“Study on Workings of Check Dams in M.P.”

Stop Dam: A Small Wonder

(Status and Impact)

Study Commissioned by:
State Planning Commission, Madhya Pradesh
Poverty Monitoring and Policy Support Unit
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We are glad to bring forward the final report of "Study on Workings of Check Dams in Madhya Pradesh", a study aimed to find the technical and social feasibility of the check dams in the state of Madhya Pradesh. First of all we would like to thank the State Planning Commission, Madhya Pradesh, Poverty Monitoring and Policy Support Unit for providing an opportunity of undertaking this study. Their continuous guidance and support helped us immensely in this study.

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Abbreviations

ASA	Action for Social Advancement
DPAP	Drought Prone Areas Programme
DWDU	District Watershed Development Unit
EE	Executive Engineer
FD	Forest Department
FGD	Focus Group Discussions
GIA	Gross Irrigated Area
GCA	Gross Cropped Area
GoMP	Government of Madhya Pradesh
GP	Gram Panchayat
Ha	Hectare
HH	Households
LICs	Lift Irrigation Cooperatives
MAPCOST	Madhya Pradesh Council of Science & Technology
MP PMPSUS	Madhya Pradesh Poverty Monitoring and Policy Support Unit Society
MP	Madhya Pradesh
MPSPC	Madhya Pradesh State Planning Commission
IWDP	Integrated Wasteland Development Programme
MPDPIP	Madhya Pradesh District Poverty Initiative Project
MPRLP	Madhya Pradesh Rural Livelihoods Programme
NABARD	National Bank for Agriculture and Rural Development
NGO	Non-governmental Organization
NREGS	National Rural Employment Guarantee Scheme
NRM	Natural Resource Management
NVDA	Narmada Valley Development Authority
O&M	Operation & Maintenance
PIA	Project Implementing Agency
P&RD	Department of Panchayats & Rural Development
PHED	Public Health Engineering Department
PVSP	Participatory Varietal Selection Promotion
RES	Rural Engineering Services
RGMWM	Rajiv Gandhi Mission for Watershed Management
SC	Schedule Caste

SHGs	Self Help Groups
SLNA	State Level Nodal Agency
SRTT	Sir Ratan Tata Trust
ST	Schedule Tribe
UG	User Group
VDC	Village Development Committee
WDC	Watershed Development Committee
WRD	Water Resources Department
ZP	Zilla Panchayat

List of Content

Executive Summary

1. Action for Social Advancement (ASA) has been contracted to undertake the "Study on Workings of Stop dams in M.P. constructed during the 9th and 10th Five Year Plans", by the Poverty Monitoring and Policy Support Unit (PMPSUS), of the State Planning Commission, Madhya Pradesh in October, 2008. The objectives of the study were as following:

- to ascertain efficacy and sustainability of Stop dams both technical and institutional, constructed under various programme, across various parts of the State and by various departments and agencies.
- to understand the impact stop dams in poverty reduction;
- to investigate the factors influencing the working of Stop dams both technical and institutional aspects; and
- to draw lessons for the improvement in the efficacy of the stop dams.

2 A multi-tier sampling method was used to identify the study districts, stop dams and households representing the various regions of the state. A total of 36 Stop dams constructed during 9th & 10th Plans were surveyed in detail. The methods of study included technical assessment of the stop dam by the research team followed by focused group discussion with the beneficiary groups and household level questionnaire survey of the direct beneficiary of the stop dam. Besides, extensive consultation was done with the secondary and tertiary level stakeholders comprising mainly the officials of the executing agencies at the block, districts and state levels. The Civil Society Organizations engaged in water resources development were also consulted. The study has also drawn further inputs from the desk review of literatures mainly sourced from the internet.

3 *Findings*

Profile and status of the surveyed Stop dam

3.1 The average length of the surveyed stop dam was within the range of 15-20 meter and average height was within 1.2 to 1.5 meter, with average storage capacity 39551 cubic meters. These are the stop dams (masonry weir) built on the small rivulets to harness the post-monsoonal flow primarily for the irrigation during Rabi season. In none of the cases, lift irrigation systems were integrated with the stop dam by design which implies that stop dams were constructed with the assumption that farmers having agriculture land nearby shall make

their own arrangement for lifting water from the dam for irrigation. This assumption was found true.

3.2 Of the total 36 stop dams surveyed 18 of them were found to be fully functional, 13 were partially functional and five were non-functional mainly due to gross damage to the structures. The average command area under direct and non-direct irrigation from the stop dam was 18 Acre, received fully or partial irrigation, benefited by 179 farmers.

3.3 The average cost was rupees four lakhs per stop dam.

Impacts of Stop dams

3.4 Undoubtedly the stop dams have contributed to the family's total income by providing additional irrigation benefits fully or partially. Of the total irrigated area of 452 acre under 31 stop dam (5 dysfunctional hence not considered), 247.7 acre (54.80%) was already under irrigation before the construction of the stop dam as the farmers were drawing water from the flowing rivulets/nullahs. However, the availability was always scarce, resulting in poor crop productivity and failure of crop. The construction of stop dam has ensured supplementary irrigation during rabi. A totally new area of 204.3 acres of cultivable land has come under the direct irrigation because of the stop dams during rabi season. Almost in all cases there were two additional watering accrued to the farmers, normally for the first two irrigation in the beginning (November – December) of the Rabi season.

3.5 There has been irrigation benefits accrued indirectly through the sub-surface and ground water recharge to the dug wells and bore wells in the downstream (within 500 meters) of the stop dam to 96.55 acres of land. As per farmers, the water level in the dug wells and bore wells has increased significantly in the post construction of the stop dam.

3.6 The net gain for an average stop dam came to Rs.91080/- (18 acre x Rs.5060/- net gain per acre). The average cost per stop dam is Rs.4 lakhs. This means that within a period of 4-5 years, it is possible to recover the cost of stop dam if we take only the crop related benefits. The other benefits like water for cattle drinking, domestic use and other environmental benefits of stop dam are not taken into consideration due to lack of data and appropriate methodology of calculating value of such benefits.

3.7 The benefit of stop dams is more or less equitably distributed within the cross section of

community. There are 179 benefiting households for 549 acres of land which came to about 3 acres or little over 1 ha. land per benefiting households.

3.8 Of the 190 surveyed households it was found that 166 were already food secured households even before the construction of the stop dam. 24 households have reported increase in food security for an average of 3 months in a year and have directly attributed this as the impact of stop dam on the food security

3.9 There has been reduction in migration as reported by 89 (57%) households (of the 157 total migrating households) in the post construction of stop dam and the reasons have been quoted as increased employment in the farm due to stop dam and easy availability of wage employment under NREGS. 68 households (43%) reported no change in the migration pattern as they found increased income through agriculture due to stop dam is not sufficient to affect migration significantly.

3.10 The least priority area during planning and execution of the stop dam was found to be lack of involvement of the beneficiary in the process. Out of 36 stop dams, only in six cases some efforts were made to collect people's contribution and mobilize community to form users' group to sustain the benefits of stop dam. The major problem appears to be lack of mandate and guidelines with the executing agencies and also the lack of required skill set with the staff. Places where UGs were mobilized, a certain degree of institutional mechanism existed for water sharing and minor repair and maintenance of the dam in comparison to other stop dams where no such effort has been made.

3.11 The formality of handing over of stop dam to the Gram Panchayat for Operation and Maintenance (O&M) has not helped in meeting objectives. They (Gram Panchayats) did not take any initiatives for the O&M of the stop dam. The possible reason is that GP is too busy with the implementation of the NREGA and other programmes.

3.12 The whole idea of PHED's construction of stop dam in the rural areas for the purpose of ground water recharge appears to be lacking rationale. All the seven stop dams constructed by PHED under this study are meant to be for ground water recharging, however apart from one which was defunct, were actually being used for irrigation through direct lifting from the dam. PHED has not made any effort for community consultation for restricting direct lifting of water from the dam for irrigation. So, a stop dam by PHED, which has a very special purpose of ground water recharge, does not look different to any other stop dam built by

other agency for irrigation purpose. Also, it is not clear that how PHED has determined the location of the stop dam which can ensure maximum recharge. There is no scientific method applied, viz. ground water mapping, which can ensure maximum ground water recharge. It is being done more of a hit and trial basis.

3.13 A few major problems observed on a close study of the five dysfunctional stop dams are as follows:

- The alignment of the gates and frame was not proper, therefore no water was being stored
- The places where site selection is faulty comprises of situations like construction of stop dam on the depression, thus severely impacting the water storage.
- Additionally, the quality of foundation was also a determining factor. In cases where the foundation was not rocky, the problem of leakage appeared.

4. Factors positively influencing the workings of the stop dam

4.1 It is observed that places where stop dams are built as follow-up activity of the soil and moisture conservation treatment (or watershed treatment) in the catchment area of the stop dam, the recharge in the stop dams in the post monsoon is higher and longer than the places where the stop dams are built as a stand alone activity. Even the silt load was observed less in cases where watershed treatment is done. The same result is found in case where the catchment area has a good forest cover.

4.2 The involvement of beneficiary in the planning and execution stage and building an institutional mechanism around the structure and proper training has significant positive implications on the workings of the stop dam in the post construction scenario.

4.3 The structures which are relatively larger in terms of water storage or where the stop dams have been constructed in a series of dams on the stream are cost effective and better in strategy. Such structures have ensured larger area for irrigation and also irrigation for a longer period of time, normally the entire rabi crop.

4.4 The orientation of the executing agency towards participatory approach has helped in better identification of the site and sustainability of the stop dams.

5. Bottleneck issues

5.1 There is a missing gap of perspective behind the whole efforts being made in the state for stop dam construction. At the executing agency level, everybody seems to have their own agenda of stop dam construction varying in objectives and approach with each other. Even at the district level such perspective and definite plan for holistic water resources development for the district is missing.

5.2 There is no standard technical guidelines and Schedule of Rates for construction of stop dams for the state resulting in varying cost norms and technical parameters being used by different departments in the same geographical area without any proper justifications for such variance.

5.3 Construction of stop is a socio-technical issue. But most of the executing agencies do not have any mandate and orientation for community mobilization. More so there is no budgetary provision for community mobilization during or after the construction of the stop dam.

5.4 There are technical problems related to the site selection, appropriateness of the design suitable to the site and construction quality. Lack of proper supervision mechanism and quality assessment through a third party leaves enormous scope for being ineffective and unaccountable.

6. Recommendations

6.1 The M.P. State Water Policy (2003) needs to specifically recognize the importance and relevance of stop dam and the measures that can be taken to harness this potential in solving the water related issues in the state for the minor irrigation, drinking water, etc. The state policy on water does not mention anything about the stop dam. About 80% of state's irrigation sources are in the private domain and it is quite likely that stop dam has a significant share in the state's overall irrigated area yet the policy has not considered this an important instrument to solve water problem. The lack of accurate data at any level is perhaps the reason for the stop dam to be kept in low profile for so long.

6.2 It is recommended to develop a district level Master Plan for small water harvesting structures like stop dam and earthen tank. The master plan will assess the water resources

potential of the district and identify the locations for minor irrigation projects including stop dams. All departments involved in the construction of stop dams shall follow the Master Plan while undertaking stop dap project. The department of Panchayat and Rural Development (P&RD) of M.P. has issued guidelines in this direction in 2007 & 2008 applicable for NREGS and general funding from the P&RD.

6.3 We further recommend that the district Master Plan should be based on the basins and sub-basins of rivers and upto the level of mili-watersheds. The milli watershed boundaries have already been delineated for the entire state by the Rajiv Gandhi watershed Mission and being religiously followed in watershed treatment. If this is done then one can correlate the stop dam construction in the context of watershed development as it is a known fact that stop dam fits well in terms of return if integrated with watershed development. Priority for stop dam construction should be given to those areas where watershed treatment is done or under progress. This reflects a much better planning scenario in comparison to the present practice of constructing stop dam in sporadic manner. Hence, effectively, we are recommending that construction of stop should be integrated with the watershed programme. Madhya Pradesh is leading in watershed treatment in the country. The Rajiv Gandhi Watershed Management Mission has been doing commendable job in watershed development and has already treated over 5 lakh ha. area and an equal amount of area under progress. With the NVDA coming into the picture for catchment area treatment (already allotted 7 lakh ha. in 2008-09 for treatment through the NGOs), and roughly over 50% fund of NREGS being spent on land and water conservation works, the opportunity in M.P. is enormous. While the watershed treatment can pave the way for sub-surface and ground water recharge, the construction of stop dam and minor tanks can harness the increased recharge to its full potential for minor irrigation development.

6.4 We recommend that for the preparation and implementation of Master Plan, a separate unit should be established at the district level. The National Rainfed Area Authority, has issued Common Watershed Guidelines effective since 2008. All watershed projects under centrally sponsored schemes, including watersheds funded under NREGS, fall under these guidelines. The guidelines have suggested a District Watershed Development Unit[1] to

[1] The DWDU is comprised of professionals drawn from the areas of Agriculture / Water management /social mobilization /management and accounts and shall work in direct coordination with the State Level Nodal Agency (Rajiv Gandhi Watershed Mission) and in active collaboration with the District Planning Committee and Zila Panchayat.

coordinate all watershed projects in the district. According to us, this body of DWDU is suitably positioned to coordinate the master plan implementation of stop dam and minor tanks because it can establish an organic link between the watershed and the small water harvesting structures.

6.5 It goes without saying that community institution around the stop dam is a must for its management effectiveness. We propose that Users' Group (those who would be benefited by the stop dam by direct irrigation) should be the best form of institution for this purpose. As it is done in several cases, the process should be that at the time of site selection these potential beneficiaries to be identified and organized into UGs and build their capacity over a period of time. It is preferred that UGs make some kind of contribution for the stop dam and maintain a bank a/c. What is must for them is a normative framework for water sharing and operation and maintenance. We also recommend formation of a federal structure with the representation from all users' group at the sub-basin level. The role of this federal body would be to look into the demand side of the water management, mediation between the UGs on inter village water sharing (up-steam-down stream) and oversee the implementation of the master plan of the sub-basin.

6.6 Needless to mention that community institution building being a long drawn process would require perseverance besides mandatory skills for community mobilization. The question is whether our executing agencies have such skill and mandate to pursue the component of community organization. For both mandate and skill few agencies like PIAs of RGWMM and NVDA, DPIP, MPRLP are well placed. As we have already recommended that stop be made an extension of the watershed development programme, we further recommend that stop dam construction should be done through the PIAs of the above mentioned agencies. There is a further advantage of doing through this route because the PIAs are assigned for an area of 5000-6000 ha. for a period of five years for watershed based livelihood development and this timeframe should be adequate to build the community institutions not only for stop dam but for other interventions also in the watershed. Alternatively, the executing agency should construct stop dams and minor tanks in coordination with the Watershed PIAs of the area.

6.7 A data monitoring cell should be created to monitor the critical data related to the water recharge at the sub-basin level and several other relevant data which are required for the planning purposes time to time. At present, there is a problem in finding such data in organized manner or not available. This facility should be housed with DWDU.

6.8 We recommend the monitoring of the master plan implementation with the help of GIS map. The M.P.Council of Science and Technology (MPCOST) has all the required skill and technology to do this effectively or the state can decide to higher the services of other agencies as well. A system of periodic monitoring of once in a year on critical parameters should be established.

6.9 A common guidelines for construction of stop should be issued applicable to all concerned departments. The guidelines must provide technical specifications, cost norms in the form of SoR, performance standards on critical parameters like site selection, storage of water, stability of the structure, usage and social mobilization. There should be the provision of third party monitoring on annual basis on the performance standards. The P&RD being the largest proponent of stop dam and also having taken initiative issuing guidelines should take the initiative for common guidelines.

6.10 There are a large number of NGOs present in the state involved in the watershed and livelihood programmes with governmental and non governmental funding. About fifty of them with adequate technical qualifications and experience, which have collaborated with RGWMM, NVDA, MPRLP, DPIP for watershed and livelihood programme implementation in nearly eight to nine lakh ha. area. All these NGOs were selected through a meticulous screening process by the independent experts in most cases. The state must use this pool of human resources in developmental works more proactively.

6.11 As like Gujarat, Rajasthan, Jharkhand the M.P. Government should consider utilization of part of the tribal sub-plan money in the minor irrigation development of the state which will have direct contribution to the enhancement of livelihoods in the tribal areas.

Section 1

Introduction

1. A. Introduction:

Traditionally, water is stored through various water conservation and harvesting techniques for the dry seasons of the year. The practice is more evident in an agrarian – monsoon based - country like India, where most of the total rainfall is distributed within three to four months of a year. Tankas, kund, kundi, vadis, step wells etc are just few examples of these practices. However, these small but important water harvesting technologies have fallen prey to inattention and ignorance of time.

Lately, intra and interstate water conflicts in the country, increased pressure on agricultural land, decrease in natural resources, increased dependency on government supplies and over utilization of groundwater resources (80% of the country's drinking water is based on groundwater resources) has demanded serious efforts from all the concerned sectors, public and private, to manage the water right from the catchment and conserving all the run-off for optimal utilization. Numerous schemes initiated by different departments at country as well as at state level, like IWDP, National Project for Repair, Restoration and Renovation of Water Bodies, River Valley Project and Flood Prone River Programme, NREGS, Hariyali, DPAP, MPDPIP are attempts towards it.

Furthermore, it is found that 'stop dams**2**' are the most commonly constructed structure in all the said programmes for water and land conservation programmes. Within MP only, more than 4000 stop dams were constructed during the IXth and Xth Five Year Plans. How viable is this structure? Should the construction of stop dams be continued in similar magnitude (in numbers)? And, what are the structural changes which have to be made during the pre-construction, construction and post-construction phases of the stop dams? The study tries to answer these questions with the help of the sampled stop dams from M.P. along with the experiences of people/organizations related to the structure at various levels.

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[2] 'Stop Dam' has been defined in section 1.B.

1.B. Defining Stop Dams:

Before the outset of the study, it is felt that the definition of structures used for the study should be made clear as it varies among the implementing agencies. Usually, a word 'check dam' is used to define the type of structures studied. Some of the implementing agencies describes check dams as structures made in first, second and third line of drainage and can be made of loose rocks, boulders, brush, wires etc other than concrete. Some agencies also define check dams as concrete or masonry barriers constructed on small rivulets or rivers.

