20,571**	**4,931**	**26,699**	**9,723**	**44,982**	**23,756**	**109,330**
%		**16%**		**19%**		**24%**		**41%**		**100%**

6. Unit Costs

34. The unit costs for the various land treatments models are usually calculated by listing the component activities for each treatment, and applying unit costs to each activity based on state government approved schedules of rates. The unit costs provided in government schedules of rates do not always clearly differentiate between labor costs and the cost of other inputs, and labor costs are not always calculated in labor days (for example labor inputs may expressed in cost per cubic meter or lineal meter rather than in labor days).

35. There has been no systematic approach to recording and analyzing the land treatment unit costs, and for the second phase of the project it would be beneficial to establish a system for assessing the validity of unit costs as part of project monitoring. This will require maintaining an inventory on the location and extent of treated areas, and details on the inputs and labor that are utilized to complete these works. This information would provide a basis for making judgements on the validity of the unit costs that are being used.

36. There is considerable variation in the unit costs for similar activities in different states. A full list of the initial and current unit costs are given in Attachment 3. A summary of the different unit costs that are currently being applied for three of the main land treatment models are given in the following Table 6.

Table 6. Comparative Unit Treatment Costs

Activity	Haryana (Rs/ha)	Himachal Pradesh (Rs/ha)	Jammu & Kashmir (Rs/ha)	Punjab (Rs/ha)
Rainfed horticulture	8,350	17,379	9,200	7,000
Silvipasture (VCL)	8,778	13,439	7,726	5,839
Afforestation (RF)	14,499	16,293	14,187	7,052

37. These unit costs do not include beneficiary contributions, which may partly explain the considerable variation in unit costs being used by different states for similar activities. However, there is a need to more closely examine the unit costs being applied in different states participating in this project as well as comparing the unit costs between this project and other similar domestic and externally funded projects.

7. Technical Training

38. The project has supported a centralized project training facility located at the Punjab Agricultural University zonal research station at Ballowal Saunkhri. The objective was to provide training for project staff on technical and project management subjects, and it was envisaged that farmer level training would be the responsibility of the state project implementation teams. Funds for the centralized training activities were released through the Ministry of Agriculture (under the central government component of the project) and about half of the funds were spent on civil works for improving the accommodation and training facilities at Ballowal Saunkhri, and the other half on salaries and operating costs.

39. Since the beginning of the project, the Ballowal Saunkhri centre has conducted 86 training courses, and 2,136 project staff have participated. Details of the number of courses and participants are given in the table below.

Table 7. Training Conducted by Ballowal Saunkhri

Year	Courses	Training	Participants					
	(no)	Days	Punjab	Haryana	HP	J&K	Others	Total
1992/93	6	20	28	28	24	7	16	103
1993/94	7	21	50	25	26	15	58	174
1994/95	12	40	54	37	54	33	144	322
1995/96	14	57	143	75	86	18	44	366
1996/97	18	58	275	90	58	38	31	492
1997/98	14	52	182	21	46	41	30	320
1998/99	15	32	275	5	13	23	33	359
Total	**86**	**280**	**1,007**	**281**	**307**	**175**	**366**	**2,136**

40. The training courses have mainly focussed on technical issues, but have also covered management topics. During the last two years courses have been conducted at the main training facility and at field locations in Himachal Pradesh and Punjab and have covered the following topics:

- Rainfed crop production technology
- Design and construction of soil conservation structures
- Vegetative technology and seed multiplication
- Rainfed horticulture
- Forage production technology
- Drainage line treatments
- Project evaluation
- Joint forest management and community participation
- Communication techniques

41. The training provided by Ballowal Saunkhri has been appropriate, but because of the geographical extent of the project, the project units that are located in closer proximity to the centralized training centre, and in particular Punjab (47% of the trainees have been from this state), have been able to obtain greater benefits from the training activities. An important benefit that has been derived from the centralized training facility has been the provision of a forum for project staff from all participating states to meet and to share experiences gained during project implementation.

8. Geographic Information Systems (GIS)

42. There has been limited success in establishing functional GIS systems in any of the four participating states. The overall technical guidance for this activity was to have been provided by a

consultant(s) to be recruited by the Ministry of Agriculture (under the central government component of the project), with training for staff from the project offices to be provided by the Punjab Remote Sensing Centre at Ludhiana in Punjab, also funded from the central government component. Although computer hardware and GIS software has been purchased in all four states, the consultant who was to guide this activity was not recruited, and this is an important factor in the lack of progress with GIS.

9. Environmental Impact

43. Impact evaluation studies undertaken during project implementation indicate that there have been significant environmental benefits from the project. These benefits include a reduction in soil loss due to erosion in both the upper catchment areas and in the lower arable areas, a more regulated discharge of water from project sub-watersheds with a reduction in flooding both within the project sub-watersheds and in areas downstream of the project, improved productivity in arable and non-arable areas due to improved soil moisture, the protection of land adjacent to streambanks and the recharge of groundwater systems.

44. A substantial portion of the positive environmental impacts resulting from project activities are downstream and outside the project area. Comprehensive quantification of the environmental impact and assigning financial values to these benefits is extremely difficult. Although the main project objective is to slow and reverse environmental degradation in the Shivalik zone, because of the complexity of assigning financial values to environmental benefits, the SAR did not attempt to quantify these benefits and the financial viability of the project was based on increases in the production of food, fruit, fodder fuelwood and timber that would result from project activities.

45. All participating states have contracted independent agencies to conduct impact evaluation studies. The impact evaluation reports for three of the participating states (Haryana, Himachal Pradesh and Punjab) had been finalized by the end of project implementation. These studies have attempted to quantify the environmental benefits, particularly in respect of the reduction in surface run-off and soil loss as measured at silt observation posts (SOP's) that have been established in all states; the increase in surface leaf litter in the non-arable areas that have been treated; and increased moisture infiltration from contour trenching in non-arable areas. While these assessments provide some quantitative data there is considerable variation in the results in different states.

Run-off and soil loss

46. An important issue in respect of the run-off and soil loss measuring conducted at the SOP's is that they were not constructed until project activities in the catchment areas had started or were about to start, and therefore there is no extensive data on the pre-project situation in respect of soil loss and run-off.

47. SOP data is summarized in Table 8 below.

Table 8. Summarised SOP data for Haryana, Himachal Pradesh and Punjab

Haryana (Sirsa sub-watershed)						
Year	Rainfall (mm)	Run-off		Infiltration		Soil loss (t/ha)
		(mm)	(%)	(mm)	(%)	
1994	1,283	92	7.2	1,190	92.8	2.65
1995	1,443	73	5.0	1,371	95.0	1.48
1996	766	29	3.7	737	96.3	1.36
1997	1,351	51	3.8	1,300	96.2	1.02
Himachal Pradesh (Nalagarh)						
Year	Rainfall (mm)	Run-off		Infiltration		Soil loss (t/ha)
		(mm)	(%)	(mm)	(%)	
Untreated[1]			70.0		30.0	200.00
1995/96	1,731	660	38.1	1,071	61.9	84.73
1996/97	1,820	716	39.3	1,104	60.7	82.72
1997/98	1,389	537	38.6	852	61.4	74.32
Punjab (Jainti Devi Ki Rao sub-watershed)						
Year	Rainfall (mm)	Run-off		Infiltration		Soil loss (t/ha)
		(mm)	(%)	(mm)	(%)	
1995	1,522	505	33.2	1,017	67.0	151.07
1996	938	70	7.5	868	92.5	51.94
1997	832	36	4.3	769	95.7	24.03

48. While the results from all SOP's indicate positive environmental benefits, the data varies considerably between sites and it is difficult to draw conclusions that could be adopted on a project-wide basis. The data from Haryana indicates that the SOP was located in a sub-watershed that had low run-off and soil loss at the beginning of the project. The improvements in Himachal Pradesh are based on estimates of the likely pre-project situation. The results from Punjab do provide credible data and indicate a significant reduction in run-off (from 33% to 4%), a significant increase in infiltration (from 67% to 96%) and a reduction in soil loss from 151 tonnes per ha to 24 tonnes.

49. This information does provide indicative data on environmental impact. Substantial variations in yearly rainfall are normal in the Shivalik zone, and it would be necessary to commence catchment measuring several years in advance of the treatment works, and to continue recording for a longer period of time after the works have been completed in order to obtain a more accurate assessment of the environmental impact of this project.

Leaf litter in non-arable areas

50. Leaf litter shed by the trees and shrubs that have been planted as part of the non-arable land treatments provide a protective soil cover, and facilitate conservation of soil moisture and protects the soil against erosion. The state impact evaluations have measured changes in leaf litter in treated non-arable areas to demonstrate positive environmental impacts. The results from the three completed impact evaluation surveys show a very significant increase in leaf litter in planted areas, but no attempt

[1] Estimate

has been made to correlate this data with quantifiable reductions in run-off and soil loss. Table 9 summarizes the impact of the project on improved leaf litter in areas that have been afforested.

Table 9 - Summary Details on Surface Leaf Litter

State	Leaf litter (kg/ha)		
	Control (mean)	Afforestation (mean)	Silvipasture (mean)
Haryana	Not measured	1,992	1,702
Himachal Pradesh	135	4,197	2,592
Punjab	151	6,267	not measured

Contour trenching in non-arable areas

51. The adoption of contour trenching, usually called v-ditches in the project area, as a component of all non-arable land treatments has had an important impact on controlling surface run-off and increasing infiltration in the upper catchment areas. This has had a corresponding positive impact on regulating the flows in lower drainage lines, and reducing erosion in lower arable areas. This technique is not commonly adopted in the afforestation activities being implemented by the state Forestry Departments.

52. The impact evaluation survey conducted in Punjab has attempted to quantify the impact of using the contour trenches. It was found that in comparison to the control (untreated area), soil moisture was 94 to 275% higher.

Impact on groundwater

53. There is extensive anecdotal evidence from the inhabitants of village communities throughout the project area that water tables have risen following the completion of land treatment activities. Some limited data is available from Punjab that substantiates these claims in respect of improving water tables. The table below provides details on changes in groundwater levels in four sub-watersheds in Punjab.