Thus, to clear the confusion on the structures to be selected for the study, the structures selected are named 'stop dams' (henceforth it will be used for the structures selected throughout the study). And to define 'stop dam' following definition is used:

'It is a masonry barriers built across the direction of water flow on shallow rivers and streams for the purpose of water harvesting for irrigation as well as for domestic and animal use.'

1.C. Objective of the study:

Various water harvesting and conservation techniques are adopted and structures are constructed under several Central and State Government initiated programmes including DPAP, IWDP, RGMWM and NREGS as well as donor-supported initiatives like MPDPIP, MPRLP etc. However, 'stop dams[3]' – a low cost water harvesting technique, is the foremost in this account. Thus, to comprehend the viability of stop dams in the State, a study supported by PMPSUS[4] (henceforth society) has been proposed with the following objectives:

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[3] 'Stop Dam' has been defined in section 1.B.

[4] PMPSUS is a registered society anchored within the MPSPC (Department of Planning, Economics & Statistics) of GoMP. The Society is mandated to support government departments of the State in the design and review of their policy initiatives and programmes. In line of this mandate, the society undertakes or

1. ascertain technical and institutional efficacy including sustainability of stop dams constructed under various programme across the state of M.P.,
2. understand the impact of stop dams on various socio-economic groups in regard to poverty reduction,
3. undertake cost-benefit analysis of stop dams,
4. identify the factors influencing the working of stop dams both technical and non-technical aspects,
5. a comparative analysis of at least 6 stop dams identifying the critical factors responsible for success or failure of the stop dam, and
6. draw appropriate lessons, bottleneck issues, framework and approach for improvement in both technical and non-technical aspects.

To accomplish the study with the given objectives, PMPSUS invited 'expression of interest' from various organizations/institutions. Of the list of received applications, selected organizations/institutions have been asked to submit as well as present a 'request for proposal'. Among all the selected organizations/institutions, ASA has been chosen to conduct the study through a competitive bidding process. Before the initiation of the study, a 'ToR' was signed between ASA and PMPSUS. As per the ToR (Annexure IV), the study has to be concluded in two parts:

1. A study to understand the status and impact of sampled stop dams in the State along with the recommendations for the further strengthening.
2. Based on the secondary documents/information received from the various executing agencies, a compendium has to be prepared on the stop dams constructed in the State during ninth and tenth five year plans (1997-2007).

This report is the first part of the study. The second part, which is the compendium of the stop dams has been prepared as a stand-alone report.

1.D. Scope of the Study

- Review of secondary documents received from various departments of all the districts of

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commissions specialized research on issues relating to poverty, inequality, gender and social exclusion.

the State and preparing a database[5] accordingly of stop dams constructed during ninth and tenth plans.

- Sample study of stop dams analyzing their status and its impact on ground water recharging, and also mapping its benefits received by stakeholder(s)
- Efficiency and effectiveness of technical design and institutional performance of user group including governance, maintenance, functioning, guiding principles etc.
- Recommending detailed framework including specific means and ways to improve overall workings of check dam (department specific) including location wise – site selection process, innovative construction methods, and financing of future check dams.

1.E. Madhya Pradesh as a State

Madhya Pradesh, the second largest state of India, is located at the center of the country and is surrounded by five states, namely, Chhattisgarh on the east, Uttar Pradesh on the north-east, Rajasthan and Gujarat on the west and Maharashtra on the south. The state comprises nine percent of the country's total geographical area and six percent of the total population. Thus, the population density (196) is comparatively low and the habitations are sparsely located. The State consists of 50 districts, which is further divided into nine revenue divisions and 313 development blocks for administrative purpose. The State has strong rural base with 55393 villages.

As per the census of 2001, the total population of the State is 60.35 million. In spite of steady urbanization, three-quarter (73.54 percent) of the state population lives in rural area of which 37 percent are below the poverty line, making it the fourth poorest state in the country in terms of per-capita income. Madhya Pradesh has a large population of scheduled tribes (20.27%) and scheduled castes (15.17%). The sex-ratio of the State is 919.

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[5] Include at least State/District/Block/Panchayat/village/name of check dam/year of construction/total cost/command area/no. of beneficiaries/status of working

In total 78 percent of the total population is engaged directly in agriculture. As per the agriculture census of 2000-2001, there were about 73.6 lakh landholders in the State, of which 65 percent of the land holders own less than 2 hectares of agricultural land which is not enough for the sustainability of a family, especially if the land is rain fed.

M.P. represents one of the natural resource-rich states in the country. Of the 14 major Indian river systems, the state encompasses the upper catchments of seven and is also the source of all major river systems of Central India. The state receives an average annual rainfall of 1150 mm. Since it is concentrated in the brief monsoon season, most watercourses remain dry from January to June. As a result, water availability depends critically on the extent of water storage from surface water capture or groundwater.

Only 47.7 percent of the total geographical area of the State is cultivable. Out of this area, about 30.91 percent is irrigated. The poor spread of irrigation in the state notwithstanding, the area under irrigation has increased by more than six times over the last five decades. Most of this expansion has come after mid-eighties due to increase in minor irrigation schemes, namely ground water and lift irrigation schemes. As per the available data from land-use department, in the initial five years of the present decade (2000-05), irrigation from wells and tube wells has increased by 51 percent and from tanks by 47 percent, whereas irrigation from canal has increased by 24 percent only. This trend however, is more prominent in the western parts of the state. The cropping intensity of the State is only 132%.

Table 1: Area Irrigated by Various Sources ('000 Ha)

YEAR	CANALS	TANKS	WELLS & TUBE-WELLS.	OTHER SOURCES	% OF NET IRRIGATED AREA TO NET AREA SOWN	% OF GROSS IRRIGATED AREA TO GROSS AREA SOWN
2000-01	808	85	2651	591	28.0	23.8
2001-02	881	93	3039	722	31.6	25.6
2002-03	748	94	2988	664	30.7	25.5
2003-04	949	127	3735	820	37.4	30.1
2004-05	1006	125	3993	918	40.1	30.5

Source:- Commissioner, Land Records, M.P. through website

Whereas the expansion of irrigation facilities has aided areal expansion of wheat, mustard and gram in the state, there has been a substantial reduction in area growing coarse cereals. There has been one exception, though, the area for soyabean, a dry crop, which was introduced in the state in early 1980s, has expanded rapidly and it has become the most important crop in the state.

Notwithstanding the growing importance of some of the irrigated crops in the state, according to the M.P. Human Development Report, 1998, even if the irrigation potential from surface and groundwater sources was fully realized, over 55 per cent of the net sown area in the state would still remain dependent on uncertain rainfall. Thus development of dryland farming techniques is of utmost importance in the state.

1.F. Guide to the report :

The report contains 5 sections. Section 2 focuses on the methodology of the study. Section 3 provides the major findings of the study, while Section 4 presents the observations and major recommendations. A separate section (Section-5) presents seven selective case studies including abstract of each case study.

Section-2
Approach and Methodology of the Study

2.A. Approach of the Study

The study is developed with the hypothesis that stop dam facilitates irrigation and also provides water for human and animal consumption. Therefore, the study has reviewed the status and impact of stop dams constructed across the State during IXth and Xth plan. As per the suggestions of the society, only those stop dams constructed during IXth and X^{th} Five Year Plans (April 1997 – March 2007) are considered for the study.

2.B. Sampling Technique:

A multi-tier sampling procedure has been adopted for the selection of stop dams for the study.

Tier I: Selection of districts

For the selection of district, the state has been divided in six regions as per their locations, namely-

1. Central
2. Malwa
3. Northern
4. South
5. South-western and
6. Vindhya

From each region, two districts have been selected for the study. For the selection of districts from each region, percentage of Gross Irrigation Area (GIA) to Gross Command Area (GCA) of the district is calculated. After having the percentage, the list of districts in a region are arranged in descending order, and then divided in two equal categories. One category has districts of higher GIA to GCA percentage and the other has lower. From these two categories, a district has been selected randomly. The list of districts selected from each region is given below:

Table 1: Selected sampled districts based on % of GIA to GCA

Sr. No.	Region	Selected Districts	% of GIA to GCA
1	Central	Raisen	36.1
2.		Damoh	27.3
3.	Malwa	Shahajapur	30.1
4.		Ratlam	25.0
5.	Northern	Sheopur	60.1
6.		Guna	30.8
7.	South	Narsingpur	43.1
8.		Chindhwara	20.3
9.	Southern Western	Burhanpur	35.6
10.		Barwani	28.4
11.	Vindhya	Chhatarpur	43.1
12.		Anuppur	2.0

Tier II: Selection of Stop Dams from Selected Districts

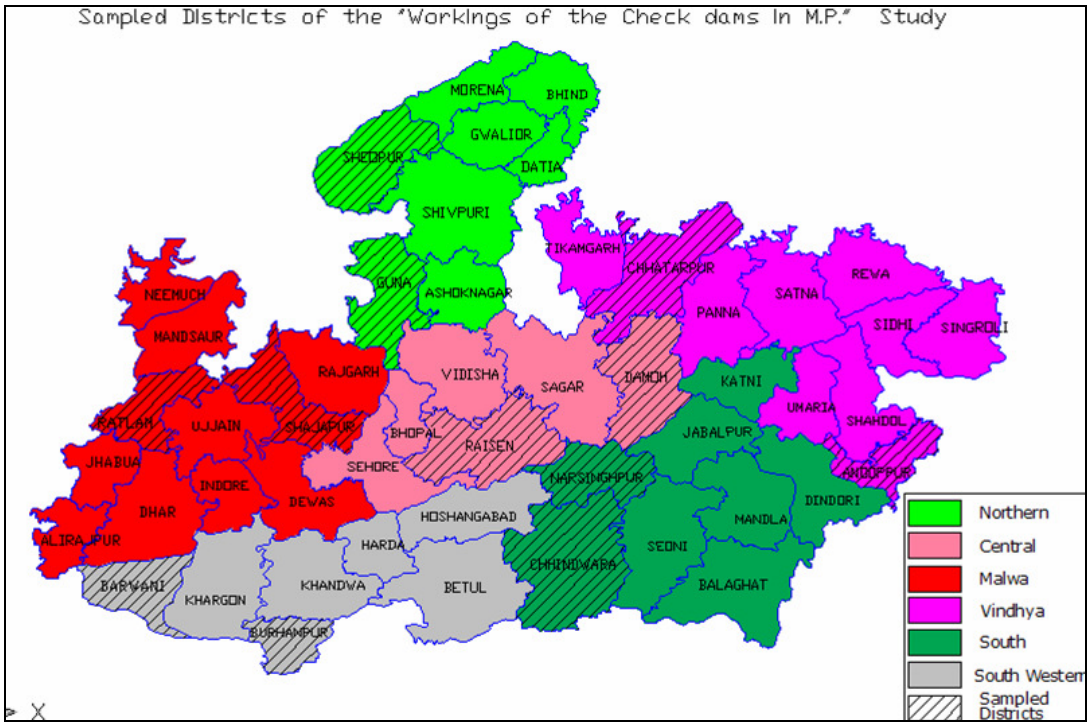
After the identification of two districts from each region, the departments listed below were contacted wherever relevant to generate a list of stop dams that they have constructed during the 1997 to 2007 entailing the information related to name of the stop dams, village, panchayats, designed command are and approximate costs and year of construction. Based on this list, the executing agencies were requested to identify 'well performing' and 'not so well performing' stop dams as per their information. These agencies are listed below.

- *Zilla Panchayat* (responsible for National Rural Employment Guarantee Scheme, Rajiv Gandhi Watershed Mission)
- PHED,
- RES,
- Forest Department,
- Agriculture Department,
- DPIP (wherever applicable),
- MPRLP (wherever applicable), and
- Collector Sectors Fund (District Planning Committee)

From the list of stop dams received from the various departments of the district - three stop dams were selected randomly from each district with the consultation of the concerned officials. While sample selection, an adequate amount of consideration had been given to select stop dams constructed under various programmes/departments. However, in presence of less than two departments/agencies in a district, the said methodology could not be followed, and thus, stop dams constructed by same department/agencies were repeated for the selection, like in Sheopur and Anuppur.

Similarly, it was decided that equal proportion of 'well performing' and 'not so well performing' and 'various size (> than 7 ha, 2 to 7 ha and < than 2 ha)', of stop dams would be selected as samples.

However, it was found during the visits that the information shared by the agencies did not match with the actual scenario, especially in case of irrigated command and also in case of functioning status of the stop dam. Hence, the criteria of selecting sample in accordance to the size of command area could not be followed in all the cases. However in the overall sample such distribution of sample according to the prescribed size could be more or less found. In total, 36 stop dams were selected for the study – three from each district (refer Table 2).



Tier III: Selection of Households:

Previous to the field visit, it was decided that sample of beneficiaries representing various social as well as economic status would be selected. However, during filed data collection, it was found that number of actual beneficiaries[6] was very few in each selected stop dams. Thus, it was decided that all the actual beneficiaries will be selected for the study. However in three cases, where the number of beneficiaries were more than 15, a maximum of 15 beneficiary households were selected as agreed with the society. The table below gives the list of all the selected stop dams for the study along with the agency, which has constructed it and number of HHs selected from each sampled stop dams.

[6] Those households who are using water from stop dams directly and/or indirectly are considered to be actual beneficiaries.

Table 2: List of Stop Dams along with their Location

Sr.No.	District	Agency	Name of the Sampled Stop Dam	Total no. of benefitting HHs	Sampled HHs	Remarks
1	Narsinghpur	PHE	Barodiya Aamgaon Naala SD	3	3	
2		Forest	Dilhari SD	4	4	
3		RES	Tinsara Naala SD	5	5	Dysfunctional
4	Chhatarpur	DPIP	Jai Ganga Maiya SD	9	9	
5		RES	Barua Naala SD	4	4	
6		RES	Kariyar Naala SD	5	5	Dysfunctional
7	Ratlam	RES	Wagariya Nalla SD	6	6	
8		AGD	Undwa Nalla SD	10	10	
9		RGM	Gundiwala Nalla SD	8	8	
10	Shajapur	PHE	Lahori Nalla SD	3	3	
11		DPIP	Mohanbala SD	5	5	
12		FD	Khal Nala SD	4	4	Dysfunctional
13	Seopur	RES	Daduni SD	18	15	
14		RES	Siruti Ka Anda SD	6	6	
15		RES	Near Shamsham SD	5	5	
16	Anuppur	RES	Nifra Nalla SD	6	8	
17		RES	Nifra Nalla SD	19	15	
18		RES	Jogi Tola Surjhi Nalla SD	21	15	Dysfunctional
19	Barwani	RES	Halgaon SD	4	4	
20		RGM	Ghumariyakhurd SD	4	4	
21		Govt (MPRLP)	Rajangaon SD	2	2	
22	Guna	FD	Badera SD	1	1	
23		RGM	Udaipura SD	4	4	
24		DPIP	Akoda Nadi SD	5	5	

Sr.No.	District	Agency	Name of the Sampled Stop Dam	Total no. of benefitting HHs	Sampled HHs	Remarks
25	Raisen	ZP	Ghoda Pachada	1	1	
26		RGM	Pathardhera on Sautar Ki Nadi SD	7	7	
27		PHE	Bagra Walla SD	7	7	
28	Chhindwara	Agri	Jhiri Stop dam	5	5	
29		RES	Sonapipri SD	2	2	
30		PHE	Chiklikala SD	3	3	
31	Burhanpur	FD	Masandia Nallah	1	1	
32		PHE	Borban SD	0	0	Dysfunctional
33		PHE	Sukhi Nadi SD	3	3	
34	Damoh	PHE	Pipariya Hathini SD	4	4	
35		DPIP	Indira SS SD	4	4	
36		RES	Marutal SD	3	3	
	Total			201	190	

In total, there were 201 beneficiaries of stop dam of which 190 were surveyed (95%). The households survey included 161 beneficiaries out of 166 (97%) from the functional and partially functional stop dam category and 29 beneficiaries out of total 35 beneficiaries (83%) of dysfunctional stop dam who once received the benefits of stop dams. For Borban, a dysfunctional stop dam in Burhanpur, no household survey could be conducted as there was no direct benefits (in terms of irrigation) accrued to any households during the one year period of its life after construction.

FGD, conducted in related villages of each sampled stop dams, were also organized with both beneficiaries as well as non-beneficiaries, including Village *Sarpanch* (wherever available), to assess the impacts of stop dams and also to have suggestions to harness the said resources optimally.

Besides, extensive consultation was done with the secondary and tertiary level stakeholders comprising mainly of the officials of the executing agencies at the block, districts and state levels. Discussions were also held with the State Water Data Analysis Center (SWARDAC), the Project Coordinator of MP DPIP, Director of RGWMM. The Civil Society Organizations

engaged in water resources development were also consulted. A list of officials met with are given in Annexure II and III. These discussions were centered around the strategic and policy issues related to the executing agencies in regard to promotion of stop dam in M.P.

The study has drawn further inputs from the desk review of literatures mainly sourced from the internet. Particular references are : Independent Evaluation of Check dams in Gujarat – strategies and Impacts by IIM, Ahmedabad, 2002; Integrated Watershed Development by Dr. Rajesh Rajoura; The Reign of God and Watershed Management Values By Michael V.d. Bogaert S.J.XIDAS, Jabalpur, Small River Basin Approach in Watershed in Central West India by Ashis Mondal, ASA, Bhopal, Website of M.P. Water Resources Department, M.P.Department of Farmers' Welfare and Agriculture Development and M.P. Public Health Engineering Department.

It is pertinent to mention here that the selected 36 samples of the stop dams was a small sample size to be representative for the entire state, especially when a large number of stop dams are being built every year. However, more samples could not be drawn due to time and resource constraints. In order to make up for this limitation, this study involved extensive consultations with the number of experts and organizations involved in the business of stop dam construction over many years and have largely drawn from their vast experiences. In addition, 7 selective case studies were developed to substantiate some of the findings of the study.

Section-3
Major findings

Profile and status of the surveyed Stop dam

3.1 The sampled stop dam can be considered small as far as size is concerned. The average length of the surveyed stop dam was within the range of 15-20 meter and average height was within 1.2 to 1.5 meter, except one in Burhanpur built by the PHE which was 120 meter in length and 2.5 meter in height. These are the stop dams (masonry weir) built on the small rivulets to harness the post-monsoonal flow, primarily for the reason of irrigation during Rabi season and ground water recharge with supplementary use like drinking water for cattle, etc. The stated objective of constructing stop dam by the PHE department is ground water recharge however in practice is being mostly used for the irrigation. In none of the cases, lift irrigation systems were integrated with the construction of stop dam by design which implies that stop dams were constructed with the assumption that farmers having agriculture land nearby shall make their own arrangement for lifting water from the dam for irrigation. This assumption was found true as in all the cases wherever irrigation is taking place the farmers have made own arrangement by installing diesel and electric pumps for irrigation.

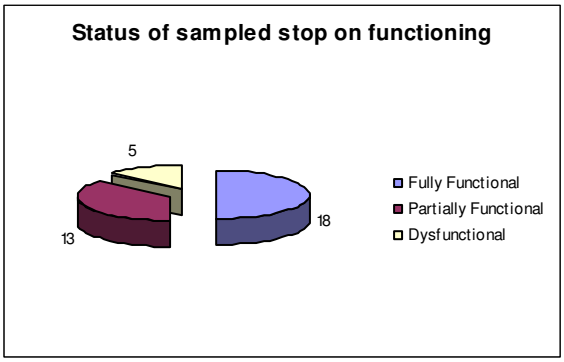
3.2 The average water storage capacity of the studied check dams came out to 39,551 cubic meters. The highest capacity was found to be 2,80,000 cubic meters in Burhanpur district in another check dam built by PHE department. The lowest capacity was 3,375 cubic meters of a check dam built by Agriculture department in Chhindwara district.

Table 1: Profile and Present Status of Stop Dam

Sr. No.	District	Name of the SD	Executing Agency	Direct Irri. Area (Acre)	Age (yrs.)	Approx. Cost (Rs. Lac)	Current status
1	Narsinghpur	Bhamori	PHE	10	2	4.5	Fully Functional
2		Dilhari	Forest	3	9	2.75	Partially Functional
3		Aamgaon	RES	0	11	4.5	Dysfunctional
4	Chatarpur	Naiguwan	DPIP	31.25	4	5.31	Fully Functional
5		Mudhara	RES	8	2	3.8	Partially Functional
6		Padro	RES	0	4	2.9	Dysfunctional
7	Ratlam	Bilpak	RES	26.5	8	4.22	Partially Functional

Sr. No.	District	Name of the SD	Executing Agency	Direct Irri. Area (Acre)	Age (yrs.)	Approx. Cost (Rs. Lac)	Current status
8		Saurikheda	Agri. Dept	18	10	2.09	Fully Functional
9		Umar ka nasinaka	RGM	17.25	2	3.02	Fully Functional
10	Shajapur	Lahori	PHE	8	3	2.82	Fully Functional
11		Sugaon	DPIP	25	4	2.31	Fully Functional
12		Pipaliya	FD	0	11	3.5	Dysfunctional
13	Seopur	Daduni	RES	14.5	2	5	Fully Functional
14		Pandola	RES	5.5	2	3.58	Partially Functional
15		Soinkalan	RES	7	3	4.73	Partially Functional
16	Anuppur	Katkona	RES	60	2	14.99	Fully Functional
17		Piparaha	RES	32	3	11.75	Fully Functional
18		Devgawan	RES	0	3	10	Dysfunctional
19	Barwani	Halgaon	RES	5	6	1	Fully Functional
20		Ghumariya Khurd	RGM	17.25	4	4.75	Partially Functional
21		Rajangaon	MPRLP	14	3	4.88	Partially Functional
22	Guna	Badera	FD	3	11	2.6	Partially Functional
23		Udaipuri	RGM	14	7	3.3	Fully Functional
24		Khairoda	DPIP	36	6	6.1	Fully Functional
25	Raisen	Bhanwarkhedi	ZP	4	6	1	Fully Functional
26		Mahuli	RGM	7	5	1.5	Partially Functional
27		Hinotia Padaria	PHE	5	2	2.01	Fully Functional
28	Chhindwara	Jhiri Jamuniya	Agri	37.7	2	8.69	Fully Functional
29		Sona Pipri	RES	3.5	2	1.75	Fully Functional
30		Chiklikala	PHE	4.5	12	1.95	Partially Functional
31	Burhanpur	Aamgaon	FD	3.8	8	0.628	Fully Functional
32		Borban	PHE	0	7	13	Dysfunctional
33		Sangrampur	PHE	7.5	6	9	Partially Functional
34	Damoh	Piparia Hathini	PHE	19	2	4.77	Fully Functional
35		Darali	DPIP	2	3	0.925	Partially Functional
36		Marutal	RES	3	6	1.75	Partially Functional
Total				**452**		**161**	
Mean				**13**		**4**	

Fig:1



3.3 Of the total 36 stop dams surveyed 18 of them were found to be fully functional, 13 were partially functional in meeting their objective in terms of water storage and five were non-functional mainly due to gross damage to the structures.

3.4 The average command area under direct irrigation from the stop dam was 13 Acre, which has received fully or partial irrigation benefits from the surveyed stop dam.

3.5 The average cost was rupees four lakhs per stop dam.

3.6 In all the sampled check dams the land used for construction was either Government owned or came under the jurisdiction of Panchayat.

3.7 The classification of the respondent households on the socio-economic parameters are as following:

- Out of the total 190 sample respondents the social profile of the respondents were SC-24 (12.6%); ST-55 (28.9%); OBC-77 (40.5%) and General-34 (17.9%).

- There were 120 samples from the APL category (63.16%) and 70 from the BPL Category (36.84%)

Impacts of Stop dams

3.8 The impacts of stop dams are diverse as observed. Attempts have been made to enumerate the impacts at the beneficiary household level on income, food security and other social impacts like migration and institutional aspects. The stop dams which have been surveyed are without doubt contributing to the family's income by way of providing additional irrigation benefits fully or partially. Therefore, statistically it becomes difficult to segregate the exact benefits (income and others) that can be attributed solely to the stop dam. Hence, the study has relied significantly on the informant about the data regarding perceivable benefits. To ensure minimization of error, professionally trained persons were

engaged for interview and extensive probing was done with the informant to extract real information.

3.9 The total irrigated area under 31 stop dam (5 dysfunctional hence not contributing any irrigation benefits) was 452 Acre which has received direct irrigation from the stop dam fully or partially (Table-1). Out of the 452 acre, 247.7 acre was already under irrigation as the farmers' were drawing water from the flowing rivulets/nullahs or from the places of natural pondage or from their own sources like dug wells and bore wells. However, the availability was always scarce, resulting in poor crop productivity and failure of crop. Hence, the post construction of stop dam has made significant contribution in supplementing irrigation during rabi crop and thus provided an assured crop. Almost in all cases, there were two additional watering accrued at the farmers' level and used normally for the first two irrigation in the beginning (November – December) of the Rabi season. So in this case, no irrigation area has increased but the actual impact is because of the increase in number of supplementary irrigation resulting in assured crop production in rabi.

3.10 An additional 204.3 acres of cultivable land has come under the direct irrigation because of the stop dams during rabi in most cases (Table-2). This is the land adjoining to the existing irrigated area (247.7 acre) which has now come under the irrigation command. In 97% of the cases, this additional land belonged to the owner of the existing irrigated area (247.7 acre). The total number of beneficiaries under direct irrigation is 136 (Table-2). The degree of irrigation benefits again was two irrigations. Importantly, this 204.3 acre was Rabi fallow earlier and now the farmers have started growing short matured variety of wheat (Lok-1) and in majority (84%) of the cases growing gram for which two irrigations is more than adequate.

Table 2: Irrigation benefits – Direct and Indirect

No. of Stop Dam	Status	Direct Irrigation benefits post construction					Indirect Irrigation benefits post construction				
		Increased area in Kh.(acre)	Increased area in Rabi (acre)	Increased area in Summer (acre)	Total	No. of direct irri. beneficiary	Increased area in Kh. (acre)	Increased area in Rabi (acre)	Increased area in Summer (acre)	Total	No. of Indirect irri. beneficiary (Recharged wells)
18	Functional	1	143.55	0	144.55	94	0	76.55	0	76.55	32
13	Partially Functional	0	59.75	0	59.75	42	0	20	0	20	11
5	Dysfunctional	0	0	0	0	0	0	0.00	0	0	0
Total		**1**	**203.3**	**0**	**204.3**	**136**	**0**	**96.55**	**0**	**96.55**	**43**

3.11 Table-2 shows that there has been irrigation benefits accrued indirectly mainly through the sub-surface and ground water recharge to the dug wells and bore wells in the downstream (within 500 meters). This data is based on the perception of the benefiting farmers. In total 96.55 acre of land receiving irrigation benefits during rabi season shared among 43 farmers. As per farmers, the water level in the dug wells and bore wells has increased significantly in the post the construction of the stop dam which has helped them to irrigate this additional area during rabi in comparison to the pre-stop dam scenario.

3.12 Considering both direct and indirect irrigation benefits and also the partial and full irrigation the average irrigation per stop dam came to about 18 acre (without consideration of the dysfunctional stop dam), mainly during rabi season.

Table 3: No. of years SD functioned before becoming defunct

No. of years SD functioned before becoming defunct						
Sr. No	**District**	**Stop dam**	**Year of Construction**	**Year of becoming defunct**	**No of years functional**	**Main reason for becoming defunct**
1	Chhatarpur	Kariyar Nalla SD	2004-05	2005-06	1	Siltation, damaged flank
2	Narsinghpur	Tinsara Nalla SD	1998	2004	7	Leakage, Damaged Gates, Main Weir & Flank
3	Shajapur	Kahal Nalla SD	1997-98	1998-99	1	Leakage from foundation
4	Anuppur	Jogi Tola Surjhi Nalla SD	2005-06	2006-07	1	Siltation and leakage in foundation
5	Burhanpur	Borban SD	2001-02	2002-03	1	Heavy siltation

3.13 It was difficult to enumerate the actual income that has accrued due to stop dam as stated earlier that irrigation benefits came as supplementation to other irrigation sources in case of direct as well as indirect irrigation. In such case, increase in income attributable to stop dam solely was a difficult proposition for the study team. The total net income for 452 acre of land which received direct irrigation calculated as Rs.22.87 lakhs at an average of Rs.5060/- per acre per year during rabi. For the 96.55 acre area which has received irrigation through indirect means the total net income came to Rs. 4.88 lakhs per annum during rabi. Since the irrigation during kharif and summer was negligible, therefore those two seasons were not considered. Going by the suggestions of the surveyed households, fifty percent of the net income in case of direct irrigation and seventy five percent in case of indirect irrigation can be considered as contribution by the stop dam.

3.14 Food security is intrinsically related to poverty. A specific question was asked to the surveyed farmers about the impact of stop dam on the food security. Out of the 190 surveyed households it was found that 166 were already food secured households even before the construction of the stop dam. Hence there was no direct connotation to these households as far as food security is concerned. 24 surveyed households have reported increase in food security for an average of 3 months in a year and have directly attributed this as the impact of

stop dam on the food security (Table-4).

Table 4: Impact on food security

Total surveyed farmers	Farmers food secured before constr. of SD	Farmers reported achieving food security after constr. of SD	No. of mths. Increased (average)
190	166	24	3

3.15 According to our findings, prior to the construction of the stop dam 157 households out of the total surveyed households of 190 were going for migration seasonally for about 6-8 months (table-5). There has been reduction in migration as reported by 89 households in the post construction of stop dam and the reasons have been quoted as increased employment in the farm due to stop dam and easy availability of wage employment under NREGS. 68 households reported no change in the migration pattern as they found increased income through agriculture due to stop dam is not sufficient to affect migration significantly.

Table 5: Impact on migration

Total surveyed household	HH migrating before SD construction	HH reported reduction in migration due to SD & NREGS	HH reported no change in migration
190	157	89	68

3.16 The least priority area during planning and execution of the stop dam was found to be lack of involvement of the beneficiary in the process. Table-6 & 7 show that out of 36 stop dams only in case of 6 stop dams where people's contribution has been collected in the range of 2-5% of the total cost of the dam. The Users' group, which is formed and developed for involvement in the planning and implementation and future O&M, has been formed in six cases. Two executing agency namely, DPIP and Rajiv Gandhi Watershed Management Mission have made efforts in forming and developing the UGs around the stop dam constructed by them. This has perhaps happened due to the guidelines issued by these agencies for users' group formation and have provided required training to their staff. For other departments neither such guidelines exist nor has anyone made effort towards this

direction. The Department of Panchayat and Rural Development has issued guidelines for users' group formation around water harvesting structures in 2008, which is applicable to the RES also, a key agency for stop dam construction in the state.

Table 6: People's contribution in Stop dam construction

Total Sampled SD	No. of SD where people made contribution	%age to cost of SD	No. of SD where no contribution collected
36	6	2 to 5%	30

Table 7: Users' Group formation

Total Sampled SD	No. of SD where UGs formed	No. of SD where no UGs formed
36	6	30

3.17 Except for the above mentioned 5 or 6 stop dams, nowhere we have found a systematic approach by the executing agency followed to involve the community in the process of stop dam construction. This has implications as we have found out that places where UGs were developed, a certain institutional mechanism exists for water sharing and minor maintenance of the dam in comparison to the places where no such effort has been made.

Table 8: Handing Over of Stop Dams

Total Sampled SD	No. of SD where handing over done	No. of SD where handing over not done
36	21	15

3.18 While as per the norms, a stop dam after its construction is supposed to be handed over formally to the Gram Panchayats. This is done to ensure the involvement of community in

proper maintenance and developing a high level of ownership. However, as per the findings of the study, out of the 36 sampled stop dams, while the handing over was done in 21 stops dams, this was not followed in case of a sizeable 15 stop dams. While in case of DPIP and RGM, the stop dams were handed over to the relevant community institutions namely VDC and WDC. However, even in 15 cases where the stop dam was handed over to Gram Panchayats, tasks like opening and closing of the gates were largely being performed by the immediate beneficiaries of the stop dams and not on the initiative of Gram Panchayats, which are engaged in other developmental tasks as well. In most cases, it was noticed that the users did not have any information on whom to approach in case of any problem with stop dams. This clearly shows as mentioned above that an absence of user groups and along with proper training results is ineffective use of stop dams.

3.19 It was found out in the study that out of 36 sampled stop dams, 28 were meant for irrigation as primary use, 7 for ground water recharge and 1 for Nistar as stated objective. In practice all the 31 functional (fully or partially) are used for irrigation.

Table 9: Design Parameters of the Stop Dams

Design Parameter							
Status	**No. of Stop Dams**	**Provision of Gates**		**Provision of Apron**		**Site Selection**	**Stability of Structure**
		Gated	**Functional**	**Apron**	**Functional**	**Appropriate**	
Functional	18	16	16	16	15	18	18
Partially functional	13	7	7	10	5	13	9
Dysfunctional	5	3	1	3	1	3	1

3.20 As evident from the Table 9, while the major design parameters were in place and operational in functional stop dams and minor and immediate repair was needed in case of partially functional stop dams. 50% stop dams coming under the category of partially functional had eroded apron and 30% stop dams needed repair work in flanks and foundation. In case of dysfunctional stop dams, only 3 had gates out of which only 1 was functional. Furthermore, in dysfunctional stop dams, in 3 cases there was an apron out of which only 1

was found functional. 4 out of the 5 structures were not stable owing to damaged flank and leakage from the foundation. In dysfunctional stop dams, it was clearly evident that technical parameters like apron, flank and other aspects like foundation were severely damaged and as a result, were beyond repair.

A few major problems observed on a close study of the 5 dysfunctional stop dams are as follows:

- The alignment of the gates and frame was not proper, therefore no water was being stored
- The places where site selection is faulty comprises of situations like construction of stop dam on the depression, thus severely impacting the water storage.
- Additionally, the quality of foundation was also a determining factor. In cases where the foundation was not rocky, the problem of leakage appeared.

3.20. The study findings point out that out of 18 functional stop dams in 12 (66%) no role was being played by any institution for its maintenance, in remaining 6 (34%) either user group or village level institutions were doing the maintenance work. In case of partially functional stop dams only 4 (31%) stop dams were being maintained by either user group and panchayats. Overall, panchayats were doing maintenance work only in 3 stop dams out of 15 stop dams, which were handed over to panchayats. The point to be noted that maintenance here refers to closing and opening of gates in time. It does not involve any work related to de-siltation and repair.

3.21 The major suggestions made by the beneficiaries as found out in the study were as follows:

- Site selection should be participatory, training to user group including that on O&M should be given, community contribution should be taken from members of user group, handing over of stop dam should be done formally

- Stop dams requiring repair works in different components like flanks, wing wall, gates, apron, foundation etc should be undertaken immediately. Missing components like apron, gates and spillway should be provided.

- Besides, de-siltation at many places needs to be carried out.

- In places where storage capacity was not adequate, in those places work should be done to further increase it.

Section-4:
Observations & Recommendations

4.1 As minor irrigation tool or as water harvesting for general use stop dam is unique. As we have seen that out of the 36 stop dams surveyed 31 of them have made their presence felt in terms generating benefits for the purpose they were built (mostly irrigation), despite there are lacuna on technical front and management of stop dam at the users' level. In the following paragraphs, we have discussed our observations and recommendations for improvement in whole business of approaching construction of stop dam as a method of decentralized water harvesting measure based on the data from the sampled stop dam and several discussions we have had with the officials from the executing agencies at the block, district and state level.

Taking the figure of average 18 acre of land under irrigation per stop dam as the standard for calculating the benefits, the net gain for an average stop dam came to Rs.91080/- (18 acre x Rs.5060/- net gain per acre). The average cost per stop dam is Rs.4 lakhs. This means that within a period of 4-5 years, it is possible to recover the cost of stop dam if we take only the crop related benefits. The point to be noted that other benefits like water for cattle drinking, domestic use and other environmental benefits of stop dam are not taken into consideration due to lack of data and appropriate methodology of calculating value of such benefits. However, the benefits of this nature were also found limited except that some families have used the water storage in the stop dam for cattle drinking.

4.2 The construction of stop dam and its operationalization favours decentralized approach and therefore enables community to take charge of the operation and maintenance with initial period of guidance and handholding. We have observed such phenomena in hundreds of stop dams in M.P. and elsewhere where careful strategy was followed for people's involvement in the planning and execution of stop dam.