Table 10 - Changes in Ground Water Levels in Punjab (metres below surface)

Sub-watershed	Village	1990 June	1990 Oct.	1997 June	1997 Oct.	1998 June
Dasuya	Malewal	7.68	7.38	4.49	3.95	3.30
Dasuya	Bhanowal	16.64	16.24	9.44	8.94	8.90
Dasuya	Mastiwal	14.69	14.49	7.79	6.49	5.90
Arniala	Baghpur	4.54	3.22	3.63	2.79	2.50
Arniala	Arniala	25.55	24.10	18.55	19.50	18.20
Arniala	Mustafapur	35.40	32.11	24.60	24.45	24.30

10. Production Models

54. Attachment 4 presents the following production models:

Cereal crops	• Rainfed wheat • Rainfed maize
Rainfed horticulture	• Mango
Non-arable land treatments	• Vegetative shrub barrier production model • Silvipasture • Afforestation

ATTACHMENT 1

SUB-WATERSHED DETAILS

TABLE OF CONTENTS

Attachment 1(a) - Haryana

Treated Sub-watersheds

Name of Sub-watershed	Arable Area (ha)	Non-arable Area (ha)	Total Area (ha)
INITIAL SUB-WATERSHEDS			
Sirsa	4,967	3,997	8,964
Boli-Yamuna	3,595	2,811	6,406
ADDITIONAL SUB-WATERSHEDS ADDED AT MTR			
Madhkali	2,093	1,943	4,036
Begna	12,274	5,071	17,345
Somb	12,570	3,320	15,890
Pathrala	6,917	4,380	11,297
ADDITIONAL SUB-WATERSHEDS ADDED AT EXTENSION			
Dangri	13,135	11,723	24,858
Nakti	4,608	4,850	9,458
Suk Rao	0	5,930	5,930
TOTAL	**60,159**	**44,025**	**104,184**

Attachment 1(b) - Himachal Pradesh

Treated Sub-watersheds

Name of Sub-watershed	Arable Area (ha)	Non-arable Area (ha)	Total Area (ha)
INITIAL SUB-WATERSHEDS			
Kheri Ka Khala	323	2,315	2,638
Kawal Khad	524	2,801	3,325
Balad Nadi Left Bank	880	1,656	2,536
Sarahan Di Khad Right Bank	1,088	1,913	3,001
Upper Swan	1,041	1,991	3,032
Harar Chakki	1,105	2,741	3,846
ADDITIONAL SUB-WATERSHEDS ADDED AT MTR			
Trilok Pur-Wala-Nallha	309	2,832	3,141
Gamloti Khad Left Bank	426	2,084	2,510
Nalagarh	708	1,892	2,600
Brahman Majra	1,182	1,918	3,100
Bhagol	800	2,300	3,100
Sarhan Di Khad Left Bank	577	1,123	1,700
Bhin Wali Khad	1,509	1,291	2,800
Govindpur Khad	1,201	1,599	2,800
Take Wali Khad	1,197	2,403	3,600
Katilu Khad	1,230	570	1,800
Balud	1,568	1,332	2,900
Lodhwan	624	976	1,600
ADDITIONAL SUB-WATERSHEDS ADDED AT EXTENSION			
Bhanglan Wali Khad	1,129	1,235	2,364
Patta Khad	797	2,019	2,816
Gamloti Khad	166	1,295	1,461
Moginand Wali Khad	392	2,319	2,711
Daggar Ka Choe	730	1,870	2,600
Upper Barera Khad	760	2,840	3,600
Mahot	2,028	2,257	4,285
Ladori	2,027	965	2,992
Galore	687	1,750	2,437
TOTAL	**25,008**	**50,287**	**75,295**

Attachment 1(c) - Jammu & Kashmir

Treated Sub-watersheds			
Name of Sub-watershed	**Arable Area (ha)**	**Non-arable Area (ha)**	**Total Area (ha)**
INITIAL SUB-WATERSHEDS[1]			
Dudh Ganga	12,294	13,094	25,388
Ramkote	5,742	7,776	13,518
Devak	2,088	7,282	9,370
	20,124	28,152	48,276

Footnote:

1. No additional catchments were added at the MTR or at project extension

Attachment 1 (d): Sub-Watershed Details - Punjab

Treated Sub-watersheds

Name of Sub-watershed	Arable Area (ha)	Non-arable Area (ha)	Total Area (ha)
INITIAL SUB-WATERSHEDS			
Jainti Devi Ki Rao	601	1,990	2,591
Arniala	1,107	1,615	2,722
Nara Dada Manijhi	986	5,075	6,061
Adasuya Langerpur	4,302	13,306	17,608
UPPER CATCHMENTS[1]			
Basu Khad	4,239	6,182	10,421
Chak Sadhu	949	4,578	5,527
Jhanda Ji Ki Khad	1,486	6,793	8,279
Kamahi Devi	1,841	3,472	5,313
Kukar Suha	589	1,935	2,524
Patiari	808	2,346	3,154
Rattewal	580	1,650	2,230
Sahora	450	979	1,429
West Suan	3,543	6,801	10,344
ADDITIONAL SUB-WATERSHEDS ADDED AT MTR			
Sughrao	1,961	5,600	7,561
Balachaur	966	1,413	2,379
Mohan Majra Nighi	1,518	1,970	3,488
Suan Khad	4,310	5,989	10,299
ADDITIONAL SUB-WATERSHEDS ADDED AT EXTENSION			
Asron Paniali Bhalla	1,488	3,436	4,924
Bachhoi	2,728	7,940	10,668
Noorpur Group of Choes	2,402	4,499	6,901
TOTAL	36,854	87,569	124,423

Footnotes:

1. Only the upper catchment areas were treated during the first phase of the project. The lower catchment areas will be treated in the second phase of the project.

ATTACHMENT 2

DETAILS OF PHYSICAL ACHIEVEMENTS

TABLE OF CONTENTS

Attachment 2 (a) - Haryana

Achievement of Physical Targets

Activity	Unit	Initial Target	Revised Target[1]	Project Achievement
ARABLE LANDS				
Vegetative barriers	ha	786	13	13
Terrace repair/vegetative reinforcement	ha	785	23	23
Vegetative field boundaries	ha	1,318	8,377	7,859
Rainfed horticulture	ha	52	1,160	1,443
Rainfed crop demonstrations	ha	1,765	4,959	4,515
Herb garden	no	0	1	1
NON-ARABLE LANDS				
PRIVATE				
Vegetative/shrub barriers	ha	222	1,184	363
Silvipasture	ha	171	1,191	311
Afforestation	ha	40	7,271	6,589
VILLAGE COMMON LANDS				
Vegetative/shrub barriers	ha	320	657	448
Silvipasture	ha	204	504	129
Afforestation	ha	50	2,674	3,224
FOREST LANDS				
Vegetative/shrub barriers	ha	1,093	1,835	1,863
Silvipasture	ha	124	0	355
Afforestation	ha	474	1,062	3,794
DRAINAGE LINES				
Cratewire structures (gully stabilisation)	m^3	13,248	61,693	26,842
Earthern gully plugs	no	124	472	782
Masonry cement structures	m^3	8,000	58,489	58,702
Dry stone structures	m^3	11,760	79,313	60,119
Small stone check dams	m^3	22,800	60,800	56,731
Vegetative check dams	m	249	880	3,055
Silt detention structures	no	35	173	275
Cratewire structures (streambank protection)	m^3	6,420	6,420	3,306
Vegetative spurs	m	878	14,878	4,452
Village tanks/ponds	no	39	311	269
Sub-surface dam	no	0	11	19
Water harvesting structures	no	5	0	0
Water supply system large	no	0	4	31
Water supply system small	no	0	32	24
ANIMAL HUSBANDRY				
Artificial insemination	no	0	36,500	53,866
Health coverage	no	0	510,000	940,264
Supplementary feeding	no	220	2,820	2,769

Footnotes:
1. The targets were revised at the MTR and again at the time of the two extensions in time

Attachment 2 (b) - Himachal Pradesh

Achievement of Physical Targets

Activity	Unit	Initial Target	Revised Target[1]	Project Achievement
ARABLE LANDS				
Vegetative barriers	ha	285	285	285
Terrace repair/vegetative reinforcement	ha	1,648	7,998	5,814
Vegetative field boundaries	ha	2,180	9,787	8,742
Rainfed horticulture	ha	422	2,358	2,172
Rainfed crop demonstrations	ha	1,581	8,466	7,831
On-farm fodder production	ha	1,176	5,171	3,844
NON-ARABLE LANDS				
PRIVATE				
Pasture development	ha	788	3,830	2,927
Afforestation	ha	381	2,069	2,702
Silvipasture	ha	0	15	15
Vegetative shrub barriers	ha	0	13	13
VILLAGE COMMON LANDS				
Vegetative shrub barriers	ha	141	505	536
Woodlots	ha	84	524	144
Silvipasture	ha	17	346	166
Afforestation	ha	17	884	321
Rehabilitation	ha	90	90	90
Replenishment	ha	0	1,000	25
FOREST LANDS				
Vegetative shrub barriers	ha	473	2,907	2,792
Silvipasture	ha	150	2,010	1,746
Afforestation	ha	239	4,641	4,546
Replenishment	ha	283	2,499	2,568
Rehabilitation	ha	230	3,639	1,980
Smokeless chullahs	no	0	6,225	5,503
DRAINAGE LINES				
Masonry cement structures	no	5	81	83
Dry stone structures	m^3	24,656	163,103	123,998
Brushwood check dams	km	0	300	254
Brushwood check dams	m^3	53,375	53,375	53,375
Cratewire structures	m^3	10,102	62,723	78,662
Livehedge spurs	km	0	301	205
Livehedge spurs	m^3	90,669	90,669	90,669
Landslide treatment	ha	75	429	431
Village ponds	no	85	525	623
Earthen run-off structures	no	18	64	46
Water harvesting structures - large	no	6	0	0
Water harvesting structures - small	no	0	89	69
Roadside erosion control	km	0	1,533	113
	m^3	4,812	4,812	5,312
Roadside erosion control	ha	0	0	28
ANIMAL HUSBANDRY				
Natural breeding centres	no	9	69	65
Livestock reduction	no	218	2,018	231
Supplementary feeding				
Late pregnancy ration	no	1,089	7,114	6,933
Calf starter	no	493	493	493
Female calf rearing	no	796	4,446	3,321
Construction of stalls	no	407	7,732	8,662
Rehabilitation of stalls	no	794	3,294	1,034
Chaff cutters	no	0	3,739	3,223
POST HARVEST PROTECTION				
Grain storage bins	no	2,656	13,606	13,828

1. The targets were revised at the MTR and again at the time of the two extensions in time

Attachment 2 (c) - Jammu & Kashmir

Achievement of Physical Targets

Activity	Unit	Initial Target	Revised Target[1]	Project Achievement
ARABLE LANDS				
Vegetative barriers	ha	5,870	774	665
Terrace repair/vegetative reinforcement	ha	3,020	7,355	6,415
Vegetative field boundaries	ha	2,813	8,954	7,883
Rainfed horticulture	ha	334	4,100	3,197
Rainfed crop demonstrations	ha	5,400	9,518	8,018
On-farm fodder production	ha	891	2,134	2,134
Horticultural rejuvenation	ha	172	2,927	1,728
NON-ARABLE LANDS				
PRIVATE				
Vegetative barriers	ha	110	140	132
Pasture development	ha	130	100	62
Silvipasture	ha	1,845	1,728	1,728
Afforestation	ha	150	550	464
VILLAGE COMMON LANDS				
Vegetative barriers	ha	873	1,115	822
Pasture development	ha	0	100	50
Silvipasture	ha	671	2,967	2,563
Afforestation	ha	653	3,574	3,306
FOREST LANDS				
Vegetative barriers	ha	2,320	1,665	1,559
Pasture development	ha	1,395	2,595	2,390
Silvipasture	ha	2,091	2,112	1,977
Afforestation	ha	2,164	3,997	3,992
Forest Augmentation	ha	2,203	7,868	7,663
DRAINAGE LINES				
Dry stone structures	m^3	185,000	634,350	634,350
Earthen run-off dams	no	25	200	198
Cratewire structures (gully stabilisation)	m^3	125,000	125,000	116,818
Vegetative gully control	m	9300	300,000	342,367
Cratewire structures (streambank protection)	m^3	98,000	98,000	53,207
Vegetative spurs	m	11,000	300,000	238,843
Village ponds	no	256	800	736
Water harvesting structures - large	no	6	0	0
Water harvesting structures - small	no	0	241	184
Roadside erosion control	m	1,100	50,000	93,917
Landslide treatment	ha	127	0	0
Landslide treatment	m	0	200,000	187,318
ANIMAL HUSBANDRY				
Livestock reduction	no	No data		
	no			
Supplementary feeding				
Late pregnancy ration	no			
Female calf rearing	no			

1. The targets were revised at the MTR and again at the time of the two extensions in time

Attachment 2 (d) - Punjab

Achievement of Physical Targets

Activity	Unit	Initial Target	Revised Target[1]	Project Achievement
ARABLE LANDS				
Vegetative barriers/field barriers	ha	7,783	7,718	6,439
Rainfed horticulture	ha	116	203	673
Rainfed crop demonstrations	ha	5,620	6,943	8,283
On-farm fodder production	ha	525	635	850
NON-ARABLE LANDS				
PRIVATE				
Shrub barriers	ha	181	No data	1,219
Vegetative barrier - production component	ha	513		4,090
Silvipasture	ha	779		7,698
Afforestation	ha	2,426		12,050
VILLAGE COMMON LANDS				
Shrub barriers	ha	173		730
Vegetative barrier - production component	ha	568		2,911
Silvipasture	ha	581		2,951
Afforestation	ha	2,669		5,214
FOREST LANDS				
Shrub barriers	ha	142		339
Vegetative barrier - production component	ha	431		2,529
Silvipasture	ha	830		678
Afforestation	ha	990		4,573
DRAINAGE LINES				
Masonry cement structures	m^3	49,043	41,455	48,765
Cratewire structures (gully stabilisation)	m^3	72,017	67,556	72,660
Dry stone structures	m^3	213,713	165,410	156,876
Vegetative check dams	m	258,039	296,489	283,407
Cratewire structures (streambank protection)	m^3	21,406	46,820	69,041
Vegetative spurs	km	523	572	832
Village ponds	no	28	26	28
Rehabilitation of ponds	no	53	34	41
Makhowal structures	no	17	34	37
Water harvesting structures	no	7	0	0
Silt retention dams	no	0	116	220
ANIMAL HUSBANDRY				
Livestock improvement	no	26,844	35,694	47,604
Supplementary feeding				
Late pregnancy ration	no	16,487	9,478	9,478
Female calf rearing	no	8,180	5,498	5,498

1. The targets were revised at the MTR and again at the time of the two extensions in time

ATTACHMENT 3

UNIT COST DETAILS

TABLE OF CONTENTS

Attachment 3 (a) - Haryana

Unit Costs

Activity	Unit	Initial unit cost (R's)	Current unit cost (R's)
ARABLE LANDS			
Vegetative barriers	ha	550	0
Terrace repair/vegetative reinforcement	ha	1,835	0
Vegetative field boundaries	ha	760	1,484
Rainfed horticulture	ha	3,900	8,350
Rainfed crop demonstrations	ha	1,000	1,660
NON-ARABLE LANDS			
PRIVATE			
Vegetative/shrub barriers	ha	3,000	5,770
Silvipasture	ha	5,760	10,973
Afforestation	ha	8,570	14,449
VILLAGE COMMON LANDS			
Vegetative/shrub barriers	ha	3,380	6,161
Silvipasture	ha	6,149	8,778
Afforestation	ha	8,950	15,481
FOREST LANDS			
Vegetative/shrub barriers	ha	3,380	5,770
Silvipasture	ha		
Afforestation	ha	8,950	14,499
DRAINAGE LINES			
Cratewire structures	m^3	163	331
Earthern gully plugs	no	10,000	20,626
Masonry cement structures	m^3	310	738
Small stone check dams	m^3	50	0
Dry stone structures	m^3	138	258
Vegetative check dams	m	229	1,421
Vegetative spurs	m	8	30
Village ponds	no	25,000	45,500
Village tanks	no	29,000	45,500
Sub-surface dam	no	0	300,000
Water supply system large	no	0	700,000
Water supply system small		0	90,000

Footnotes:

1. The targets were revised at the MTR and again at the time of the two extensions in time

Attachment 3 (b) - Himachal Pradesh

Unit Costs

Activity	Unit	Initial unit cost (R's)	Current unit cost (R's)
ARABLE LANDS			
Vegetative barriers	ha	550	0
Terrace repair/vegetative reinforcement	ha	1,840	0
Vegetative field boundaries	ha	760	1,641
Rainfed horticulture	ha	17,360	17,379
Rainfed crop demonstrations	ha	2,370	2,700
On-farm fodder production	ha	1,000	1,100
NON-ARABLE LANDS			
PRIVATE			
Pasture development	ha	760	2,928
Afforestation	ha	7,500	16,293
Silvipasture	ha	8,330	13,439
Vegetative shrub barriers	ha	1,650	4,664
VILLAGE COMMON LANDS			
Vegetative shrub barriers	ha	1,650	4,664
Woodlots	ha	7,500	0
Silvipasture	ha	8,330	13,439
Afforestation	ha	7,500	16,293
Rehabilitation	ha	2,500	5,467
Replenishment	ha	1,200	0
FOREST LANDS			
Vegetative shrub barriers	ha	1,650	4,664
Silvipasture	ha	8,330	13,439
Afforestation	ha	7,500	16,293
Replenishment	ha	1,200	0
Rehabilitation	ha	2,500	5,467
Smokeless chullahs	no	0	400
DRAINAGE LINES			
Masonry cement structures	no	50,000	183,245
Dry stone structures	m^3	100	360
Brushwood check dams	km	5,000	31,800
Cratewire structures	m^3	200	604
Livehedge spurs	km	10,000	42,400
Landslide treatment	ha	10,000	21,200
Village ponds	no	25,000	53,003
Earthen run-off structures	no	100,000	254,410
Water harvesting structures - large	no	1,000,000	0
Water harvesting structures - small	no	0	254,500
Roadside erosion control	km	230	2,015
ANIMAL HUSBANDRY			
Natural breeding centres	no	53,000	0
Livestock reduction	no	300	0
Supplementary feeding			
Late pregnancy ration	no	240	600
Calf starter	no	600	0
Female calf rearing	no	2,500	4,220
Construction of stalls	no	1,000	2,831
Rehabilitation of stalls	no	400	0
Chaff cutters	no	0	1,600
POST HARVEST PROTECTION			
Grain storage bins	no	600	760

Attachment 3 (c) - Jammu & Kashmir

Unit Costs

Activity	Unit	Initial unit cost (R's)	Current unit cost (R's)
ARABLE LANDS			
Vegetative barriers	ha	2,926	0
Terrace repair/vegetative reinforcement	ha	3,740	1,185
Vegetative field boundaries	ha	3,285	0
Rainfed horticulture	ha	22,500	9,200
Rainfed crop demonstrations	ha	1,610	2,565
On-farm fodder production	ha	1,780	2,160
Horticultural rejuvenation	ha	6,360	0
NON-ARABLE LANDS			
PRIVATE			
Vegetative barriers	ha	4,290	6,709
Pasture development	ha	5,200	4,402
Silvipasture	ha	7,500	7,726
Afforestation	ha	6,418	14,187
VILLAGE COMMON LANDS			
Vegetative barriers	ha	4,290	6,709
Pasture development	ha	5,200	4,402
Silvipasture	ha	7,500	7,726
Afforestation	ha	6,418	14,187
FOREST LANDS			
Vegetative barriers	ha	4,290	6,709
Pasture development	ha	5,200	4,402
Silvipasture	ha	7,500	7,726
Afforestation	ha	6,418	14,187
DRAINAGE LINES			
Masonry cement structures	m^3	88	100
Cratewire structures	m^3	358	460

Footnotes:

1. The targets were revised at the MTR and again at the time of the two extensions in time

Attachment 3 (d) - Punjab

Unit Costs

Activity	Unit	Initial unit cost (R's)	Current unit cost (R's)
ARABLE LANDS			
Vegetative barriers/field barriers	ha		
Rainfed horticulture	ha	8,000	7,000
Rainfed crop demonstrations	ha	1,500	1,500
On-farm fodder production	ha	650	1,200
NON-ARABLE LANDS			
PRIVATE			
Shrub barriers	ha	1,090	2,197
Vegetative barrier - production component	ha	1,759	3,541
Silvipasture	ha	2,732	5,495
Afforestation	ha	2,801	5,642
VILLAGE COMMON LANDS			
Shrub barriers	ha	1,248	2,334
Vegetative barrier - production component	ha	2,012	3,762
Silvipasture	ha	2,422	5,839
Afforestation	ha	3,201	5,994
FOREST LANDS			
Shrub barriers	ha	1,560	2,746
Vegetative barrier - production component	ha	2,515	4,426
Silvipasture	ha	3,903	6,869
Afforestation	ha	4,007	7,052
DRAINAGE LINES			
Masonry cement structures	m^3	528	900
Cratewire structures	m^3	320	595
Dry stone structures	m^3	152	200
Vegetative check dams	m	31	25
Vegetative spurs	m	28	17
Village ponds	no	120,000	112,000
Rehabilitation of ponds	no	53,000	55,000
Makhowal structures	no	195,000	375,000
Silt retention dams	no	0	250,000
ANIMAL HUSBANDRY			
Livestock improvement	no	100	100
Supplementary feeding			
Late pregnancy ration	no	120	0
Female calf rearing	no	650	0

Footnotes:

1. The targets were revised at the MTR and again at the time of the two extensions in time

ATTACHMENT 4

PRODUCTION MODELS

TABLE OF CONTENTS

Wheat - Rainfed Crop Production Model
Yield and Inputs (per ha)

		Unit	Unit cost (R's)	Without project	Total (R's)	With project	Total (R's)
Main products	Grain	kg	5.50	900.00	4,950.00	1,830.00	10,065.00
	Straw	kg	1.50	1,300.00	1,950.00	2,000.00	3,000.00
Inputs	Seed	kg	11.00	100.00	1,100.00	100.00	1,100.00
	Termite control	ml	0.32	-	-	400.00	128.00
	Fungercide	gm	0.59	-	-	250.00	147.50
	Fertilizer						
	FYM	tons	100.00	1.00	100.00	-	-
	CAN	kg	4.80	10.00	48.00	162.00	777.60
	SSP	kg	2.78	-	-	125.00	347.50
	Pesticide	l	100.00	-	-	1.00	100.00
	Land preparation	ls			700.00		700.00
							-
Labour		md	60.00	22.00	1,320.00	40.00	2,400.00
				Total income	6,900.00	Total income	13,065.00
				Total costs	3,268.00	Total costs	5,700.60
				Net return	3,632.00	Net return	7,364.40
Return per family labour day (assuming all family labour)					225.09		443.84

Total arable area	142,000	
Coverage	55%	From impact evaluation reports

Maize - Rainfed Crop Production Model
Yield and Inputs (per ha)

		Unit	Unit cost (R's)	Without project	Total (R's)	With project	Total (R's)
Main products	Grain	kg	3.50	800.00	2,800.00	1,385.00	4,847.50
	Straw	kg	0.85	1,200.00	1,020.00	1,800.00	1,530.00
Inputs	Seed	kg	10.00	30.00	300.00	20.00	200.00
	Seed treatment	gm	0.59	-	-	60.00	35.40
	Fertilizer						
	FYM	tons	100.00	2.00	200.00	2.00	200.00
	CAN	kg	4.80	-	-	162.00	777.60
	SSP	kg	2.78	-	-	125.00	347.50
	Pesticide	l	100.00	0.70	70.00	2.00	200.00
	Land preparation	ls			700.00		700.00
Labour		md	60.00	18.00	1,080.00	30.00	1,800.00
				Total income	3,820.00	Total income	6,377.50
				Total costs	2,350.00	Total costs	4,260.50
				Net return	1,470.00	Net return	2,117.00
Return per family labour day (assuming all family labour)					141.67		217.61

Total arable area	142,000	
Coverage	45%	From impact evaluation reports

Mango - Rainfed Production Model
Yield and Inputs (per ha)