4.3 The benefits of stop dams are perhaps more equitably distributed within the cross section of community than any other conventional method of irrigation. As in the case of this study there are 179 benefiting households for 549 acres of land which came to about 3 acres or little over 1 ha. land per benefiting households. More or less equitable distribution of benefits is also found among the various social groups SC (12.6%); ST (28.9%); OBC (40.5%) and General (17.9%). However, in case of economic category of the beneficiaries the APL (63.16%) tend to have benefited more than the BPL (36.84%). Having said that, we must

caution the readers not to derive conclusion that stop dams benefit more to the people above poverty line because selection of stop dam site is determined by the suitability of the site in terms of maximum water storage, cost effectiveness and other technical parameters. The poor or the poorest families may or may not have the land near to the potential stop dam site.

4.4 Since it is not so technical and does not require big investment it has great potential to attract farmers' own investment in water harvesting. In case of Ratlam district (see case study) a group 6 farmers have contributed 75% of the cost of the stop dam by borrowing fund of Rs.1.87500/- (from a revolving fund created for this purpose) and repaid the same within 2 years. This proves the viability of the stop dam. However, this may sound a sporadic event but in M.P. it is a common incidence now a days in the rural areas during winter season to see thousands of Bori Bandhan (temporary weir made of fiber sacks filled with sand) built across the rivulets to harvest water by the farmers on their own. Thanks to some of the most effective water harvesting campaign made in the state in recent years like Pani Roko Abhiyan, Jalabhishek which had received the patronage from the highest level of political leaders of the state. An extension to this fact that although stop dam can be an area for private investment there are two issues coming in view. Firstly, whether there is an institutional funding available for the farmers to take loan on a reasonable rate of interest (as applicable for the agriculture loan) for constructing stop dams. Perhaps not. After the first experiment in Ratlam, there were at least five interested group of farmers, which came forward to replicate the model, however this could not be done as the bankers did not find any appropriate scheme through which such lending could be done, despite the fact that the bankers were convinced about the viability of the project. The NABARD has a window called "Umbrella NRM scheme" through which such project can be funded but in this case the loan is extended to an implementing agency, not to the direct borrowers. So here is a policy issue which needs to be addressed. The second issue is related to the ownership of land where the stop would be built. Normally, the rivulets are on the Government land and therefore ownership of the stop dam built with private investment becomes an issue. One possible way out is providing the primary usufruct rights for irrigation to the people who have invested on it with set of conditions which give entitlement to the rest of the villagers for general use like drinking for cattle, domestic use, indirect recharge, etc. This is again a policy issue and requires a bigger debate among the various stakeholders before finalization.

4.5 We have observed that places where stop dams are built as follow up activity of the soil and moisture conservation treatment (or watershed treatment) in the

catchment area of the stop dam, the recharge in the stop dams in the post monsoon is higher and longer than the places where the stops dams are built as a stand alone activity. Even the silt load was observed less in cases where watershed treatment is done. The same result is found in case where the catchment area has a good forest cover. In a structure like stop dam which harvests primarily the post monsoonal flow and water impounding area is relatively small (in comparison to earthen tank) the real crux is that it is located in a stream which receives maximum possible recharge during post monsoon and for a longer period of time. In such case, the stop dam as an extension activity of the watershed programme ensures better return on investment.

4.6 The whole idea of PHED's construction of stop dam in the rural areas for the purpose of ground water recharge appears to be lacking rationale. All the seven stop dams constructed by PHED under this study are meant to be for ground water recharging as stated objective, however apart from one which was defunct were actually used for irrigation through direct lifting from the dam thus defeating the stated purpose. There are two issues need discussion. First is about the determining the location of the stop dam which can ensure maximum recharge. We have not come across any scientific base, viz. ground water mapping, while discussing the matter with the field officials of the PHED, which can confirm that scientific measures being taken in identification of the location of the dam. It is being done more of a hit and trial basis. The second issue is about how the PHED has approached the work at the ground level to ensure that the stated objective is met. It is obvious that without taking the community in agreement and without establishing an institutional mechanism around the stop dam such objective is difficult to meet as the farmers would always take water at first instance. We have not found any such effort made by the PHED. Also, there are no explicit guidelines by the PHED for the community consultation and building institution around it. So, a stop dam by PHED, which has a very special purpose of ground water recharge, does not look different to any other stop dam built by other agency for irrigation purpose. In this regard, references can be made to several stop dams made by various agencies (Govt. and NGOs both in the watershed programme in M.P.) where local institutions and normative framework has ensured restriction of direct lifting from the structures instead taking the benefits through the downstream recharge in the dug wells and bore wells.

4.7 The lacuna in institution building around the stop dam is a general issue found in all the cases, except for six stop dams where some efforts were made at least. As per Government instructions, all the stop dams are to be handed over to the Gram Panchayat once completed. This has been done in many cases however that did not help in better operation and

maintenance of the stop dam. With the huge pressure of implementing NREGS, the GPs have hardly anytime to look after the stop dams. As a result in no cases we found GPs taken proactive steps in O&M of the stop dam including the places where the stop dams are dysfunctional or places where the structures require immediate attention for repair. Where the UGs have been formed some amount of vibrancy is seen in terms of closing and opening the gates of the stop dams in time and safe keeping of the gates. Some informal arrangement is also seen in case of water sharing. However, UGs could not take any further steps like deciding and collection of water fees, undertaking minor repairs, crop planning for effective water management and related issues. Surely, the UGs need more exposure and training on these subjects before one can expect them to carry such functions. What is heartening though that in all cases of fully or partially functional stop dams, an informal institution exists with the involvement of the immediate beneficiaries of the structure. They are active during the beginning of the irrigation season in closing the gates (not necessarily every one gives equal sharing of labour), and at the end while taking the gates off from the frame. The rule of first come first serve exists in distribution of water. There is a general acceptance of such rule as we have not come across any conflict situation with the sharing of water. Water is such a powerful commodity that it can bring people together for common goods and therefore building institution on such a tangible commodity is easier than on other issues like health and education. On the other hand the executing agencies do not have any orientation and skill, except RGM, DPIP & MPRLP, on the community institution building. Also there is no incentive, financial or non financial, for the agencies for not doing the community institution work around the stop dam. More so, there is no binding on them for community mobilization work. Hence, the issue of staff capacity building, orienting them towards community mobilization, etc. is to be tackled by each of the department involved in the business of stop dam construction.

4.8 Bottleneck issues:

Some of the key bottleneck issues in regard to the construction of stop dams are :

- There is a lack of perspective behind the whole efforts of stop dam construction in M.P. This problem prevails both at the policy and execution level. At the executing agency level, everybody seems to have their own agenda of stop dam construction varying in objectives and approach with each other. Even at the district level such perspective and definite plan for holistic water resources development for the district is missing.

- There is no standard technical guidelines and Schedule of Rates for construction of stop dams for the state resulting in varying cost norms and technical parameters being used by different departments in the same geographical area without any proper justifications for such variance.

- Construction of stop is a socio-technical issue. But most of the executing agencies do not have any mandate and orientation for community mobilization. More so there is no budgetary provision for community mobilization during or after the construction of the stop dam.

- There are technical problems related to the site selection, appropriateness of the design suitable to the site and construction quality. Lack of proper supervision mechanism and quality assessment through a third party leaves enormous scope for being ineffective and unaccountable.

4.9 Factors positively influencing the workings of the stop dam

- It is observed that places where stop dams are built as follow-up activity of the soil and moisture conservation treatment (or watershed treatment) in the catchment area of the stop dam, the recharge in the stop dams in the post monsoon is higher and longer than the places where the stop dams are built as a stand alone activity. Even the silt load was observed less in cases where watershed treatment is done. The same result is found in case where the catchment area has a good forest cover.

- The involvement of beneficiary in the planning and execution stage and building an institutional mechanism around the structure and proper training has significant positive implications on the workings of the stop dam in the post construction scenario.

- The structures which are relatively larger in terms of water storage or where the stop dams have been constructed in a series of dams on the stream are cost effective and better in strategy. Such structures have ensured larger area for irrigation and also irrigation for a longer period of time, normally the entire rabi crop.

- The orientation of the executing agency towards participatory approach has helped in better identification of the site and sustainability of the stop dams.

4.10 Recommendations

We are suggesting here few concrete steps to improve the management and effectiveness of the stop dam.

i. Firstly, the M.P. State Water Policy (2003) needs to specifically recognize the importance and relevance of stop dam in solving the water related issues in the state for the minor irrigation, drinking water, etc. and the measures that can be taken to harness this potential. The state policy on water does not mention anything about the stop dam except that saying "percolation tank and minor irrigation tank can be adopted for ground water recharge". About 80% of state's irrigation sources are in the private domain and it is quite likely that stop dam has a significant share in the state's overall irrigated area yet the policy has not considered this an important instrument to solve water problem. The lack of accurate data at any level is perhaps the reason for the stop dam to be kept in low profile for so long.

ii. We are in full agreement with the guidelines issued by the M.P. Department of Panchayat and Rural Development in 2007 and 2008 for the construction of stop dam. These guidelines applicable for NREGS and general funding from the P&RD have suggested to develop a district level Master Plan for small water harvesting structures like stop dam and earthen tanks to be coordinated by the Executive Engineer, RES with the support of the other technical departments like WRD, PHED, Forest, etc. The master plan is supposed to assess the water resources potential of the district and identify the locations for minor irrigation projects including stop dam. All departments involved in the construction of stop dams are expected to follow the Master Plan while undertaking stop dam project. A district level committee involving heads of the concerned departments and experts is recommended under the chairmanship of the Collector to periodically over see the implementation of the master plan. According to the P&RD, 32 districts have already completed the exercise of Master Plan and the rest are in the process. This is a noble effort and we think that if done properly majority of the problem related to management of stop dam construction will come to an end.

iii. Going back to the State Water Policy on water resources planning it suggests that "water resources development shall be planned on the basis of river basin or sub-

basin. Each development project shall be designed in such a manner that each basin or sub-basin is inherently integrated (with) water resources planning so that the best alternative can be identified". Considering this directive we recommend that the district Master Plan should be based on the basins and sub-basins of rivers and upto the level of mili-watersheds. The milli watershed boundaries have been already delineated for the entire state by the Rajiv Gandhi Watershed Management Mission and being religiously followed in watershed treatment. If this is done then one can correlate the stop dam construction in the context of watershed development as it is a known fact that stop dam fits well in terms of return if integrated with watershed development. Priority for stop dam construction should be given to those areas where watershed treatment is done or under progress. This reflects a much better planning scenario in comparison to the present practice of constructing stop dam in sporadic manner either following a formula of equal distribution among the blocks or based on the proposal of political leaders from all levels.

iv. Taking the argument further of integrating stop dam and minor earthen tanks with watershed we find that M.P. is leading in watershed treatment in the country. The Rajiv Gandhi Watershed Management Mission has been doing commendable job in watershed development and has already treated over 5 lakh ha. area and an equal amount of area is under progress. With the NVDA coming into the picture for catchment area treatment (already allotted 7 lakh ha. in 2008-09 for treatment through the NGOs), and roughly over 50% fund of NREGS being spent on land and water conservation works, the opportunity in M.P. is enormous. While the watershed treatment can pave the way for sub-surface and ground water recharge the construction of stop dam and minor tanks can harness the increased recharge to its full potential for minor irrigation development.

v. In contrast to the P&RD's suggestion of making the EE, RES as the nodal point to coordinate the preparation and implementation of Master Plan, we recommend a separate unit at the district level for this purpose. We feel that the institution of EE, RES shall not be adequate to provide exclusive focus to the work that it demands or given the magnitude of the job. The National Rainfed Area Authority, Ministry of Agriculture, has issued Common Watershed Guidelines since 2008. All watershed projects under centrally sponsored schemes, including watersheds funded under NREGS by the M.P. State, fall under these guidelines. Besides a

SLNA (which is the Rajiv Gandhi Watershed Management Mission in this case) the guidelines have suggested a DWDU to coordinate all watershed projects in the district. The DWDU with a team of professionals drawn from the areas of Agriculture / Water management /social mobilization /management and accounts shall work under the direct monitoring of the SLNA and in active collaboration with the District Planning Committee and Zila Panchayat. According to us this body of DWDU is suitably positioned to coordinate the master plan implementation of stop dam and minor tanks primarily because of finding an organic link between the watershed and the small water harvesting structures. Effectively we are recommending that minor water harvesting structures should be integrated with the watershed programme.

vi. It goes without saying that community institution around the stop dam is a must for its management effectiveness. We propose that Users' Group (those which would be benefited by the stop dam by direct irrigation) should be the best form of institution for this purpose. As it is done in several cases the process should be that at the time of site selection these potential beneficiaries to be identified and organized into UGs and build their capacity over a period of time. It is preferred that UGs make some kind of contribution for the stop dam and maintain a bank a/c. What is must for them is a normative framework for water sharing and operation and maintenance. We also recommend forming a federal structure with the representation from all users' group at the sub-basin level. The role of this federal body would be to look into the demand side of the water management, mediate between the UGs on inter village water sharing (up-steam-down stream) and oversee the implementation of the master plan of the sub-basin. Such institutions are not unheard of. Tarun Bharat Sangh in Alwar had facilitated in creating such federation of UGs on the Aravari river sub-basin called "Aravari Sansad" (which means Water Parliament)", Sadguru Water and Development Foundation in Gujarat (see case study) has formed such federation around Lift irrigation schemes integrated with stop dams and this federation provides all kind of technical services to their member society for the operation and maintenance of the lift irrigation and stop dam. ASA in Jhabua, has recently formed federation of UGs and watershed development committees on two small river basins consisting of over 80 UGs and 38 WDC. Needless to mention that community institution building being a long drawn process would require perseverance besides mandatory skills for community mobilization. The question is whether our

executing agencies have such skill and mandate to pursue the component of community organization. For both mandate and skill few agencies like PIAs of RGWMM and NVDA, DPIP, MPRLP are well placed. As we have already recommended that stop dam be made an extension of the watershed development programme we further recommend that stop dam construction should be done through the PIAs of the above mentioned agencies. There is a further advantage of doing through this route because the PIAs are assigned for an area of 5000-6000 ha. for a period of five years for watershed based livelihood development and this timeframe should be adequate to build the community institutions not only for stop dam but for other community institutions too in the watershed. Alternatively, the executing agency should go though the route of watershed PIAs of the area and the responsibility of community institutions be given to the PIAs for stop dam or any other minor water harvesting structures being built in the watershed villages.

vii. A data monitoring cell should be created to monitor the critical data related to the water recharge at the sub-basin level and several other relevant data which are required for the planning purposes time to time. At present there is a problem to find such data in organized manner or not available. This facility should be housed with DWDU. Needless to say that the data related to the master plan implementation, periodic review report, etc. should also be available in this Cell.

viii. We recommend the monitoring of the master plan implementation with the help of GIS map. The MPCOST has all the required skill and technology to do this job effectively or the state can decide to higher the services of other agencies as well. A periodic monitoring of once in a year on critical parameters should be adequate.

ix. We recommend that a common guidelines for construction of stop should be issued agreed by all concerned departments, something in line with the Common Watershed Guidelines issued by the Central Government. The guidelines must provide technical specifications, cost norms in the form of SoR, performance standards on critical parameters like site selection, storage of water, stability of the structure, usage and social mobilization. There should be a provision of third party monitoring on annual basis on the performance standards. The P&RD being the largest proponent of stop dam and also having taken initiative issuing guidelines should take the initiative for a common guidelines.

x. There are a large number of NGOs present in the state involved in the watershed and livelihood programmes with governmental and non governmental funding. About fifty such NGOs which are technically qualified have collaborated with RGWMM, NVDA, MPRLP for watershed and livelihood programmes implementation in nearly eight to nine lakh ha. area. All these NGOs were selected through a meticulous screening process by the independent experts in most cases. The NGOs therefore should be encouraged to take part in the watershed programme.

xi. As like Gujarat, Rajasthan, Jharkhand the M.P. Government should also consider utilization of part of the tribal sub-plan fund in the minor irrigation development of the state which will have direct contribution to the enhancement of livelihoods in the tribal areas.

Section-5
Case Studies

5.1 Brief of Seven Case Studies

Case 1
An Integrated Approach – A Case Study of Jhabua

Integrated watershed development has been initiated by ASA in Jhabua district of MP. The district can be characterized as semi arid with undulating topography, strong tribal dominance and subsistence agriculture. For the purpose, the organization has followed a strategy that includes land and water development, intensification of agriculture and promotion of people institutions.

Thirty-eight villages of 17000 hectares were taken in phased manner from 1997-2001 and later on from 2004-2008 another 70 villages of 32970 hectares were also included in the project. The basic idea of treating entire basin is to augment the flow of water in streams/rivers for few more months and also increase the storage of surface water. Of all the work done in the area, about 10-15 percent was contributed by community.

In all the works done, water harvesting techniques has gained major emphasis as 52 masonry stop dams, 33 earthen tanks, 13 gabion structures (mainly for silt harvesting) and 580 shallow dug wells were constructed. The structures were located in a cascading manner so that excess flow from one structure can be harvested in the next down-stream. Other than this, waste lands and common lands were reclaimed, community-wise lift irrigation was promoted, participatory selection and promotion of crop varieties was introduced, and SHG, watershed development committee (plan and execute thee WSD activities) and user groups (operation and maintenance of water bodies) are formed.

Impacts which can be distinctly visible after the implementation of programme are:

- In general the sub surface flow of water has increased significantly. This is witnessed by increase in post monsoon flow,
- Increased water table as observed in hand pumps and dug well;
- Increase in gross irrigated area through water harvesting structures and dug wells;

- About 64 percent of the households in the selected area are gaining from the irrigation sources developed during the project period;
- Improved irrigation facility has increased the crop survival rate along with the total productivity of the area;
- Increase in the yield through PVSP technology
- A study in this area has revealed that the increase in economic prosperity has able to improve the quality of house and increased the owning of assets;
- Increase in total agricultural land;
- Decrease in migration and increase in the number of children attending school;
- Decrease in the practice of financial borrowing and debt and increase in saving practices;
- Increase in the satisfaction level of people in concerned to social status/circumstances.