		Unit	Unit cost (R's)	Years 1	2	3	4	5	6	7	8	9	10	11 to 30
Income														
	Mango yield	kg					250	500	2,000	3,000	6,000	8,000	10,000	10,000
	Mango revenue	Rs	10				2,500	5,000	20,000	30,000	60,000	80,000	100,000	100,000
	Intercrop net revenue													
	Wheat	Rs	1,997.60	1,798	1,798	1,598	1,199	599						
	Maize	Rs	661.50	595	595	529	397	198		-				
	LESS: Rainfed crop rev.	Rs	2659.1	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659	2,659
	Total gross income			-266	-266	-532	1436	3139	17341	27341	57341	77341	97341	97341
Inputs														
	Seedling	no		100	30	20								
		Rs	15	1,500	450	300								
	Thimate - 10G	kg		5.00	5.00	5.00	5.00	5.00	6.25	6.25	6.25	6.25	6.25	6.25
		Rs	52	260	260	260	260	260	325	325	325	325	325	325
	Phaspomidone	l				1.00	1.00	1.00	1.50	1.50	1.50	2.00	2.00	2.00
		Rs	355	-	-	355	355	355	533	533	533	710	710	710
	Plantozine	l				2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50
		Rs	150	-	-	300	300	300	300	375	375	375	375	375
	Topsine	kg					0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00
		Rs	870	-	-	-	435	435	435	870	870	870	870	870
	Fertilizer													
	NPK	kg			20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	180.00
		Rs	8	-	160	320	480	640	800	960	1,120	1,280	1,440	1,440
	FYM	t		10.00	4.00	3.00	1.00	1.00	1.50	2.00	3.00	4.00	5.00	5.00
		Rs	100	1,000	400	300	100	100	150	200	300	400	500	500
Labour		md		155	40	45	35	35	40	45	50	55	60	60
		Rs	60	9,300	2,400	2,700	2,100	2,100	2,400	2,700	3,000	3,300	3,600	3,600
	Total input cost	Rs		12,060	3,670	4,535	4,030	4,190	4,943	5,963	6,523	7,260	7,820	7,820
	Net Income	Rs		-12,326	-3,936	-5,067	-2,594	-1,051	12,398	21,378	50,818	70,081	89,521	89,521
	Return per family labour day (assuming all labour is family)			-20	-38	-53	-14	30	370	535	1,076	1,334	1,552	1,552
	Financial rate of return: *(assuming all labour hired)*	48%												

Note: Production for years 11 to 30 will continue as for year 10

	Haryana	HP	J&K	Punjab	All states
Area planted to fruit trees (ha)	1,442	2,172	3,197	673	7,484

1. Intercropping (% inputs and yields)

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
90%	90%	80%	60%	30%	0%

2. Figures in production model for intercropping are for net income and based on the before project rainfed wheat and maize production models
3. Area coverage is 55% for wheat, and 45% for maize

Afforestation Production Model
Yield and Inputs per ha

	Unit	Unit cost (R's)	Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Income																						
Timber	m^3																10.00					35.00
	Rs	4000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40,000	-	-	-	-	140,000
Fuelwood	m^3																5.00					10.00
	Rs	600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,000	-	-	-	-	6,000
Bhabbar grass	ton			0.50	2.00	2.00	1.50	1.00	1.00	0.50	0.50											
	Rs	1750	-	875	3,500	3,500	2,625	1,750	1,750	875	875	-	-	-	-	-	-	-	-	-	-	-
Fodder grass	ton			1.00	2.00	2.00	1.50	1.00	1.00	1.00	1.00											
	Rs	300	-	300	600	600	450	300	300	300	300	-	-	-	-	-	-	-	-	-	-	-
Total gross income			-	1,175	4,100	4,100	3,075	2,050	2,050	1,175	1,175	0	0	0	0	0	43,000	0	0	0	0	146,000
Inputs																						
Tree seedlings	no		550	165	110	55																
	Rs	2.00	1,100	330	220	110																
Bhabbar tuffs	no		3,600	1,080	720	360																
	Rs	0.15	540	162	108	54																
Chlorpiriphos	litre		0.50	0.30	0.20	0.20																
	Rs	200.00	100	60	40	40																
Urea	kg		15.00	30.00	30.00	30.00																
	Rs	4.00	60	120	120	120																
DAP	kg		15.00	5.00	3.00	1.00																
	Rs	9.00	135	45	27	9																
Labour	days		139	38	22	12	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Rs	60	8,340	2,280	1,320	720	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480
Total input cost			10,275	2,997	1,835	1,053	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480
Net income			-10,275	-1,822	2,265	3,047	2,595	1,570	1,570	695	695	-480	-480	-480	-480	-480	42,520	-480	-480	-480	-480	145,520
Return per family labour day (assuming all labour is family)			-14	12	163	314	384	256	256	147	147	0	0	0	0	0	5,375	0	0	0	0	18,250
Financial rate of return (assuming all labour hired)		22%																				

20 year rotation

Afforestation achievements by state

Haryana	HP	J&K	Punjab	Total
13,607	7,569	7,762	21,837	50,775

Silvipasture Production Model
Yield and Inputs (per ha)

	Unit	Unit cost (R's)	Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Income																	
Timber	m^3																40
	Rs	4000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160000
Fuelwood	m^3						2					3					10
	Rs	600	-	-	-	-	1200	0	0	0	0	1800	0	0	0	0	6000
Bhabbar grass	ton				0.8	1	1	1	1	0.8	0.8	0.6	0.6				
	Rs	1750	-	-	1400	1750	1750	1750	1750	1400	1400	1050	1050	0	0	0	0
Fodder grass	ton				2	4	6	6	5	4	4	3	3	2	2	1	1
	Rs	300	-	-	600	1200	1800	1800	1500	1200	1200	900	900	600	600	300	300
Total gross income	Rs		-	-	2000	2950	4750	3550	3250	2600	2600	3750	1950	600	600	300	166300
Inputs																	
Tree seedlings	no		550	165	110												
	Rs	2.00	1,100	330	220												
Grass seed	kg		1.00	0.30													
	Rs	75.00	75	23													
Bhabbar tuffs	no		1650	500	330												
	Rs	0.15	248	75	50												
Chlorpiriphos	litre		0.25														
	Rs	200.00	50														
Urea	kg		15	30	30												
	Rs	4.00	60	120	120												
DAP	kg		15														
	Rs	9.00	135														
Labour	days		128	39	26	12	8	8	8	8	8	8	8	8	8	8	8
	Rs	60	7,680	2,340	1,560	720	480	480	480	480	480	480	480	480	480	480	480
Total input cost	Rs		9,348	2,888	1,950	720	480	480	480	480	480	480	480	480	480	480	480
Net income	Rs		-9,348	-2,888	51	2,230	4,270	3,070	2,770	2,120	2,120	3,270	1,470	120	120	-180	165,820
Return per family labour day (assuming all labour is family)			-13	-14	62	246	594	444	406	325	325	469	244	75	75	38	20,788
Financial rate of return (assuming all labour hired)		27%															

15 year rotation

Silvipasture achievements by state

Haryana	HP	J&K	Punjab	Total
795	1,927	6,268	11,327	20,317

Vegetative Shrub Barrier Production Model
Yield and Inputs (per ha)

	Unit	Unit cost	Years														
		(R's)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Income																	
Timber	m^3																20
	Rs	4000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80,000
Fuelwood	m^3											5					5
	Rs	600	-	-	-	-	-	-	-	-	-	3,000	-	-	-	-	3,000
Bhabbar grass	ton				0.8	1	1	1	1	0.8	0.8	0.6	0.6				
	Rs	1750	-	-	1,400	1,750	1,750	1,750	1,750	1,400	1,400	1,050	1,050	-	-	-	-
Fodder grass	ton				2	4	6	6	5	4	4	3	3	2	2	1	1
	Rs	300	-	-	600	1,200	1,800	1,800	1,500	1,200	1,200	900	900	600	600	300	300
Total gross income	Rs		-	-	2,000	2,950	3,550	3,550	3,250	2,600	2,600	4,950	1,950	600	600	300	83,300
Inputs																	
Tree seedlings	no		200	40	20												
	Rs	2	400	80	40												
Grass seed	kg		5														
	Rs	75	375														
Bhabbar tuffs	no		1650	500	330												
	Rs	0.15	248	75	50												
Chlorpiriphos	litre		0.25														
	Rs	200.00	50														
Urea	kg		15	30	30												
	Rs	4.00	60	120	120												
DAP	kg		8	8	8												
	Rs	9.00	72	72	72												
Labour	days		89	31	24	12	8	8	8	8	8	8	8	8	8	8	8
	Rs	60	5,340	1,860	1,440	720	480	480	480	480	480	480	480	480	480	480	480
Total input cost	Rs		6,545	2,207	1,722	720	480	480	480	480	480	480	480	480	480	480	480
Net income	Rs		-6,545	-2,207	279	2,230	3,070	3,070	2,770	2,120	2,120	4,470	1,470	120	120	-180	82,820
Return per family labour day (assuming all labour is family)			-14	-11	72	246	444	444	406	325	325	619	244	75	75	38	10,413
Financial rate of return (assuming that all labour is paid)		27%															

15 year rotation

Vegetative Shrub Barrier achievements by state	Haryana	HP	J&K	Punjab	Total
	2,676	3,341	2,504	11,818	20,339

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX D

LIVESTOCK ASPECTS

TABLE OF CONTENTS

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX D

LIVESTOCK ASPECTS

1. Introduction

1. In the livestock component the main strategy to increase the income of project beneficiaries has been to raise the milk production from cattle and buffaloes through:

(i) improved breeding, both by AI and natural breeding;

(ii) improved feeding by expanding feed resources through growing grasses like napier on bunds and establishing silvipasture and better availability of crop residues through adopting high yielding grain varieties and promoting stall feeding of chopped residues; and

(iii) better animal health cover by establishing modern veterinary dispensaries. Further, it was also envisioned to reduce the number of scrub animals.

2. In Jammu and Kashmir, in addition to cattle and buffaloes, sheep were also included in the treatment for livestock sector.

2. Himachal Pradesh

3. In Himachal Pradesh the main mission findings are as follows:

(i) **breed improvement:** both AI and natural breeding approaches are necessary. This is because in inaccessible areas where AI will be difficult and an expensive technology, it would be more useful and cost effective to establish Natural Breeding Centres (NBC). It was, however, observed that at some places bulls were assigned for three years and more, which may lead to in-breeding. It is, therefore, suggested that after three years, these bulls should be interchanged between the villages to avoid such risk of in-breeding. Further, since the maintenance cost of bulls and honorarium to the Bull Keeper has been withdrawn after the Mid-Term Review (MTR) of the project the same practice may be continued in Phase 2. It is, therefore, necessary that NBC should be established on a need basis and the Bull Keeper could charge the service fee to maintain them properly. For AI, the World Bank has already made a provision in the project establishing a deep frozen semen (DFS) production centre in the

State. This is required as it will help the State to produce quality semen for both cattle and buffalo. The institution of para vets should be established to provide AI and first aid to the farmers' animals and the services provided should be charged so as to make the para vet operations sustainable.