It can be concluded from the results derived from the programme that small river basin approach in WSD development programme enriches the natural resource condition of the area through various surface water harvesting techniques. However, institutional credit for various purposes is required after the programme to optimize the gain.

Case Study 2

Multi-Purpose Usage: Betwa Barrage, Bhojpur

Betwa Barrage Scheme across Betwa river is designed for multi-purpose usage. However, when the farmers around the storage tank used the stored water for irrigating their rabi crop, their crop turned yellow. This has been attributed to the polluted water discharged from the neighbouring industries. According to the Water Resource Department, it is the responsibility of Pollution Control Board and Industry Department to ensure the release of treated water from the industries. There is no mechanism whereby these agencies (Pollution Control Board, EPCO, and Industry Department) can be held accountable for release of untreated water in the river as they work independently and are not accessible to users (farmers) where they can lodge their grievance. Thus, at the policy level there is a need to define and determine a nodal agency that can be held accountable in cases where quality of water adversely affects the ability of users to fully realize the potential of investments.

Case Study 3
Hand-holding Support to User Group: Stop dam in Bhadbunjee Village

On the demand of villagers from Bhadbhunjee village in Shajapur district, a stop dam was constructed in 2002 with the financial contribution from MPDPIP, Drought Relief Fund, Local Area Development Fund and people's contribution in form of cash and labour. Within a year of construction, the stop dam was able to reduce migration and increase the yield of the crops substantially. Furthermore, within a period of another two years, the stop dam was able to accrued Rs.60 lakh as additional crop yield, and also 50 acres of non arable land was converted to arable land. However, due to lack of proper maintenance, the stop dam became dysfunctional within in third year.

An important learning emerged from this episode is that hand-holding support of PFT is required not only in pre-construction and construction phase but also in post-construction phase of a stop dam to the Users' group. Absence of this in this present case has led to a loss of huge gains that this stop dam could have offered. Thus, it could be concluded that involvement of agency is equally required in post-construction phase for the optimal use of infrastructure.

Case Study 4
Stop Dam Loan – A Pilot in Ratlam

Ten farmers from different marginalized communities of Karamadi village had approached ASA in 2006 with a request of constructing causeway-cum-stop dam in a nullah (stream) near their fields. After a detailed site selection, cost of construction was estimated around Rs 2.5 lakh. Of which, about 25 percent was generated from the project, rest 75 percent had to be generated through contribution from beneficiary- 25 percent as labour and rest 50 percent as cash which the farmers agreed to take a loan. After many discussions, the farmers agreed to pay interest for the loan taken for the construction of stop dams. However, most of the banks approached by ASA had demanded high interest rate or had no such schemes for such projects. To resolve the problem, ASA decided to offer the loan from a revolving fund from the project at the interest rate of eight percent. Series of meeting was organized to decide on the repayment of loan. It was decided that farmers would repay the loan in three installments to the revolving fund. Before the construction, ASA facilitated the process of formation of user group named Sunehra Kal Saawariya Jal Upyog Samiti, which was made responsible for

all the construction work of stop dams, certainly with a hand-holding support of ASA team. The causeway-cum-stop dam was successfully completed in July 2007. Increased irrigation facility has consequently increased the total productivity and thereby the income. Till now, farmers had repaid the full loan with interest. This experiment clearly indicates that even small water harvesting measures like stop dams are bankable.

ASA is exploring the avenues to replicate the similar experiment, however, with so many Government schemes around, especially NREGA, offering so much of free resources; it is difficult to sell such ideas in the villages any more.

Case Study 5
Supplying Drinking Water: Sehore Municipality Corporation

Kahari kadim stop dam in Sehore district was constructed by PHE Department in 1983-84 to meet the water requirement of Sehore Municipal Area. After the construction, the dam was handed over to Sehore Municipal Corporation for operation and maintenance. The Municipal Corporation filters water through its 'Water Treatment Plant and supplies daily to 8000 households of the Sehore Municipal Corporation. The present capacity of the plant is 80 lakh ml per day and it distributes around 40 lakh liter per day. The plant is able to meet the 72 percent of urban water need. Even now, when the State is facing an acute water shortage, the plant is able to supply the required quantity to the city.

The corporation is planning to increase the present filtration capacity to the extent of 80 lakh lpd by installing an additional filter owing to the growing demand.

Case Study 6
Sadguru's Lift Irrigation Initiative: Lifting the Spirits of Tribals in Gujarat and Rajasthan

Sadguru's 'Lift Irrigation' (LI) initiative covers 22,271 families with a total command area of 43,706 acres in Gujarat, Rajasthan and Madhya Pradesh. These systems are managed by a two-tier system of cooperatives consisting of 305 LICs and four federations of LICs. The Federations were created at the block level with the purpose of helping the LI cooperatives to become relatively independent in the running and maintenance of the LI schemes. The system is able to provide various services, other than operations and management, to its members,

like installing micro irrigation schemes (drip irrigation), developing wastelands through horticulture and supplying fodder during recurrent drought.

Till now, the federation is able to build up a total fund of Rs.33.34 lakhs. Also it is giving a dividend of 12 percent each year since 1999. It is important to note that since 2004 onwards, the federation has not received any grants and is meeting its expenses on its own. Various studies by institutions and scholars have informed a positive impact of the scheme on the local economy and socio-economic condition.

It can be concluded from the experience and available literature on the initiative that water user federation could provide maintenance services to its constituent members in a cost effective way. However, at the initial period of establishment it needs a hand holding support from the support agency.

Case Study 7

Kachnaria Dam- Way to brightness

ASA has been involved in providing irrigating facility particularly to underprivileged population, i.e. small and marginal farmers, ST and SC population. ASA has been working in Nagda block of Ujjain district since past few years. In one of its village named Kachnaria, it worked on building a stop dam for an economically backward Banjara community. The Banjara community had small landholdings and no access to irrigation. Consequently, they were able to take crops only in Kharif season and the productivity was also very low.

They used to work locally as agricultural labour post monsoon period. During rest of the year from January to May, they would migrate. The site selection for the stop dam was done in consultation with the community, which covered 11 Banjara families, who had their lands near the proposed site. A significant step was the formation of a water user group of these proposed beneficiaries. The stop was constructed in three months in 2008 at a cost of Rs.2.95 lakhs, which included Rs. 45,000 as community contribution. With the construction of stop dam, the Banjara community members got labour locally and did not migrate. In 2008-09 Rabi season, the water lasted till late January and as a result of which these 11 families started taking Rabi crops for the first time. The income generated was around Rs. 6000/- to

Rs. 7000/-. The food sufficiency has risen from 3 months to 7 to 8 months and there was no migration this year. Now, ASA plans to impart trainings on improved package of practices.

5.2 Detailed Case Studies

Case 1
An Integrated Approach – A Case Study of Jhabua

There has been a continuous debate on the efficacy of models of river basin development within the circle of policy makers and academicians. The most dominant model in the river basin development advocates the construction of large centralized reservoir to harness the runoff from the catchments areas. This of course is capital intensive and requires highly technical skills for construction and continued resource flow for maintenance. This is mainly state financed. On the other hand an alternative model of river basin development is emerging for over a decade in the water scarce regions of Central India which has encouraged decentralized land and water resources development activity following the ridge to valley watershed approach. Following soil and moisture conservation measures in the upper ridge of the basins numerous tiny masonry stop dams and earthen tanks have been constructed across the river basins with community involvement and sometimes without the technical and financial support from the State. While the debate on the efficacy of these two models continues in terms of impact and their suitability considering geo-hydrology parameters, this case study presents the case of Jhabua district of M.P. where small river basin approach has been adopted for watershed treatment with special emphasis on small scale water harvesting structures across the basins of small rivers.

District profile of Jhabua

District Jhabua, one of the 50 districts of Madhya Pradesh is considered to be one of the most backward districts of India. It has a geographic area of 6793 sq km with a population density of about 230 per square km. Out of 1.6 million population, 91.3 percent live in the rural areas. It is a predominantly tribal district with 87 percent of the population belonging to scheduled tribe (*Bhil* clans). The literacy rate is 32 percent and the families living below the poverty line is 47 percent as compared to overall M.P. average of 37.43 percent. The primary occupation is rain-fed agriculture, except for a minority, the production of food crops for subsistence dominates agriculture. The district is prone to the incidence of consecutive years of drought. The average annual rainfall is about 750mm, however, is extremely erratic. Farmers report a

crop failure of 3-4 years in ten and serious shortfall in 4 to 5 years out of ten. Irrigation facility for second crop is less than 15 percent of the total cultivable land of the district.

The project area and its characteristics

This case study particularly has looked at 38 villages of Jobat, Udaigarh[7] and Ranapur blocks of Jhabua where Action for Social Advancement (ASA)[8] has worked for comprehensive watershed development during 1997-2004. These villages together comprising of nearly 17000 ha. of land with 3306 families, all tribal, and about 22000 population. The villages are part of the basins of four small rivers namely *Dohi, Panchi* (sub-basin of Hathni, a major tributary of Narmada) & *Mod* and *Bhamchi* (sub-basins of Anas and Mahi river). Later we have discussed in detail about these small river basins and their implications in the selection of the watersheds and the strategy development.

The project area bears a resemblance to the characteristics of Jhabua as mentioned earlier. The area is characterized by the deterioration of natural environment and has resulted in a decline in farm yields reducing the ability of the average households in the area to maintain a stable access to basic human needs. As per the baseline information about 62% of the families of the project area did not have the food security for the whole year from own agriculture sources and out of which 36% reported severe shortage of food grain for 6-7 months in a year. The rest 38% had just enough to meet the food requirements for the whole year with marginal marketable surplus, but in a drought year they too had to face the shortage of food grain from own sources.

Once forested extensively, the degradation of the environment has been caused by a combination of factors. The denudation of forest cover has led to extensive soil erosion in the generally undulating topography of the area. Declining farm productivity increases population pressure on natural resources and accelerates further degradation by inappropriate agriculture practices.

The average land holding per family is about 2 ha. but considering the undulating topography, poor soil health (low soil depth, gravelly & low in nutrition) and lack of

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[7] Jobat & Udaigarh now fall under the Alirajpur district which has been carved out of Jhabua district in 2008

[8] ASA is a not for profit development organization based in Bhopal, has been working over a decade for rural livelihood promotion through natural resources development in M.P. and Bihar.

irrigation, this is not considered enough for providing stable income source for a family of 5-6 members. The table below provides information on the state of agriculture in the project area. This is an average of all the project villages collected as part of the baseline exercise.

Table 1: Land, Water & Agriculture Features of the Project area

Sr. no	Particulars	Data
1	Average land holding	2 ha
2	% of Net sown area to total geographical area	77
3	% of Net irrigated area to net sown area	9
4	Fertilizers consumption Kg/Ha	19
5	Cropping intensity %	118
6	Double cropped area to Net sown area	<10%
7	Seed Replacement Rate %	3

Source: Baseline information

Table 2: Major Crops & their Productivity (Qtls/Ha.) of the Project area

Sr. no	Crop	% of the crop sown to the net sown area[2]	Av. Productivity Project area[2]	Av. Productivity Natioanl[1]
1	Maize	76	10	19.83
2	Blackgram	11	3	4.5
3	Soyabean	8	6.41	12.08
4	Paddy	2	4.88	20.51
5	Cotton	3	1.18	5.6
6	Wheat	30-35	12	27.07
7	Gram	60-65	3	7.92

[1]source: Commissioner of Land records, M.P., Gwalior

[2]Source : Baseline information

The table above infers two findings clearly. Firstly, the production of food crops dominates agriculture and secondly the productivity is far below the desired level. Also it was found that the varieties grown were very old and had lost genetic purity due to improper conservation measures. The agronomic practices were also not upto the mark.

As livelihoods became more difficult to sustain, borrowing to supplement livelihood deficits was the norm to survive. Poor outreach of banks and other formal financial service organizations to meet credit needs of these people have forced them to accept the exorbitant interest rates of local moneylenders which is perpetuating into debt cycles. The rate of interest is as high as 120%. As it was found that 70-80% of the households in the area were supported by the extra income obtained through seasonal migration for about 6-8 months in a year.

The approach that was followed

ASA realized that significant opportunities for enhancement of livelihoods exist in the area through restoration and management of available natural resources. It developed a strategy which was based on the hypotheses that –

- ***Development of Land, Water and Vegetation holds the key for improvement in livelihood; and***

- Agriculture intensification and diversification and provision of institutional credit for agriculture and finally local institutional development for management and sustainability are key instruments in optimizing the investment on the natural resources.

The strategy essentially included three basic components. They were :

(i) Land development, which is the fundamental for productive agriculture, to check the soil erosion and increase the precipitation of rainfall. The key element of the strategy was to reduce the velocity of water through different mechanical measures (viz. farm bunds, contour trenching, vegetative barriers, gully checks, etc.) so that maximum percolation of water takes place and at the same time the soil erosion is checked.

(ii) Water resources development by harvesting surface run off in the valley portion in the form of small to medium size[9] masonry Stop dams on the streams and rivers flowing through the

[9] Small size means 15-20 meters in length and medium is within the range anything between to 20 to 89 meters.

area and construction of earthen tanks in the valley portion of the basin. The water harvesting structures were built (especially the stop dams) in a cascading manner so they formed a series of stop dams in the streams. The idea was to increase the storage of surface water which can be used for the purpose of irrigation for Rabi crop (winter crop) and for life saving irrigation for monsoon crop in the event of failure of monsoon in the mid way.

(iii) Agriculture intensification and diversification was the third component of the strategy which aimed at making appropriate farming technologies available to the farmers who can themselves test and adopt the suitable technologies to build further on the augmented resources. While other agriculture interventions take time to mature, varietal change can increase productivity up to 30-40% in one or two years time. The participatory method of selection of crop varieties and its adoption and improving the seed Replacement Rate was taken up as the key strategies for agriculture intensification.

(iv) The most important strategy was to build and promote people's institutions around the natural resource interventions. There were two types of peoples' institutions that were promoted. They were :(a) creating institutional mechanism for supply of agriculture credit. Community members (12-15 families), mainly women, were formed into SHGs for monthly thrift and credit activity to inculcate community banking practices and after a certain period of time they were linked with the formal financial institutions for refinance; and (b) building community institutions around the natural resources in the form of Users' group and watershed committees to plan, execute and maintain the natural resources interventions. To make the institutional development process more inclusive special emphasis was given to the poorest and women who are largely vulnerable group in the society. Community contribution towards the costs of interventions was encouraged to strengthen community participation and ownership.

(i) Inherent supportive conditions

Two distinct agro-climatic conditions of the area were favourable for the implementation of the above model. *Firstly*, the geological formation of the area consists of compact basalt rock which favoured more discharge of water in the form of base flow as a result of various mechanical measures of soil and water conservations in the ridges of the villages or watersheds. Due to increased sub-surface recharge the availability of water in streams and in the valley increases substantially. *Secondly*, the area has innumerable number of small streams draining to the smaller rivers flowing through the area. These streams and small rivers are seasonal in nature and are alive only during the monsoons. The network of these streams and rivers are part of the basin and sub–basins of the bigger rivers of the region. The above two conditions helped in determining strategy to adopt a mechanism of ridge to valley treatment for the natural resources development. The villages were therefore chosen or the project area was identified in a manner that they are geo-hydrologically contiguous and are

from the basins of the four small rivers namely *Dohi, Panchi* (sub-basin of Hathni which is a major tributary of Narmada) & *Mod* and *Bhamchi* (sub-basins of Anas and Mahi river). The basins of these four rivers comprise of about 120 villages with an area of 61200 ha.

Selection of Area

ASA started working in 17000 ha. of 38 villages of these four basins in a phased manner. 15 villages were taken up in 1997 followed by 14 and 09 in the year 2000 and 2001 respectively. Later on from 2004, ASA has again started expanding its work in these basins and have reached 70 villages (32970 ha.) till 2008. The basic idea here is to systematically treat the entire basins of these four small rivers for land and water resources development in order to (a) augment the sub-surface ground water system so that increased flow in the streams and rivers continue more number of months in a year, and (b) increase the storage of surface water through water harvesting structures for creating additional source for irrigation.

The investment

The work has been supported for the 38 villages of the reference of this paper through multiple sources of funding. The main funding came under the National Watershed Programme of the Government (Rs.597.39 lacs for 29 villages) and Rs.270 Lakhs from the non-governmental donors. An estimated average of 10-15% of the cost came through the community contribution. All together an average of Rs.5000-5200 per ha. was the total cost of investment in the project.

The results

Till 2004 the resources that were developed were :

Comprehensive Soil and Moisture Conservation works were completed in 10500 ha. This includes reclamation of 437 ha. of waste land by harvesting silt through natural process and converting them into paddy field. This was a traditional practice in the area called "NAD", however disappearing due to people's inability to put in labour (the works require substantial amount of labour) due to high opportunity cost of labour.

Major emphasis was placed to the water harvesting and that led to the construction of 52 Masonry Stop Dams on the rivulets and rivers, 33 Earthen tanks (Talav), 13 Gabion structures (mainly for silt harvesting) and 580 shallow dug wells (of which 480 were at the individual household level and 100 as common wells shared between two-three households).

All the water harvesting structures were constructed mainly in the valley portion mainly on the rivers and rivulets. The structures were located in a cascading manner so that excess flow from one structure can be harvested in the next in the down stream. This was an effort for optimizing water harvesting with economics in view.

Three small group based lift irrigation and one big community based lift irrigation system were developed.

Nearly 200 ha. of Common Land (Forest and Revenue), which was barren, brought under collective protection resulting into natural regeneration. Planting of trees in the common land and in the homestead was avoided by design due to the experience of poor survival rate in the region due to lack of moisture during critical stage and also a generally callous attitude of the farmers towards caring of the plants. Instead efforts were made for regeneration of the common land through collective protection. Fortunately the area still has a good amount of root stock available which proliferates rapidly if human and cattle disturbances are taken care of.

For agriculture a single focused effort was made towards replacement of varieties and increasing Seed Replacement Rate (SRR). 5-6 varieties of Maize, 4 varieties of wheat and paddy each and 2 varieties of Black Gram were tested with nearly 780 farmers over a period of 5 years following the protocol of Participatory Selection of Varieties. Following PSV about 500 quintals of Certified and Foundation level seeds of farmers' preferred varieties (which came out of the participatory trials) of the above mentioned crops were distributed among 1500 farmers (approx.).

1032 Self-Help Groups[10] have been developed covering 10132 families. 67% of these SHGs are women. The saving base of these SHGs is Rs. 96 Lakh and have taken loan to the tune of Rs.363 Lakh. Three Block Level SHG Federation, Registered under Societies Act. are functioning in Jhabua in which the SHGs of the project villages are the members.

[10] ASA has 1032 SHGs in over all Jhabua, including the 38 villages of the reference of this paper

Ninety one Users' Groups have been formed and developed mainly for the operation and maintenance of the water bodies (85 Water Users' Group, 2 Common Land Users' Group & 4 Lift Irrigation Group).

Thirty eight watershed Development Committees were formed and developed essentially to plan and execute the watershed activities in conjunction with the project implementation team from ASA.

Impacts which are distinctly visible are :

- In general the sub surface flow of water has increased significantly. This is witnessed by

  a. In five major rivulets of the area it has been observed that post monsoon flow time has increased at least by 3-4 months than pre-watershed programme. These rivulets used to dry up by end of November in a normal rainfall year which now flow till mid of March or some cases till mid April. In a scanty rainfall year too the additional flow of one and half month to two months is observed in comparison to pre watershed scenario.

  b. Fifty five hand pumps and 87 dug wells in the project area have been monitored and found of their increased recharge status in the post watershed. Some of the hand pumps which were dry earlier has revived again as reported by the farmers. The incidence of increased recharge can be corroborated by the fact that during 2002-06 nearly 450 new shallow dug wells have been constructed by the farmers on their own due to availability of water in shallow depth.

  c. A survey was conducted in January 2004 and repeated in 2008 for **all** water harvesting structures including 58% of the total dug wells constructed to assess the effectiveness revealed that :

     § 96% of the water harvesting structures - stop dam and earthen tank are being used for the irrigation purposes, mainly during Rabi season. In total 1735 ha. of land is

under irrigation during Rabi benefiting 1041 farmers by direct lifting of water from the structures. It is estimated that another 400-500 ha. is getting irrigation benefits in the down stream of the structures due to increased flow in the streams.

- Out of the 336 dug wells surveyed (58% of the total constructed) it was found that 98% of the dug wells are functioning and each well is irrigating about 1 ha. of land during Rabi; 78% of them are used for survival irrigation in Kharif; and 49% of the surveyed wells are being used for summer crop (mainly vegetables, and green fodder). Extrapolating from this fact one can estimate that about 550-560 Ha. of land is under irrigation during rabi because of the 580 dug-wells constructed in the project. Considering the double or triple irrigation benefits as it has happened in case of dug wells and also the 450 dug wells constructed by the farmers on their own the gross irrigated area amounts to nearly 1500 ha.

- Hence, considering all water harvesting sources the Gross Irrigated Area in the project villages has increased to nearly 3300 ha. from the pre-watershed scenario of 1178 ha., a nearly 300% increase to the gross irrigated area to the net sown area. The Gross Irrigated Area to Net Sown Area of these villages has increased to 25.21% from the baseline figure of 9%.

- In terms of distribution of irrigation benefits it has reached to a total of 2137 farmer households of the total of 3306 number of households at the time of baseline. So 64% of the households have now irrigation benefits for an average area of 1.54 ha.

d. In November 2007, ASA commissioned an external study[11] to assess the impact on livelihood of the watershed programme in the project villages. The objective of the study was limited to understand the economic impacts and social impact– in particular, the impact on migration and education. The sampling was drawn only from the population of those benefited by irrigation. Fifty samples were randomly drawn from seven project villages. Some of the findings of the study are:

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[11] Gettings, S. & Malviya, S. (Nov'2007), Durable Livelihood Assets: Impact Assessment of ASA's Watershed Programme

- The number of homes owned by farmers is a good measure of economic prosperity. Of all farmers surveyed, 54% (27 individual farmers) improved their houses from Kachcha to Pakka constructions.

- Of all individuals interviewed, 82% (41 farmers) gained further assets of livestock & agriculture implements. For instance, 58% of respondents gained a water pump consequent to the WSP and 30% increased the number of small livestock. Other assets reported are motor cycle (24%), big livestock (22%), television (16%), tractor (8%), treasure/ornaments (8%), etc. indicate some improvements to aspects of living standards.

- Inadequate irrigation clearly poses problems to the productivity of farmers' land. The larger the amount of land irrigated the more productive a farmer's crop can be. Subsequent to the WSP the amount of farmers land irrigated has dramatically improved. Prior to the WSP just 13% of farmers' land was irrigated. Following the WSP this has increased to 57%; a growth of 44 percentage points. Farmers now have 259 Acres of irrigated land in total, an addition of 204 Acres compared to before WSP.

- Subsequent to the WSP the area of land in production during Rabi has increased considerably from just 14 Acres prior to WSP to 137 Acres afterwards; an increase of 879%. Additional income from this increased availability of irrigated land has provided farmers food security without the need to migrate to support themselves financially as well as additional saving through reduced dependency on credit to purchase food.

- The total increase in land in cultivation during kharif has risen by 31% from 293 Acres to 382 Acres.

- Prior to the WSP on average just under half of every household (64%) were forced to migrate to earn enough money to survive during lean agriculture period. After the WSP and especially after having the irrigation benefits the proportion of the household migrating has been reduced to under 20%. More encouraging is that the proportion of households reporting that no family members were required to migrate

has almost doubled from just 30% to almost 60% following the WSP. .

§ A second important social impact that has been noted since the implementation of the WSP is the increase in the number of children attending school. Between the period before the WSP and afterwards this number has increased by 70% from 53 children pre-WSP to 90 children post-WSP, largely due to reduction in number of migrating families.

§ Previous research carried out by ASA also suggests that due to the WSP the issue of financial borrowing and debt is less pronounced. In some cases, the dependency on this form of subsistence is completely removed whilst for others it is reduced. The result of both is increased savings; increased self-sufficiency and reduction in the issues connected to extortionate money lending.

§ Prior to WSP, 84% of respondents found their social status unsatisfactory. Following WSP all farmers are at least satisfied with their circumstances and the majority (50%) considered their social circumstance as good. A number of further indicators support these improvements including the number of economic migrants as well as access to education and farmers' debt situation.

e. An internal assessment was carried out in 2006 to find out the extent of dissemination of the varieties that were selected through farmers' participation and subsequently promoted. The variety[12] called NLD of Maize and Vandana of Paddy were found to be preferred by the farmers due to bigger cob size, higher yield and drought resistance (for Maize) and higher yield, early maturity and better grain size (for Paddy). The rapid assessment in the project area found that over 20% of the cropped area is under the varieties of NLD and Vandana, thus ensuring about 25-30% of yield increment per unit of area.

f. It is observed that the productivity of land has improved due to check in soil erosion

[12] NLD is a variety originated from Government of Sikkim & seeds sourced from the Department of Agriculture, GoMP & Vandana is originated from the Central Upland Rainfed Rice Research Station, Hazaribaug, Jharkhand & seeds sourced from the CURRRS

and enhancement of moisture regime in the soil. As a result the crop survival rate has improved and the area under chick pea which is grown with the help of residual moisture has increased significantly during rabi.

g. The cumulative performance figures of micro finance programme of ASA show impressive growth, which picked up since March'05-06 and has accelerated during the past two years. The total number of members joining the SHG movement in the region increased from 355 in March 2003 to 10,631 by March '08. The corresponding figures for the number of SHGs were 189 to 1032 representing a five-fold increase. Similar trends could be seen for the amount of savings, which increased from INR 0.85 m to INR 9.6 m during the same period and the total loans, which increased from INR 2.4 m to INR 36.3 m. The annual credit requirements range from about Rs. 15,000/- in interior villages like Tikikheda to about Rs. 25,000/- in villages, which are more dependent on agriculture. At present the older SHGs (more than 5 years of age), are able to meet about 60-70% of this requirement through the credit service from the SHGs[13].

h. The Users' group formed around water and other interventions are found to be active in maintenance of the structures (since 2004, ASA has not provided any support for closing or opening of the gates of the Stop dams. It is found that the gates are timely closed and opened by the members of the users' groups and repaired as and when required), and distribution of water. Same has been the case with the lift irrigation groups. For the Common Land users' Groups one is functioning well while the other one has gone into the conflicts over the resources. The Watershed Development Committees which were found to be active during the planning and implementation stage are now found dormant. It is apparent that they lack vision and guidance to take the progress to the next level. An attempt is being made by ASA to organize the WDCs and UGs of the project area under an umbrella organization for the purpose of demand and supply management of the said four basins of the small rivers. This organization can coordinate with the primary organizations like WDC & UGs for supply and demand management of the micro watersheds and also can become a

[13] Pastakia, A (May-June'2008) : Promotion of Micro finance initiatives in Jhabua district of M.P in central-west India by ASA - an evaluation study

service delivery organizations for agribusiness and agriculture extension.

Key lessons:

§ Small River basin approach in watersheds makes a positive and fundamental change in the resource conditions because the geo-hydrological conditions in the area is such that it helps significantly for sub-surface recharge. Under such condition the small river basin approach results in more benefits.

§ Major thrust needs to be on the surface water harvesting which creates condition for intensification and diversification of agriculture.

§ The approach of constructing the small water harvesting structures and that too in a cascading manner seems ideal as it optimizes the water harvesting in one hand and cost effective on the other.

§ Decentralized approach in water harvesting and engaging the Users' group for distribution and future maintenance seems to be working well. As it is found that small users' group concept works well around an economic asset like stop dam or earthen tank in this case.

§ Small and medium sized (5-20 mts. width) nullahs (drainage system) can be converted into paddy fields if water velocity in the ridge is controlled. This activity can reclaim thousands of ha. of wasteland for productive agriculture. This is important especially when the per capita quality land is abysmally low and shrinking fast in the area

§ Post watershed activities like dug wells, small group lift irrigation, orchards, vegetable garden, improved seeds and technologies like vermi compost can add significant value to the farm income and these activities can be done with less subsidy or on loan basis,

§ Institutional credit for agriculture is a necessary requirement to support the growing NRM based economy, otherwise majority of the marketable surplus of the farmers would end up in paying the high credit cost to the private money lenders.

§ Jhabua is a classic representation of Central India which is semi arid, undulating

topography, tribal dominance and subsistence agriculture – the approach therefore has a larger relevance.

Case Study 2
Multi-Purpose Usage: Betwa Barrage Bhojpur

Bhojpur village is a place of historical and religious importance located in the districts of Raisen. Named after its founder, the Parmar King Bhoj, the village is situated on the banks of river Betwa and houses a Shiva temple and a Jain shrine. The Bhojeshwar temple dedicated to Lord Shiva and is famous for the largest Shiva Lingam and the fact that the temple was never completed. An unfinished Jain shrine is also located in the village containing a 6 meter tall statute of Mahavir and two statues of Parsvanath and Mantunga.

Betwa river finds mention in Mahabharat along with Charmanwati river. Both these rivers are tributaries of Yamuna. Also known as 'Vetravati', which means 'containing reeds', the river in the Vindhya Range just north of Hoshangabad and flows north-east through Madhya Pradesh and empties itself in to Yamuna at Hamirpur town in Uttar Pradesh. Nearly half of its course of 610 kms runs over the Malwa Plateau before it breaks in to the uplands of

Towards the west of Bhojpur there was once a vast lake. The site for the lake included a natural wall of hills that enclosed the whole area except for the opening of 100 and 500 yards in width. These gaps were closed by earthen dams as a result of which the embankments held water of about 250 sq miles of water. This lake was destroyed by Hoshang Shah with the aim of adding an area with very high fertility to his possession. According to the Gond legend, it took an army three months to cut through the dam and three years for the lake to empty itself. The bed of the lake was habitable 30 years after the water was drained off. The remains of the cyclopean dam exist in the area and the local population is familiar with the stones that were used for the construction of the dam.

Betwa Barrage Scheme

Betwa Barrage Scheme is a multi purpose project designed to construct a concrete barrage across Betwa river with the objective to supply water @ 48 lakhs liters per day to cater to the water requirement for 25 MW thermal capacity power plant of HEG limited at Mandideep; and for providing irrigation of 140 hectares of area in 8 villages adjoining the dam. The Scheme also includes raising the height of Bhojpur Barrage by 0.5 meters that has been constructed on Kaliasot river. This increase in height is expected to increase the present storage capacity of 1.42 to 1.73 mcum. The cost of raising the height of the dam was included in the Betwa Barrage Scheme which also included additional protection works and repairing of gates of the Bhojpur Barrage.

The cost of water supply and laying of pipes from the Barrage to HEG was borne by HEG. In addition HEG deposited Rs 1 crore as advance payment of water charges to the department so that construction could be started. The Schemes was approved in 2003 and was completed in 2007. The initial estimate of Rs 441.70 lakhs was overrun by double this amount.

According to the DPR of the scheme, the tropical situation of the Betwa river along with its tributaries is flatter up to 10 to 15 kms upstream of the proposed site and it forms 6 to 8 meters deep gorge near the Bhojpur temple. This typical situation of the Barrage site makes it capable to store 3.38 million cubic meters (mcum) of water. With a mean rainfall of 1247 mm and the catchment area of 1647 sq kms, it has been estimated that the Barrage will have Storage capacity of 5.28 mcum and Live Storage of 4.75 mcum. The Full Reservoir Level of the dam was estimated at 422.5 meters that will be available with the construction of a Concrete Spillway (Ogee) type structure with a height of 6.5 m and length of 120 meters. The design also included installation of 20 gates of 1.5 x 2 m size.

Utilization

The storage capacity created for the HEG is being realized and the water is supplied to the factory through pipe lines. The issue is with respect to the non utilization of irrigation potential on account of poor quality of water stored in the dam. The Scheme had visualized that the farmers would lift water on their own from the storage tank and hence no channel or canal was constructed from the storage tank of the dam.

The farmers around the storage tank of the canal used stored water for irrigating their wheat crop during Rabi season of 2005. They found their crop turning yellow (*fasal jal gayee*) and attributed it to the poor (polluted) quality of stored water in the tank. The reasons that led farmers to attribute their loss of crop to the quality of water was based on their observations that included:

- the water in the barrage reservoir was black in colour and muddy
- presence of constant stench and bad odour around the storage tank
- people who took bath in the tank had boils on their body

As a result, the farmers stopped lifting water from the reservoir of the barrage for irrigation from 2006 onwards. They instead prefer to take water from the wells that are in the vicinity of the barrage that according to them have been recharged and have a higher level of water after the construction of the dam.

Issue

The present study did not conduct any scientific tests to determine the quality of water in the storage reservoir of the Betwa Barrage. Yet the discussions with the farmers and the representatives of the Water Resources Department, Panchayat representatives and the members of the village community strongly indicate:

- colour of water is muddy to black
- bad odour emanating from the reservoir
- no presence of aquatic life due to fall in the proportion of dissolved oxygen in water
- water unfit for drinking purpose (water to Bhojpur village is supplied through a bore well)
- people would take bath in the river during Makar Sakranti and Shivratri have stopped doing so as they find the water *dirty*

It is not that the quality of water has decreased **after** the construction of the barrage. The fact is that earlier the water was flowing that would treat the water as the pollutant would be exposed to sun and would get deposited at different places. However, with damming, the water is now stored and stands in the reservoir that has been created by the barrage. This has the affect of bringing the pollutants and depositing them on the bed of the reservoir. The Water Resource Department and the farmers find that the water is unsuited for irrigation purposes as it would adversely affect the health of standing crops and also affect the quality and fertility of land in the long run. According to the Department they did not take in to account the issue of quality of water as they were aware that the Pollution Control Board and the Industry Department has the responsibility of ensuring the release of treated water from the industries.

Construction of a check dam or barrage is part of public investment to provide private benefit to farmers and public benefit in terms of ecological restoration and tourism. Release of waste (industrial or otherwise) that adversely affects the realization of these benefits also adversely affects the cost benefit ratios that have been determined for such investments. The agencies responsible for ensuring release of quality water (treated water) work independently and are not accessible to users (farmers) where they can lodge their grievance. There is no mechanism whereby these agencies (Pollution Control Board, EPCO, and Industry Department) can be held accountable for release of untreated water in the river. At the policy level there is need to define and determine a nodal agency that can be held accountable in cases where quality of water adversely affects the ability of users to fully realize the potential of investments.

Case Study 3

Hand-holding Support to User Group: Stop dam in Bhadbhunjee Village

The Madhya Pradesh District Poverty Initiatives Project (MPDPIP)[14] was launched in March 2001 in 2932 villages spread over 53 blocks of 14 districts of the State to improve the economic wellbeing of the poor. One of the important strategies of this project was formation of Project Facilitation Teams (PFTs) for a cluster of 25-30 villages to guide the villagers for self-development and providing them with the support mechanism.

In the Agar block of Shajapur district, Centre for Advanced Research and Development (CARD), an NGO working on the issues of livelihoods was chosen as PFT. While working there in a village named Bhadbhunjee in 2001-02, a PRA was conducted it was found that there was lack of infrastructure related to irrigation in that village. Although, there was a minor irrigation dam known as 'Tillar dam' near the village, however the water from this dam could barely reach Bhadbhunjee since it was located in the tail of the this dam's command area.

There was local river Lakhundar flowing nearby on which the villagers expressed their demand for a stop dam. The PFT team members including an engineer visited the site for a detailed inspection and assessment to find about the suitability of stop dam to be built of this site. After a detailed study, the site was found to be suitable for the construction of stop dam.

The total cost estimated by the PFT for this stop dam was found to be Rs. 24.65 lakhs. Convinced with the great utility that this stop dam would offer, the District Project Manager of the DPIP gave the approval for its construction. However, the DPIP approved to pay a cost of Rs. 12 lakhs only (under the Z category of DPIP meant for common interest infrastructure) and rest was supposed to be raised from other sources.