(ii) **improved feeding:** as a further means of improving feed resources, the project initially provided supplemental feeding to pregnant dairy animals and calf starters for female calves. These were provided free to farmers. This has rightfully been discontinued following the MTR. However, a simple mineral mixture containing common salt, calcium carbonate, zinc sulphate, copper sulphate and di-calcium phosphate costing Rs7-8/kg should be introduced for lactating and growing animals to improve production and reproduction. These could be simply compounded by the project. Conservation of fodder in the form of hay and silage may be introduced with more emphasis on haymaking. Supply of manual chaff cutters to improve feed utilisation and reduce the wastage, appears to have been quite successful and is to be continued in Phase 2. The Mini Kit Programme of the Central Government had very little impact on fodder production. However, the proposed Mini Kit Programme envisioned in the project should be based on farmers' needs.

(iii) **improved animal health:** the project should strengthen the Animal Husbandry Department (AHD) activities rather than involving the project staff in the routine treatment of the animals. However, the project may support AHD's efforts in vaccination and sterility campaigns.

4. Significant impact was observed in milk production, which was stated to have increased by 40% through farmers adoption of improved breeding, feeding and disease control practices.

3. Punjab

(i) **breed improvement** was by artificial insemination. About 47,604 cows and buffaloes were inseminated with frozen semen from improved cow and buffalo bulls. Breed improvement impact was observed in the field. In discussion with the farmers they stated that their income had doubled through increased sales of milk. The AI was conducted both by the veterinary officials of the project and lay inseminators who were paid a monthly honorarium of Rs500. About 39 local, educated, unemployed youth were trained for three months in AI and 65% of the insemination was done by them. They were provided with all the logistics free of cost by the project. After the completion of Phase 1 of the project, these lay inseminators are not doing anything, and their activities have been stopped. In order to sustain the institution of Lay Inseminator, they should be provided with additional training in first aid treatment. The logistics of frozen semen, liquid nitrogen, insemination guns, etc., should be provided by ADH to complement their activities. Many dairy farmers maintain large herds in semi-urban areas, having buffalo bulls for natural service which need to be monitored and, if necessary, replaced by improved bulls.

(ii) **improved feeding:** farmers have started feeding their improved animals in the stalls and do not send them for grazing. Grazing pressure has been reduced thereby from 80% to 42%. The beneficiaries were provided with supplemental feeding (9,478 pregnant cows and buffaloes and 5,498 improved female calves), at 50% subsidy, which has been stopped. The practice with supplemental feeding in Phase II, may be replaced with supplemental feeding of simple mineral mixtures which should be charged at cost price to sustain the improved feeding.

Farmers have adopted growing improved fodder varieties for feeding their animals. The availability of grasses and straws has been increased by 30%. About 17,000 farmer families were provided with improved fodder seeds and fertilizer free of cost.

(iii) **improved animal health:** better animal health services were provided to the animals. Eight dispensaries were constructed under the project in the District of Hoshiarpur and Ropar in the last nine years. There has been an impact on milk production, which was reported to have doubled.

4. Haryana

(i) **breed improvement:** artificial insemination in cattle and buffaloes using frozen semen involved some 53,866 animals with a 55% conception rate in cattle and 40% in buffaloes at first insemination. The artificial insemination was mostly carried out by the Veterinary Assistant Surgeons (VAS) and Veterinary Livestock Development Assistants (VLDA).

Since Haryana has an extensive network of veterinary hospitals (managed by VAS), the AI in Phase II may be continued through them.

(ii) **improved feeding**: supplementary feeding rations were provided at a 50% subsidised price to 2,769 cows and buffaloes to demonstrate to the farmers the effect of feeding in the last quarter of pregnancy and raising female calves. This has since been discontinued after the MTR and completion of the Phase I and there is no need to continue it in Phase II. Instead, simple mineral mixtures consisting of common salt, calcium carbonate, zinc and copper sulphate, may be introduced at cost price to farmer beneficiaries to demonstrate the beneficial effect of feeding mineral supplements in the rations. Mini Kits with improved seeds of chari, cowpea, guar, maize and berseem may be continued to be given to farmers to increase fodder production. Similarly, agro-forestry and silvipasture establishment should be continued to increase fodder production.

(iii) **animal health:** the project provided inputs to about 54 hospitals and an equal number dispensaries. This included construction of 3 new hospitals and 12 new dispensaries. The clinics are well equipped with refrigerators, microscopes, centrifuges, liquid nitrogen containers, etc., to maintain the cold chain for diagnosis of diseases and treatment of animals. Some 940,264 animals were

provided services in castration, de-worming, vaccination and treatment by the project.

5. Jammu and Kashmir

5. Jammu and Kashmir was not visited by the mission, but it was reported that during the project there had been a significant improvement in the genetics of the livestock (cattle, sheep and goats), and increase in biomass production (both green fodder availability and cup residues). The success of vetiver in the cultivated fields is low. Better animal health cover was provided to the livestock.

6. Summary of Mission Findings

6. During the project, there has been a significant increase in milk production from the cattle and buffaloes kept by the target beneficiaries in all the four States, namely Himachal Pradesh, Haryana, Punjab and Jammu and Kashmir. This has been possible due to the breed improvement programme undertaken by the project employing both artificial insemination and natural breeding (in Himachal Pradesh). In Phase 2, both the techniques, namely artificial insemination and natural breeding centre with improved bulls, should be provided on a need basis, and in order to sustain the programme, the farmers should pay for these services.

7. Farmers have started feeding their animals in the stalls constructed by the project and have stopped the practice of sending them to graze in the forests. The increased availability of green fodder through establishing napier hybrid bajra on the bunds and green grasses available in silvipasture in the forest has further improved the nutritional condition of lactating animals. The increased availability of crop residues through the adoption of high yielding varieties has further improved the feed resources in the watershed areas, thus reducing the gap in the availability of green fodder for animal feed.

8. The improved animal health services provided by the project have reduced the mortality and provided better services to the farmers' animals.

9. **Human Resources Development (HRD).** There should be a continuous training of the project staff by conducting study tours to the Indian Grass and Forage Research Institute at Jhansi (IGFRI) for silvipasture and conservation of forages; and to the National Dairy Research Institute (NDRI) at Karnal for artificial insemination. The farmer beneficiaries, especially women, should be trained in one-day training sessions in improved livestock management practice, including forest conservation.

7. Lessons Learned

10. The main lessons learned from the implementation experience of the livestock component are as follows:-

(a) the need for, and benefit of, an integrated watershed management approach in planning and management;

(b) the need for participation of the beneficiaries in order to establish need-based interventions in the area of animal husbandry and fodder production;

(c) in some places, there will be a need for the bulls for natural breeding, which should be provided with good bulls. In such cases costs for the caretaker/feed supply should be met through levying reasonable charges for the services provided;

(d) the sanctioned staff for livestock should be appointed on a full-time basis for the project and not given to additional responsibilities;

(e) mobility to the staff working in the project is essential so as to provide services and monitoring to the staff. This should also include provision of a mobile dispensary.

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX E

SOCIOLOGICAL ASPECTS

TABLE OF CONTENTS

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR.2100-IN/LN.3175-IN)

APPENDIX E

SOCIOLOGICAL ASPECTS

1. Introduction

1. The main purpose of this Appendix is to make a social assessment of the project. Its first objective is to record the visible socio-economic changes that have occurred among the beneficiaries; and secondly, to find out how far institution building has been successfully implemented during the Ist Phase of the implementation of the project.

2. The assessment of **social transformation** in the watershed areas has been looked at from the point of both direct and indirect benefits accruing to the beneficiaries in terms of :

- increasing/decreasing levels of agricultural productivity and the income levels of the people;
- increased/decreased availability of employment opportunities for the rural people, especially the youth and women;
- availability of better living conditions in terms of housing structures, sanitation and health facilities, and reduction in drudgery of work;
- changes in the socio-cultural fabric of the rural people

3. The provision of an **institutional support system** and its strengthening during the Ist phase has been assessed basically to find out how far the dimension of interactive planning had been taken care of and has been successful in ensuring sustained management of Common Property Resources. This has been done by:

- identifying the actual or potential response of the community towards watershed treatment;

- studying the working of the participatory planning processes at the village level, and the amount of success they have achieved in the cultivation of local community commitment to present and future operation and maintenance of community resources.

- assessing the extent to which motivators have been successful in consensus building among the beneficiaries.

- studying the extent to which capacity building has been achieved through identification, prioritisation and cultivation of human resources among the beneficiaries

4. assessing the extent to which the different line departments and institutions co-operate and facilitate the strengthening of the institutional support system developed at the village level.

5. **The methodology** used in arriving at this assessment is largely based on:

- field visits with the other mission and interviews with the beneficiaries and government staff;

- study of ICR/SAR and other reports provided by the state governments;

- study of impact studies conducted by the state and private organizations or individuals based in the different universities of the concerned states.

2. Findings - Overall Assessment of Project Implementation in the States of Punjab, Haryana, Himachal Pradesh and Jammu and Kashmir

(a) Socio-economic Situation

6. By and large the project has had a positive social impact in many ways. There is greater accessibility and provision of water resources for domestic as well as irrigation purposes. This has changed the life patterns of the people. Time spent in fetching water by women from long distances has been reduced by three to four hours and the number of days of employment of men and women in agricultural and related activities have increased considerably. Growth of quality fodder has led to stall feeding practices and the increased availability of fodder. "Babbar" and other grasses nearer home has on the one hand reduced the time spent in procuring fodder and fuelwood and on the other in increasing income generation through "ban" or rope making, basket making and in dairy farming. In a nutshell, increased productivity and availability of raw materials has led to the overall growth of labour opportunities and income generation activities. The dependency ratio has decreased considerably.

7. As a result of all these socio-economic transformations, **improvements in the lifestyles** of the beneficiaries are reflected through the quality of their housing structures, ownership of tangible and intangible assets and household conveniences, and the increased land values. The overall improvement in the social situation of the beneficiaries has checked the process of out-migration of whole families to a large extent. Now only seasonal migration of able bodied males takes place. Improvements in the socio-economic status of the beneficiaries is also reflected in the enhancement of the marriage prospects of the village youth especially the boys. Beneficiaries on the whole have become highly conscious of educating their children especially daughters and increasing their employment related skills. In fact, in every village that the mission visited there were demands for creating income generation activities particulary for women and youth. Improvements in sanitation and health facilities were also visible in some villages.

8. Although some benefits such as availability of water for domestic and irrigational purposes, cutting of fodder, gathering fuelwood from the forest lands, making "ban" and ropes were available even to the poorest households, size of landholding, non-ownership of land and gender were found to be important discriminatory factors.

(b) Institutional Set up

9. In general, the beneficiaries were highly appreciative of the activities undertaken by the project staff. Their aspirations from the project had risen manifold. In every village that was visited by the mission, demand for more water availability for domestic as well as irrigation purposes was made. There were also demands for expansion of project activities in areas which did not fall within the purview of the project. For example, the demand for starting income generation activities and imparting the relevant skills particularly to the village youth and women. There were also demands for better health, sanitation and educational facilities in the villages.

10. The project design laid considerable emphasis on interactive planning with the beneficiaries to ensure sustained management of common property resources. To give a practical shape to this objective formation of Village Development Committees (VDCs) were promoted by the project. Notable progress has been made in this direction in all the states. Care was taken to ensure that there was at least one woman and a member of reserved categories in each VDC. A few VDCs and FPS's (Forest Protection Societies) exhibited exemplary interactive processes because of the innovative methodologies used by the project staff. Consequently, these VDCs had become self reliant and showed signs of sustainability even after the withdrawal of the project staff. However, their replication as role models had not occurred on a larger scale. The establishment of village level institutions has inculcated a sense of empowerment among the beneficiaries. However, the mobilisation of the community differs from state to state. People's initiative, motivation and willingness to manage the VDCs by themselves has not been forthcoming because of a long formed habit of expecting aid from the government and other donor agencies. As a result their own capacities had remained dormant. Only a few motivators have been highly successful in consensus building among the beneficiaries. By and large the majority or the dominant caste or classes have a major say in VDCs or FPS's. Adequate

representation of women and weaker sections of the society and also the different user groups was considerably lacking at the micro-level.

Box - 1

Barriers in Women's Involvement

Most development agencies tend to address themselves to men because of the prevalence of patriarchy. Women's role as a change agent thus stands neglected. It is often ignored that women play an important role in organizing the community by performing the most vital functions of socialising the young and maintaining the family and kinship linkages intact. Their role as householders becomes extremely difficult if the natural environment does not support them. They are the custodians of keeping the kitchen fires ablaze and the managers of the water requirements of the village and the Gujjar and lower caste women are a substantial source of farm labour and cattle care. They are also responsible for the health and hygiene of the household and the neighbourhood. In spite of all these activities they are largely confined to the private or domestic realm and they are regarded as unproductive members of society. Moreover, social customs encourage male dominance and rigid segregation between the sexes. Women are perceived as izzat (honour) of the household that must be confined to the four walls of the household. Above all, development planners fail to recognize the vital role women play in ushering social change. If the interactive process has to be made a reality , women's voice have to find a place within the public decision making bodies, especially in the states of Punjab and Haryana.

11. The objective of **capacity building** for the protection of land from further degradation has been partially achieved. A visible change in people's consciousness has occurred. They do not regard the project as part of other developmental programmes run by the government. People's resistance to adopt development programmes initiated by the project has been broken down. Instead there is a greater willingness and demand for more such watershed projects. People's participation and enthusiasm varies according to the long- term, short-term or immediate benefits available to the beneficiaries. Wherever the benefits perceived are immediate the enthusiasm is overwhelming, but in activities where the perceived or actual benefits accruing to the beneficiaries are long range or collectivity oriented their interaction and mobilisation is very limited. For example, wherever tree plantations have been executed on individual lands they stand greater chances of sustainability as

compared to projects initiated and executed on common property resources such as the Panchayat lands, Village Common Lands or the "Mushtarka Malkan" Lands. Wherever assets such as Makkowal type tanks and village ponds have been created, they show greater chances of sustainability. The central government's objective of recruiting consultants to train staff in participatory planning and capacity building of the stakeholders has not been implemented. Project staff experienced difficulties in developing successful and sustainable strategies for cost and benefit sharing arrangements.

12. Assets created on CPR's have not sufficiently evinced the underlying spirit of social forestry and waste land development because of the breakdown of indigenous systems of management and because the forestry rights are not well defined GOI needs to take adequate measures in reframing forest laws in such a way as to instill confidence among the villagers and enthuse them to indulge in social forestry.

13. Inter-institutional co-operation and interaction has been a relatively weak link of the project. Although the WPIO as an umbrella organisation consisting of multi-disciplinary specialists functions very effectively, the co-operation and co-ordination of the activities of the different line departments is often lacking. In certain areas, it was observed that there was compartmentalisation of functions between the different institutions of the village society such as the VDCs and the Village Panchayats, or again the activities undertaken by the Block Development Officer and the Project Staff, or even between the NGOs and VDCs and the project staff. Such compartmentalisation hampers sustainability of the project and also its implementation and intensification of project activities and slows the growth in solidarity, trusts and self-organisation of the group members.

(c) Future suggestions

14. **Capacity building** of beneficiaries and the project staff through the appointment of consultants/co-ordinators needs to be undertaken immediately for a truly interactive planning process. For capacity building, NGO support could also be utilised. However, care must be taken to avoid conflicts between the NGOs/VDCs and the project staff. There exists an acute paucity of fully trained well equipped NGOs in the region. It would therefore be necessary to undertake training programmes for NGOs as well. **All future planning must include:**

- training programmes for rural women and youth in improved livestock management, other income generation activities such as mushroom cultivation, bee-keeping or tailoring according to the felt needs of the local populations.

- women's representation in VDCs should be at least 33% in accordance with the guidelines of the 73rd Amendment Act.

15. Forestry rights such as grazing rights, cutting of fodder and Bhabbar grass collection of fuelwood, demarcation of boundaries of individually owned lands and cutting and sale of forest produce need to be well defined particularly where the concept of social forestry is being introduced

and experimented with. Although each state government has formulated Joint Forest Management rules in actual practice the villagers sometimes perceive them as hindrances in their long term commitment protection and conservation of forests or plantations particularly on "Mushtarka Malkan" lands.

16. User financing, contributions by users in cash or in kind, individually or as a group to the capital and/or recurring cost in the provision of basic services must take into account efficiency, equity and sustainability.

17. Social considerations in the planning of IWDP (Hills) were not considered significant in the initial stages. The lessons learnt during implementation of the project have brought home the necessity to involve a social consultant.

3. State Specific Comments

(a) Punjab Situation

18. A rapid survey of the catchment areas of the IWDP revealed that the **socio-economic status** of the people had considerably improved in terms of higher incomes, greater availability of employment opportunities, and in the reduction of women's working hours by saving time spent on the collection fodder and fuelwood and also in fetching water from long distances. Increase in agricultural productivity, forest produce, and milk yield had facilitated all this because of the increasing availability of water, checking of soil erosion and fodder availability. Migration of people due to floods and famines had been checked. Only people from small and marginal households migrate to the adjoining towns and mandis to avail of labour opportunities there. Housing structures and consumption patterns of the people have also shown a remarkable improvement. The availability of fodder and Bhabbar grasses has not only introduced stall feeding of cattle, the scheduled caste households have specifically benefited from the easy availability of subsidised mechanical and electrical rope making appliances introduced in these areas. Breed improvement of cattle had encouraged dairying activities among the Gujjars and Jats of these areas. On the whole, people were highly appreciative of the project activities and in every village there was demand for greater availability of water resources. Augmentation and introduction of income generation activities and imparting of such skills was particularly stressed upon by the women. However, in some villages where there was a preponderance of the Jats, rise in family incomes had also increased the oppression of women because of the increased emphasis on liquor consumption.

19. **Institutional Set Up.** Self help users groups such as water users committees or joint forest management societies were found to hold regular meetings. However, the participation of members increased only when they realised the importance of these meetings. Membership of women in these committees was only nominal or passive. These self help groups contributed their labour for soil conservation activities such as plantations, constructing bunds and silt control structures, and growing soil binders along the ridges. The construction of Makkowal type tanks which took care of local considerations in watershed planning helped in facilitating the interactive

process. A few VDCs were also formed. Women generally were unaware of the presence of VDCs. However, the true spirit behind the interactive process was lacking and no VDC had become absolutely self reliant. Beneficiary reluctance was clearly visible as far as user financing both in cash as well as kind was concerned for the maintenance and construction of basic services in the village. Very little or no collective funding was available for the activities of the VDCs. Whatever income accrued from the sale of grass or other assets was appropriated by the individuals who owned the land or by the Panchayats. Moreover, inter-institutional rivalries between the Panchayats, VDCs and the different line departments hindered the interactive process. Non-existence of NGO had further hindered the interactive process.

Box - 2

In village Soonk of Jainti Devi Ki Rao the members of the Forest Management Committee had raised Khair (Acacia Catechu) Plantation on 1200 acres of forest land through the efforts of the project staff. The Khair trees are now mature and ripe for cutting. According to the agreement between the stakeholders and the project staff, the beneficiaries claim that they had sold the forest to a private contractor for Rs. 1 Crore 17 Lakhs but the state government did not give them the per mission to cut or sell the trees for the last four years according to the existing forest laws. Beneficiary response to the government attitude was highly critical as they believed that the land belonged to them, that is, it was Mushtarka Malkan land and the trees they wanted to cut were of harvestable size and not small saplings. As a sequel to this conflict the villagers showed stiff resistance in facilitating the participatory process or in considering the project work as their own programme. They were even thinking of going to the court of law.

20. Although the training centre at Ballowal Saunkhri had provided good service in training staff in different subspecialties, the social dimension was treated as a tertiary element in its training programme. As a result, the capacity building of project staff and the stakeholders has taken a back seat. Forest Management Committees had been successful in keeping a check on the grazing rights of the community and in the collection of fodder and other grasses and fuelwood wherever the concept of social forestry was introduced. However, as far as the sale and cutting of plantations raised on Mushtarka Malkan land was concerned the forest laws need to be made more explicit. Lack of well defined forest rights of the different user groups such as the villagers, the panchayats, and the state had generated conflicts between the different user groups especially the state and the beneficiaries. (See Box 2).

21. **Suggestions** are as follows:

(i) Strengthening of VDCs, capacity building of staff and participating communities and the removal of other institutional bottlenecks is very necessary to make the project a people's programme. Capacity building through project and NGO interventions is the immediate requirement to infuse the spirit of direct democracy and self reliance among the beneficiaries.

(ii) More income generation activities need to be introduced with a specific focus on women.

(iii) Clear-cut demarcation of forestry rights needs to be looked into by the GOI and the State Government.

(b) Haryana

22. A rapid survey of the project areas in Haryana revealed that the **socio-economic status** of the people has considerably improved in terms of higher family incomes, higher levels of literacy especially for women, and increased labour and employment opportunities. Improvements in the standard of living could also be observed by looking at the overall assets of the villagers such as housing structures, consumer durables and their consumption patterns. Expenses on socio-cultural activities have increased. Increased prosperity of the villagers has also enhanced the marriage prospects of the youth in the village particularly the boys. Drudgery of women's work has been considerably reduced because of the availability of drinking water, fodder and fuelwood. Socio-cultural characteristics of the villagers in Haryana and Punjab are almost the same throughout the Kandi tract. People are generally very enthusiastic about the project activities. They want more such projects to be undertaken in the adjoining areas. Gain from the project activities had accrued to all sections of the society but the gains of the landowning classes were much higher than other sections.

23. The **institutional set up** in terms of user groups such as Hill Resource Management Societies or water users societies was quite satisfactory but the VDCs require greater representation of women and capacity building of the beneficiaries. In some user groups the foundation for a healthy interactive process was laid by taking people's needs into consideration, while framing programmes for watershed development. (See Box No. 3).

24. In some projects the user groups had created their own financial resources through the lease of water, Bhabbar and other resources. In such user groups sustainability of the project on a long term basis has been ensured. People's participation in the project activities has been evinced wherever the benefits are immediate. Haryana has an earlier experience of Hill Resource Management Societies. Lessons learnt from these societies have allowed greater flexibility in drafting the agenda for the different user groups and in taking care of local needs. Moreover, the success stories of the HRMS, and other user groups have not been replicated on a large scale. Controversies over cost-sharing mechanisms and lack of flexibility between the beneficiaries and the project staff have also slowed the pace of development. There is much scope for the effective

functioning of the VDCs. Fear was expressed about the reversal of project gains through indiscriminate boring of tubewells in or near plantations, and the emergence of land related disputes in the future because of non-demarcation of individual holdings on "Bhai Chara' lands (See Box No. 4). Women's needs have not been sufficiently focused and women's representation in the VDCs was much below the desired level.