Thereafter, the PFT began concentrating on tapping the various resources through which the

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[14] MPDPIP is a poverty alleviation program designed to empower people for self development so that the poor create and manage their own development opportunities. The DPIP targets socially and economically disadvantaged groups, particularly:

· the SC/ST households;

· households migrating out for wage employment;

· households without proper shelters/ dwellings;

· women and women headed households.

rest of the money could be raised for the stop dam construction. Along the course of this process, a lot of stakeholders chipped in with their contribution to make the stop dam a reality. An important source which the PFT was able to secure was in form of the Drought Relief Fund worth Rs. 5 lakhs. Mr. Manish Singh, CEO, who came across the proposal of this stop dam, visited the site and found it to be of significant value helped in attaining this fund.

Furthermore, the PFT also approached the local M.P. and was able to convince him about the acute need of the stop dam. Realizing this, he agreed to set aside Rs. 2.5 lakhs from the M.P. Local Area Development Fund for this project. This led to a total of Rs. 19.5 lakhs being raised for the stop dam's construction. The rest of Rs. 4.5 lakhs were raised from the community in form of cash and labour contribution as mandated by the projects approved under DPIP.

In this project, there were 360 beneficiaries, 260 from Bhadbhunjee village and 100 from five adjoining villages. A group known as 'Bhairu Maharaj Samhit Samooh' to undertake construction of the stop dam was formed of all the 360 proposed beneficiaries were formed which comprised of a President, Secretary and two signatories. Once the pre-construction phase of community & fund mobilization, user group formation and strengthening got over, in February 2002, the construction of the stop dam was initiated amongst much fanfare and got over in June, 2002. With prudent planning the stop dam construction was finished in Rs. 19, 60, 000. This stop dam known as "Kalaghata Stop Dam' was 125 meters in length, 1.21 meters in height and had 40 gates. That year there were early monsoon and the gates were closed in September. At the time of final inauguration, the backwater of this stop dam went till a distance of 5 km.

Another group 'Bhairu Maharaj Jal Vikas Samiti' was formed for the upkeep of this stop dam. It had three wings namely, 'Water Fee Collection'; 'Maintenance' and 'Administration'. It had three different presidents and had byelaws in place.

The immediate result as a result of the stop dam's construction was that 100 families in the Bhadbhunjee village didn't migrate that year, which they would usually do to work in Kota in the limestone activity. The villagers along with the facilitation from PFT did crop and irrigation planning. In the first year itself, Rs.9 lakhs worth of additional crop yield was produced as a result of assured irrigation of the stop dam. The amazing results led to many high profile visits to this site. In the second year of its operation, after closing of the gates, the backwater of this stop dam went till a distance of 9 km. Furthermore, in two years time Rs.

60 lakhs were accrued as a result of this stop dam. Additionally, a total of 50 acres of non arable land was converted to arable land.

However, slowly there were problems which emerged like key people slowly leaving the project. As a result, there was a loss in momentum of the work. Without lack of proper facilitation and initiative, the community members did not put in enough efforts towards the maintenance work. In the first years maintenance work worth Rs. 30, 000 needed to be done, which was not undertaken. This resulted in further damages to dam and the expense of undertaking the maintenance work later rose to Rs. 2 lakhs. Furthermore in the third year, the gates were not taken out. Consequently, the intense flow of water damaged the key-wall and the stop dam could work properly only for two years.

There was no proper water fee collection, moreover, a village on the other bank had constant supply of electricity started lifting more water. Then this idea came of inviting GAIL to avail water from this stop dam at a fixed rate provided it leaves enough water for the village. It continued for a year and thereafter, since there was no water storage in tank GAIL could no longer avail water. Eventually the stop dam was rendered dysfunctional.

An important learning emerging from this episode is that the construction of any infrastructure comprises of three phases 1) Pre-construction phase (comprising of community and mobilization, collectivizing the community in user group, facilitation in planning), 2) Construction phase (handholding and facilitation of the community during the construction) and 3) Post construction phase (providing support in maintenance and maximizing gains from the infrastructure) and equal efforts need to be put in all the three phases by an agency executing such a project.

While the PFT in this case made huge efforts in the first two phases and started on the right note in the last phase as well, but the clear absence of constant support to the people's institution for a longer duration led to undoing of this project, thus failing to capitalize the huge gains that this infrastructure had the potential to offer. To derive the maximum advantage from any infrastructure created, no agency involved can discount the significance of post project involvement and constant support needed for the community on a long term basis.

Case 4

Stop Dam Loan – A Pilot in Ratlam

ASA has been working in Ratlam district since past few years with an aim to enhance rural livelihoods in the area. Karamadi is one of the programme villages where ASA has been working. There, a group of farmers, who had their fields in the vicinity of a 'Nullah' (stream) were facing major problems in terms of free movement due to nullah acting as a barrier and water shortage for irrigation. These farmers had seen the works being undertaken by ASA and approached the organization in 2006 with a request to construct a causeway-cum-check dam. Comprising of 10 farmers, this group had members from different marginalized communities with majority having small land holdings.

Subsequent to receiving of this request, a dialogue process was initiated with the community to explore various possibilities of taking this task forward. A detailed site selection was done and the estimated cost of the causeway-cum-check dam in the area was found to be Rs. 2, 50, 000. Since no readily available money was there with only 25 percent of the being contributed from this project, the rest of the money would have to come from farmers' side. This will include 25 percent will be farmers' contribution and rest 50 percent of the money will be raised through a bank. After the initial dialogue, the farmers evinced interest in this mechanism and ASA started exploring loan option for this project. But most of the banks either demanded high rate of interest or had no schemes for such projects. Moreover, farmers expressed their ability to pay an interest rate of not more than 8 percent.

This led to the project not taking off for some time. Finally, after exploring all the possibilities, ASA decided to offer 50 percent loan from a revolving fund from the project at the interest rate of eight percent. The entire process took a series of meetings by ASA with the farmers, where their concerns were addressed and convincing was done for the contribution and the farmers agreed on this arrangement. As per this arrangement, the causeway cum check dam was to be constructed with 75 percent contribution by 10 users of this proposed structure. The contribution from the farmers was calculated on a differential basis as per the need and the size of land holdings. The farmers were supposed to pay the loan amount in three installments. The structure was constructed with high involvement of the community going far above only the cash contribution component. ASA facilitated the process by forming a user group at the very inception. This group was named Sunehra Kal Saawariya Jal Upyog Samiti.

This group had a president and a treasurer elected by the users were involved in the purchase of material, making the labour available, overseeing the construction work, management and maintenance of accounts with facilitation of ASA. In this process, the group cohesion and capacities were developed thus sowing the seeds of sustainability. The causeway-cum-check dam was successfully completed in July 2007. A major benefit was that the farmers had ready access to proper pathway to their fields. Besides, there was enhanced recharging and water availability. A total of six farmers spread over 15 acres have started reaping direct benefits. These farmers, who had just about sufficient water available for only two waterings in Rabi for wheat, now had four waterings available, thereby increasing the production by 20 to 25 percent in Rabi 2007-08. Moreover, 3 other farmers were benefiting indirectly with enhanced water level in their tubewells and their wells had water available for 20 more days. In the Kharif of 2008, the famers were able to take life saving irrigation for soybean since it rained less in Ratlam.

Post Construction Scenario (2008)

Kharif	**Av. Production**	**Rabi**	**Av. Production**
Soybean	5 quintal/acre	Wheat	12 quintal/acre

Till now, farmers had repaid the full loan with interest.. This experiment clearly indicates that even small water harvesting measures like check dams are bankable. However, it takes longer processing time and requires the area/beneficiary to be in a little better off condition. The economics that we have worked out for two successive seasons are very favourable with very high internal rate of return in a short span of time like 4 years, while the life of such check dam with little maintenance can be more than 20 years easily. ASA is exploring to conduct this experiment on a little bigger scale and with different samples. However, with so many Government schemes around especially NREGA offering so much free resources, it is difficult to sell such ideas in the villages any more.

Case 5

Supplying Drinking Water: Sehore Municipality Corporation

Role of Stop Dams in Providing Drinking Water in Sub-Urban & Urban Areas in Madhya Pradesh

The general perception of stop dams is that they are primarily constructed for providing irrigation facility. However, their utility goes beyond provision of just irrigation water. An important utility is also of providing drinking water. A significant department in the state involved in constructing of stop dams for drinking water provision is PHED.

One such stop dams was named Kahari Kadim visited in Sehore district which was constructed by PHED. This stop dam is located on Parvarti river constructed in 1983-84 had the objective of supplying drinking water to the municipal area of Sehore. After the stop dam was constructed, it was handed over to Sehore Municipal Corporation (Nagar Pallika). The municipal corporation's role is to get the water filtered through its water treatment plant. Besides, the municipal corporation's role also extends to maintenance and operation of this stop dam. This role is being played through a 250 strong team of PHED staff members, who are on deputation with the municipal corporation. Their salaries and other benefits are being met by PHED. Thus this stop dam is a great example of inter staff collaboration. This plant has the present capacity of 80 lakhs liter per day (lpd) through which 40 lakhs liters per day is filtered and further distributed through pipeline network.

Today, this stop dam is providing tap water to 8000 households and serving a population of around 45,000 in the urban region Sehore. The per capita per day requirement in Sehore district is 50 liters out of which 72 percent is being met through this stop dam, while remained 28 percent is being catered through local sources like borewell, hand-pumps, dugwells etc. Therefore it can easily be said that this stop dam is the lifeline of the Sehore urban region. Even at this time of year, when the state is facing an unprecedented shortage of water, the region is able to manage its water needs with this stop dam proving its criticality in meeting the water requirement in the region.

Basic Details of the Stop Dam

Sr. No.	Particular	Details
1	Name of District	Sehore
2	Name of Stop Dam	Kahari Kadim
3	Name of Department	PHE
4	Year of Construction	1983-84
5	Storage Capacity	45 mcft
6	Length	143 m
7	Height	4 m
8	Back water	7 Km
9	Openings	60
10	Filters capacity	8 lpd

The future plans of the municipal corporation is to increase the present filtration capacity of 80 lakhs lpd to 120 lakhs lpd by installing an additional filter owing to the growing demand.

Case 6

Sadguru's Lift Irrigation Initiative: Lifting the Spirits of Tribals in Gujarat and Rajasthan[15]

Introduction

Sadguru Foundation[16] has earned over a period of three decades, a national reputation for promoting large scaled Lift Irrigation (LI) systems, which are eventually run and managed by the tribals themselves. Sadguru's model of LIs has worked where many similar initiatives in different parts of the country failed.

Sadguru's LI initiative has come a long way since the first three LI schemes were launched in 1976 and 1977 on an experimental basis. Sadguru's LI initiative covers 22,271 families with a total command area of 43,706 acres in the three states of Gujarat, Rajasthan and Madhya Pradesh. These systems are managed by a two-tier system of cooperatives consisting of 305 Lift Irrigation Cooperatives (LICs) and four federations of LICs. The Federations were created at the block level with the purpose of helping the LI cooperatives to become relatively independent in the running and maintenance of the LI schemes.

Federation as Service Provider

Table 1 provides a brief profile of the four federations. A fifth one is also visualized to cover the remaining LICs under Sadguru Foundation's supervision. The functioning of Jhalod federation is discussed in more details below, as it has existed for more than nine years and shown the way to the other federations.

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[15] Based on an evaluation study for SRTT by Astad Pastakia, March 2009.

[16] Established in 1974, Sadguru is a non-profit organization, promoting rural and tribal development through community based natural resources management in the tribal, rain-fed districts of Dahod and Panchmahal (Gujarat), Jhabua (Madhya Pradesh) and Jhalawar Banswara and Dungarpur (Rajasthan).

Table 1: Profile of LI Federations under review

Sl. No.	Name of Federation	District \ State	No of LICs (current)	No of LICs (near future)	Registration year
1.	The Jhalod Taluka Lift Irrigation Cooperative Federation Ltd., Jhalod	Dahod, Gujarat	60	75	5 July 1999
2.	The Banswara Taluka Lift Irrigation Cooperative Federation Ltd., Banswara	Banswara, Rajasthan	36	62	9 March 2007
3.	The Sadguru Lift Irrigation Cooperative Federation Ltd., Jhalawar	Jhalawar, Rajasthan	21	49	17 March 2007
4.	Divisional Lift Irrigation Cooperative Federation Ltd., Limkheda	Dahod, Gujarat	22	58	Process of registration
	Total		139	244	

The Jhalod Taluka Lift-Irrigation Cooperative Societies' Federation Ltd.

Membership: The federation has 60 LICs as its members. Fifteen more LICs are being established, which will become members of the federation in due course. In order to become member each cooperative has to pay a minimum of Rs. 1,001/- (Rs. 1000/- towards purchase of share and Rs. 1/- as membership fee). The expectations from the member cooperatives are:

- They should attend all the meetings regularly.
- They should provide data about the functioning of their cooperatives including data on land irrigated, cropping pattern, recovery status etc.
- They should develop their own norms for efficient and equitable distribution of water, pricing of water and collection of water charges.
- They should create a fund for maintenance and appoint suitable persons for

running and maintaining the LI schemes and maintaining the books of accounts.

Executive Committee:

The general body has selected a 15 member executive committee. Significantly, all the present members of the executive committee are male members. In the past, the committee had an active woman member who also served as the vice-chairperson. But she voluntarily withdrew after 3 three years from the selection process citing unavailability of time due to other commitments. The 15th member is the representative of Sadguru Foundation. The committee draws upon the suggestions and advice of this representative whenever are unsure of their decision and feel the need to do so.

Constraints faced by LICs:

Some of the constraints faced by the LICs were identified as follows:

- The fluctuations in rainfall pattern affect the working of the cooperative. The average rainfall in that area is about 30 inches but in 2008 it has received only 17 inches.
- The lift irrigations were earlier designed with the assumption that they will have access to electricity for about 16 to 18 hours per day, but it is only for 4 to 6 hours per day. The use of diesel pumps is prohibitively expensive.

Key Achievements and Aspirations:

Some of the main achievements of the federation as stated by the committee members are as follows:

1. Service for maintenance of LI scheme: The federation has set up a system of servicing and trouble shooting for its members. Whenever there is a major fault in the LI scheme a member cooperative can lodge a complaint with the federation by depositing Rs. 100/- with it. The federation then attends to the complaint on first come first serve basis by sending its technicians (electrician and/or pipe fitter).

2. Dealership for Micro Irrigation products: There are about 300 *wadis* (orchards) in Dahod district, which have adopted micro-irrigation. Sadguru Foundation promoted the *wadis*, while the Jhalod Federation installed the drip systems as a dealer of Jain Irrigation Company. Sadguru has deputed a technical person to the federation, who also serves as its manager on a part-time basis. The federation also provides after-

sales services.

3. *Developing wastelands through horticulture*: The federation made a small beginning by cultivating Mango and Amla (Gooseberry) plantations at Vakol village, in seven acres of wasteland in 2001-02. Encouraged by the success of this experiment it set up a 20-acre plantation at Chasiya village in 2003-04. This plantation is now 4 years old and will start bearing fruit within a year.

4. Supply of fodder during recurrent drought: From 1998 to 2001, Gujarat experienced recurrent droughts. The federation organized supply of dry fodder for its members in the year 2000. Each LIC was supplied about 1 truckload worth Rs. 19,250/-, which helped its members to tide over the crisis.

5. Supply of castor cake from Mehsana: The members made a demand for supply of seeds and fertilizers of good quality. In 2002-03, it decided to supply castor cake to its members, procured from Mehsana. This activity could not be continued due to lack of storage facilities and working capital. (Farmers typically are willing to pay the money at the time of purchase and not in advance.)

Financial Status of the Federation:
As on 2007-08, the federation has a total share capital of Rs. 62,500/-. As per cooperative law it has built up several funds including a reserve fund of Rs. 17.16 lakhs, Community development fund of Rs. 6.03 lakhs, building fund of Rs. 3.04 lakhs, revolving fund of Rs. 2.32 lakhs and other funds of Rs. 5.79 lakhs. Hence the total funds built up over the years, amounts to Rs. 34.34 lakhs. However, as per cooperative law this money must be used for the purpose for which it is earmarked. Permission is needed from the registrar of cooperatives to use this reserve fund money. The reserve fund however, can be used to leverage some funds as working capital from the banks.

The federation has been giving a dividend of 12%, each year, since 1999. It has also passed a resolution in the Annual General Body Meeting of 2007 to increase the shareholding. By this resolution, every year, each member LIC will purchase 100 shares of Rs.10 each, i.e Rs.1000/- per LIC. This will enable the federation to leverage more funds for its increasing economic activities and to develop the necessary infrastructure.

It is worth noting that SRTT provided three small grants under its SG Programme to the

Jhalod federation as shown below:

- April 2000-March 2001- Rs. 2,75,000/-
- Sept 2001 to Aug 2002 - Rs. 3,00,000/-
- Dec 2003 to Nov 2004 - Rs. 3,00,000/-

The Federation used this money to establish its office and recruit the required staff for office and fieldwork independently. During this period federation also provided various trainings, field exposure visits for its member farmers, established drinking water systems for 204 families of three member villages, provided Agriculture Extension services to 34 families, and served 277 women beneficiaries of member villages under horticulture programme. Also 217 families of 3 member villages benefited from wasteland development programme. Since 2004 onwards, the federation has not received any grants and is meeting its expenses on its own.

Impact of the Initiative

As per various studies the LI intervention has over the years made a positive impact on the local economy and socio-economic situation. An early study by scholars from IRMA (Dinesh Kumar et. al., 1999)[17] reported a benefit-cost ratio of 1.33 for a sample of six LI schemes. For an irrigation scheme this was considered fairly high. Comparative analysis of the total cost of production and supply of water showed that the cost was 1.10 paise / liter for the LI schemes against the government norm of 5 paise /liter in the case of public water systems.

The agronomic and economic efficiencies of water use for the four main crops cultivated were found to be different (Table 2). The agronomic efficiency for wheat was the highest at 1.23 kg/cu m while the economic efficiency was the highest for gram at Rs. 7.72/cu m.

Table 2: Agronomic and Economic efficiencies of Water Use (1999)

Crop	No of watering	Agronomic Efficiency (Kg/cu	Economic efficiency (Rs. cu

[17] Dinesh Kumar M, Vishwa Ballabh, Rakesh Pandey and Jayesh Talati, *Sustainable Development and Use of Water Resources: Sadguru's Macro-initiatives in Local Water Harnessing and Management.* IRMA Working Paper, Anand: Institute of Rural Management, 1999.

		m)	m)
Wheat	4-6	1.23	4.72
Gram	2-3	1.15	7.72
Maize	3-4	1.17	4.05
Mustard	3-4	0.70.	6.10

The study concluded that the LI schemes were sustainable from the viewpoint of water use and physical systems.