Box – 3

In village Pargian near Pinjore the project staff has tapped a perennial source of water from the mountain top. It has benefited three villages. The Hill Resource Management Society which has members from each village takes decisions about the distribution, usage, maintenance and financing of the water resource. Availability of water for domestic as well as agricultural purposes has brought considerable prosperity in these villages. Land values have gone up. Women's burden of work in fetching water from the hill top has been considerably reduced. Better living conditions had increased the marriage prospects of boys of these villages. Girls were being educated now. Women in this village were not only aware of HRMS but the society had a woman "Pradhan" along with two other women as members. There was also a separate Mahila Mandal in the village but it was not really functional as it was being dominated by women of 5-6 influential families of Rajputs. However, small and marginal farmers living downstream near the foot of the hill complained that they were not getting enough water for domestic or irrigational purposes because of the closure of the downstream pipeline during the major portion of the day by the villagers situated upstream. Resultantly they had to climb up 2-3 kms everyday to fetch water.

Box - 4

In village Tagra near Pinjore a large Khair and Amla Plantation has been raised on "Bhaichara Mukammil" lands by making use of rainfed technology. A few villagers whose land formed part of this plantation expressed the fear that the actual tenurial boundaries of their land had been done away with during the plantation and a few years later when the plants mature boundary disputes are likely to arise. Moreover, they informed that the adjoining owner of land was thinking of boring a tubewell just next to this plantation which will in due course of time reduce the level of subsoil water. All these factors need to be considered in the VDC's to avoid future conflicts and factionalism. Moreover, when plantations are raised on "Bhaichara Mukammil" lands the individual tenurial boundaries should not be completely dispensed with even though

partition was based on "hasab rasad raqba khewat"or according to the proportion of the land revenue paid by the owner of the khewat.

25. **Suggestions** are as follows:

(i) VDCs need to be made proactive. Capacity building of beneficiaries and staff needs to be given serious consideration. Training programmes for women in paramedical veterinary and health services need to be introduced. Other income generation activities for women as well as men need to be introduced;

(ii) intervillage and intra-village rivalries for the usage of facilities created by the project need to be minimised;

(iii) successful village institutions need further strengthening and replication on a larger scale.

(iv) NGO support needs to be initiated for capacity building and facilitating the interactive process.

(v) training programmes for staff and stakeholder would help to increase social capital.

(c) Himachal Pradesh

26. A rapid survey of IWDP in the state revealed that the **socio-economic profile** of the people had considerably improved as a result of project interventions. The income graph of the people had shown an uptrend because of the various farm and non-farm activities introduced by the project implementing staff. The total number of mandays of employment in forestry, farming and animal husbandry had recorded an overall increase. Wherever project interventions have taken place the village economy had moved over from subsistence level to a commercial economy. Better standards of living were visible in all the project areas. These could also be observed from the nature of "pucca"(concrete) housing structures built in the project villages and the acquisition of other household assets such as consumer durables or other tangible acquisitions.

27. **The socio-cultural profile** of villages in Solan district of Himachal Pradesh shows that the state's performance in terms of sex ratios, literacy rates, particularly female literacy, and female work participation rates is much above the states of Punjab and Haryana. The state also has a much better profile of health statistics in terms of immunisation records and the provision of basic health services. (Census of India 1981 and 1991). The state (especially the Solan district) also has a good record of NGO activities and the successful functioning of various Mahila Mandals which has

positively contributed to an increased awareness and interest in village development activities. Consequently, people in these areas are highly conscious of the project interventions. They are also highly appreciative of these activities and communities lying outside the project purview often expressed a desire to be included in it. Another social benefit of the project has been that the higher living standards have increased the marriage prospects of the youth in these areas.

28. **The institutional set up** of villages where project interventions have been made was also quite commendable. In the initial stages the VDCs faced stiff resistance from different sections of the community but after 1993-94 when local needs of the people and other services were taken into consideration while in making project plans, the interactive process started and the communal forestry activities became more popular. People also came forward with their voluntary labour for protecting drainage lines.

Box-5

In village Gol-Jamala and Amli-dol of Nalagarh project a water harvesting structure has been constructed on a perennial water source which has helped in irrigating around 200 bighas of land. The construction of this structure was undertaken with the help of beneficiary participation to the extent of Rs42,000 worth of voluntary labour. The villagers of Amlidol not only shared the cost of construction of the dam but have shown an exemplary form of proactive approach in managing the VDC. In fact, it was the first VDC this consultant visited which had collected a substantial amount of money (several thousands) for the management of existing structures and undertaking new activities for village development. The VDC was also maintaining proper accounts of its income and expenditures. Women's representation in this VDC was also substantial and their voices found a place in the decision making about the several activities undertaken by the VDC.

The immediate benefits that helped in facilitating the interactive process were checking of soil erosion , better irrigation facilities, availability of subsidized chaff cutting machines and stall feeding; and over all increase of one and a half times in crop production and crop demonstrations. Women's working hours spent in fetching fodder and water were considerably reduced. Since all these vital needs of the people were fulfilled they felt involved in all the project activities.

29. Community participation was much higher in check-dam areas because of the availability of life saving water and irrigation facilities and because the benefits drawn were immediate. Project

staff took care to explain the benefits that the people could draw from their participation in the VDCs. Moreover, the project staff felt the need to involve women in the decision making process by training them through the organisation of Farmer's Training Camps. Though the aspect of capacity building has been looked into, VDCs require constant nurturing, monitoring and maintenance. For adequate capacity building it is necessary that VDCs function around a particular activity and generate their own income. This helps the VDCs to become self-reliant and participate actively in the cost-benefit sharing arrangements. (See Box 5). Cost sharing by beneficiaries was much higher in horticultural activities. Wherever the VDC and the Participatory Rural Appraisal (PRA) were strongly integrated with one another, the project results were excellent. It also laid a strong foundation for the takeover of developmental activities by the VDCs after the withdrawal of the project. However, it was found that withdrawal of the project often slackened the pace of development.(See Box 6). Sometimes, NGOs obstructed rather than facilitating the project activities. In some project areas, intravillage caste/class dissensions had appeared over sharing of developmental gains.

Box - 6

In village Tujhar of the Sirsa Catchment under the Nalagarh unit, a hundred year old water tank was renovated in 1993-94. The tank water is the only source of drinking water for the residents, their cattle and also for irrigation of vegetable crops. The construction of this tank came as a sequel to the lessons learnt that if people's participation has to be sought then the need for water, which is vital a need of the residents, has to be met. Once this flexibility was introduced in the project plan people contributed not only towards the cost of renovation of the tank but also developed an effective HRMS for the management of the assets created. They propose to construct a Mahila Bhawan, a road and lay a pipeline for lift irrigation system. However, after the withdrawal of the project from this area the pace of development and maintenance of the village activities has slowed down. People expressed a great desire for the continuation of project services because their interactions with other governmental institutions such as the banks and other line departments, at the block level were not very satisfactory.

30. **Suggestions** are as follows:

(i) Constant nurturing and monitoring of VDCs, even when the project is withdrawn, is a must for the sustained development of the region. NGOs that act as facilitators

rather than obstructors in the development process need to be encouraged both for the sustenance of the VDCs and the capacity building of the stakeholders;

(ii) Allied social issues such as health and income generation activities also need to be monitored as part of the project to bring about a truly interactive process.

(iii) Although women's participation in VDCs is there, it needs far greater emphasis to usher in an era of true social transformation.

(d) Jammu & Kashmir State (which was not visited by the Mission)

31. The **socio-economic profile** according to the State Government's ICR shows an increase in production and income from crops, horticulture, fodder, fibre fuelwood and livestock management. Total number of mandays of employment in the forestry sector had increased and every household was getting an additional income of almost Rs14,300 from farming activities.

32. **Institutional set up** of the state showed that only a few functional VDCs had been formed but where they were functioning they were eliciting a lot of beneficiary satisfaction. In the initial stages beneficiary response was rather lukewarm. Later, when people started receiving benefits from the project interventions, their response was appreciable. However, while liasing with the government departments where much time was wasted in bureaucratic delays the beneficiaries exhibited substantial resistance. Non-functioning of the VDCs can to some extent also be attributed to the law and order situation in the state.

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR. 2100-IN/LN. 3175-IN)

APPENDIX F

FINANCIAL AND ECONOMIC ANALYSIS

TABLE OF CONTENTS

TABLES:

INDIA

INTEGRATED WATERSHED DEVELOPMENT (HILLS) PROJECT

(CR.2100-IN/LN.3175-IN)

APPENDIX F

FINANCIAL AND ECONOMIC ANALYSIS

1. Introduction

1. The analyses have been made in a way similar to that used in the SAR, that is to say by quantifying only those benefits from farmland, particularly wheat and maize (and horticulture) and from non-arable areas where treatments involve increased production of grasses and other non-wood forest products and timber.

2. A major difficulty in the analyses is in making realistic assumptions or estimates regarding the without project situation. At appraisal the area was notably remote and backward and this is reflected in the low pre-project yields recorded in the SAR. It could be argued that without the project steadily increasing erosion would have led to further yield decline. However, for the analyses a more conservative assumption has been made that in the without project situation some increase in yields would have occurred as a result of all the other Government programmes as well as private sector initiatives.

2. Financial Analysis

3. The basis for the financial analysis is as set out in Appendix C, Crop Models. For the analysis it is conservatively assumed that even without the project there would be some increase in yields over the pre-appraisal situation. It has therefore been assumed that without the project yield of wheat would be 1.2 tons per ha and yield of maize would be 1.0 tons per ha. This compares with pre-project and with-project yield of wheat estimated at 0.9 tons per ha and 1.83 tons per ha respectively. For maize pre-project yield was 0.8 tons per ha and with-project is estimated at 1.385 tons per ha. Cropping intensity is assumed at 100%, of which 55% wheat and 45% maize. Prices used for valuing output and input items are farmgate prices in May 1999 (Table 3). Full use has been made of the Impact Evaluation Reports commissioned by the project, but in general the estimates of with-project yields adopted for the analysis as representing average yields are less than those reported in the Impact Evaluations.

4. On the basis of these assumptions and estimates the net return per ha after charging all labour would increase from Rs3,880 without the project to around Rs5,000 with the project, an

increase of almost 30%. Assuming all labour used is provided by the family, the return per family labour day would increase by almost 40% from Rs246 without the project to Rs342 with the project – both figures well above the current average labour rate of Rs60 per day.

5. In line with the SAR, no analysis has been made of the effect of increased livestock output, particularly milk, on farm family incomes, nor is data readily available to make such an analysis. Estimation of the without project situation is again problematic. Undoubtedly there has been a major increase in milk production – reported in some areas as "twice as much"or "50% increase". Much of this increase has been due to the project and in areas relatively close to centres of population is quite dramatic, although estimating benefit for the whole project area would be problematic. Although the effect of increased livestock production, particularly milk, on farm-family income cannot be calculated, it is quite clear that it is significant, particularly as cash income for the family

6. As presented in Appendix C, the financial result for horticulture is predictably attractive with a financial rate of return of 48% and high returns per family labour day at full development.

7. Financial analysis of the three main types of non-arable land treatment are presented in Appendix C, and show financial rates of return from 27% to 22%

3. Economic Analysis

8. As in the SAR, the economic analysis takes incremental net benefits from arable (wheat and maize) and non-arable areas (afforestation, silvipasture and vegetative barriers). In addition it includes horticulture development (as represented by the mango model) which was not included in the SAR analysis. Tradable outputs and inputs have been valued at border parity prices as calculated in Table 2. India being generally close to self-sufficiency in foodgrains, wheat and maize have been valued at the average of import and export parity prices. Crop chemicals, cost of land preparation, and labour have been valued at their financial market rates. Much of the project area is still subject to outmigration, particularly of young people and labour is sometimes scarce. Other non-tradable items have been adjusted by the Standard Conversion Factor (SCF) of 0.9. Prices used for the financial and economic analysis are presented in Table 3.