Jagawat (2005) mentions that a number of impact studies had revealed that yields and incomes of farmers had gone up between four to nine times the levels before the intervention. An IMWI-TATA research project (quoted by Jagawat, 2005) in Mahudi and Mota Dharola villages of Dahod found a nine-fold increase in income. The study had taken into account the additional income generated through boost in animal husbandry.

A rapid impact assessment by Mathur and Rao (2006)[18] found an increase in social esteem of LI members. Earlier the people of the region had difficulty in finding brides, as the region was prone to droughts. This situation had completely changed now. The level of indebtedness had gone down and quality of living in terms of food, clothing and shelter had improved significantly. Stress migration had also gone down. However, these conclusions were based on anecdotal data rather than empirical data.

Sadguru Foundation has initiated an internal study on impact on migration due to LIs in Jhalavar, Rajasthan, with a sample size of 121 families drawn from 8 lift irrigation schemes. Preliminary findings show a significant drop in migration of both, men and women (from 62.8% to 33.0%) as well as the number of days of migration per year (from 100 to less than 70). The proportion of women migrating continued to remain the same at about 40%.

Conclusions

The LI systems promoted by Sadguru Foundation have stood the test of time except in the

[18] Mathur Madhvi and Sudhir Rao, *Rapid Impact Assessment of Government Supported Water Resources Development Programme, Jhalawar, Rajasthan*, Study prepared for N M Sadguru Water and Development Foundation, Dec. 2006.

state of MP where it had only constructed the LI on behalf of the state government. The federations are being created to decentralize the system of supervision, empower the people and help in the overall sustainability of the LI intervention. The Jhalod federation has already established a system of providing maintenance services to its constituent members in a cost effective way. It is also on the way towards financial self-sufficiency through its own income generation activities.

The relationship between the federations and Sadguru Foundation would change over time as the federations mature. For the initial 3-5 years, federations need to be supported with a grant to get them started and meet administrative expenses. Federations will also need financial support to invest in income generation activities, which could make them financially autonomous in the long run. They will also need to access working capital from commercial financial institutions if necessary with the help of a bank guarantee. Sadguru will need to continue its role in sector development and policy advocacy for a long time to come.

Case Study 7

Kachnaria Dam- Way to brightness

Since its inception in 1996, one of the major focuses of ASA is to develop water resource of the State for providing irrigating facility particularly to underprivileged population, i.e. small and marginal farmers, ST and SC population. ASA has been working in Nagda block of Ujjain district since past few years. In one of its project areas in a village named Kachnaria. The village is inhabited by two major heterogeneous communities, namely the Banjara community, which is economically backward and better off Patel community. The social and political conflicts have been observed between these two equally populated communities.

The Banjara community in the village had small landholdings with an average size of 2 acres. They did not have any access to irrigation. Consequently, they were able to take agricultural activity on their lands only in Kharif season, where they grew Soyabean crop. The productivity at an average of 3 to 3.5 quintals per acre was also very low owing to poor agricultural practices and lack of inputs because they could not afford it. They used to work locally as agricultural labour post monsoon period. During rest of the year from January to May, they would migrate to Gujarat and Maharashtra, where they would work as agricultural labour and other menial jobs. Through migration, their savings were very little ranging from Rs. 3500/- to Rs. 4000/- per family.

The strategy adopted by the ASA to reach out to the Banjara community was that of collectivizing them in form of small Self Help Groups (SHGs). With the help of SHGs, ASA initiated soil conservation activities, which showed positive results with the whole Banjara community coming forward to participate in these activities. Simultaneously, ASA started constant dialogue with the Patel community, which showed initial resistance to ASA and made them an important stakeholder in the development process of the village.

Gradually, the SHGs, which had been feeling the acute need for water conservation and harnessing for irrigation expressed their demand for the construction of a stop dam on a local stream in second half of 2007. The water on this stream did not last till Rabi season. Realizing the severe need of irrigation, the construction of the stop dam was agreed along with thorough involvement of the community. As the first step, the site selection was done in consultation with the community. The site proposed by the community covered 40% members of 3 SHGs, which made it a logical choice. Besides, it also met the technical

criterion required for the construction of the stop dam. There were 11 Banjara families, who had their lands near the proposed site. A significant step was the formation of a water user group of these proposed beneficiaries.

Finally, the construction work began in January, 2008 and got over in March, 2008. The total cost incurred was Rs. 2.95 lakhs including Rs. 45,000 as community contribution, which was mandatory as per the resolution passed by the water user group. The constructed stop dam was 15 meter in length and 1.5 meter in height and had a command area of 17.5 acres, out of which 15 acres belonged to these Banjara community members. With the construction of stop dam, since the Banjara community members got labour locally, they did not migrate that year.

This year the water lasted till late January and as a result of which these 11 families started taking Rabi crops for the first time. They took Lok-1 variety of wheat on their 15 acres of the command land through 3 to 4 waterings, when not even a single irrigation was available to them earlier. The results have been encouraging and the productivity has been 7 to 9 quintals per acre. The income generated through selling the marketable surplus after keeping the required amount of grains for their own consumption and seed, was around Rs. 6000/- to Rs. 7000/-. The food sufficiency after the construction of stop dam has risen from 3 months to 7 to 8 months. With the availability of irrigation facility locally, they did not migrate this year. Now, ASA plans to impart trainings on simultaneously training them on improved package of practices and providing them with improved varieties, so that food sufficiency and agricultural incomes can be further enhanced.

Annexure I

Names of the State Level Officials met for the study:

- Mr. Pravesh Sharma, Principal Secretary, Department of Farmer's Welfare and Agriculture Development, Govt. of Madhya Pradesh
- Mr. Sachin Sinha, Director, Rajiv Gandhi Watershed Management Mission, Govt. of Madhya Pradesh
- Dr. Ravinder Pastor, Project Coordinator, MP DPIP
- Dr. D.N. Sharma, Director, Department of Farmer's Welfare and Agriculture Development, Govt. of Madhya Pradesh
- Mr. Vivek Dave, Rajiv Gandhi Watershed Management Mission Cell, Govt. of Madhya Pradesh
- Mr. R.K. Chanchodiya, Director, State Water Data Analysis Center (SWARDAC), Govt. of Madhya Pradesh

Annexure II

Names of the District Level Officials met for the study

1. Mr. Dinesh Farrakya (EE), RES, Ratlam

2. Mr. P. K. Vishvakarma (DDA), Agriculture Department, Ratlam

3. Mr. R.L.Mahor (Executive Officer), Soil & Water Conservation Department, Ratlam

4. Mr. J.M. Lalwani, A.E.-PHE, Shajapur

5. Mr. R.S Gokuliya, SDO (Forest Dept), Shajapur

6. Mr. R.B.Sharma, PFT Co-ordinator (Agar DPIP), Shajapur

7. Mr. R.K. Hardania, A.E.-NREGA, Zilla Panchayat, Sheopur

8. Dr Jagdish Baistale, Monitoring and Learning Coordinator, DPIP- Damoh

9. Mr G C Jain, Executive Engineer PHE, Damoh

10. Mr. Noor Khan, District Planning Officer, Damoh

11. Mr. Sanjeev Shrivastav, Joint Collector and DPM (DPIP-Raisen)

12. Mr. Ramesh Yadav, APO, ZP-Raisen

13. Mr. Ashok Thakur, Agriculture Coordinator, DPIP, Chhatarpur

14. Mr. A.K Shrivastava, Engineer, Zilla Panchayat, Chhatarpur

15. Mr. Vijay Singh Thakur, Upyantri, PHE, Narsinghpur

16. Uday Bofle, Anuvaikshak-PHE, Narsinghpur

17. Mr. S,K.Dixit, Range Officer, Barman Division, Forest Department, Narsinghpur

18. Mr. N. Dilawar Khan, Gotegaon Division, Forest Department, Narsinghpur

19. Mr. J.P. Harda, S.E.-RES, Annupur

20. Dr Gagan Saxena, DPM, DPIP- Guna

21. Mr. N D Gupta, ASCO in Charge, SDO Agriculture, Chhindwara

22. Mr. G C Chaudhary, Executive Engineer, PHE, Burhanpur

23. Mr. U K Sharma, DFO, Forest Department, Burhanpur

24. Mr. Gautam, District Planning Officer, RGWMM, Barwani

25. Mr. Yadav, Sahayak Karyapalan Yantri, RES, Barwani

24. Mr. Pankaj Sinha, DMLD, MPRLP

Annexure III (Photos of Sampled Stop Dams)

1. **Barodiya Aamgaon Naala Stop Dam, Bhamori, PHE, Narsinghpur, Fully Functional**

2. **Dilhari Stop Dam, Dilhari, Forest Department, Narsinghpur, Partially Functional**

3. Tinsara Naala Stop Dam, Aamgaon, RES, Narsinghpur, Dysfunctional

4. Jai Ganga Maiya Stop Dam, Naiguwan, DPIP, Chattarpur, Fully Functional

5. Barua Naala Stop Dam, Mudhara, RES, Chattarpur, Partially Functional

6. Kariyar Naala Stop Dam, Padro, RES, Chattarpur, Dysfunctional

7. Wagariya Nalla Stop Dam, Bilpak, RES, Ratlam, Partially Functional

8. Undwa Nalla Stop Dam, Saurikheda, Agriculture Department, Ratlam, Fully Functional

9. Gundiwala Nalla Stop Dam, Umar ka Nasinaka, Zilla Panchayat (RGM), Ratlam, Fully Functional

10. Lahori Nalla Stop Dam, Lahori, PHE, Shajapur, Fully Functional

11. Mohanbala Stop Dam, Sugaon, DPIP, Shajapur, Fully Functional

12. Khal Nala Stop Dam, Pipaliya, Forest Department, Shajapur, Dysfunctional

13. Daduni Stop Dam, Daduni, RES, Seopur, Fully Functional (NA)

14. Siruti Ka Anda Stop Dam, Pandola, RES, Seopur, Partially Functional (NA)

15. Near Shamsham Stop Dam, Soinkalan, RES, Seopur, Partially Functional (NA)

16. Nifra Nalla Stop Dam, Katkona, RES, Anuppur, Fully Functional

17. Nifra Nalla Stop Dam, Piparaha, RES, Anuppur, Fully Functional

18. Jogi Tola Surjhi Nalla Stop Dam, Devgawan, RES, Anuppur, Dysfunctional (NA)

19. Halgaon Stop Dam, Hagaon, RES, Barwani, Fully Functional

20. Ghumariyakhurd Stop Dam, Ghumariya Khurd, RGM, Barwani, Partially Functional

21. Rajangaon Stop Dam, Rajangaon, MPRLP, Barwani, Partially Functional

22. Badera Stop Dam, Badera, Forest Departmen, Guna, Partially Functional

23. Udaipura Stop Dam, Udaipuri, RGM, Guna, Fully Functional

24. Akoda Nadi Stop Dam, Khairoda, DPIP, Guna, Fully Functional

25. Ghoda Pachada, Bhanwarkhedi, ZP, Raisen, Fully Functional

26. Pathardhera on Sautar Ki Nadi Stop Dam, Mahuli, RGM, Raisen, Partially Functional

27. Bagra Walla Stop Dam, Hinotia Padaria, PHE, Raisen, Fully Functional (NA)

28. Jhiri Stop dam, Jhiri Jamuniya, Agriculture Department, Chhindwara, Fully Functional

29. Sonapipri Stop Dam, Sona Pipri, RES, Chhindwara, Fully Functional

30. Chiklikala Stop Dam, Chiklikala, PHE, Chhindwara, Partially Functional

31. Masandia Nallah, Aamgaon, Forest Department, Burhanpur, Fully Functional

32. Borban Stop Dam, Borban, PHE, Burhanpur, Dysfunctional

33. Sukhi Nadi Stop Dam, Sangrampur, PHE, Burhanpur, Partially Functional

34. Pipariya Hathini Stop Dam, Piparia Hathini, PHE, Damoh, Fully Functional

35. Indira SS Stop Dam, Darali, DPIP, Damoh, Partially Functional

36. Marutal Stop Dam, Marutal, RES, Damoh, Partially Functional

Annexure IV

Terms of Reference

Background & Purpose:

The Poverty Monitoring and Policy Support Unit Society (PMPSUS), Madhya Pradesh (MP), a registered Society anchored within the MP State Planning Commission (MPSPC), Department of Planning, Economics & Statistics, Government of MP (GoMP) is mandated to support GoMP departments in the design and review of their policy initiatives and programmes and, in line with this mandate, undertake or commission specialized research on issues relating to poverty, inequality, gender and social exclusion.

Land and water management is crucial to the largely rural State of Madhya Pradesh (MP) and the wide-ranging issues around the Agriculture Sector it faces. Several programmes including the Drought Prone Areas Programme (DPAP), Integrated Wasteland Development Programme (IWDP), Rajiv Gandhi Mission for Watershed Management (RGMWM) and the National Rural Employment Guarantee Scheme (NREGS) as well as donor-supported initiatives such as the MP District Poverty Initiative Project (MPDPIP) and the MP Rural Livelihoods Programme (MPRLP) have supported works in this direction. Check dams are among the most common structures invested in as part of land and water management package under these initiatives.

Objectives of the Study:

The GoMP now proposes to undertake study on workings of **Check dams**[19] in Madhya Pradesh with a view to:

4 Ascertain efficacy and sustainability of check dams both technical and institutional, constructed under various programme, across various parts of the State and by various departments and agencies.

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[19] Working definition of Check Dam includes structures like stop dam, barrage, and other similar structures with an objective to build across a gully to hold water, reduce the speed of water flow, and to trap soil.

5 Undertake a cost-benefit analysis of check dams in various agro-climatic regions of MP, and how it has impacted various social categories in the light of poverty reduction.

6 Investigate the factors influencing the working of check dams both technical and institutional aspects

7 A comparative analysis and documentation of at least 6 check dams (three best models and three failed check dams) across State that should include in-depth analysis on "Why these Check Dams succeeded under what conditions while other Check Dams could not have the intended impacts"

8 Draw appropriate lessons, bottleneck issues, framework and approach for the improvement in site selection, process, and design along with costing, operations, and maintenance of their check dam.

Scope of the Work:

- Based on secondary document review of various departments, develop database[20] of check dams constructed under various programme, across various parts of the state and by various departments and agencies in ninth and tenth five year plan. From this database only, appropriate sample should be taken for the study.

- Impact of check dam on ground water recharging; assessment about equitable distribution of water, maintenance cost etc.; mapping types of benefits received by Stakeholder(s) from check dam.

- Efficiency and effectiveness of technical design and institutional performance of user group including governance, functioning, guiding principles etc.

- Recommend detailed framework including specific means and ways to improve overall workings of check dam (department specific) including location wise – site selection process, innovative construction methods, and financing of future check dams.

[20] Include at least State/District/Block/Panchayat/village/name of check dam/year of construction/total cost/command area/no. of beneficiaries/status of working

- Report should provide detailed analysis of beneficiaries based on social category (General/SC/ST/Privitive tribes); economic class (BPL/Non-BPL); Rural/Urban/Semi-Urban; Remoteness v/s Near road to all or most of the questions asked in the household interview schedule.

- Undertake a sample study of check dams across the State to assess their working; the sample selection should be such that it allows for comparisons in the check dams constructed under various programmes, across various parts of the State and by various departments and agencies

- Factors influencing the working of check dams, including but not limited to technical factors that lead to silting and breaching and 'non-technical' factors such as community engagement levels and maintenance arrangements; the identification of these factors needs to be undertaken from the perspective of all major stakeholder groups using a judicious mix of quantitative and qualitative approaches, and again, needs to allows for comparisons of factors for check dams constructed under various programmes, across various parts of the State and by various departments and agencies

Sample Design:

Agency has to undertake sample from check dams constructed during IXth, and Xth Five year plan of MP. Appropriate sample should be taken from various intervals of command area from each six regions of the State to assess workings of check dam. While doing sampling of check dams' its remoteness, existence in tribal v/s non-tribal blocks; constructed by NGOs/Dept./Agencies; year of construction etc. should be given consideration. While selecting beneficiaries, equal composition of tail ender v/s head; large/marginal/small/landless; social category etc. should be keep in consideration.

Appropriate instruments are to be prepared for data collection and review of secondary documents at different levels. Tool kit along with quality assurance process to be adopted during study should be highlighted in the quality assurance section.

Expertise:

The team should have the following experts in the team for conducting this study:

- Team Leader & Soil & Water Conservation Expert
- Agricultural/ Irrigation Expert
- Evaluation Expert
- Social Development Expert
- Statistical Expert

The experts should meet the following criteria:

- Experience and proven track record of evaluating the impacts of large programmes particularly in the soil and water conservation (essential)
- Experience of evaluating impacts of large government/ donor funded programmes, particularly programs with social sector focus and community development (essential)
- Experience of working in India (essential)
- Experience of working in Madhya Pradesh (desirable)

Timeline and Deliverables

1) Inception Report – Within 30 days i.e. one month of Contract
2) Progress Report 1 – Within 45 days of inception report
3) Progress Report 2 – Within 90 days of inception report
4) Draft Final Report with Presentation – Within 20 days of Progress Report 2
5) Final Report – Within 10 days of Draft Final Report

The report and all background documentation including computer databases of questionnaires will be the property of PMPSUS and will be divulged as appropriate by PMPSUS. Softcopy in DVD/CD and hard copies of above reports, maps and other documents must be submitted to PMPSUS.

References:

1. Sen, Suchitra; Shah, Amita; and Kumar, Animesh, 2007, Technical Paper, Watershed Development Programmes in Madhya Pradesh: Present Scenario and Issues for Convergence, Gujarat Institute of Development Research
2. Farmer Welfare & Agricultural Development Department, 2006-07, Compendium of Agricultural Statistics, Madhya Pradesh, Bhopal, M.P. State Agricultural Marketing Board
3. Water Resources Department, Govt. of M.P., (http://www.mp.gov.in/wrd/)
4. Madhya Pradesh State Water Policy (Year 2003) (http://www.mp.gov.in/WRD/ORG_RECORDS/Policy/SWP/SWP_REV.html)