9. Project costs for the analysis are as presented in Table 11 and include all costs such as training and research, which have additional benefit streams. Project costs have been brought to 1998/99 constant terms by applying a local currency inflator derived from the domestic wholesale price index as reported in International Financial Statistics. One difficulty in the analysis is that the non-arable treatment and horticulture models, include items of capital expenditure which also appear in project costs. Accordingly, a part of the capital expenditure in these two types of models has been added back to the net benefit streams. The method used for doing this is the same for both model types. Aggregated input costs for the first three years of each model, compared with project expenditure in each case increase from representing about 40% in the first year to around 70% of project cost for that item by 1992/93. These aggregated estimates of capital costs have been added back to the net benefit streams for non-arable treatments and horticulture. For the period 1993/94 to 1998/99 when the aggregate estimates increase progressively to more than project expenditure, the amount of capital costs added back to the net benefit streams has been limited to 75% of project costs for that item. This adjustment is intended to reduce the

double counting of costs between project costs and capital cost for establishment of fruit orchards or treatments to non-arable areas included in the models. Since the adjustment assumes that between 30% and 60% of project expenditure over the period up to 1992/93 and 25% thereafter is spent in ways not related to the areas developed, there remains the possibility of double counting costs both in horticulture and for non-arable treatments, despite these adjustments, as well as in arable areas where it is assumed that all project costs are for items not charged in the crop models.

10. Area benefited is taken to be 142,145 ha of arable, 7,484 ha of orchards and 109,330 ha of forest land. The latter is mainly accounted by 50,775 ha of afforestation, 20,317 ha of silvipasture and 20,339 ha of vegetative shrub barrier treatment.

4. Result

11. Based on the above assumptions and estimations, the economic rate of return of the project is calculated at 17%, the same as the figure calculated at appraisal. As in the SAR, benefits from increase in livestock production, development of an estimated 2,000 ha of perennially irrigated land, decrease in flooding, reclamation of the edges of stream beds for agriculture use, and improvements in groundwater regime and other environmental benefits, have not been quantified.

INDIA: Integrated Watershed Development (Hills) Project
(Cr. 2100/Ln. 3175-IN)
Implementation Completion Report
Appendix F: Financial and Economic Analysis

Table 1. Project Costs, Exchange Rates and Domestic Currency Inflator

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	Total
Project Costs by Component	.....				Rs.Current Million						
Watersheds	11.19	75.58	136.33	167.06	211.67	260.23	401.47	348.24	410.15	434.73	2456.65
Technology improvement	0.00	1.29	4.86	4.62	5.66	5.35	5.32	5.16	5.58	2.91	40.74
Project implementation	1.49	14.42	29.74	38.48	49.97	61.38	75.14	73.19	87.28	106.21	537.31
Central Support	0.00	0.00	0.00	2.93	0.16	0.57	1.26	0.76	1.26	3.65	10.58
Total Project Costs	12.68	91.29	170.93	213.09	267.47	327.52	483.18	427.35	504.27	547.50	3045.28
Project Costs by Activity											
Non-arable areas (forestry etc.)	4.26	53.30	85.12	96.04	115.00	117.82	191.96	181.20	207.44	211.04	1263.19
Arable areas (field crops)	0.00	2.72	12.31	11.77	15.44	27.92	46.86	45.70	46.23	37.18	246.12
Horticulture (fruit trees)	0.00	1.37	6.00	8.01	8.52	15.41	16.89	12.26	17.30	30.04	115.79
Contribution by beneficiaries	0.00	0.41	1.34	7.94	11.17	23.99	29.03	25.96	32.58	45.47	177.90
Sub-total	4.26	57.79	104.77	123.77	150.13	185.14	284.74	265.12	303.56	323.73	1803.00
Livestock development	3.04	2.11	2.73	3.04	6.58	8.37	12.95	10.72	11.83	15.96	77.33
Soil cons./drainage lines etc.	3.89	15.68	28.84	40.25	54.96	66.72	103.78	72.4	94.76	95.04	576.32
Research	0.00	1.29	4.86	4.62	5.66	5.35	5.32	5.16	5.58	2.91	40.74
Training	0.00	0.00	0.00	2.93	0.16	0.57	1.26	0.76	1.26	3.65	10.58
Project Implementation	1.49	14.42	29.74	38.48	49.97	61.38	75.14	73.19	87.28	106.21	537.31
Total Project Costs (Rs mill)	12.68	91.29	170.93	213.09	267.47	327.52	483.18	427.35	504.27	547.50	3045.28
	.....				Rs per US$ (average in each year)						
Exchange Rate	16.546	18.814	23.536	27.062	30.713	31.637	33.179	35.653	37.550	42.093	
Total Project Costs (US$ mill)	0.77	4.85	7.26	7.87	8.71	10.35	14.56	11.99	13.43	13.01	92.80
	.....				Inflator						
Domestic Inflator	2.083	1.889	1.677	1.531	1.404	1.277	1.188	1.125	1.065	1	
	.....				Constant 1998/1999 Rs million						
Total Project Costs (in Constant 1998/99 Rs. mill)	26.41	172.45	286.65	326.24	375.52	418.24	574.02	480.76	537.05	547.50	3744.86

Table 2 : Derivation of Parity Prices of Outputs and Inputs

	Unit	Import Parity					Export Parity	
		Wheat	Maize	Urea	TSP	DAP	Wheat	Maize
Projected World Price								
In 1990 constant dollars, ave. 1999-2010 1/	US$/t	127.5	103.3	104.6	132.0	174.4	127.5	103.3
Adj. factor to 1998 dollars	%	104.00	104.00	104.00	104.00	104.00	104.00	104.00
In constant 1998 dollars	US$/t	132.6	107.4	108.8	137.3	181.4	132.6	107.4
Quality Adjustment	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World Market Equivalent	US$/t	132.6	107.4	108.8	137.3	181.4	132.6	107.4
Intnl Transport	US$/t	100.0	50.0	50.0	50.0	50.0	(50.0)	(50.0)
Border Price Indian Port	US$/t	232.6	157.4	158.8	187.3	231.4	82.6	57.4
Exchange rate 2/	US$/Rs	41.5	41.5	41.5	41.5	41.5	41.5	41.5
		..... Rs						
Border Price Indian Port	Rs/t	9,653	6,533	6,590	7,772	9,602	3,428	2,383
Port charges	Rs/t	330	330	330	330	330	(300)	(300)
Internal transport	Rs/t	300	300	300	300	300	(300)	(300)
Internal handling/marketing	Rs/t	150	150	150	150	150	(150)	(150)
Wholesale Price	Rs/t	10,433	7,313	7,370	8,552	10,382	2,678	1,633
Conversion Ratio	%	100	100	100	100	100	100	100
Processing cost	Rs/t		-	-	-	-		
Raw Materials Value	Rs/t	10,433	7,313	7,370	8,552	10,382	2,678	1,633
Local marketing/transport	Rs/t	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Farmgate price	Rs/t	10,333	7,213	7,270	8,452	10,282	2,578	1,533
Farmgate price	Rs/kg	10.33	7.21	7.27	8.45	10.28	2.58	1.53

Sources: Mission estimate.

1/ Global Commodity Markets, January 1999; in constant 1990 price.

2/ Office Memorandum, December 2, 1998, the World Bank.

Table 3 Financial and Economic Prices Used in the Analyses

	Unit	Financial	Economic
		.....Rs.....	
A. OUTPUTS			
Wheat	kg	5.5	6.4
Maize	kg	3.5	4.4
Wheat straw	kg	1.5	1.35
Maize stover	kg	0.85	0.76
Mango	kg	10	9
Timber	m3	4000	4000
Fuelwood	m3	600	540
Bhabbar grass	ton	1750	1575
Fodder grass	ton	300	270
B. INPUTS			
Wheat seed	kg	11	12.8
Maize seed	kg	10	12.6
Mango plant	per plant	15	13.5
Tree seedling	per seedling	2	1.8
Bhabbar tufts	per tuft	0.15	0.14
Grass seed	kg	75	68
Urea	kg	4	7.3
Calcium ammonium nitrate	kg	4.8	6.2
Single super phosphate	kg	2.78	3.6
NPK Compound	kg	8	10.2
Di-ammonium phosphate	kg	9	10.3
Farmyard manure	ton	100	90
Termite control	ml	0.32	0.32
Fungicide	gm	0.59	0.59
Pesticide	l	100	100
Thimate - 10G	kg	52	52
Phaspomidone	l	355	355
Plantozine	l	150	150
Topsine	kg	870	870
Chlorpiriphos	l	200	200
Land preparation	per ha	700	700
Labour	per day	60	60

Table 4 Economic Rate of Return Calculation

	Project Costs	Recurrent Costs	Net Incremental Benefits				Balance
			Arable	Horticulture	Non-Arable	Total	
Year							
1989/90	26.41		0.00	0.00	0.00	0.00	-26.41
1990/91	172.45		0.37	-0.03	0.22	0.56	-171.89
1991/92	286.65		2.44	-0.18	3.76	6.02	-280.63
1992/93	326.24		6.13	-0.41	18.31	24.02	-302.22
1993/94	375.52		11.94	-2.19	29.24	39.00	-336.53
1994/95	418.24		21.60	-3.91	42.68	60.38	-357.86
1995/96	574.02		37.34	-7.15	-4.80	25.38	-548.65
1996/97	480.76		57.67	-7.21	67.52	117.97	-362.79
1997/98	537.05		82.74	1.46	53.90	138.09	-398.96
1998/99	547.50		110.81	19.79	86.55	217.15	-330.35
1999/00		10.62	135.03	51.94	276.65	463.62	453.00
2000/01		10.62	152.81	102.94	183.61	439.36	428.74
2001/02		10.62	164.29	170.26	186.53	521.08	510.46
2002/03		10.62	169.41	246.78	156.73	572.92	562.30
2003/04		10.62	169.41	335.17	145.52	650.10	639.48
2004/05		10.62	169.41	412.76	451.41	1033.58	1022.96
2005/06		10.62	169.41	497.08	635.59	1302.08	1291.46
2006/07		10.62	169.41	549.99	687.56	1406.96	1396.34
2007/08		10.62	169.41	583.78	792.91	1546.11	1535.49
2008/09		10.62	169.41	583.78	813.52	1566.71	1556.09
2009/10		10.62	169.41	583.78	1651.39	2404.58	2393.96
2010/11		10.62	169.41	583.78	1800.83	2554.02	2543.40
2011/12		10.62	169.41	583.78	2057.41	2810.60	2799.98
2012/13		10.62	169.41	583.78	2218.36	2971.55	2960.93
2013/14		10.62	169.41	583.78	801.90	1555.10	1544.48
2014/15		10.62	169.41	583.78	1322.45	2075.64	2065.02
2015/16		10.62	169.41	583.78	1251.73	2004.92	1994.30
2016/17		10.62	169.41	583.78	1439.22	2192.41	2181.79
2017/18		10.62	169.41	583.78	1469.15	2222.34	2211.72
2018/19		10.62	169.41	583.78		753.19	742.57
2019/20		10.62	169.41	576.88		746.29	735.67
2020/21		10.62	169.41	546.65		716.06	705.44
2021/22		10.62		506.25		506.25	495.63
2022/23		10.62		463.32		463.32	452.70
2023/24		10.62		385.61		385.61	374.99
2024/25		10.62		300.46		300.46	289.84
2025/26		10.62		238.66		238.66	228.04
2026/27		10.62		151.44		151.44	140.82

Economic Rate of Return = 17%